ISSN 0002-9920

Notices

of the American Mathematical Society

October 2002 **Volume 49, Number 9**

Baltimore specialties: crabs and the 2003 Joint Meetings
(see pages 1054 and 1166)

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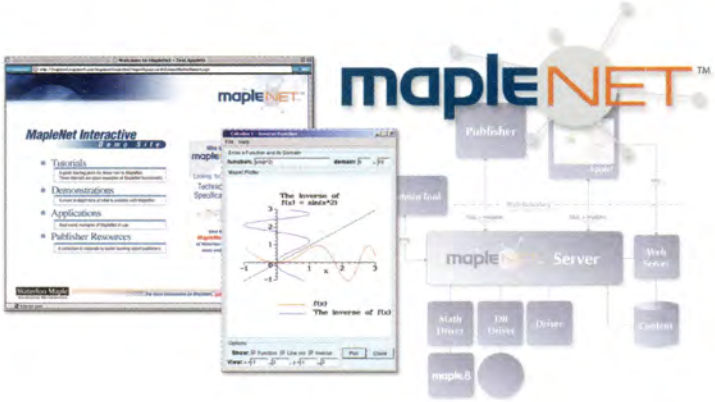

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- An Elliptic Incarnation of the Bailey Chain, *V. P. Spiridonov*
- Equilibrium Distribution of Zeros of Random Polynomials, *Bernard Shiffman and Steve Zelditch*
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of the American Mathematical Society

October 2002

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Departments

From the AMS Secretary

The Amateur Professor

I am an amateur professor. That statement, coming from a tenured faculty member at a major state university, may sound like an oxymoron. Yet there is no contradiction if the word "amateur" is interpreted in the sense of its Latin root *amator* (lover). Most of my "professional" activities are tasks that I do for the love of the endeavor rather than because they are an assigned part of my job.

Administrators who view the modern university as a business venture would no doubt be shocked to learn that I have spent half an hour revising the wording of a single sentence while drafting a research paper; that I have invested the time to compose a crossword puzzle for an advanced calculus class; that I have written a referee's report so detailed that it numbered half as many pages as the manuscript under review. Although an efficiency expert would not approve of such activities, an amateur does them for love of the future readers of the research article, for love of the students, for love of a beginning colleague struggling with the challenges of mathematical exposition.

Unlike me, my wife is a professional. In her role as a nurse practitioner, she has a license, a written job description, a specific requirement for continuing education to maintain her certification, protocols governing the services that she provides, and an annual evaluation of the strengths and weaknesses of her performance of assigned duties. In contrast, I have had little formal training for most of the things I do professionally and even less oversight of how I do them. The state legislature thinks that my main function at the university is teaching, yet I have never had formal instruction in how to organize a syllabus, or select a textbook, or compose an examination, or lecture to a class. Nor have I been taught how to write a review, present a seminar talk, run a committee meeting, prepare a grant proposal, or mentor a graduate student. I am an amateur professor.

And I hope that many of my colleagues too are amateurs—lovers—of their work. History suggests, however, that exhortations to love one's fellow human beings are ineffective unless accompanied by prescribed standards of behavior. I find it puzzling that we mathematicians have formulated few standards for our profession.

Teaching, for example, is a major part of the job of most mathematicians based at universities, yet there is no widely understood and generally accepted characterization of good teaching. Although the theory of mathematics pedagogy has been discussed at least since the time of Socrates, today one finds among mathematicians little agreement about what to teach or how to teach it. Indeed, the second edition of Steven G. Krantz's book *How to Teach Mathematics* contains a lengthy appendix in which other mathematicians express disparate views. Concerning mathematics education at the elementary level, the National Council of Teachers of Mathematics issued in 2000 the *Principles and Standards for School Mathematics*, but this document has not been enthusiastically endorsed by research mathematicians (see the October 2000 issue of *Notices*, pages 1072–9, for four reactions to the document).

Nor is there agreement about how to measure the success of a mathematics teacher. The only widely adopted mechanism for evaluating teaching is to survey students' feelings about the instructor on a five-point scale. Although this method pleases administrators, faculty wonder what the numbers measure. Indeed, my own mathematics department switched to a free-response student opinionnaire after an internal study showed that students' numerical responses had no statistical significance. Despite a dearth of supporting documentation about the quality of teaching, each year we happily nominate candidates for teaching awards. Apparently good teaching, like beauty, is in the eye of the beholder.

Although technical writing, like teaching, is another primary activity of many mathematicians, the principles of good mathematical exposition are rarely made explicit. Being comfortable with the idea of abstract definitions, mathematicians should have no difficulty assimilating the arbitrary rules of English grammar and composition. The subtler issues of understanding the target audience, organizing the material, choosing appropriate notation, finding the proper level of generality, and so forth, need repeated explication. Yet one finds in the AMS online bookstore more items about the technicalities of typesetting equations than books about how to write mathematics well.

There are promising indications that the leaders of the mathematics community recognize the need of our profession for standards in all aspects of our work. In 1995, for example, the AMS Council endorsed a set of ethical guidelines (reprinted in the June/July 2002 issue, pages 706–7). This year, the International Mathematical Union endorsed a set of best current practices for the electronic communication of information (see the September 2002 issue, pages 922–5). May this trend continue in which designated authorities issue formal recommendations, and may the members of the mathematics community follow the lead.

—Harold P. Boas
Editor

Letters to the Editor

André Bloch

Isn't it ironic that diametrically opposite the letter to the editor "A Beautiful Mind" (June/July 2002 issue) warning of the danger that the lay person would confuse schizophrenia with "the mind of a mathematician", the technical article "Singular Surfaces and Meromorphic Functions" mentions A. Bloch, a mathematician confined to a lunatic asylum for killing three relatives? What I find interesting is that many complex function theorists who were so very careful about their epsilons and deltas reported vastly divergent versions of the story ("Beauty and the Beast: The Strange Case of André Bloch", *The Mathematical Intelligencer* **7** (1985), no. 4, 36–8).

It is amusing that one of them was George Pólya, who wrote the famous book *How to Solve It*. Incidentally Pólya actually collaborated with Bloch on a paper.

—George DeRise
Thomas Nelson Community College

(Received June 18, 2002)

Commutative Diagrams in the Fine Arts

The pages of the *Notices* are precious in the sense that they are rare space for the discussion of mathematical activities which are conducted at an unusually high level of endeavor, not in the sense that they should be filled with precious articles such as Karl Heinrich Hofmann's "Commutative Diagrams in the Fine Arts" (June/July 2002).

There is a strong technical argument that commutative diagrams are as inherently obfuscatory as the heavy sub- and superscripting in classical differential geometry, but their use originated in a creditable intention to clarify some things. Contrary to this objective, Bernar Venet's graphical art, far from bridging the moat between the paying public and the stratospheric spires of formal mathematics, exploits the public's ignorance of mathematics to achieve its effects. That is, the public is invited to enjoy a feeling of unmitigated amazement that, of all the possible ornate squiggles which might appear on a wall, these particular ones happened to occur, and this in an age when the most successful business on the internet seems to be pornography.

Commutative diagrams may indeed provide fine examples of the typographer's art, but any claim that they convey to the uninitiated an appreciation of mathematical elegance is as preposterous as the notion that they are erotic. And, in fact, as Hofmann almost admits, they are far from perfect for the mathematical ends that they purport to serve. If the editors of the *Notices* wish to fulfill their manifest duties to their professional constituency in some regard that relates to commutative diagrams, the editors might consider devoting a portion of the *Notices* to material on the origins, current status, and prospects of abstract category theory, with an emphasis on the evolution (if there has been any) on the attitudes of working mathematicians toward this field. In fact, it would be useful to see a survey of not only the mathematics research community, but of computer scientists and mathematical modelers.

In other words, let's get back to work.

—Pat Donaly
Bonneville Power Administration

(Received June 26, 2002)

About the Cover

The cover image shows a colorful pile of cooked crabs, a regional dining favorite in Baltimore, Maryland. Baltimore is the site of the 2003 Joint Mathematics Meetings, January 15–18, 2003.

Cover photograph courtesy of the Baltimore Area Convention & Visitors Association.

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

Scaling Limits and Super-Brownian Motion

Gordon Slade

with illustrations by Bill Casselman

Students and teachers are well aware that random data tends to lie on a bell curve. The tendency is so widespread that the term "normal distribution" has acquired the technical meaning of a distribution governed by the Gaussian density

$$(1)\quad p_t(x) = \left(\frac{d}{2\pi t}\right)^{d/2} e^{-d|x|^2/2t} \quad (x \in \mathbb{R}^d,\ t > 0).$$

For $d = 1$, the graph of $p_t(x)$ is a bell curve with breadth measured by $\sqrt{t}$, centred for convenience at 0. More generally, for all $d \geq 1$, (1) has been normalised to have variance $\int_{\mathbb{R}^d} |x|^2 p_t(x)dx = t$ and hence standard deviation $\sqrt{t}$. The mathematical explanation of why the Gaussian density is "normal" in the colloquial sense is given by the central limit theorem. Although its impact can become dulled by familiarity, the central limit theorem is a startlingly remarkable assertion. As explained in more detail below, it says that a sum of n independent and identically distributed random variables X_i with finite variance, properly rescaled, has approximately a Gaussian distribution when n is large. As long as the variance of X_i is finite, the limit is the same. It makes no difference whether X_i is a discrete or a continuous random variable—you always get a bell curve. This is an example of what physicists call *universality*: The domain of attraction of the limiting distribution contains all examples obeying a certain regularity condition, which in this case is the finiteness of the variance.

The universality goes further. Consider the sequence of partial sums $S_n = \sum_{i=1}^n X_i$, with n regarded as a time variable. Then $\{0, S_1, S_2, \dots\}$ gives a random walk, with ith step X_i. Properly interpolated and scaled with n, the random walk converges to Brownian motion in the *scaling limit* $n \to \infty$. As long as the variance of X_i is finite, the distribution of X_i is again irrelevant. Brownian motion is an example of a process with the Markov property: What the process does next depends on its current state and not otherwise on its previous history. The state space of the Markov process is the set $\mathbb{R}$, or, more generally, the set $\mathbb{R}^d$ of possible positions for the motion.

The convergence to Brownian motion is an example of a limit theorem for random spatial processes. Such limit theorems derive much of their beauty and power from their universality, and they are among the most important results in probability theory. A large class of random spatial processes involves populations that undergo branching and death in addition to random spatial motion in $\mathbb{R}^d$. Often, the branching occurs on all time scales, including very small ones. Super-Brownian motion, a relatively recent and exotic Markov process, is the scaling limit of many such processes. In contrast to Brownian motion, where the state space is $\mathbb{R}^d$, *the state space of super-Brownian motion is a set of finite measures on* $\mathbb{R}^d$, and the state of the system represents the mass density of particles alive at time t. The state evolves randomly according to the random subsequent branching and particle motions.

Super-Brownian motion was introduced independently by Watanabe in 1968 and Dawson in 1975. The name "super-Brownian motion" was coined by Dynkin in the late 1980s. The subject of super-Brownian motion and of more general superprocesses, or measure-valued diffusions, has considerable depth and breadth, and there is now a large literature on the subject. This article is an introduction to some aspects of super-Brownian

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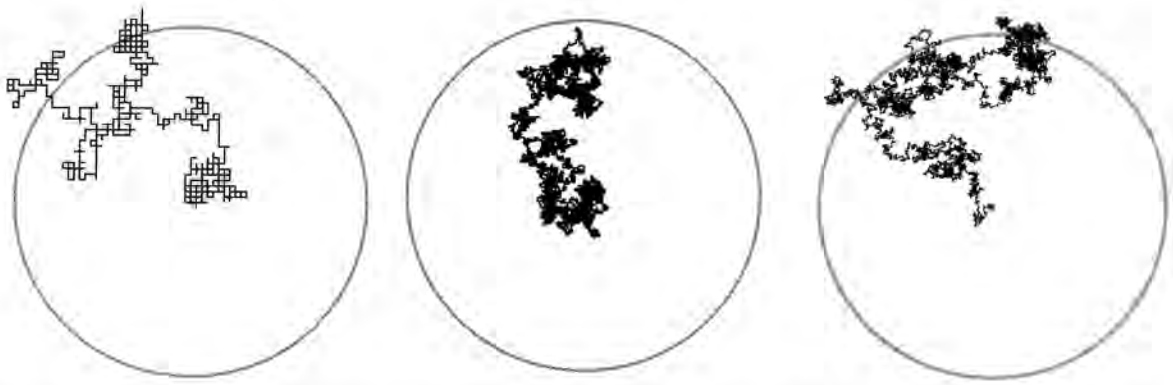

Figure 1. Nearest-neighbour random walks on $\mathbb{Z}^2$ taking n = 1,000, 10,000, and 100,000 steps. The circles have radius $\sqrt{n}$, in units of the step size of the random walk.

motion, centred on recent work showing that in high spatial dimensions its domain of attraction includes models of interest in combinatorics (lattice trees), statistical mechanics (critical percolation), and interacting particle systems (voter model and contact process). We begin with a review of the central limit theorem and Brownian motion.

Part I: Brownian Motion

The Central Limit Theorem and Random Walk

The central limit theorem implies a statement about the scaling limit of the endpoint of a random walk in d dimensions. Let $X_1, X_2, X_3, \ldots$ be any sequence of independent and identically distributed random vectors in $\mathbb{R}^d$. Then $S_n = X_1 + \cdots + X_n$ denotes the position of a random walk in $\mathbb{R}^d$ after n steps. For simplicity, we assume that X_i has mean zero and variance 1 and that the components of X_i are uncorrelated. It easily follows that the expected value of $|S_n|^2$ is n, for all $d \geq 1$. This suggests that the scaling $n^{-1/2}S_n$ is appropriate when analysing the limit $n \to \infty$. The central limit theorem confirms this scaling. It states, in the present context, that

$$\lim_{n\to\infty} \mathbb{P}(n^{-1/2}S_n \in A) = \int_A p_1(x)\,dx, \tag{2}$$

for any Lebesgue measurable set $A \subset \mathbb{R}^d$ whose boundary has measure zero. In other words, the probability that S_n lies in the set $n^{1/2}A$ is given, in the limit $n \to \infty$, by the integral over A of the standard Gaussian density p_1.

For concreteness, we focus in what follows on the *nearest-neighbour* walk in $\mathbb{Z}^d$, in which X_i is equally likely to be any one of the $2d$ nearest neighbours of the origin in $\mathbb{Z}^d$.

Brownian Motion

Equation (2) states that after n steps the endpoint of a random walk, scaled by $n^{-1/2}$, has a standard Gaussian distribution in the limit. It is natural to ask not just about the scaling limit of the endpoint, but the scaling limit of the entire walk. Consider the nearest-neighbour walk. As t varies over the interval $[0, 1]$, $S_{\lfloor nt \rfloor}$ jumps from $S_0 = 0$ to S_1 to S_2 and so on until reaching S_n. We obtain a random element of the set $C[0, 1]$ of continuous functions from $[0, 1]$ to $\mathbb{R}^d$ by linearly interpolating between the S_i and then scaling space by $n^{-1/2}$. There are $(2d)^n$ such continuous functions, corresponding to the $(2d)^n$ nearest-neighbour walks. For each n, the random walk induces the discrete probability measure μ_n on $C[0, 1]$ for which each of these $(2d)^n$ continuous functions has equal probability $(2d)^{-n}$. The question of the scaling limit of the random walk can then be rephrased as the question of whether the measures μ_n converge to a limiting measure μ as $n \to \infty$.

In 1951, Donsker proved that the answer is yes. The limiting Wiener measure μ on $C[0, 1]$ is the mathematical formulation of Brownian motion. Under μ, the probability that a Brownian path at time t is in a Borel set $A \subset \mathbb{R}^d$ is equal to $\int_A p_t(x)\,dx$. The convergence of μ_n to μ is weak convergence, meaning that for any bounded continuous function f on $C[0, 1]$,

$$\lim_{n\to\infty} \int_{C[0,1]} f\,d\mu_n = \int_{C[0,1]} f\,d\mu. \tag{3}$$

On the left side of (3), the integral is simply a finite sum, but this is not the case on the right side.

The Wiener measure μ is supported on irregular continuous paths that are nowhere differentiable and that have Hausdorff dimension 2 for $d \geq 2$. The irregularity of the paths is apparent from Figure 1, as is the fact that $n^{-1/2}$ is the correct spatial scaling.

Although Brownian motion is a Markov process, its domain of attraction includes an interesting example that is not Markovian.

The Self-Avoiding Walk

An n-step self-avoiding walk is a mapping $W : \{0, 1, \ldots, n\} \to \mathbb{Z}^d$ such that $W_0 = 0$, $|W_{i+1} - W_i| = 1$, and $W_i \neq W_j$ for all $i \neq j$. Let c_n be the number of n-step self-avoiding walks. For each n, we declare each of these c_n self-avoiding walks to be equally likely. This does not define a random walk that can be described in terms of transition probabilities. It

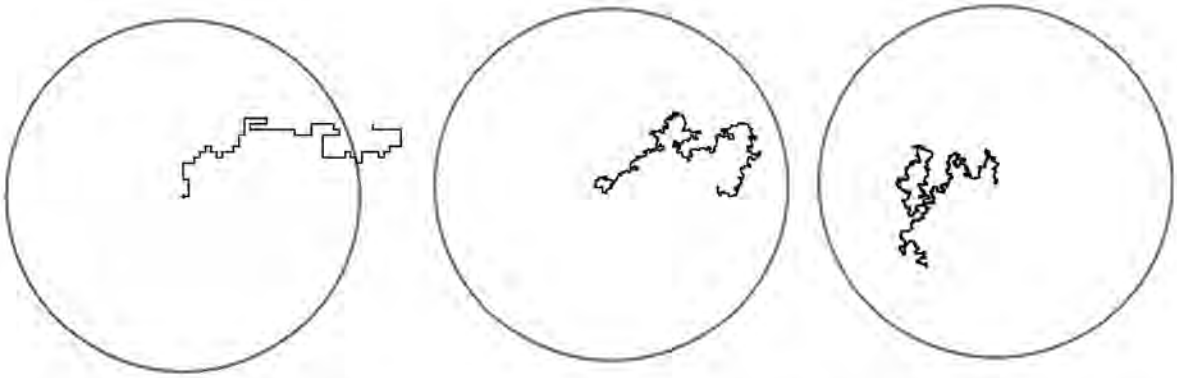

Figure 2. Nearest-neighbour self-avoiding walks on $\mathbb{Z}^2$ taking $n = 100$, 1,000, and 10,000 steps. The circles have radius $n^{3/4}$, in units of the step size of the self-avoiding walk. The walks were generated using the pivot algorithm, an algorithm invented by Lal and developed by Madras and Sokal.

is certainly not Markovian, since the path must avoid its entire past history.

Random 2-dimensional self-avoiding walks are depicted in Figure 2. They do not look like Brownian motion. Exciting recent work by Lawler, Schramm, and Werner predicts, but has not yet proved, that with spatial scaling $n^{-3/4}$ the scaling limit for $d = 2$ is described by a process called the stochastic Loewner evolution with parameter $\frac{8}{3}$ ($\mathrm{SLE}_{8/3}$). This 2-dimensional work relies heavily on a conjectured conformal invariance property of the scaling limit. For $d = 3$, no process has yet been proposed for the scaling limit, although $n^{-0.588\ldots}$ has been predicted for the correct spatial scaling. For $d = 4$, the scaling limit with spatial scaling $n^{-1/2}(\log n)^{-1/8}$ is believed to be Brownian motion, but this has not yet been proved despite recent partial progress by Brydges and Imbrie using renormalisation group methods. For dimensions $d \geq 5$, Hara and Slade used a method called the *lace expansion* to prove that the scaling limit is Brownian motion in the following sense. Define a measure ρ_n on $C[0,1]$ by assigning mass c_n^{-1} to each of the c_n paths obtained by first interpolating the W_j and then rescaling by an appropriate constant multiple of $n^{-1/2}$. Then ρ_n converges weakly to the Wiener measure in the sense that (3) holds when μ_n is replaced on the left side by ρ_n.

The dimension $d = 4$ is referred to as the upper critical dimension, above which Gaussian behaviour is observed. A rough argument predicting $d = 4$ as the upper critical dimension is the following. Brownian paths are 2-dimensional, and two 2-dimensional sets generically do not intersect above $4 = 2 + 2$ dimensions. This suggests that there is enough room in dimensions above 4 that the self-avoidance constraint is unimportant, and hence, despite its highly non-Markovian nature, the self-avoiding walk should have the same Brownian scaling limit as random walk. The lace expansion exploits this intuition and treats the self-avoiding walk as a small perturbation of simple random walk, in dimensions $d \geq 5$.

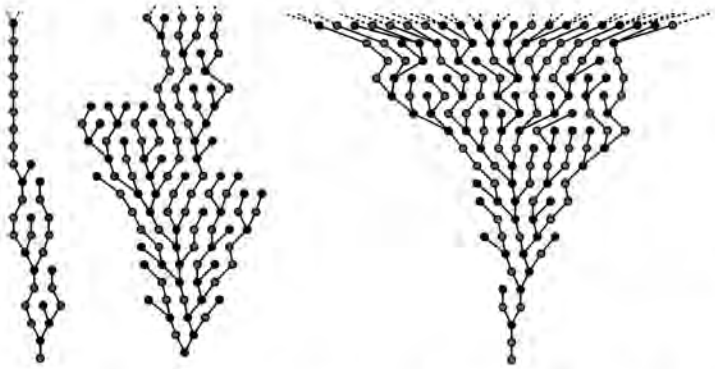

Figure 3. Random trees with binomial offspring distribution $\mathbb{P}(\xi = i) = \binom{2}{i} p^i (1-p)^{2-i}$ ($i = 0, 1, 2$) which survive for at least 20 generations, in the subcritical ($p = 0.47$), critical ($p = 0.50$), and supercritical ($p = 0.53$) regimes.

Part II: Super-Brownian Motion

Galton-Watson Trees

Super-Brownian motion combines random spatial motion with random branching. In preparation, we first consider pure branching processes, without any spatial motion.

A Galton–Watson branching process is defined as follows. Let ξ be a random variable taking values in $\{0, 1, 2, \ldots\}$, with finite variance σ^2. A single individual at time 0 has a random number of offspring, with the distribution of ξ, and then dies. At time 1, each of these offspring has a random number of offspring, each with the distribution of ξ, and then dies. At time 2, these grandchildren of the original individual have their own offspring and die, and so on. The offspring random variables are all independent. At present, we do not associate any spatial location to individuals. The process continues forever or until the family dies out. So will it die out? It depends on the mean m of ξ. If $m < 1$, then on average a generation will give

birth to a smaller subsequent generation and the family will almost surely die out. If $m > 1$, then a population explosion can occur and there is a positive probability of survival for all time. For $m = 1$, Kolmogorov proved in 1938 that the process will die out almost surely, with the probability of survival to time n going to zero as $n \to \infty$ asymptotically as $2\sigma^{-2}n^{-1}$. The case $m = 1$ is referred to as critical, with $m < 1$ subcritical and $m > 1$ supercritical. It is clear from Figure 3 that trees look qualitatively different in the three regimes.

Our focus is on the rare, long-lived critical family trees. Roughly speaking, in the critical case, the width of a tree tends to be proportional to its height n, so the total number of vertices is proportional to n^2. The large critical trees of Figure 4 suggest that a theory of continuously branching trees would be useful. Such a theory was developed by Aldous and by Le Gall in the early 1990s.

Galton-Watson Trees Embedded in Space

We introduce a spatial element to the trees as follows. Fix a large N, and consider the probability distribution of critical Galton–Watson trees conditioned to have total number of vertices equal to N. The height of a critical tree is roughly the square root of the total number of vertices, so these trees live for about $n = N^{1/2}$ generations. Given a random tree drawn from this conditional distribution, we embed it randomly into $N^{-1/4}\mathbb{Z}^d$ subject to the rules: (i) The individual at generation 0 is mapped to the origin of $N^{-1/4}\mathbb{Z}^d$; (ii) an individual is mapped at random to one of the $2d$ neighbours of its parent. See Figure 5. There are thus two sources of randomness in the embedded tree, as both the tree and the embedding of the tree are random. A tree with N vertices has $(2d)^{N-1}$ equally likely embeddings, since the root is embedded at the origin and each child can be located at any of the $2d$ neighbours of its parent.

Dynamically, we can think of this as a branching random walk, where at each time step an individual gives birth to a random number of offspring and dies, with the offspring located at random neighbours of their parent's position. An individual born into a generation of order $n = N^{1/2}$ has a line of ancestry that is a random walk path from the origin

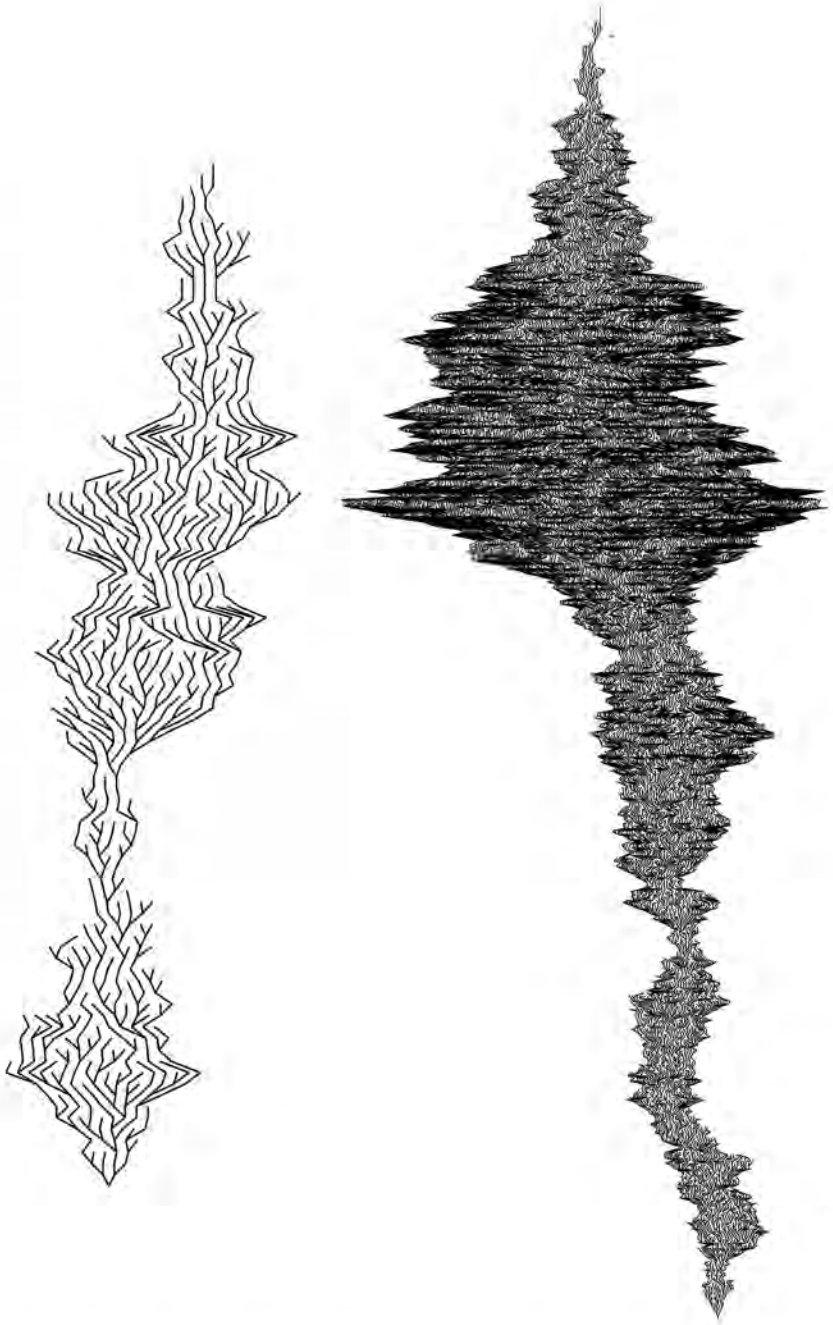

Figure 4. Rare critical trees that survive for (approximately) 100 and 500 generations. The offspring distribution is the same as for the middle tree of Figure 3.

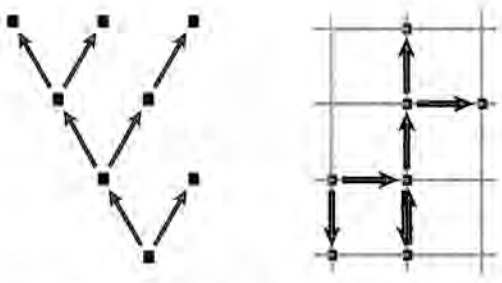

Figure 5. A tree together with an embedding into $\mathbb{Z}^2$.

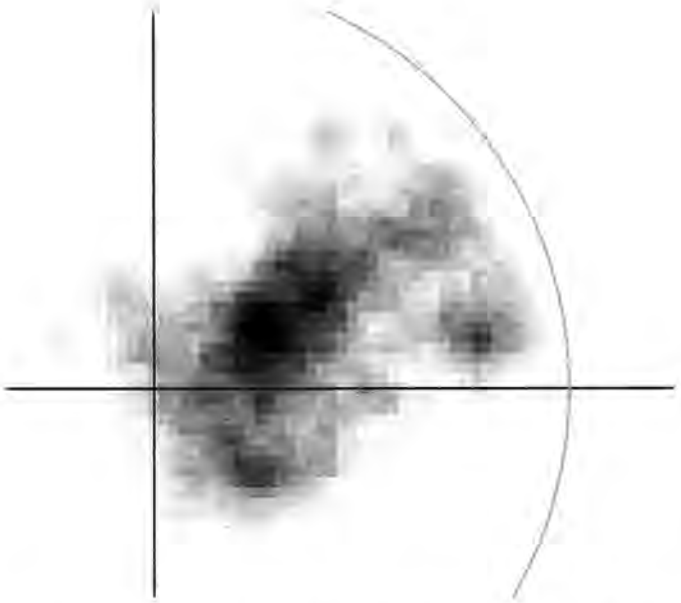

Figure 6. A random mass distribution drawn from $\mathcal{I}_N$, with $N \approx 96,000$. Darker shading represents higher mass, and the arc has radius $N^{1/4}$.

taking about n steps. According to Brownian scaling, the individual is thus located at a distance about $n^{1/2} = N^{1/4}$ from the origin, so $N^{-1/4}\mathbb{Z}^d$ is the natural scaling.

The Scaling Limit: Integrated Super-Brownian Excursion (ISE)

We want to take the limit $N \to \infty$ of the embedded trees and need to decide how much structure to attempt to track. A simple choice is to record only the location and multiplicity of the N embedded vertices and to forget, for now, all trace of ancestral lines.

Thus we assign mass N^{-1} to each embedded vertex, with multiplicity. The total mass is 1, so an embedded tree (T, φ), where T is the tree and φ is its embedding, produces a discrete probability measure τ on $\mathbb{R}^d$, with $\tau(x)$ equal to the embedded mass at $x \in \mathbb{R}^d$. The measure τ represents the mass distribution of the embedded tree. Since τ depends on the random tree T and the random embedding φ of T, τ is a *random measure*. The randomness can be described by a discrete probability measure $\mathcal{I}_N$ on the measures τ, with $\mathcal{I}_N(\tau)$ equal to the probability that the mass distribution τ occurs as the mass distribution of an embedded N-vertex tree. A random τ is depicted in Figure 6.

The measure $\mathcal{I}_N$ is a probability measure on probability measures on $\mathbb{R}^d$. This is fancier language than is really essential to understand finite N, but it is the right framework to describe the limit $N \to \infty$. The limit of $\mathcal{I}_N$ is a probability measure $\mathcal{I}$ on probability measures on $\mathbb{R}^d$, called integrated super-Brownian excursion (ISE). Its initial study and properties were developed by Aldous and by Le Gall. The measures on $\mathbb{R}^d$ represent mass distributions, and the measure $\mathcal{I}$ characterises their randomness. The convergence $\mathcal{I}_N \to \mathcal{I}$ is weak convergence, which means the following. Let $M_1(\mathbb{R}^d)$ denote the space of probability measures on $\mathbb{R}^d$, equipped with the topology of weak convergence of measures on $\mathbb{R}^d$. Then, given any bounded continuous real-valued function f on $M_1(\mathbb{R}^d)$,

$$\lim_{N\to\infty} \int_{M_1(\mathbb{R}^d)} f(\tau)\, d\mathcal{I}_N(\tau) = \int_{M_1(\mathbb{R}^d)} f(\tau)\, d\mathcal{I}(\tau). \tag{4}$$

In other words, the average of a function f of the discrete mass distributions converges to the average of f over random mass distributions that have the probability distribution of ISE. In this way, ISE describes the scaling limit of the embedded trees.

ISE represents a random mass distribution on $\mathbb{R}^d$. A natural question is: What is the average amount of mass located in an element dx? The answer is $f^{(1)}(x)dx$, where

$$f^{(1)}(x) = \int_0^\infty t e^{-t^2/2} p_t(x)\, dt, \tag{5}$$

and where we assume for simplicity that the offspring distribution ξ has variance $\sigma^2 = 1$.

The factor $p_t(x)$ has the interpretation that mass arrives at x at time t via a Brownian path. The time t is integrated over $[0, \infty)$ against the density $te^{-t^2/2}$, which accounts for the possible arrival times of mass at x. Similarly, the mean joint mass in $dx_1 dx_2$ is $f^{(2)}(x_1, x_2)dx_1 dx_2$, where

$$f^{(2)}(x_1, x_2) = \int_0^\infty \int_0^\infty \int_0^\infty \int_{\mathbb{R}^d} t e^{-t^2/2} p_{t_1}(y) \times p_{t_2}(x_1 - y) p_{t_3}(x_2 - y)\, dy\, dt_1 dt_2 dt_3 \tag{6}$$

with $t = t_1 + t_2 + t_3$. In (6), the intuition is that x_1 and x_2 have a common ancestor at time t_1. Equations (5) and (6) are the densities of the first and second *mean moment measures* of ISE. Similar formulas apply for the lth mean moment measures, for $l \geq 3$. Together the mean moment measures characterise ISE, and to prove weak convergence of a sequence of probability measures on $M_1(\mathbb{R}^d)$ to $\mathcal{I}$, it suffices to prove convergence of the mean moment measures.

The formulas (5) and (6) suggest that ISE has not completely forgotten that for $\mathcal{I}_N$ the underlying trees have a time variable indexed by generation number. The temporal structure is also apparent in Figure 7. Thus we might ask that the scaling limit retain the ancestral structure of the original trees, rather than just the overall mass distribution. We will come to this later. But first we discuss two examples where ISE arises.

Lattice Trees

A lattice tree on $\mathbb{Z}^d$ is a finite connected graph with no cycles, whose vertices are in $\mathbb{Z}^d$ and whose edges are chosen, for our purposes, from either

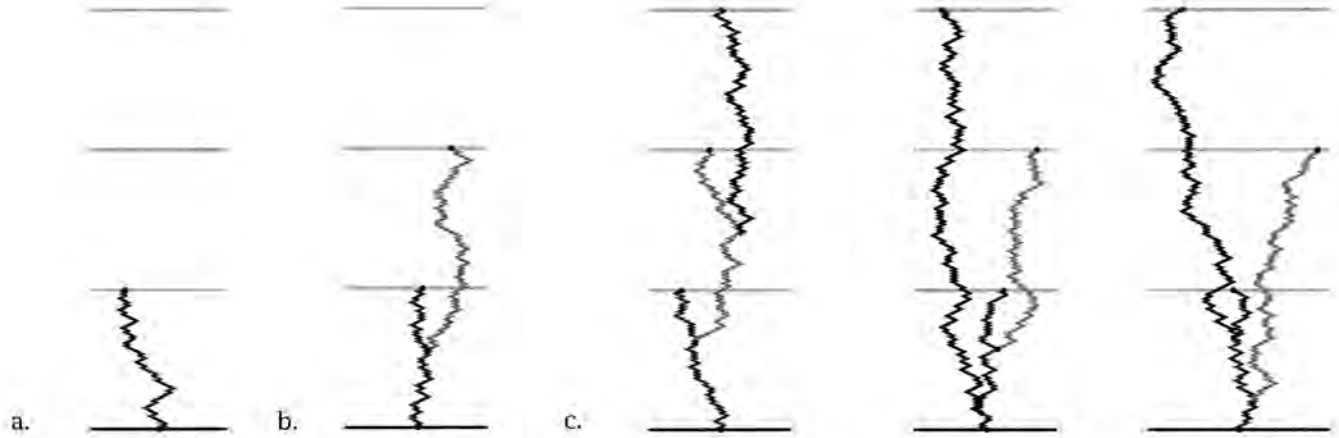

Figure 7. (a) Schematic representation of $f^{(1)}$ of (5), where the path corresponds to $p_t(x)$. (b) Schematic representation of $f^{(2)}$ of (6), where the three factors $p_t(x)$ of (6) correspond to the three paths. (c) For $f^{(3)}$, there are three terms, each with five factors $p_t(x)$.

$$\text{(7)} \qquad \begin{aligned} &\{\{x,y\} : x,y \in \mathbb{Z}^d,\ |x-y| = 1\} \\ \text{or}\quad &\{\{x,y\} : x,y \in \mathbb{Z}^d,\ 0 < \|x-y\|_\infty \le L\}, \end{aligned}$$

for some (large) $L \ge 1$. The first model is the *nearest-neighbour model* and the second is the *spread-out model.* We restrict attention to lattice trees that contain the origin, and we define a probability measure on the set of N-vertex lattice trees by declaring them to be equally likely. Lattice trees provide a good model of branched polymers, and they are also natural combinatorial objects. The hypothesis of universality suggests that scaling behaviour should be the same for both the nearest-neighbour and the spread-out models and be essentially independent of L for the spread-out models. Spread-out models are introduced because the small parameter L^{-1} is useful in applying the lace expansion, which is a perturbative method.

To construct a scaling limit of lattice trees, the correct spatial scaling must be used. A natural definition of length scale for N-vertex lattice trees is the root mean-squared radius of gyration[1] r_N. Numerical and other evidence supports the conjecture that r_N grows like a constant multiple of N^ν, for some dimension-dependent critical exponent ν. It is therefore natural to attempt to construct a scaling limit as follows. Given an N-vertex lattice tree in the rescaled lattice $cN^{-\nu}\mathbb{Z}^d$ for a suitable constant $c > 0$, define a discrete probability measure λ on $\mathbb{R}^d$ by placing mass N^{-1} at each vertex of the lattice tree. Let $\mathcal{J}_N$ be the probability measure on $M_1(\mathbb{R}^d)$ induced on the measures λ by the fact that each N-vertex lattice tree is equally likely. Thus λ represents the mass distribution of a random lattice tree in the rescaled lattice, with the randomness described by $\mathcal{J}_N$.

[1] *Given a lattice tree T, its squared radius of gyration $r(T)^2$ is the mean-squared distance of vertices in T to the centre of mass of T, and r_N^2 is the average of $r(T)^2$ over N-vertex lattice trees containing the origin.*

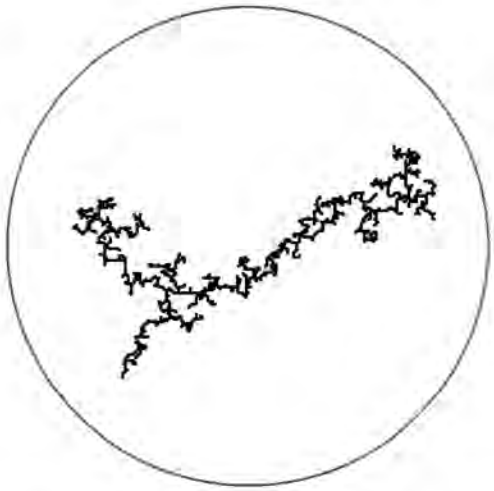

Figure 8. A random nearest-neighbour lattice tree on $\mathbb{Z}^2$ with $N = 1,000$ vertices. The circle has radius $N^{0.64}$. The tree was generated using an algorithm of Janse van Rensburg and Madras.

It follows from a result of Dawson, Iscoe, and Perkins that a random mass distribution under ISE is almost surely supported on a set of Hausdorff dimension 4, in dimensions above 4. An analogue of the rough argument discussed above for the self-avoiding walk led Aldous to conjecture that lattice trees should have ISE as scaling limit in dimensions $d > 8 = 4 + 4$. The conjecture captures the idea that in dimensions $d > 8$ there should be little qualitative difference between embedded critical Galton-Watson trees that can have many vertices per lattice site and lattice trees that can have only one. Consistent with the conjecture, in 1992 Hara and Slade showed that r_N scales like $N^{1/4}$ in dimensions $d > 8$ for spread-out models with L

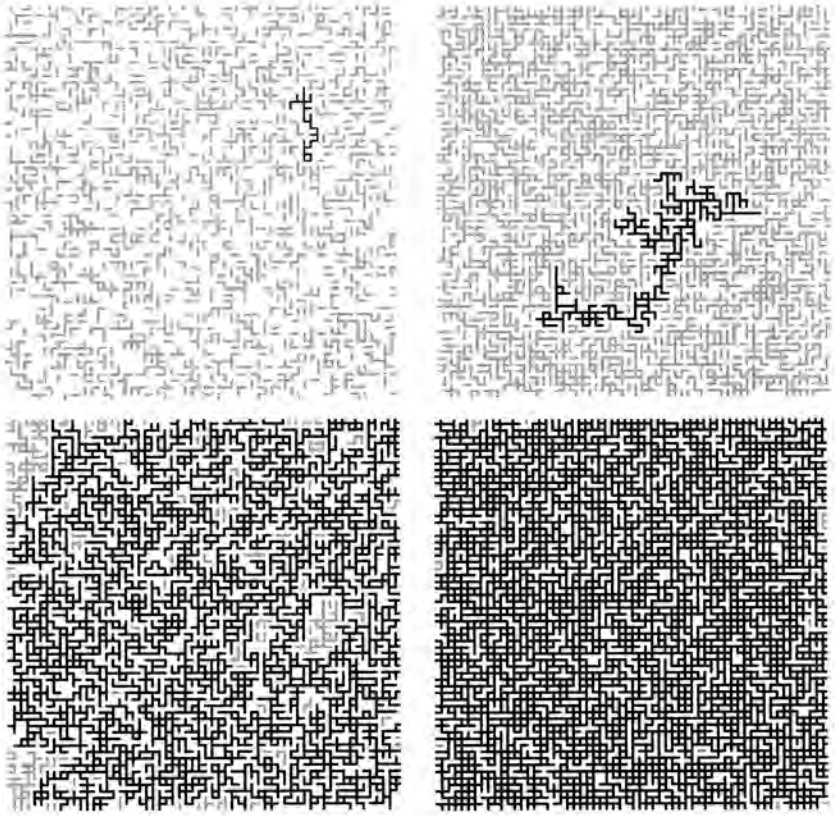

Figure 9. Nearest-neighbour bond percolation configurations on a 60×60 piece of the square lattice $\mathbb{Z}^2$ for $p = 0.25$, $p = 0.45$, $p = 0.55$, and $p = 0.75$. For the square lattice, $p_c = \frac{1}{2}$. The largest cluster in each figure is darkened.

sufficiently large (depending on d) and for the nearest-neighbour model in dimensions much higher than 8. Under the same assumptions on the dimension, Derbez and Slade proved in 1998 that $\mathcal{J}_N \to \mathcal{I}$ weakly, in the sense of (4). The proof uses an adaptation of the lace expansion to lattice trees to prove convergence of all the moment measures of $\mathcal{J}_N$ to the moment measures of $\mathcal{I}$.

For $d < 8$, the scaling limit is predicted to be dimension-dependent and not to be ISE (contrast the 2-dimensional Figures 6 and 8). The limiting processes are not known.

Percolation

Percolation was introduced by Broadbent and Hammersley in 1957 as a model of fluid flow in a random medium. For our purposes, the setting for bond percolation is the infinite graph with vertex set $\mathbb{Z}^d$ and edge set given by either possibility of (7). Edges are now called *bonds*. To each bond b is associated a random variable n_b that takes the value 1 (b is *occupied*) with probability p and the value 0 (b is *vacant*) with probability $1 - p$. Here p is a parameter in the interval $[0, 1]$, and the random variables n_b are independent. Occupied bonds are interpreted as permitting fluid flow, whereas vacant bonds are blocked. The focus is on the geometry of the connected clusters of occupied bonds. What makes this model interesting is that it undergoes a phase transition. For $d \geq 2$, there is a critical value $p_c \in (0, 1)$ such that for $p < p_c$ there is no infinite cluster with probability 1, while for $p > p_c$ there exists a unique infinite cluster with probability 1 ("percolation occurs"). The phase transition is apparent in Figure 9. It is analogous to the transition in a Galton-Watson branching process as the mean of the offspring distribution is varied through $m = 1$. The conjecture that an infinite cluster occurs with probability zero when $p = p_c$ is widely and strongly believed. However, proofs[2] remain restricted to dimensions $d = 2$ and $d \geq 19$ for nearest-neighbour models and to $d > 6$ for spread-out models with $L \gg 1$. A general proof in arbitrary dimensions remains a central outstanding problem in the field.

Let us concentrate on the critical value $p = p_c$, and assume that percolation does not occur. This presents a delicate situation in which there is no infinite cluster, but the slightest increase in the bond density p would create an infinite cluster. The term "incipient infinite cluster" is used with various meanings to refer to the emerging structures that are poised to appear, when p is exactly critical. One approach to studying this is to investigate the scaling limit of $C(0)$, the random set of vertices in $\mathbb{Z}^d$ that are connected to 0 by paths consisting of occupied bonds; see Figure 10.

Given a set A containing N vertices that is a possible candidate for $C(0)$, we define a discrete probability measure $\pi \in M_1(\mathbb{R}^d)$ by assigning mass N^{-1} to each vertex in $cN^{-1/4}A$, for a suitable constant c. The spatial scaling $N^{-1/4}$ is ISE scaling and is expected to be the correct scaling for $C(0)$ only in dimensions $d > 6$. We then define a probability measure $\mathcal{P}_N$ on $M_1(\mathbb{R}^d)$ by defining $\mathcal{P}_N(\pi)$ to equal the conditional probability that $C(0) = A$ given $|C(0)| = N$. In other words, $\mathcal{P}_N$ gives the distribution of rescaled mass profiles that arise from critical percolation clusters that are conditioned to contain exactly N vertices. Hara and Slade conjectured that $\mathcal{P}_N \to \mathcal{I}$ weakly for $d > 6$ and partially proved the conjecture by showing that for the nearest-neighbour model in dimensions much higher than 6 the first and second moment measures of $\mathcal{P}_N$ converge to those of $\mathcal{I}$ (see (5) and (6)). A weaker statement links $\mathcal{P}_N$ to $\mathcal{I}$ for spread-out models with $d > 6$ and $L \gg 1$. The proof uses the lace expansion. The critical dimension 6 arises in the proof as the dimension above which an ISE cluster and a Brownian path typically do not intersect, which is

[2] *The final step for $d = 2$ was obtained by Kesten in 1980, following earlier work of Harris, Russo, and Seymour and Welsh. The high-dimensional results are due to a combination of theorems of Barsky and Aizenman and of Hara and Slade.*

above dimension $6 = 4 + 2$. This is more subtle than the formula $8 = 4 + 4$ that arises for lattice trees.

It is believed that different, unknown scaling limits apply when $3 \le d < 6$. Celebrated recent results of Smirnov and of Lawler, Schramm, and Werner prove that for critical site percolation on the 2-dimensional triangular lattice the scaling limit has a conformal invariance property and is described by the stochastic Loewner evolution with parameter 6 (SLE_6). Universality suggests that the same should be true for critical bond percolation on $\mathbb{Z}^2$.

Canonical Measure of Super-Brownian Motion

We return now to the question of the scaling limit of embedded Galton–Watson trees. Previously, with ISE, we considered trees consisting of N vertices and kept track of the mass distribution of the embedded vertices. In so doing, we worked with probability measures on $\mathbb{R}^d$ that fixed the overall mass to be 1. Also, we lost information about the time evolution inherent in the underlying trees. Now, we want to revisit the scaling limit in such a way that the limiting object experiences a time evolution and has a random mass.

Let T be a critical Galton–Watson tree. We make no assumption about the total number of vertices in T. Typically, T will have few vertices, but we are most interested in the rare, long-lived trees like the examples in Figure 4. Let T_0 denote the initial individual in the 0th generation, let T_1 denote the offspring of the initial individual, and more generally, let T_m denote the individuals of generation m. Since T is finite, eventually $T_m = \varnothing$. We regard m as a discrete time variable.

Fix a large integer n, the scaling variable. We will select embedded trees that survive for order n generations, in the limit $n \to \infty$. This involves four simultaneous scalings, as follows.

- *Scaling of time.* We rescale time to a new time variable $t = \frac{m}{n}$. This fixes attention on the individuals T_m in generations m of order n.
- *Scaling of space.* If we embed a tree into $\mathbb{Z}^d$ according to the previous rules that T_0 is embedded at the origin, and an individual is embedded at a random neighbour of its parent, then an individual in generation n (if T lives so long) is embedded at the endpoint of an n-step random walk path. Such a point is typically at distance order $n^{1/2}$ from the origin, so we rescale the lattice to $n^{-1/2}\mathbb{Z}^d$.
- *Scaling of mass.* A critical tree that survives to a generation of order n typically has order n members in that generation. To obtain a generation mass of order 1, we assign mass n^{-1} to each embedded vertex.
- *Scaling of probability.* By Kolmogorov's theorem, the probability that a critical tree survives for order n generations is of order n^{-1}. The large trees of interest thus have a vanishingly small probability. To compensate, we multiply probabilities by n, so that survival to order n generations will have measure of order 1, rather than probability of order n^{-1}. This produces an unnormalised measure, rather than a probability measure.

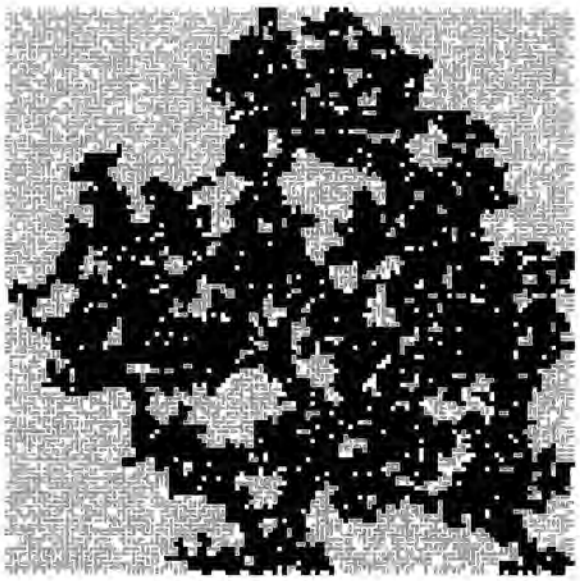

Figure 10. The connected cluster $C(0)$ of the origin consists of vertices that are joined to the origin by a path consisting of occupied bonds. Here $p = p_c = \frac{1}{2}$ for $\mathbb{Z}^2$, and the vertices in $C(0)$ are depicted by dark pixels. It is a rare event that $C(0)$ is so large at the critical point.

The above is carried out, in detail, as follows. Given a critical Galton–Watson tree T and an embedding of T into $n^{-1/2}\mathbb{Z}^d$, we denote by $R_n^{(m/n)}$ the mass distribution in $n^{-1/2}\mathbb{Z}^d$ of the mth generation T_m of T. Explicitly, $R_n^{(m/n)}$ is the discrete finite measure on $\mathbb{R}^d$ that places mass n^{-1} at each embedded vertex of T_m, with multiplicity. Note that $R_n^{(m/n)}$ need not be a probability measure. The measure $R_n^{(m/n)}$ is a *random measure*, since T and its embedding are random. Let $\mathcal{R}_n^{(m/n)}$ denote the probability law of this random measure. Thus $\mathcal{R}_n^{(m/n)}$ is a probability measure on the space $M(\mathbb{R}^d)$ of finite measures on $\mathbb{R}^d$, which quantifies how likely it is that a particular mass distribution occurs as the embedding in $n^{-1/2}\mathbb{Z}^d$ of the mth generation of a critical Galton–Watson tree. So far, we have rescaled generation m to time m/n, space to $n^{-1/2}\mathbb{Z}^d$, and vertex mass has been set equal to n^{-1}.

It remains to scale the probability measure $\mathcal{R}_n^{(m/n)}$. Think of m of order n. The random measure $R_n^{(m/n)}$ is the zero measure on $\mathbb{R}^d$ with probability $1 - O(n^{-1})$, since the probability of survival for m generations is order $m^{-1} \approx n^{-1}$. To amplify the rare event of survival to m generations, we consider the measure $n\mathcal{R}_n^{(m/n)}$ on $M(\mathbb{R}^d)$, which has total measure n. This measure places measure $n - O(1)$ on the zero measure on $\mathbb{R}^d$ and the

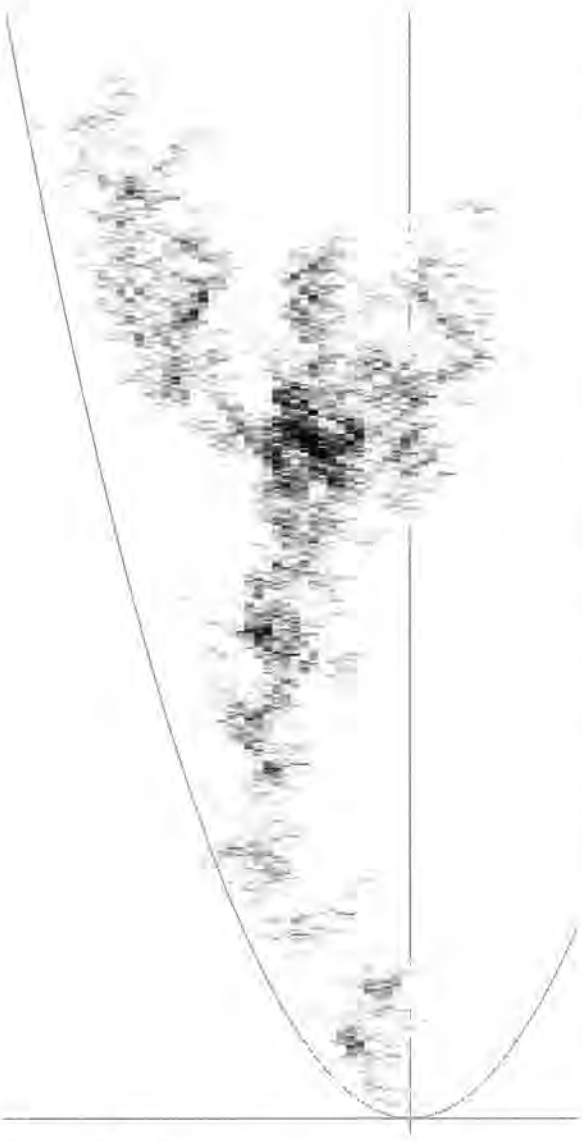

Figure 11. The evolution of a random mass distribution under the canonical measure, with time vertical and 1-dimensional space horizontal. Darker shading represents higher mass, and the parabola $t = x^2$ shows the spatial scaling. The mass distribution arises from an embedding of a large critical tree like those in Figure 4. A superposition of all the mass onto the spatial axis produces a random mass distribution, whose total mass K is a random variable. The superposition, with mass rescaled by K^{-1} and space rescaled by $K^{-1/4}$, has the same distribution as ISE, depicted in Figure 6.

remaining measure $O(1)$ on the nontrivial mass distributions due to the rare trees that survive for m generations. It can be shown that the limit of $n\mathcal{R}_n^{(\lfloor tn \rfloor/n)}$, as $n \to \infty$, consists of an infinite point mass on the zero measure on $\mathbb{R}^d$, plus a nontrivial finite measure $\mathcal{R}^{(t)}$ on $M_0(\mathbb{R}^d)$, the finite measures on $\mathbb{R}^d$ excluding the zero measure. More precisely, there is a measure $\mathcal{R}^{(t)}$ on $M_0(\mathbb{R}^d)$ such that $n\mathcal{R}_n^{(\lfloor tn \rfloor/n)}$ converges weakly to $\mathcal{R}^{(t)}$ plus an infinite point mass on the zero measure on $\mathbb{R}^d$. This means that for every bounded continuous function f on $M_0(\mathbb{R}^d)$,

$$\lim_{n\to\infty} n \int_{M_0(\mathbb{R}^d)} f(R)\, d\mathcal{R}_n^{(\lfloor tn \rfloor/n)}(R) = \int_{M_0(\mathbb{R}^d)} f(R)\, d\mathcal{R}^{(t)}(R). \tag{8}$$

In other words, the average of a function over the interesting, long-lived, random configurations of the discrete mass distribution defined by $\mathcal{R}_n^{(\lfloor tn \rfloor/n)}$ converges to a corresponding average over the random configurations of the continuous mass distribution defined by $\mathcal{R}^{(t)}$. The family of measures $\mathcal{R}^{(t)}$, for $t > 0$, is intimately related to the canonical measure of super-Brownian motion.

The *canonical measure* $\mathcal{N}$ describes the evolution in continuous time of a mass distribution on $\mathbb{R}^d$ arising from a single initial individual at the origin whose progeny survives for some positive time. Thus $\mathcal{N}$ is a measure on functions $Y^{(\cdot)}$ from the time interval $[0, \infty)$ into finite measures on $\mathbb{R}^d$. A representative measure-valued path $Y^{(\cdot)}$ is illustrated in Figure 11. For a specific time $t > 0$, and restricted to configurations that have not died out by time t, the distribution of $Y^{(t)}$ under the canonical measure is given by $\mathcal{R}^{(t)}$.

The moment measures of ISE have natural analogues for the canonical measure of super-Brownian motion. The first mean moment measure describes the average amount of mass in an element dx at time t and is equal to $g_t^{(1)}(x)dx$, where

$$g_t^{(1)}(x) = p_t(x). \tag{9}$$

This is consistent with mass arriving at x at time t via a Brownian path started from the origin of $\mathbb{R}^d$. The second mean moment measure describes the average amount of mass in dx_1 at time t_1 and in dx_2 at time t_2 and is equal to $g_{t_1,t_2}^{(2)}(x_1, x_2)dx_1 dx_2$, where

$$g_{t_1,t_2}^{(2)}(x_1, x_2) = \int_0^{\min\{t_1,t_2\}} \int_{\mathbb{R}^d} p_s(y) \times p_{t_1-s}(x_1 - y)p_{t_2-s}(x_2 - y)dy\, ds. \tag{10}$$

Here, we have again taken the variance of the offspring distribution ξ to be $\sigma^2 = 1$. Similar explicit formulas can also be given for the higher mean moment measures. Figure 7 provides a schematic representation for the $g^{(l)}$ as well as the $f^{(l)}$. Convergence of the moment measures is one possible statement of convergence to the canonical measure, and we will see it used below.

Super-Brownian Motion

The canonical measure describes a situation in which all particles are descendants of a single initial particle subject to critical branching. In the discrete setting, instead of starting with a single

particle and amplifying the rare event of survival to time n by multiplying probabilities by n, we may instead start with order n initial particles located at distances within order 1 from the origin in $n^{-1/2}\mathbb{Z}^d$ (so within order $n^{1/2}$ lattice spacings from the origin). Each initial particle has probability asymptotically proportional to n^{-1} to have progeny that survive to a time of order n and thus remain visible in the scaling limit. In rescaled continuous time, order ϵ^{-1} of the initial particles will have progeny that survive to time ϵ for small ϵ, but only order 1 particles will have progeny that survive to time 1.

After taking the scaling limit, the family tree of each survivor corresponds to an evolution under the canonical measure. The initial state is now given by a finite measure on $\mathbb{R}^d$, rather than a single initial particle. The resulting evolving random measure $X^{(t)}$ is a Markov process with state space $M(\mathbb{R}^d)$, and it is essentially built from independent copies of the canonical measure. It is the Markov process $X^{(\cdot)}$ that is usually referred to as super-Brownian motion. The evolution of $X^{(t)}$ is governed by a nonlinear partial differential equation.[3]

Next, we discuss three more examples that lie in the domain of attraction of super-Brownian motion.

Oriented Percolation

Percolation models can be defined on any infinite graph. A much-studied example is oriented, or directed, percolation. Oriented percolation takes place on the graph with vertex set $\mathbb{Z}^d \times \mathbb{N}$. The bonds are directed bonds of the form $((x,n),(y,n+1))$, with $\{x,y\}$ chosen from one of the two options in (7) and with $n \geq 0$ corresponding to a discrete time variable. Bonds are again occupied with probability p, but now a vertex (x,n) is in the connected cluster $C(0,0)$ of the origin if and only if it can be reached from the origin by a *directed* path consisting of occupied bonds. See Figure 12. For $d \geq 1$, this model undergoes a phase transition as in the nonoriented case, at a critical value $p_c \in (0,1)$. For oriented percolation, it was proved by Bezuidenhout and Grimmett that $C(0,0)$ is almost surely finite when $p = p_c$, for any $d \geq 1$.

The cluster $C(0,0)$ is somewhat similar to the embedding of a Galton–Watson tree. However, an important difference is that for oriented percolation there is no multiple occupation of a vertex by $C(0,0)$ at a given time, whereas a tree can have several distinct vertices simultaneously embedded at the same location. This difference would appear to diminish as the dimension increases, and one might expect that critical oriented percolation should behave like super-Brownian motion in sufficiently high dimensions. This is the case.

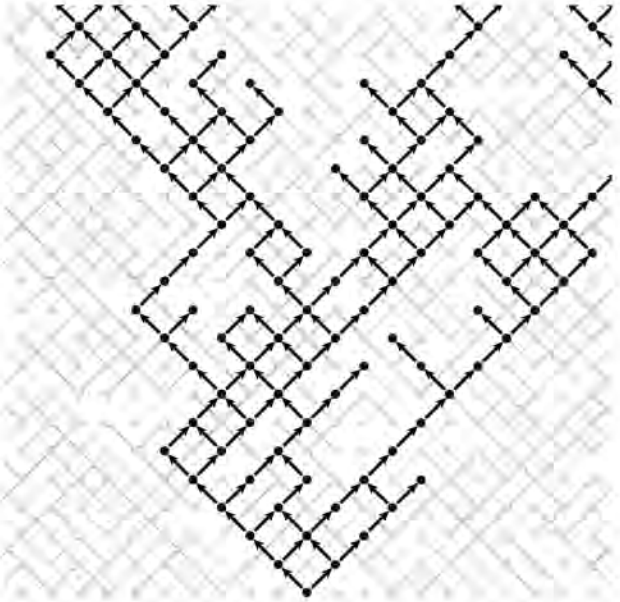

Figure 12. The connected cluster $C(0,0)$ of the origin for oriented percolation. Here $p = 0.7$ is a little above $p_c \approx 0.645$. For the nearest-neighbour model depicted, the lattice decomposes into two noncommunicating lattices. This will not be the case for the spread-out model when $L \geq 2$.

Consider the random cluster $C(0,0)$ of the origin, when $p = p_c$, and apply the four scalings of time, space, mass, and probability that were used in the construction of the canonical measure for super-Brownian motion. For spread-out models in dimensions $d > 4$ with $L \gg 1$, van der Hofstad and Slade used the lace expansion to prove that all the rescaled mean moment measures of critical oriented percolation converge to those of the canonical measure of super-Brownian motion (see (9) and (10)). In the proof, the critical dimension 4 appears as the dimension above which the graphs of independent super-Brownian motion and Brownian motion do not intersect. Different, unknown scaling limits are expected when $d < 4$.

Contact Process

The contact process is a model of an infection that spreads via contact with an infected neighbour. It has been studied for close to thirty years and is a basic example in the field of interacting particle systems. A particle is located at each vertex of $\mathbb{Z}^d$, and the process evolves over the continuous time interval $[0,\infty)$. Each particle is either healthy (state 0) or infected (state 1), so the state of the system at time t is defined by a mapping $\xi_t : \mathbb{Z}^d \to \{0,1\}$. Each

[3] *In this respect, it is noteworthy that the classical representation of the solution of the boundary-value problem for the Laplace equation $\Delta u = 0$ in terms of Brownian motion has an extension, due to Dynkin, to a representation of the solution of the boundary-value problem for the nonlinear equation $\Delta u = u^2$ in terms of super-Brownian motion.*

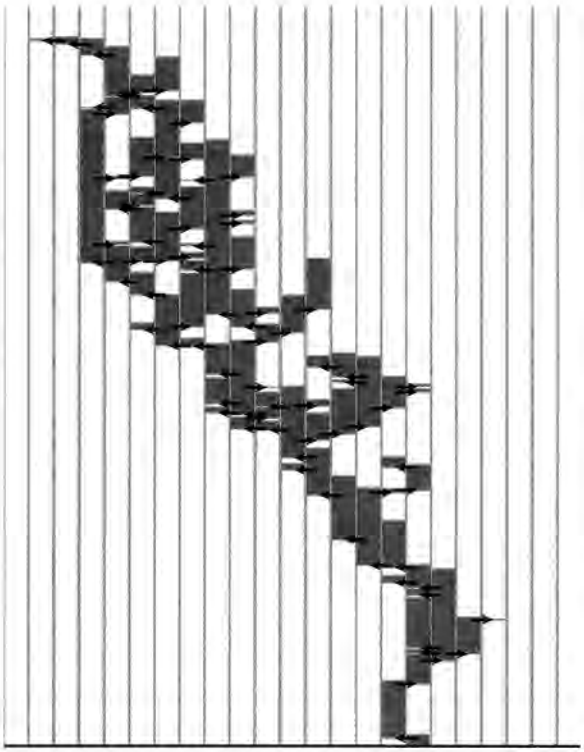

Figure 13. The contact process on $\mathbb{Z}^1$ with nearest-neighbour infections. Here $\beta = 1.6 < \beta_c \approx 1.65$. The legacy of infection of a single infected individual at time zero is shaded. Arrows show successful attempts at infection.

vertex $x \in \mathbb{Z}^d$ has two alarm clocks:[4] a recovery clock that randomly rings at rate 1 and an infection clock that randomly rings at rate β. All clocks ring independently, and a clock resets itself immediately after ringing. If the particle at x is infected when its recovery clock rings, it becomes healthy spontaneously at that time. If the particle at x is infected when its infection clock rings, it chooses a random neighbour at that moment and infects the neighbour if the neighbour is healthy and does nothing otherwise. Neighbours are defined via either alternative of (7). Nothing happens if one of a healthy particle's clocks rings. The process is depicted in Figure 13.

The contact process undergoes a phase transition in the sense that there is a critical value β_c such that an infection started from a single infected individual will die out in finite time when $\beta < \beta_c$, whereas for $\beta > \beta_c$ there is a positive probability of survival for all time. Bezuidenhout and Grimmett proved that, as in oriented percolation, the infection also dies out when $\beta = \beta_c$. Our focus is on scaling limits for the critical case $\beta = \beta_c$.

[4] *The statement that a clock randomly rings at rate β means that the time between rings is an exponential random variable with mean β^{-1}, i.e., with probability density function $\beta e^{-\beta x}$ $(x \geq 0)$. In other words, the clock rings according to a Poisson process.*

In 1999, Durrett and Perkins studied the scaling limit of the critical spread-out contact process, but with an additional new scaling. The infection range $L = L_n$ of (7) is no longer independent of n but increases as $L_n = n^{1/d}$ for $d \geq 3$, and $L_n = (n \log n)^{1/2}$ for $d = 2$. Time and mass are scaled as usual by n and n^{-1}, and now the spatial lattice is rescaled to $n^{-1/2} L_n^{-1} \mathbb{Z}^d$. Given an initial condition ξ_0 whose rescaled mass distribution converges to a finite measure $X^{(0)}$ as $n \to \infty$, Durrett and Perkins proved a full statement of convergence to super-Brownian motion, going beyond convergence of moment measures, for all dimensions $d \geq 2$. Thus the legacy of infection of the initially infected individuals is described by the evolution of super-Brownian motion, under the above scaling.

Scaling the infection range can affect the limiting distribution, and it is believed that the finite range (fixed L) critical contact process converges to super-Brownian motion above dimension 4 but not below. Oriented percolation can be regarded as a discrete time version of the contact process, and it is likely that the results described above for oriented percolation could be extended to the finite range contact process for $d > 4$, using an observation of Sakai. For finite-range infection in dimensions $d < 4$, it is not known what the scaling limit should be.

Voter Model

The voter model is a model of the spread of opinion, where an individual's opinion is affected by its neighbours' opinions. Like the contact process, the voter model has been studied for about thirty years and is a basic example of an interacting particle system. An individual is located at each vertex $x \in \mathbb{Z}^d$ and holds either opinion 0 or opinion 1. Each individual has an alarm clock that randomly rings at rate 1, and all clocks are independent. When the clock of the individual at x rings, the individual spontaneously adopts the opinion of a randomly selected neighbour, leaving the neighbour's opinion unchanged. No change occurs if the opinions of x and y already agree when the clock rings. The state of the system at time t is thus described by a mapping $\eta_t : \mathbb{Z}^d \to \{0, 1\}$. There is no parameter in the model.

Cox, Durrett, and Perkins studied the scaling limit of the nearest-neighbour voter model, with time speeded up by a factor n and the lattice spacing rescaled to $n^{-1/2}$. In dimensions $d \geq 3$, mass n^{-1} is placed at each vertex x holding opinion 1, whereas for $d = 2$ mass $n^{-1} \log n$ is used instead. Given an initial condition η_0 whose rescaled mass distribution converges to a finite measure $X^{(0)}$ as $n \to \infty$, Cox, Durrett, and Perkins proved that the scaling limit is super-Brownian motion started from $X^{(0)}$. They also proved related results treating long-range voter models. The dimension $d = 2$

arises in this work as the borderline between recurrence and transience of random walk.

Bramson, Cox, and Le Gall have applied the above theorem to relate the voter model to the canonical measure of super-Brownian motion. They consider an initial condition in which the origin has opinion 1 and all other vertices have opinion 0 and condition on the unlikely event that opinion 1 survives until time $t = n$. For $d \geq 2$, under the above scaling, they prove that the probability law of the mass distribution of the individuals holding opinion 1 at time n converges to the canonical measure of super-Brownian motion at time 1, conditioned to survive until time 1.

Concluding Remarks

Super-Brownian motion is a rich and beautiful mathematical structure that models the randomly evolving mass distribution of populations that undergo critical branching and spatial diffusion. The five examples discussed above show that it is a universal object arising as a scaling limit in models from combinatorics, statistical mechanics, and interacting particle systems. Much more can be said, for example, concerning its connections with nonlinear partial differential equations and its representation in terms of Le Gall's Brownian snake. These and other topics can be found in the books and major reviews in the references.

Acknowledgments

Much of my understanding of super-Brownian motion is a result of collaborations with Eric Derbez, Takashi Hara, and Remco van der Hofstad. Timely pointers from David Aldous and Jean-François Le Gall and numerous clarifications from Ed Perkins are also gratefully acknowledged. This work was supported in part by NSERC of Canada.

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Max Dehn, Kurt Gödel, and the Trans-Siberian Escape Route

John W. Dawson Jr.

This article contains the text of an invited address prepared for a special session on the exodus of mathematicians from Nazi-occupied territories, held in Vienna in mid-September 2001 as part of a joint meeting of the Deutsche Mathematiker-Vereinigung and the Österreichische Mathematische Gesellschaft. Awareness of how difficult it was for those caught up in the rise of Nazism to escape from the terrors they experienced was reinforced by the terrorist attacks of September 11, which prevented the author's attendance at the conference. He is grateful to Professor Karl Sigmund of the University of Vienna for having read the paper in his absence and to Professor Michael Drmota for granting permission for its reprinting here. It originally appeared in the April 2002 issue of the Internationale Mathematische Nachrichten.

The careers of Max Dehn and Kurt Gödel followed very different trajectories. Yet Dehn and Gödel were linked by one historical circumstance: They were the only mathematicians of stature to flee the scourge of Nazism via the trans-Siberian railway. The stories of their escapes and the contrasts in their situations before and after their emigration exemplify both the perils and the limited range of opportunities that confronted intellectual refugees of the Holocaust.

In 1940 Max Dehn and Kurt Gödel each left Europe, never to return. Dehn was then a distinguished topologist nearing the end of his academic career, while Gödel was a young *Privatdozent* who had only recently burst into prominence for his startling discoveries in mathematical logic. Dehn was a Jew. Gödel was not. And their personalities were starkly opposed: Whereas Dehn was an outgoing, generous man, esteemed by students and colleagues alike for his humanity, his breadth of intellectual and cultural interests, and his love and knowledge of the outdoors, Gödel was a reclusive hypochondriac who had few close friends, worked in isolation, and suffered recurrent bouts of mental illness. Nevertheless, in a few respects their careers were similar: Both solved problems on Hilbert's famous list [16]; both published important papers on decision problems; and both, by force of circumstance, emigrated to America via the trans-Siberian railway.

The disparity between the situations of Dehn and Gödel prior to their emigration exemplifies the diversity of backgrounds among the mathematicians who fled Hitler. The circumstances of their escapes highlight the dislocations, difficulties, and dangers such emigrés faced. And the contrast in their subsequent careers in America is illustrative of the range of institutions in the United States that provided havens for intellectual refugees.

Dehn's European Career

As yet there is no full-length biography of Max Dehn, nor a collective edition of all of his published works. But several shorter articles provide details of his life and mathematical accomplishments. For the present brief survey I have drawn primarily on [13], [15], and, especially, the chapter on Hilbert's third problem in [16].

Dehn was born November 13, 1878, in Hamburg, one of eight children of a physician, Maximilian Moses Dehn. According to Max's son Helmut, the family were secularized Jews who "lived by principles that some...would call 'good Christian'", and who did not think of themselves as Jewish until the Nazis came to power [16, p. 118]. After graduating from the *Gymnasium* in Hamburg, Max went first to Freiburg and later to Göttingen, where he

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received his doctorate in 1900 under Hilbert's supervision. In his dissertation he established that the Archimedean postulate is essential in order to prove in neutral geometry that the sum of the angles of a triangle does not exceed 180° (Legendre's theorem).

Later that same year, soon after Hilbert's address on "Problems of Mathematics" at the International Congress of Mathematicians in Paris (and before the appearance of its printed version, in which the list of problems was expanded from ten to twenty-three), Dehn established a related result that solved the third of the published problems (one of those left unstated during the lecture [8]): By exhibiting two tetrahedra with the same base and height that are neither equidecomposable into finite, congruent parts nor equicomplementable by such parts to produce two polyhedra that are equidecomposable, he demonstrated that the Archimedean postulate is also needed in order to prove that two tetrahedra of equal base and height have equal volumes.

For his solution of Hilbert's third problem Dehn was awarded his *Habilitation* at Münster, where he served as a *Privatdozent* from 1901 until 1911. In 1907 he was coauthor with Poul Heegaard of the influential survey article "Analysis situs" in the *Enzyklopädie der mathematischen Wissenschaften.* In 1910 he introduced the so-called "Dehn diagrams" for groups and published a fundamental paper on the topology of 3-dimensional space, which included the result that has since come to be known as "Dehn's lemma" (though with a proof later seen to be faulty) and the technique now called "Dehn surgery". That paper also introduced the word and conjugacy (decision) problems for groups, which Dehn explored further in two subsequent papers, the second of which employed an algorithm now named after him.

From 1911–1913 Dehn was *Extraordinarius* at Kiel, and from 1913–1921 *Ordinarius* at Breslau. On August 23, 1912, he married Toni Landau, who bore him three children during their years in Breslau. In 1914 Dehn published a proof that a trefoil knot is not continuously deformable into its mirror image—an important early result in knot theory. Then, from 1915–1918, his work was interrupted by army service.

In 1921 Dehn succeeded Ludwig Bieberbach as *Ordinarius* at Frankfurt, and the following year he founded a seminar there on the history of mathematics, whose history and significance, as well as Dehn's leadership role in it, is poignantly recounted in the memoir by Siegel cited above [13]. Dehn continued to direct the seminar until 1935, when, at age 56, the Nazis forced him to retire (later than most, due to his earlier war service).

After his removal from the university Dehn continued to live in Frankfurt for another three years. For a time he received a pension and traveled to various European countries to lecture. He also continued to publish, including an important paper that appeared in 1938, in which he introduced the notion now referred to as "Dehn twists". By 1936, however, he had prudently sent his children out of reach of the Nazis, his son Helmut to the United States and his daughters Maria and Eva to a boarding school in Kent, England, where Dehn himself taught from January to April of 1938.

Later that spring Dehn returned to Frankfurt — a fateful act, as it turned out, for on November 11, 1938 (the morning after *Kristallnacht*) he was arrested by Nazi agents and taken to a local detention center. Providentially, however, he was released later that day, so many having been rounded up that there was no place to hold them all.

Subject to imminent re-arrest and deportation, Dehn and his wife immediately fled to Bad Homburg, where they were given shelter by his friend and colleague Willi Hartner; and there, in the company of Hartner and Siegel, Dehn celebrated his sixtieth birthday. Hartner recalled the occasion years later in a newspaper tribute to Dehn [9]: "Unforgettable for those who saw him at the time was his calmness, his philosophical composure. For the conversations centered not on the events of the day, but on the relationship of mathematics to art, on problems of archaeology, and finally on the concept of humanity of Confucius."

Once the brutal initial phase of the pogrom in Frankfurt ended, Dehn and his wife, with the assistance of Albert Magnus (son of Dehn's student and colleague, Wilhelm Magnus), managed to escape by train through Frankfurt to Hamburg, where they hid for a few weeks at the home of one of Dehn's older sisters who had been left unmolested because of her age. From there, with further help from Siegel and "a Danish colleague and former student of Dehn's" [15] — perhaps Jakob Nielsen — a way was found for the Dehns to escape to Denmark and from there to Norway. In January 1939 they reached Copenhagen, and not long afterward Dehn secured a temporary position at the *Technische Hochschule* in Trondheim as a replacement for Viggo Brun, who was then on leave.

Until March 1, 1940, when the Nazis invaded Norway, the Dehns were relatively safe. Financially, however, their situation was precarious. Before leaving Germany Dehn had been forced to sell his library and much of his furniture at great loss. He was, of course, paid by the *Hochschule* in Trondheim, and from the university in Frankfurt he somehow managed to obtain an official leave of absence, valid from April 1, 1939, until June 30, 1940, that enabled his pension payments to continue. They were credited, however, to an account in Hamburg from which disbursements could only be made to parties within the Reich, so that he was

unable to pay storage charges on what little furniture and other personal effects he had been able to ship to London. Consequently, they too were lost.

When the Nazis invaded Trondheim, the Dehns fled to the nearby countryside. But actions against the Jews there quickly subsided, so after a short time the Dehns moved back to the city, apparently with little effort at concealment. Indeed, correspondence preserved among Dehn's papers at the University of Texas includes a letter he wrote from Trondheim on June 5, 1940, requesting an extension of his leave of absence, and another dated August 29, 1940, informing the German authorities of his move to Hvalstad, near Oslo.

Under the circumstances it seems extraordinary that Dehn continued to behave as "a good German", dutifully making his whereabouts known and seeking official permission to remain longer in Norway. Perhaps he knew how long it would take for the Nazi bureaucracy to respond. In the meantime, with the help of Ernst Hellinger and other former colleagues who had escaped to the United States, he was making preparations for his own long journey to America.

Gödel's Life Prior to Emigration

Several sources provide details of Gödel's life and work. [1] is a full-length biography, while the introductory essay [6] in the first volume of Gödel's *Collected Works* is an excellent shorter survey.

Briefly, Gödel was born April 28, 1906, in Brno, Moravia, where he spent his youth. After graduating from the *Realgymnasium* there, he entered the University of Vienna in the autumn of 1924. Influenced especially by the lectures of Phillip Furtwängler and Hans Hahn, he soon switched from physics to mathematics and became active in the mathematical colloquium directed by Karl Menger. For a time he also attended meetings of Moritz Schlick's seminar, later to become famous as the Vienna Circle.

Unusually for the time, Gödel never enrolled in courses at any other university. In 1929 he was granted Austrian citizenship, and that same year he submitted his doctoral dissertation to Hahn. In it he established the semantic completeness of countable first-order theories. He was awarded the degree of Dr.Phil. on February 6, 1930.

The following September, at a conference in Königsberg, Gödel gave the first, somewhat veiled, announcement of his first incompleteness theorem. The second followed soon thereafter, and both were published in his epochal paper [7], which became his *Habilitationsschrift*. In 1933 he was granted his *Dozentur*, and that fall he accepted an invitation to spend the academic year 1933–1934 in Princeton, at the newly founded Institute for Advanced Study.

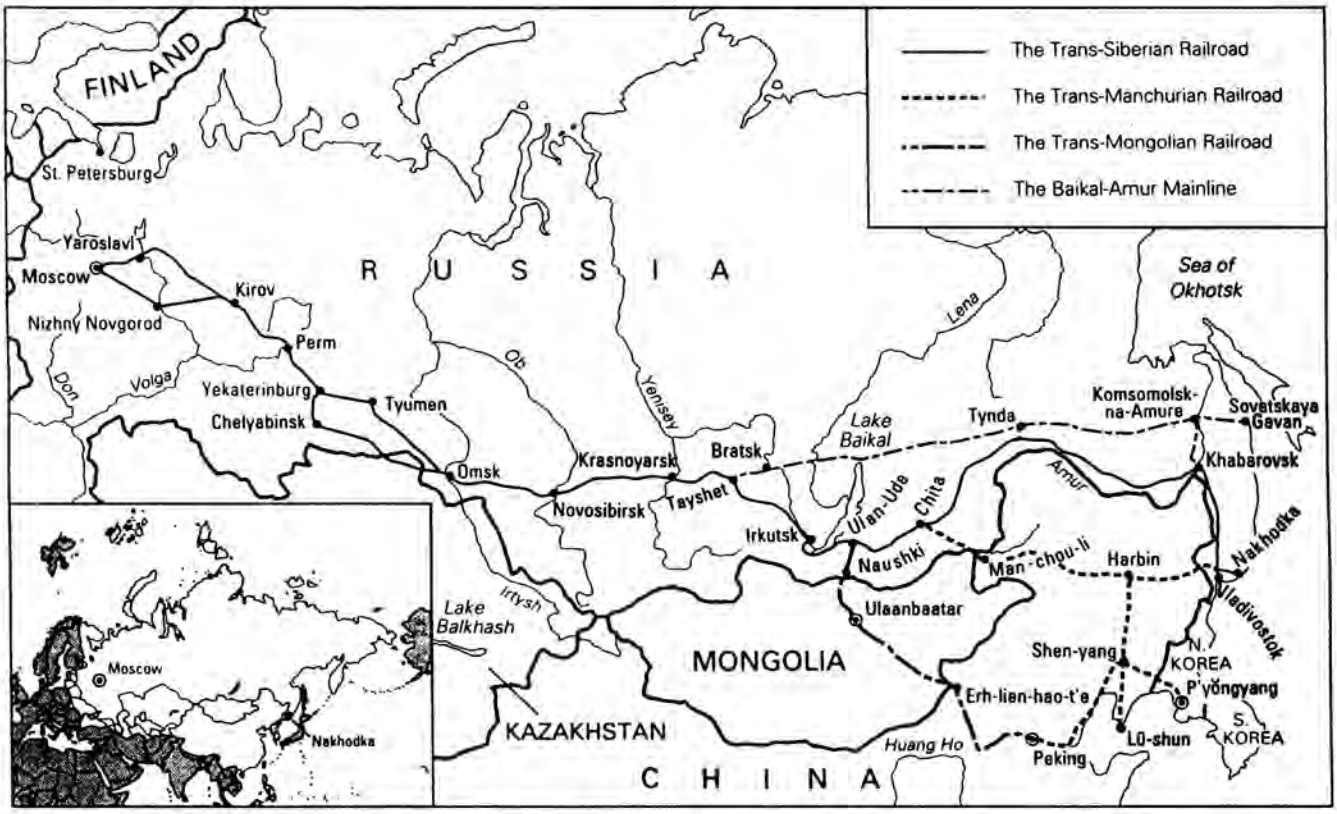
Shortly after his return to Austria in the spring of 1934 Gödel suffered a serious bout of depression and was admitted to a sanatorium in Purkersdorf bei Wien. By 1935 he had recovered enough to prove the relative consistency of the axiom of choice with the axioms of Zermelo-Fraenkel set theory, but a subsequent relapse left him incapacitated until the spring of 1937, when he finally succeeded in proving the relative consistency of the generalized continuum hypothesis as well.

Gödel taught for the last time in Vienna during the summer of 1937. The following spring, not long after the *Anschluß*, his authorization to teach was withdrawn and the unpaid rank of *Dozent* was abolished and replaced by that of *Dozent neuer Ordnung*—a salaried rank, but one that required vetting by the Nazi authorities. Gödel applied for the new title, but by the time it was granted he had already emigrated. ([14, p. 29], reproduces one of the letters evaluating Gödel's application.) In the meantime, while the financial situation in Austria deteriorated, Gödel was left unemployed.

Despite the uncertainty, in September of 1938 Gödel married, and soon thereafter he returned once more to America. He lectured that fall at the Institute for Advanced Study and went on in the spring of 1939 to the University of Notre Dame. He planned to return to the IAS again the following autumn, but on his return to Vienna he was called up for a military physical and declared fit for Nazi military service.

Even then, Gödel seemed strikingly oblivious to what was happening around him: In a letter to John von Neumann of September 17, 1939, he wrote, "Bei mir gibt es nicht viel Neues; ich hatte in letzter Zeit eine Menge mit Behörden zu tun. Ende September hoffe ich wieder in Princeton zu sein." ("There's not much news around here; recently I had a lot of dealings with the authorities. I hope to be in Princeton again around the end of September.") On September 30, in a letter to Karl Menger that Menger thought "set a record for non-involvement on the threshold of historic events", Gödel wrote, "Ich bin seit Ende Juni wieder hier in Wien u. hatte in den letzten Wochen eine Menge Laufereien, so dass es mir bisher leider nicht möglich war, etwas für das Kolloquium zusammenzuschreiben." ("Since the end of June I've again been here in Vienna, and in recent weeks I've had a lot of running around to do, so that up to now it was unfortunately impossible for me to compile anything for the colloquium.") And after his emigration, when asked by Oskar Morgenstern how things were in Vienna, he offhandedly replied, "Der Kaffee ist erbärmlich." ("The coffee is wretched.")

At the same time, however, Gödel had begun trying to find a way out: He applied both for a leave of absence from the university and an exit visa from the Reich, on the grounds that he had no



means of support in Austria but had been offered temporary employment by the IAS. Given his military status, the likelihood of his obtaining permission to return to the United States must have seemed remote; and there were difficulties on the American side as well. For although he had earlier possessed a U.S. immigration visa, he had forfeited it on his return to Austria in 1938, and thereafter U.S. policy stipulated that visas for those in teaching or research positions would be "granted only to applicants...who ha[d] had such positions...in the country they c[a]me from" in the "two years...immediately preceding their application."

In the end Gödel succeeded in obtaining the necessary documents, in large part due to the efforts of IAS director Frank Aydelotte, who interceded on Gödel's behalf with consular and immigration authorities in both Austria and the United States. (For details of the negotiations involved see [1, chapter VII].) Exit permits for Gödel and his wife were finally issued in December 1939, and the two left Europe in mid-January. By then, however, crossing the Atlantic had become quite risky. The alternative—explicitly stipulated by their exit permits—was to take the trans-Siberian railway, from whose terminus at Vladivostok they could cross the Sea of Japan and then voyage from there across the Pacific.

The Trans-Siberian Escape Route

Begun in 1891, the trans-Siberian railway was constructed in stages. From Moscow the tracks extended some 9,200 km to Vladivostok, via one of two routes. The first, completed in 1901, crossed Manchuria. The second, following the course of the Amur river and lying entirely within Siberia, was built out of concern that the Japanese might take control of Manchuria (as they later did) and was completed in 1916.

Always a route of last resort, during the early years of the Third Reich the trans-Siberian railway was nonetheless taken by thousands of Holocaust refugees, most of whom emigrated in large groups either to Kobe, Japan, or Shanghai, China. (Among the former, the several thousand Polish Jews issued visas by the Japanese diplomat Chiune Sugihara are perhaps best known.) Later, after the last sea routes out of Europe were closed off in June 1940, and until June 1941, when Hitler violated the German-Soviet nonaggression pact by invading Russia, it was the only avenue of escape available to Europe's Jews.

The trip across the vast Russian taiga was long and grueling, especially during the winter, when there were long hours of darkness and temperatures sometimes fell to $-50°$ C. Few emigrés left any account of their trans-Siberian experiences, and the Gödels were no exception. But from entries in Gödel's passport (see [14, p. 32]) and other documents in his *Nachlaß* we know that on January 18 he and his wife crossed from Latvia into Russia at Bigosovo and boarded a train for Moscow. Following the Manchurian route, they arrived in Yokohama on February 2, too late for the ship they intended to take, and remained there until February 20,

Photograph courtesy of the Institute for Advanced Study.

Kurt Gödel and wife Adele, in Vienna prior to emigration.

when they were at last able to board the *President Cleveland*. After an intermediate stop in Hawaii they debarked in San Francisco on March 4 and went on to Princeton by train. Altogether, their emigration took nearly two months. Yet, remarkably, despite his hypochondria and earlier mental health crises, Gödel apparently came through the long journey in good physical and mental condition.

The Gödels' departure was precipitate. Dehn and his wife, however, planned their escape with deliberation. How they procured the necessary documents to emigrate to the U.S. is unclear, but it is known that Dehn secured an academic post in America—a prerequisite to his admission as an immigrant—through the efforts of Clare Haas, a physician the Dehns had known in Frankfurt. Haas had found a position as a psychiatrist in Pocatello, Idaho, and she was able to arrange a temporary appointment for Dehn at Idaho Southern University (now Idaho State), where he served as associate professor of mathematics and philosophy from February 1941 through the spring of 1942 [16, p.129]

The Dehns finally left Norway in late October, and Dehn chronicled their journey in a talk he gave at Idaho Southern not long after his arrival there, the text of which is preserved as an eight-page typescript among his papers at the University of Texas [2]. According to that narrative, a small group of friends saw them off at the station in Oslo. At the frontier between Norway and Sweden their luggage was "ransacked" and they were treated "extremely unkind[ly] and rough[ly]" by the border guards—actions that led Dehn to wonder how "young people could exult in [such] unkindness without any real profit for themselves or their community." They were delayed three weeks in Stockholm, allegedly because of an outbreak of plague in Manchukuo and Vladivostok, but actually, Dehn thought, for "obscure political" reasons. In the end they took the Amur River route and so did not pass through Manchukuo. Meanwhile they found Stockholm a pleasant place to stay, not least because it was "splendidly illuminated", in contrast to the blackout throughout the rest of western Europe.

At last the necessary tickets and travel documents were issued, the Dehns were vaccinated against smallpox, typhoid, paratyphoid, and plague, and they flew on to Moscow, where Dehn found it necessary to consult a doctor. Three more days elapsed there before the departure of the next trans-Siberian train—an interlude that gave them time to explore the city and even attend the opera and ballet. Dehn noted that there were long lines in the stores, but that food was not rationed.

During the several days they spent crossing the "endless Russian plain", the temperature at times fell so low that the only liquid that could be used for bathing was cologne (though hot water was available in samovars for tea), and Dehn developed a life-threatening combination of influenza and pneumonia, for which he was treated in Irkutsk. Yet in his account he dwelt hardly at all on the hardships they experienced, describing instead the grand railway station in Novosibirsk, the great Siberian rivers, frozen Lake Baikal, and "the handsome settlements...in the capital of the...[nominally] Jewish state of Birobidjan", founded in 1934 as one of several "autonomous" states that were intended as ethnic havens for Russian minority groups but that never succeeded in attracting many settlers.

When the Dehns finally reached Vladivostok, they were forced to remain six more days while waiting for a ship to Kobe. Dehn took the opportunity to visit the Pedagogical Institute there and was surprised to find a good mathematical library, whose holdings included a text by Courant.

The crossing to Japan proved to be very rough and cramped, but the gentle climate in Kobe offered welcome relief and a chance for Dehn to recover his health. He said nothing about the subsequent voyage to San Francisco, where he and his wife arrived on New Year's Day, 1941.

Contrasting Refuges: The Institute for Advanced Study and Black Mountain College

The subsequent careers of Dehn and Gödel were markedly different, yet also parallel in certain respects. Both had difficulty securing permanent appointments, and both were supported at first through funds for refugee scholars. Gödel remained at the IAS the rest of his life, but he was not made a permanent member there until 1946. He was named a professor only in 1953 (the same year he was elected to membership in the National Academy of Sciences), after the departure of Carl Ludwig Siegel, a close friend of Dehn's who had himself found sanctuary at the IAS but who resolutely opposed Gödel's advancement there. For the first

six years Gödel's contract was renewed on an annual basis, and at one point his name was sent to the University of Wyoming as one still seeking a permanent position. But Gödel seems never to have complained about his status. The Institute gave him freedom to pursue his intellectual interests as he saw fit, without any obligation to lecture. He was not under pressure to publish, and he did so only occasionally. He also preferred not being obliged, as faculty were, to take part in matters of IAS governance; and even as a temporary member he was relatively well paid. (His annual stipend in 1940–1941 was $4,000.)

Dehn, on the other hand, arrived penniless in Pocatello, where he was paid a salary of only $100 per month. His teaching duties at Idaho Southern were not excessive, and he enjoyed hiking in the nearby mountains, but Pocatello was an intellectual backwater, and his short-term appointment forced him to begin searching for a position elsewhere almost immediately. He went next to the Illinois Institute of Technology, where he served as a visiting professor of mathematics. The pay was better there, but the lecture duties were more onerous, and Dehn disliked the busy Chicago urban/industrial environment. So, after only a year at IIT, he accepted a position as tutor at St. John's College in Annapolis, Maryland.

One of the oldest colleges in the United States, St. John's was distinguished by its curriculum, which focused (as it still does today) on the Great Books of western culture (based on a list of one hundred such drawn up at the University of Chicago). It was Dehn's task to teach mathematics directly from the texts of Euclid, Apollonius, Newton, etc., ending with *Principia Mathematica* (!), but he quickly realized that his students were young (most of those over eighteen having been called up for military service) and their preparation weak. Frustrated by the attempt to uphold an absurd pretense, he therefore sought yet another position.

Despite his eminence, Dehn's age (66) made it difficult for him to obtain a permanent appointment at an established institution. The Depression years, however, had spawned the creation of a few experimental academic enterprises. The Institute for Advanced Study, which began operations in 1933, was one such. Another, founded that same year, was Black Mountain College, located outside the community of Black Mountain, North Carolina, a few miles northeast of Asheville. There, in March of 1944, Dehn delivered a pair of guest lectures. And there, from 1945 until his death in 1952, he served as the sole faculty member in mathematics.

Black Mountain College was a unique institution, about which much has been written. ([4] provides a detailed history of the college, [10] is a collection of reminiscences by former students and faculty, and [12] describes Dehn's career there.) Founded by dissident faculty who had resigned or been fired from Rollins College in Winter Park, Florida, BMC was an experimental college of the arts that began life in rented quarters (as did the IAS) and moved six years later (as did the IAS) to a permanent location nearby (in the forest on the site of a former summer camp). Like the IAS, it served as a haven for many refugees of the Holocaust, including, besides Dehn, the artists Anni and Josef Albers and Willem de Kooning; the musicians Heinrich and Johanna Jalowetz, Stefan Wolpe, and Erwin Bodky; the musicologist Edward Lowinsky; the psychiatrist Erwin Straus; the physicist Peter Bergmann; and the anthropologist Paul Leser. Also like the IAS, BMC was founded on the principle of faculty governance, which (in both cases) all too often led not to consensus but to clashes and changes of leadership. Unlike the IAS, however, BMC had no endowment, so its finances were always precarious. Students and faculty collaborated in the construction of campus facilities and the growing of crops for food, and faculty received little (and sometimes nothing at all) beyond their room and board. Dehn's initial salary there was $40 per month. Moreover, whereas the IAS was authorized to offer degrees (but never has), BMC was never accredited. Instead, its graduates were certified through examinations conducted by outside scholars.

Max Dehn

BMC was, in effect, an educational commune, which attracted self-reliant students seeking an alternative to a traditional college education. It was an environment in which Gödel could not have survived. Dehn, however, thrived there. In addition to mathematics he taught philosophy, Latin, and Greek, and as several student memoirs attest, he became a revered and beloved figure, remembered especially for his love of the outdoors, the impromptu natural history lessons he gave on hikes in the nearby mountains, his unorthodox approach to the teaching of philosophy (via the Socratic method), and his friendly attitude toward students, among whom were two (Peter Nemenyi and Trueman MacHenry) who went on to receive Ph.D.'s in mathematics. (For their graduations from BMC, Nemenyi was examined by Emil Artin and MacHenry by Ruth Moufang.) Nemenyi later taught statistics in Mississippi and Nicaragua, while MacHenry became a professor at York University in Canada [16, p. 133].

One might expect Dehn to have been frustrated by the paucity of serious mathematics students at Black Mountain; yet when queried about that, he

replied, "Not at all. In fact, I have been very fortunate. In my sixty years of teaching I have had at least fifteen real students" [10, p. 298).

Dehn's intellectual isolation at BMC was mitigated by two leaves of absence (for the fall semester of 1946–1947 and the academic year 1948–1949) that he spent at the University of Wisconsin in Madison. Nevertheless, he retained his attachment to Black Mountain. Indeed, among the documents preserved in the archives of the college is a letter Dehn wrote from Chicago on July 13, 1946, thanking the board of BMC for granting his upcoming leave. In it he lamented that he would "miss the flaming October and the dark and cozy time before Xmas" at Black Mountain, and he expressed the hope that when he returned there later that summer there would be "some nice work" for him to do, such as "geometry for artists or hoeing potatoes."

Remarkably, during his leaves at Wisconsin Dehn directed one final doctoral student: Joseph Engel, who later became prominent in the operations research community. In an unpublished memoir about Dehn [5], Engel describes him as "small and frail", "an idealistic man" distinguished by "his inner peace, ...good humor, and innocence." Engel recalls how, on one occasion, following a very informal final examination that took place at the University of Wisconsin *Ratskeller*, Dehn suggested they walk across the frozen Lake Mendota. As they did so, Engel "noticed that the wind had built up a small ice barrier bordering the shoreline," and he warned Dehn, "Be careful crossing that ice." Dehn, however, ignored the warning. "He fell through the ice...[and] was in water up to his waist." His small size enabled the accompanying students to "grab...him under the armpits and yank...him out," but he was soaked, and it was bitterly cold. "To keep him from freezing" the students "made him walk briskly back to the nearest building"—and all the while Dehn "continued to chat...in his usual cheery and benevolent manner."

Engel goes on to say that "Working under [Dehn's] kind and understanding guidance was a joy and a privilege. ...Looking back at that wondrous time, I still love him, and am in awe of his wisdom and humanity and humor and compassion."

Final Years

By the time of their emigrations, the greatest works of both Gödel and Dehn were behind them. Both, however, continued to publish works of substance. Gödel's interests turned increasingly to philosophy and, for a time, to relativity theory. During the 1940s he contributed important essays on Russell's mathematical logic and Cantor's continuum problem, and in 1949 he published the first of three papers in which he described his discovery of radical solutions to Einstein's field equations of gravitation (rotating universes, in some of which time travel was possible). In December 1951 he delivered the prestigious Gibbs Lecture to the American Mathematical Society (concerning some philosophical implications of his incompleteness theorems), and in 1958 he outlined a consistency proof for arithmetic (originally obtained in the period 1938–1941) based on the notion "computable functional of finite type". After that, apart from revisions to earlier papers, he published no more and became increasingly reclusive. During the 1960s and early 1970s he was awarded several honorary degrees and memberships, and in 1975 he received the National Medal of Science. By then, however, his physical and mental deterioration had progressed to an alarming degree. He retired from the IAS in 1976 and died two years later of self-starvation.

As for Dehn, in the years 1943 and 1944 he published a series of five historical articles in the *American Mathematical Monthly*. In 1947 he contributed a short paper "On the approximation of a function by power series" to the pedagogical journal *The Mathematics Student*. And in 1950 his last publication, "Über Abbildungen geschlossener Flächen auf sich" appeared in a Norwegian journal.

According to the obituary memoir [9], "After the end of the war, [Dehn] immediately resumed his contacts with his German friends" and "inaugurated a magnanimous relief program for his former Frankfurt colleagues." In June of 1952 he retired from Black Mountain College as Professor Emeritus, with the expectation that he would continue to "serve as an advisor and...live on the campus" [12]. Hartner reports that he also "planned [to] return to the University of Frankfurt" in the winter of 1953. But it was not to be. For on July 27, 1952, apparently as the result of his overstrenuous efforts the previous day to protect some beloved trees from being cut down by loggers, Dehn developed a coronary embolism and died. He was buried in the woods at a spot marked by a stoneware tablet made in the college's pot shop. (His wife Toni lived on to become a centenarian, and following her death in 1996 her ashes were buried at the same site.)

Black Mountain College itself survived only four years beyond Dehn's death. Unable to raise funds for its continued operation, it closed abruptly in 1956. Its buildings were sold to pay its debts, and the site reverted once again to a summer camp.

Acknowledgments: I am indebted to Dr. Dallas Webster of Austin, Texas, for assistance in obtaining documents from the Archives of American Mathematics at the University of Texas; to Professor John Stillwell for providing copies of Dehn materials from Idaho State University; to Dr. Joseph H. Engel of Bethesda, Maryland, for his recollections of Dehn; and to Mrs. Maria Peters, daughter of Max

Dehn, for her reply to my inquiries about her father.

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Kurt Gödel's *Nachlaß* is held by the Institute for Advanced Study, Princeton, and is available to scholars as Collection 282 in the manuscript division of the Firestone Library at Princeton University. A microfilm edition of the papers, excluding correspondence, is available for purchase from IDC Publishers, Inc., 350 Fifth Avenue, Suite 1801, New York, NY 10118 (Web address: `http://www.idc.nl`). A catalog of the papers is forthcoming in volume V of Gödel's *Collected Works*.

Note: The photograph of Max Dehn was reprinted with permission from *History of Topology*, I. M. James, ed., "Max Dehn", pages 965-78, 1999, with permission from Elsevier Science.

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The Monster?

Richard E. Borcherds

When I was a graduate student, my supervisor John Conway would bring into the department his one-year-old son, who was soon known as the baby monster. A more serious answer to the title question is that the monster is the largest of the (known[1]) sporadic simple groups. Its name comes from its size: The number of elements is

$$8080, 17424, 79451, 28758, 86459, 90496,$$
$$17107, 57005, 75436, 80000, 00000$$
$$= 2^{46}.3^{20}.5^{9}.7^{6}.11^{2}.13^{3}.17.$$
$$19.23.29.31.41.47.59.71,$$

about equal to the number of elementary particles in the planet Jupiter.

The monster was originally predicted to exist by B. Fischer and by R. L. Griess in the early 1970s. Griess constructed it a few years later in an extraordinary tour de force as the group of linear transformations on a vector space of dimension 196883 that preserve a certain commutative but nonassociative bilinear product, now called the Griess product.

Our knowledge of the structure and representations of the monster is now pretty good. The 194 irreducible complex representations were worked out by Fischer, D. Livingstone, and M. P. Thorne (before the monster was even shown to exist). These take up eight large pages in the atlas [A] of finite groups, which is the best single source of information about the monster (and other finite simple groups). The subgroup structure is mostly known; in particular there is an almost complete list of the maximal subgroups, and the main gaps in our knowledge concern embeddings of very small simple groups in the monster. If anyone wishes to multiply elements of the monster explicitly, R. A. Wilson can supply two matrices that generate the monster. But there is a catch: Each matrix takes up about five gigabytes of storage, and to quote from Wilson's atlas page: "[S]tandard generators have now been made as 196882×196882 matrices over GF(2).... They have been multiplied together, using most of the computing resources of Lehrstuhl D für Mathematik, RWTH Aachen, for about 45 hours...." (The difficulty of multiplying two elements of the monster is caused not so much by its huge size as by the lack of "small" representations; for example, the symmetric group S_{50} is quite a lot bigger than the monster, but it only takes a few minutes to multiply two elements by hand.) Finally the modular representations of the monster for large primes were worked out by G. Hiss and K. Lux; the ones for small primes still seem to be out of reach at the moment.

In the late 1970s John McKay decided to switch from finite group theory to Galois theory. One function that turns up in Galois theory is the elliptic modular function

$$j(\tau) = q^{-1} + 744 + 196884q + 21493760q^2 + \cdots$$
$$= \sum c(n)q^n$$

($q = e^{2\pi i\tau}$), which is essentially the simplest nonconstant function invariant under the action $\tau \mapsto (a\tau + b)/(c\tau + d)$ of $SL_2(\mathbf{Z})$ on the upper half plane $\{\tau | \Im(\tau) > 0\}$. He noticed that the coefficient 196884 of q^1 was almost equal to the degree 196883 of the smallest complex representation of the monster (up to a small experimental error). The term "moonshine" roughly means weird relations between sporadic groups and modular functions (and anything else) similar to this. It was clear to many people that this was just a meaningless coincidence; after all, if you have enough large integers from various areas of mathematics, then a few are going to be close just by chance, and John McKay was told that his observation was about as useful as looking at tea leaves. John Thompson took McKay's observation further and pointed out that the next few coefficients of the

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[1] *The announcement of the classification of the finite simple groups about twenty years ago was a little overenthusiastic, but a recent 1,300-page preprint by M. Aschbacher and S. D. Smith should finally complete it.*

elliptic modular function were also simple linear combinations of dimensions of irreducible representations of the monster; for example, $21493760 = 21296876 + 196883 + 1$. He suggested that there should be a natural infinite-dimensional graded representation $V = \sum_{n\in\mathbf{Z}} V_n$ of the monster such that the dimension of V_n is the coefficient $c(n)$ of q^n in $j(\tau)$, at least for $n \neq 0$. (The constant term of $j(\tau)$ is arbitrary, since adding a constant to j still produces a function invariant under $SL_2(\mathbf{Z})$ and is set equal to 744 mainly for historical reasons.) Conway and Norton [C-N] followed up Thompson's suggestion of looking at the McKay-Thompson series $T_g(\tau) = \sum_n \mathrm{Trace}(g|V_n)q^n$, whose coefficients are given by the traces of elements g of the monster on the representations V_n, and found by calculating the first few terms that these functions all seemed to be *Hauptmoduls* of genus 0. (A Hauptmodul is a function similar to j but invariant under some group other than $SL_2(\mathbf{Z})$.) A. O. L. Atkin, P. Fong, and S. D. Smith showed by computer calculation that there was indeed an infinite-dimensional graded representation of the monster whose McKay-Thompson series were the Hauptmoduls found by Conway and Norton, and soon afterwards I. B. Frenkel, J. Lepowsky, and A. Meurman explicitly constructed this representation using vertex operators.

If a group acts on a vector space it is natural to ask if it preserves any algebraic structure, such as a bilinear form or product. The monster module constructed by Frenkel-Lepowsky-Meurman has a vertex algebra structure invariant under the action of the monster. Unfortunately there is no easy way to explain what vertex algebras are; see [K] for the best introduction to them. Roughly speaking, vertex algebras can be thought of (at least in characterstic 0) as commutative rings with derivation where the ring multiplication is not quite defined everywhere; this is analogous to rational maps in algebraic geometry, which are also not quite defined everywhere. A more concrete but less intuitive definition of a vertex algebra is that it consists of a space with a countable number of bilinear products satisfying certain rather complicated identities. In the case of the monster vertex algebra $V = \bigoplus V_n$, this gives bilinear maps from $V_i \times V_j$ to V_k for all integers i, j, k, and the special case of the map from $V_2 \times V_2$ to V_2 is (essentially) the Griess product. So the Griess algebra is a sort of section of the monster vertex algebra.

Following an idea of Frenkel, one can use the monster vertex algebra and the Goddard-Thorn "no-ghost theorem" from string theory to construct the *monster Lie algebra*. This is a $\mathbf{Z}^2$-graded Lie algebra whose piece of degree $(m, n) \in \mathbf{Z}^2$ has dimension $c(mn)$ whenever $(m, n) \neq (0, 0)$. The monster should be thought of as a group of "diagram automorphisms" of this Lie algebra, in the same way that the symmetric group S_3 is a group of diagram automorphisms of the Lie algebra D_4. The monster Lie algebra has a denominator formula, similar to the Weyl denominator formula for finite-dimensional Lie algebras and the Macdonald-Kac identities for affine Lie algebras, which looks like

$$j(\sigma) - j(\tau) = p^{-1} \prod_{\substack{m>0 \\ n\in\mathbf{Z}}} (1 - p^m q^n)^{c(mn)}$$

where $p = e^{2\pi i\sigma}$, $q = e^{2\pi i\tau}$. This formula was discovered independently in the 1980s by several people, including M. Koike, S. P. Norton, and D. Zagier. There are similar identities with $j(\tau)$ replaced by the McKay-Thompson series of any element of the monster, and C. J. Cummins and T. Gannon showed that any function satisfying such identities is a Hauptmodul. So this provides some sort of explanation of Conway and Norton's observation that the McKay-Thompson series are all Hauptmoduls.

So the question "What is the monster?" now has several reasonable answers:

1. It is the largest sporadic simple group or alternatively the unique simple group of its order.
2. It is the automorphism group of the Griess algebra.
3. It is the automorphism group of the monster vertex algebra. (This is probably the best answer.)
4. It is a group of diagram automorphisms of the monster Lie algebra.

Unfortunately none of these definitions is completely satisfactory. At the moment all constructions of the algebraic structures above seem artificial; they are constructed as sums of two or more apparently unrelated spaces, and it takes a lot of effort to define the algebraic structure on the sum of these spaces and to check that the monster acts on the resulting structure. It is still an open problem to find a really simple and natural construction of the monster vertex algebra.

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The "WHAT IS...?" column carries short (one- or two-page), nontechnical articles aimed at graduate students. Each article focuses on a single mathematical object, rather than a whole theory. The *Notices* welcomes feedback and suggestions for topics for future columns. Messages may be sent to `notices-whatis@ams.org`.

—Allyn Jackson

Mathematicians and the Mathematics Library: A Librarian's Perspective

Sara Rutter

Today the mathematics research library exists in two modes: a tangible form of books, journals, and electronic media shelved in the library; and electronic data accessible through the Internet. By linking to local and remote servers, scholars can view resources anywhere and anytime if they have the necessary software. This article presents a librarian's view of the changing nature of the library and its users' needs.

The Library Defined

Ranganathan described the library as a dynamic entity composed of three different and interacting parts [1]: the collection, the users, and the library staff. Change in one component affects the whole. Paul Raabe described the library as "not only a public service organization, such as a post office; it is also, and always has been, an intellectual and cultural center, whose immediate environment and the changes it has undergone can throw light on the forces of change generally" [2]. Library collections are changing in size, format, and location of resources, and the use of the library is being reshaped. The "forces of change" are the ability to share files easily and to communicate results rapidly without the need for a distribution system (other than access to the Internet). New technology is facilitating and accelerating—"quickening" in Robert Lucky's characterization [3]—the way that mathematicians and scientists communicate their research.

Online bookstores that offer purchasing from the desktop and delivery to the doorstep have raised the service expectations of all consumers. Library patrons expect library catalogues to be as simple to use as online shopping interfaces and delivery of items to be as fast and convenient as obtaining merchandise from an online store. Desktop delivery of articles through interlibrary loan is now common, academic libraries are staying open longer hours, and library-to-library delivery of items is offered on large campuses with distributed library systems. These services emulate models developed outside of the library world.

Many researchers in the sciences are able to work almost exclusively from their desktops to access the literature they need for current research, but until all significant works are digitized, research in mathematics will continue to require a working relationship with the library. The transformation in the way researchers acquire the literature needed for their work is affecting, and is affected by, the changing nature of library collections. In turn, the work that library staff do and expect to do is shifting.

The core work of the mathematics librarian is to gather and to organize the resources that allow mathematicians to connect to the literature in their field. In 1957 Price [4] plotted the growth of scientific literature from 1700 to 2000 as an exponential curve, the number of papers doubling

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every ten to fifteen years. The increase in the number of records in *Mathematical Reviews* from 1940 to 2000 reflects a doubling time of mathematics literature of ten years. The locations where works of significance are to be found and the methods of securing them are metamorphosing. The traditional methods of learning about these resources no longer suffice. Librarians use Web pages, email messages, paper flyers, the library catalogue, and the grapevine to tell mathematicians in their institutions about new sources of mathematical literature. Effectively organizing these resources so that others can use them continues to be a challenge and is a problem on an international scale.

Ranganathan's Five Laws of Library Science

The modern library of open stacks, books shelved by subject classifications, and staff devoted to connecting users with the resources they need owes much to the developments of librarianship in the twentieth century. Shiyali Ramamrita Ranganathan, a mathematics lecturer before he was appointed University Librarian of the University of Madras, developed systems to organize library materials for better access. In his often-cited book *The Five Laws of Library Science*, first published in 1931, he eloquently expressed principles of librarianship that are still widely endorsed today: (1) books are for use, (2) every reader his or her book (books are for all), (3) every book its reader, (4) save the time of the reader, and (5) a library is a growing organism.

First Law: Books Are for Use *or* Where Are the Books and Journals?

"The library is the mathematician's laboratory." Mathematics librarians repeat this mantra, described by Frame [5], to explain the special needs of their primary patron group. Mathematicians need to be able to use the library spontaneously to check particular works in the course of their research. Frame noted a positive correlation between the presence of a departmentally located mathematics library and institutional success in the William Lowell Putnam mathematics competition. A 1995 survey [6] showed that of 45 top-ranked mathematics departments that responded to the survey, 73% had libraries in the same building as the department (a decline from 83% in 1990). Frame indicated that mathematicians are more productive when the books and journals they need to consult are located near their offices.

For many mathematicians, the act of downloading articles to the desktop is replacing visits to the library. For electronic items, a threat to the open-shelves policy has appeared through the licensing of resources for which libraries contract with vendors. A new model of collection management shifts acquisitions from purchasing to licensing, thus moving library materials out of the fair-use guarantees of copyright law and into contract law. Keeping access open to all library users is particularly important in libraries that house mathematics collections, because members of the scholarly mathematics community often visit other institutions and expect to use the associated institutional collections.

Technological hurdles too may impede access to needed literature. Software, platform, and Internet connectivity requirements necessitate another group of skilled workers to ensure access to the files that contain the literature. Mathematicians download articles in different file formats, depending both on the operating system they use and on the software in which they most commonly work. Some prefer DVI or PostScript, while others have only the resources to download PDF files or to open HTML files, and some need to use text-only browsers. Mathematicians vary widely in their comfort level in accessing information remotely, partly because of individual differences but also because the mathematics community is culturally, economically, and geographically diverse and the availability of networked access to information is still unevenly distributed.

Historical Literature

Unlike researchers in the laboratory sciences, mathematicians commonly travel back through time in their use of the literature, unconcerned about the date of publication. In their interactions with and expectations of the library, mathematicians combine characteristics of the humanist and of the scientist.

Mathematics journals indexed by ISI (the Institute for Scientific Information) generally have cited half-lives (a measure of how long articles within a particular journal are cited [7]) that are greater than ten years. Articles in mathematics continue to be cited much longer than do articles in scientific disciplines that build rapidly on current discoveries. Indeed, the citation data gathered from mathematics journals are off of ISI's time scale for measuring research impact. Mathematicians often face the task of tracking down works that were catalogued years before automation and finding them on the shelves once a call number is retrieved. Often historical materials are separated from the working library collection to preserve them from wear. Mathematics librarians face the challenge of balancing shelf-space constraints and preservation of fragile volumes with the knowledge that mathematicians do use these older materials.

Some projects are under way to keep the older literature accessible to mathematicians. One example is the retrodigitization of the *Jahrbuch über die Fortschritte der Mathematik*, now available over the Web with links to several online historical

Digitized Historical Mathematics Materials on the Web

The Jahrbuch Project
http://www.emis.de/projects/JFM/

Cornell University historical mathematics book collection
http://library5.library.cornell.edu/math.html

Mathematica collection at Göttinger DigitalisierungsZentrum
http://gdz.sub.uni-goettingen.de/en/

Gallica collection of the Bibliothèque Nationale de France
http://gallica.bnf.fr

University of Michigan historical mathematics collection
http://www.hti.umich.edu/u/umhistmath/

Numérisation de Documents Anciens Mathématiques (NUMDAM)
http://math-sahel.ujf-grenoble.fr/NUMDAM/Public/Projet/revues.htm

JSTOR's collection of mathematics journals (available at participating institutions)
http://www.jstor.org/

collections. The sidebar lists some of the globally available digitized mathematics collections that are enriching libraries worldwide.

Second Law: Every Person His or Her Book *or* How Mathematicians Affect the Collection

Because mathematicians rely more heavily on books than do scholars in other scientific disciplines, many mathematicians actively search out new titles in their fields and send purchase requests to librarians. Librarians know from the experience of helping struggling students at the reference desk that there is also a need for introductory mathematics books. Managing the collection within the constraints of the budget, the mathematics librarian depends on library users as one of the most important sources of information about the need for new resources, books, and journals. The collection is a collaborative effort.

Third Law: Every Book Its Reader *or* How Do Mathematicians Know What Literature Is Out There?

A recent survey of University of Michigan science faculty [8] found that to stay abreast of current research developments, mathematicians rely primarily on reading preprints, browsing recent print journal issues, attending conferences, and talking with colleagues. The heavy emphasis on both preprints and collegial interactions for current awareness differentiated the mathematicians from faculty in other science disciplines (astronomy, biology, chemistry, geology, natural resources, and physics).

Many mathematicians routinely check the most current journals and the newly arrived books in the library. The new-books shelf is one way that mathematicians connect with the library as a physical place. Delivering a list of new books to the mathematics department is a common service feature of mathematics libraries. The University of Michigan extracts a list of new books once a week from additions to the online catalogue and sends it to mathematicians who have requested the list.

The MathSciNet database (the online version of *Mathematical Reviews*) is a basic tool that mathematicians use to learn about books and journal articles in their field. Using a MathSciNet entry to find an item in the local library catalogue can be problematic. Most of the reference questions that librarians receive from mathematicians revolve around the problem of connecting a citation to the library catalogue and subsequently to the library shelves or links. Librarians can act as bridges between the sometimes arcane language of library catalogues or classification systems and the citations retrieved from indexes or research papers or received from colleagues.

Library instruction is an area that mathematicians who teach mathematics to undergraduate and graduate students rarely think to introduce into their classrooms. Unlike the humanities, which rely heavily on books and introduce students to the library early in their careers, mathematics generally does not offer the experience of using the library for in-depth research projects until graduate school. Though mathematics students need to become knowledgeable about the literature to perform doctoral research, library experience comes relatively late. A wide network of colleagues may substitute for up-to-date library skills for an established mathematician, but knowledge of how to access library resources and services in the currently dynamic information environment is essential to someone just beginning a career.

Because the paths to information are changing and the resources collected by the library are not all visible to the patron on a visit to the physical space, mathematicians must receive notification about changes to the collection. Finding effective means of communicating these changes is a challenge and a source of discussion among mathematics librarians.

Fourth Law: Save the Time of the Reader

Long open hours, the collection available on open shelves, and desktop delivery of current and historical literature all contribute to saving the time of the mathematician. At the University of Michigan, print journals are not allowed to leave the library, which ensures their accessibility to the

researcher in pursuit of a reference. Anderson and Pausch [9] mention similar loan practices at the mathematics library at the University of Illinois at Urbana-Champaign.

Instruction in the use of library resources and tours of the library can save novice researchers time. Graduate students and new faculty can make their use of the library more efficient by spending a few minutes with the mathematics librarian. Current instruction in libraries is focused on teaching time-saving research skills and helping researchers become more adept users of the available research tools.

Mathematicians rely on colleagues for much of their information about new resources or services, both local and distributed. New faculty, highly motivated to understand how things work in their new institution's library, are often a source of information to the department about the library. New faculty and graduate students can act as conduits for information to flow from the librarian to the department about time-saving services that are available.

Fifth Law: The Library Is a Growing Organism

The late nineteenth century and the twentieth century saw a growth in the amount of publishing, which is reflected in the collections of many of the members of the American Research Libraries. Over the last six decades the amount of literature published has grown, making possible the coexistence of two major mathematics indexes, *Mathematical Reviews*/MathSciNet and *Zentralblatt MATH* (formerly called *Zentralblatt für Mathematik und ihre Grenzgebiete*). Older mathematicians recall research libraries far less complex than the ones their students face today. To be an adept library user two decades ago, one needed to know how to use a card catalogue and a print index. In the intervening twenty years the total number of records in *Mathematical Reviews* has more than tripled [10]. To do research productively now, a library user must cope with more information, interpret different online frameworks, navigate a Web that adheres to few overarching organizational schemes, and understand how to access several portals or gateways. Because of the increasing complexity of the information environment and the growing requirement for specialized skills, scholars in mathematics need libraries and librarians today more than ever before.

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Teaching Math in America: An Exhibit at the Smithsonian

How to teach mathematics well is a problem educators in the United States have struggled with for a long time. Some aspects of this struggle come to life in an exhibit at the National Museum of American History, part of the Smithsonian Institution, in Washington, DC. With around thirty objects that were used in mathematics classrooms from the early 1800s to the present day, the exhibit shows how mathematics teaching evolved as the United States changed over the past two centuries. "The exhibit is an attempt to put mathematics teaching into the context of American history," explains Peggy Kidwell, a museum curator who created the exhibit.

In the early 1800s any man who was free could vote. This was at a time when most nations tied voting rights to property ownership and there were concerns in the United States about whether voters would be sufficiently educated to be able to vote intelligently. This concern led to the establishment of "common schools", later called elementary schools, which taught the basics of reading and arithmetic. And they were not just for boys: it was thought that women needed to be educated too so that they could teach their own children. Kidwell points out that although much of the instruction in mathematics at this time was rote teaching of arithmetic, one can perceive echoes of the present-day concern about how to make math appealing for a diverse student population. Teachers tried various means to make math interesting to students, including using what are today called "manipulatives".

One example on display in the exhibit is a box of wooden models of geometric objects, such as spheres, cones, and cubes, created by Josiah Holbrook in the 1830s. His motto "Good enough for the best and cheap enough for the poorest" reflected the populist ideal of education for all. Similarly low-tech is one object that may be the most mathematically satisfying item in the exhibit: a set of flat wooden tiles, made in 1890 by W. W. Ross, that fit together to provide a proof of the Pythagorean Theorem. More sophisticated models generally came from Europe, often imported by American mathematicians who got their Ph.D.'s from European universities. In contrast to the wooden models that were used to teach the masses, the European models reached only the elite. A few of these models appear in the exhibit, such as a collection of models, dating from 1893, of projections of polytopes, created by the German mathematician Victor Schlegel and distributed by the German publisher Ludwig Brill.

That indefatigable constant of all mathematics classrooms, the blackboard, was introduced in the United States in the early 1800s. A blackboard from this era is in the exhibit, and it is literally a board that had been painted black. Sometimes sand was mixed with the paint in order to create a gritty surface that would hold the chalk. As a result of their successful use in math classes, blackboards began to be used in teaching other subjects. Kidwell tells the story of the curious backlash that occurred when math classes at Yale University began using blackboards. When solving a problem involving a figure, students had been allowed to look at the figure in their textbooks while solving the problem. After blackboards were introduced, the students were expected to solve the problems at the board while recalling any needed figures from memory, without referring back to the book. When this way of working problems at the board was required for geometry examinations in sophomore courses at Yale in 1830, the students refused to take the exams. As a result of the so-called "Conic Sections Rebellion", over forty students, comprising nearly half the entire class of 1832, were expelled.

In the early 1800s students brought to class whatever mathematics textbooks their families happened to own, and some students had no textbooks. Thus the blackboard was especially important for unifying the presentation of explanations

Left to right above: early blackboard, Josiah Holbrook's geometric models from the early 1800s, B. F. Skinner's teaching machine (1954). Below: (top) Cuisenaire rods from the 1950s; (bottom) one of the first graphing calculators, introduced in the United States by Casio in 1986.

of mathematics and for assigning problems to the students. At this time, textbooks were distributed locally: a text would be taken to different printers in different cities, each of which would typeset and print its own edition. Starting in the 1840s, improvements in transportation allowed textbooks to be distributed around the country from a central printing site. These improvements, as well as innovations in printing, were steps leading to the mass marketing of mathematics textbooks.

The stranglehold that rote learning has held on mathematics teaching is evident in the exhibit. One of the strangest objects is a prototype mathematics teaching machine built by the Harvard psychologist B. F. Skinner. A demonstration of the machine took place at a meeting in 1954, but it was never actually used in a classroom. The machine is a wooden box with a set of levers on the top and a handle jutting out of the front. There are numbers running alongside the tracks of the levers so that, for example, having one lever in the 7 position and another in the 2 position indicates one is supposed to perform the operation $7 - 2$. One gives an answer by moving another lever into position, then turning the handle. If the answer is right, the handle turns and one goes on to the next problem. If the answer is wrong, the handle will not turn. The device simply tests calculation skills; there is no attempt to develop the intuition behind those skills. "It's really dippy," Kidwell says of the device. Skinner and others went on to build more sophisticated devices for what came to be known as "programmed learning".

Much better for developing intuition are Cuisenaire rods, invented by the Belgian educator Émile-Georges Cuisenaire. The exhibit has a set of the rods dating from 1965. The various lengths of the rods represent different numbers; by placing the rods end-to-end and comparing the lengths, students have a visual and tactile representation of arithmetic problems. The colors of the Cuisenaire rods also have significance: they are meant to indicate multiples of numbers, so that, for example, the reddish rods represent multiples of two. As Kidwell explains it, Cuisenaire's theory holds that children learn best when they are able to manipulate objects and also have strong associations with color. For this reason his theory is sometimes called "numbers in color". The exhibit also has some examples indicating the revival of the use of manipulatives in mathematics classes in the 1990s.

And what of mathematics education today? The exhibit ends on a rather colorless note, with a display of hand-held calculators and manuals for mathematical and educational software. Compared to the hands-on manipulatives and colorful numeral boards of the past, these manuals seem dour indeed, though presumably the software itself is more exciting. Kidwell points out how cheap, easy-to-make tools like Holbrook's wooden models came to be replaced by more expensive and sophisticated tools like software. In this way, the exhibit reveals the increasing influence of commercialism in the mathematics classroom. The objects in this exhibit remind us that, while the problems of teaching and learning mathematics will never be definitively solved, a historical perspective can provide new insight into the best and most useful teaching methods.

Note: The exhibit, entitled "Slates, Slide Rules, and Software: Teaching Math in America", is on display in the National Museum of American History in Washington, DC. It is anticipated that the exhibit will remain at least through the duration of the Joint Mathematics Meetings in January 2003, which will take place in Baltimore. More information can be obtained by visiting the exhibit's website, `http://www.americanhistory.si.edu/teachingmath/` or by sending email to `mathematics@si.edu`.

—Allyn Jackson

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Book Review

The Colossal Book of Mathematics

Reviewed by Ed Pegg Jr.

The Colossal Book of Mathematics
Martin Gardner
W. W. Norton, 2001
$35.00, ISBN 0-393-02023-1

> Flexagons are paper polygons, folded from straight or crooked strips of paper, which have the fascinating property of changing their faces when they are "flexed." Had it not been for the trivial circumstance that British and American notebook paper are not the same size, flexagons might still be undiscovered, and a number of top-flight mathematicians would have been denied the pleasure of analyzing their curious structures. (Martin Gardner, December 1956)

My own introduction to Martin Gardner occurred while I recuperated from being reckless as a boy. Perhaps hoping I could be a bit more intelligent, my father gave me a copy of one of Gardner's *Mathematical Games* books at the hospital. After recovering, I learned to use my school's microfiche for issues of *Scientific American*. Through Gardner's columns in that magazine, I learned of topology, hexaflexagons, sprouts, and graph theory. Above, Gardner starts an article recounting the history of the "Flexagon Committee". This group of four Princeton University students investigated flexagons and discovered a wide variety of them.

> After my piece appeared, people all over Manhattan were flexing flexagons. Gerry Piel, publisher of *Scientific American*, called me into his office to ask if there was enough similar material to make a regular column. I assured him there was and immediately made the rounds of Manhattan's used book stores to buy as many books on recreational math (there were not many) as I could find. Once the column got under way, I began to receive fresh ideas from mathematicians and writing the column became an easy and enjoyable task that lasted more than a quarter century.

Gardner's writings became the standard for popular mathematics. As I was writing this review, author Clifford Pickover emailed me about his next book: "I'm digging up the Gardner references." Written well and well researched, Gardner's columns discussed mathematicians, problems, or research areas that often attained greatness. Members of the Flexagon Committee provide a typical example: Bryant Tuckerman found the twenty-fourth Mersenne prime (1971), John Tukey developed fast Fourier transforms (1965), and Richard Feynman won the Nobel Prize (1965).

The Colossal Book of Mathematics is Gardner's own compilation of what he considers to be his best columns. And this is not just some "greatest hits" collection put out by the studio—Gardner rewrote

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and remastered almost every column in the book. He adds, updates, and appends quite a lot. As I read through the work, I marvelled at the *vast* amount I'd missed through the years. Somehow the same columns that entertained me as a boy had hidden material that appealed to me as a mathematician. His work has been so much admired among mathematicians that he was awarded the AMS Steele Prize for Mathematical Exposition in 1987.

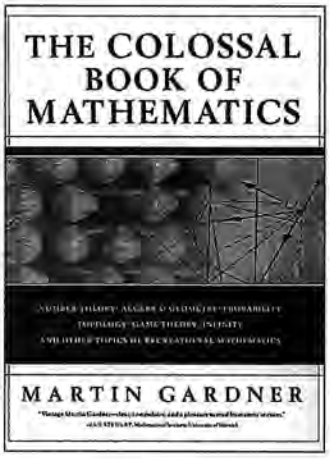
> Spheres of identical size can be piled and packed together in many different ways, some of which have fascinating recreational features. These features can be understood without models, but if the reader can obtain a supply of 30 or more spheres, he will find them an excellent aid to understanding. Ping-pong balls are perhaps best for this purpose. They can be coated with rubber cement, allowed to dry, then stuck together to make rigid models.

The chapter "Packing Spheres" opens with a friendly invitation. Many different facts follow about such interesting objects as figurate numbers, triangular numbers and squares with their algebraic interactions, tetrahedral pyramids, a sphere packing with density $\pi/\sqrt{18}$, random packings, densest packings, and loosest packings.

> In 1727 the English physiologist Stephen Hales wrote in his book *Vegetable Staticks* that he had poured some fresh peas into a pot, compressed them, and had obtained "pretty regular dodecahedrons." The experiment became known as the "peas of Buffon" (because the Comte de Buffon later wrote about a similar experiment), and most biologists accepted it without question until Edwin B. Matzke, a biologist at Columbia University, repeated the experiment. Because of the irregular sizes and shapes of peas, their nonuniform consistency and the random packing that results when peas are poured into a container, the shapes of peas after compression are too random to be identifiable.

I recently wound up doing some research on this very topic. Of course I started with Gardner's column. I later discovered that Kepler reported rhombic dodecahedral structures in a study of pomegranates. Kepler may have been wrong, but he was wrong first. Gardner ends his updated addendum with this aside: "Stanislaw Ulam told me in 1972 that he suspected that spheres, in their densest packing, allow more empty space than the densest packing of any identical convex solids." This is not true in two dimensions. Same-sized circles can cover the plane with density 0.90689, while an octagon covering has maximal density 0.90616. In 1934 Reinhardt constructed a smoothed octagon with maximal density 0.902414. (The worst packing convex shape in two dimensions is unknown.) At this time there is no known counterexample to Ulam's hypothesis, though Wlodek Kuperberg suspects that the rotation of a smoothed octagon along a diagonal axis is a good solid to check.

Gardner's "Mathematical Games" columns now make up fifteen volumes, and all of them are currently in print. A sixteenth book, *Gardner's Workout: Training the Mind and Entertaining the Spirit* (A K Peters, 2001), contains additional writings about mathematical recreations material from the period 1981 to 2001. Again, Gardner's writing and research are top notch and very light and enjoyable to read. A sampling of chapter topics includes magic squares, the minimal surface to make a cube opaque, the square root of 2, minimal Steiner trees, variations on the 12345679 trick, toroidal currency, three-point tilings, serial isogons, and new new math.



Every two years there is a Gathering for Gardner conference (`http://g4g4.com`). There, magicians and mathematicians take turns entertaining each other with tricks and mathematical fun. There are now two books of conference proceedings from these gatherings, both published by A K Peters: *The Mathemagician and Pied Puzzler: A Collection in Tribute to Martin Gardner* (1999) and *Puzzlers' Tribute: A Feast for the Mind* (2001). Among the many contributors to the latter volume are Elwyn Berlekamp, John Conway, Solomon Golomb, Scott Kim, Roger Penrose, Raymond Smullyan, and Martin Gardner.

Here are three updates Gardner might have made to *Colossal* had he started putting it together just a few months later:

1. In 2001 David Wilson found that the second player wins 3×5 Dots and Boxes. David: "If computers continue to double their capacity every 18 months, we should be able to analyze the entire 5×5 game in 2034." See `http://www.cae.wisc.edu/~dwilson/boxes/`.

2. Conway's Game of Life is still engendering discoveries. Between August 1989 and November 2000, spaceships with speeds of $c/3, c/12, 2c/5, c/5, 2c/7$, and $c/6$ were discovered. See `http://www.argentum.freeserve.co.uk/lex_s.htm` or `http://www.mirwoj.opus.chelm.pl/ca/index.html` for a program.

3. In 2001 Robertson, Sanders, Seymour, and Thomas proved the Snark Theorem: *Every Snark*

has a Petersen graph minor. Some history is in order. A four-coloring of a trivalent map is equivalent to a three-coloring of its edges (Tait's reduction). All bridgeless planar trivalent graphs can be three colored (by the four-color theorem), but rare nonplanar trivalent graphs cannot be. In his April 1976 column Gardner noted how difficult these graphs were to find and called them Snarks. The name stuck. In 1999 Robertson, Sanders, Seymour, and Thomas found a shorter proof of the four-color theorem, but this was just a warm-up exercise. In 2001 they proved what was known as Tutte's conjecture. It's now the Snark Theorem.

I spotted one flaw in typesetting: The book is arranged in twelve sections, each with three to six columns. The pictures heading the various sections, for example Topology and Probability, are swapped around. But this is a minor detail.

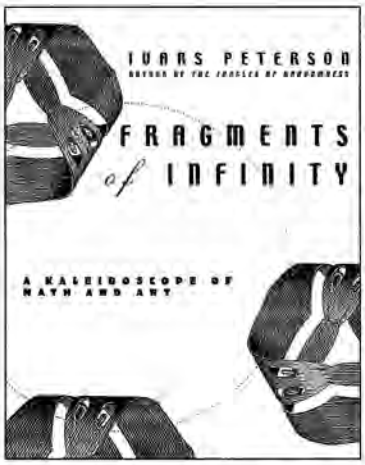
Anyone who has read Gardner's columns will enjoy seeing the many updates added to this book. Any math lovers who have not read Gardner's columns, should. The best way they can start is by reading this book.

Fragments of Infinity, A Kaleidoscope of Math and Art

Reviewed by Anthony Phillips

Fragments of Infinity, A Kaleidoscope of Math and Art
Ivars Peterson
John Wiley & Sons, New York, 2001
$29.95, ISBN 0-471-16558-1

Giorgio Vasari, in his 1550 *Lives of the Artists*, tells us how a papal envoy was sent to Florence to find out if the painter Giotto (1267–1337) was as good as his reputation. The envoy asked Giotto for "a little drawing to send to his Holiness." Vasari continues: "Giotto, who was a man of courteous manners, immediately took a sheet of paper, and with a pen dipped in red, fixing his arm firmly against his side to make a compass of it, with a turn of his hand he made a circle so perfect that it was a marvel to see it. Having done it, he turned smiling to the courtier and said, 'Here is the drawing.' " As far as I know, this is the earliest "documented" example—it may of course be apocryphal—of Math Art. It is mathematical because the object represented is a circle, a simple but completely mathematical locus; it is art because it was drawn by one person for another person to perceive and appreciate as a work of art. In *Fragments of Infinity, A Kaleidoscope of Math and Art*, Ivars Peterson takes us on a survey of the contemporary intersection of those two endeavors. His focus is on the people who work there: "mathematicians who are also artists or whose mathematical thoughts have inspired



others to create, artists enthralled by the unlimited possibilities offered by mathematically guided explorations of space and time."

Mathematics has been manifest in art almost as long as there has been art. A quick look at Greek decoration, Mayan friezework, or Indonesian textile design, to pick traditions from three very different places and times, shows a systematic and sophisticated use of symmetries evolving independently of any abstract development. Knots were represented on Roman gravestones as objects of beauty and mystery, and partial self-similarity was used in Tantric art, presumably to represent infinite processes, long before knot theory or a theory of limits existed.

During the Renaissance more explicitly mathematical objects began to appear in art. Paolo Uccello (1397–1475) set the mosaic image of a stellated dodecahedron into the floor of St. Mark's in Venice and surrounded it with an "impossible" toroidal solid (anticipating by 500 years the Penrose and Escher examples). Leonardo da Vinci drew some sixty illustrations for Luca Pacioli's 1509

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De Divina Proportione, showing regular and semi-regular polyhedra both as solids and as "solid edge" lattices, an effective illusionistic rendering technique he seems to have invented. Albrecht Dürer placed a mysterious granite polyhedron in *Melancolia*, his portrayal of "the dangers of excessive study," along with a Latin square containing the date of the engraving: 15-14. Da Vinci, and Dürer after him, drew enormously complicated knots, although it is very unlikely that either thought of knots as objects for theoretical study; they were intriguing natural phenomena having the same appeal, and decorative potential, as the unicursal mazes drawn in prehistory, antiquity and the middle ages. Around 1935 the sculptor Max Bill (1908–1994) reinvented the Möbius strip and, at about the same time, the painter and engraver Maurits Escher (1898–1972), who had visited the Alhambra in 1922, began his systematic rediscovery of Euclidean planar symmetries. In both these cases the mathematics was "in the air"—it is very difficult to imagine such inventions happening a hundred years before. Escher later (1958) discovered the work of H. S. M. Coxeter on hyperbolic tesselations and began to incorporate them into his designs, probably the first time since da Vinci's collaboration with Pacioli that professionally produced mathematics found its way into art, if we disregard the recently publicized [5], tantalizing hints about a possible Poincaré-Picasso connection. Recently the Bill-Escher tradition of artists who become de facto mathematicians has continued, along with a new breed of mathematicians who produce, show and sell their math-inspired art. These are the people who appear, with their work, in *Fragments of Infinity*.

Helaman Ferguson fleshes out his shapes with personally inspired, emotionally charged form: *Figureight Knot Complement II* (marble, 34", 1990). Williston Library, Mount Holyoke College. Photo: Cosby and Bower. Image used with permission.

The idea for the book is a very attractive one, especially for the mathematics community. Michele Emmer's beautiful *L'Occhio di Horus: Itinerari nell'immaginario matematico* [2] was published in a small edition, in Italian, in 1989 and could not reach the large, international audience that this topic deserves. What better way to introduce newcomers to the beauty of mathematics than by showing them objects or images which manifest it directly to their senses? In particular, how better to combat the image of the out-of-touch mathematician than by showing men and women unafraid to take up brush, chisel, or welding gun and make abstract ideas come to physical life? Peterson is fortunate in having found talented and eloquent type specimens for the species he studies. Each of them is interviewed at length in what turn out to be the best parts of the book, where we hear these unusual people talk about their lives and their work.

Helaman Ferguson is the prototypical mathematician artist. Beginning at age six, he lived in the home of a stone mason. There he learned the stonecutter's trade. Later these skills, combined with his professional scientist's insight, engendered his remarkable dual career as mathematician and as mathematical sculptor. Ferguson the mathematician works on algorithms (his Ph.D. topic was in harmonic analysis); the sculptor takes his subject matter from topology, and this makes a difference. The mathematical meaning of a topological shape is invariant under any deformation that does not tear it apart. Ferguson has been able to capitalize on this flexibility to flesh out his shapes with personally inspired, emotionally charged form.

Thomas Banchoff represents the mathematician as historian and promulgator of mathematical art. He grew up a Catholic. When he was in high school and first encountered the fourth dimension, he tells us, it brought on a kind of mathematical-religious epiphany, in which he understood the several aspects of the Trinity as three-dimensional cross-sections of a single, inconceivable, higher-dimensional Being. In his life as professor of mathematics, Banchoff has become the high priest of the fourth dimension. He has brought it to life in movies—starting in 1975, among the first high-quality mathematical animations—and he has championed Edwin Abbott, the whimsical author of *Flatland*—an 1884 primer on the understanding of higher dimensions, disguised as an elaborate Victorian science-fiction story. His enthusiasm came to the attention of Salvador Dali, who earlier (1954) had painted a Crucifixion where the Cross is replaced by an unfolded hypercube. Dali and Banchoff hit it off as fellow transcendentalists, and their relation continued until the artist's death in 1989.

Charles Perry is the mathematical artist with no mathematical training. An architect turned sculptor, he specializes in large outdoor works. His creations can be seen in almost every large American city, in front of a corporate headquarters, a museum, or a Federal office building. Perry may be mathematically uneducated, but he has the mind and the hands of an inventor and an uncanny sense of the rhythm and richness implicit in three-dimensional geometry and topology. The shapes he invents are as mathematical as Giotto's circle: loci pre-existing their equations.

Tony Robbin began as a painter "interested in ways of experiencing and depicting space." His conversion to mathematics dates from a 1979 visit to Brown University, where he experienced Banchoff's interactive computer displays of the four-cube. His recollections are unmistakably of the period. "For three nights, I woke frequently from dreams of the images I had seen: the green screen, the quivering geometric figure,...I had seen the fourth dimension directly." He soon realized that he needed to learn enough mathematics and computer programming to write his own software and harness this science and this technology to his art work. He went back to school. His new knowledge allowed him to absorb the lore on quasiperiodic tilings and their associated quasicrystals. Now he has a patent for the concept of "an architectural body having a quasicrystal structure," and a book explaining his radical ideas.

The study is rounded out with portrait sketches of several other denizens of the math-art intersection, among them Harriet Brisson ("Light is my medium. Geometric forms are my inspiration."), Brent Collins (who says of mathematics: "It's a language of nature I've appropriated for aesthetic purposes."), and Nat Friedman ("Art and Mathematics are both about seeing relationships. Creativity is about seeing from a new viewpoint.").

Ivars Peterson is the most prolific of the handful of scientist-journalists who have specialized in popularizing mathematics. His works include *The Mathematical Tourist, Islands of Truth: A Mathematical Mystery Cruise, Mathematical Treks: From Surreal Numbers to Magic Circles,* and *The Jungles of Randomness: A Mathematical Safari* [6, 7, 8, 9]. As the titles suggest, his role is the mathematical tour leader, organizing itineraries with stops in scientifically exotic locations.

In *Fragments of Infinity* the tour has become an art show, with Peterson taking the part of curator and guide through the galleries. Mostly, he stands back and lets his people and their work explain themselves. His own contributions are like the catalogue for the show: biographical material about the artists, tours of their studios, descriptions of installations. Understandably, since Peterson selected the participating artists and since each is virtually standing by as we go through his or her part of the show, the works are presented in a uniformly warm light. There is a minimum of what could be a valuable analysis of the interplay between medium and subject matter, and there is no criticism. In undertaking a book on the synthesis of mathematics and art, Peterson has ventured out of his domain of expertise (just as I have in undertaking this review). He is excellent at presenting mathematics to a general audience, but showing art is different. A piece of mathematics may be presented in many different ways, but an art work must speak for itself; and some speak much better than others.

A work of art needs emotional and visceral or kinesthetic resonance if it is to survive beyond the classroom. This is part of what Bernard Berenson [1] meant by "tactile values," the feeling that we are, body and psyche, co-involved with the maker in a shared aesthetic experience. Of course not all of mathematics is susceptible to a "tactile" representation. "Euclid alone has looked on Beauty bare" starts the often quoted sonnet by Edna St. Vincent Millay, which goes on to speak reverently of mathematics as "nothing, intricately drawn nowhere." The ethereal, Apollonian side of mathematical creativity is central to the subject but defies artistic expression except as music; and music is not on the agenda here.

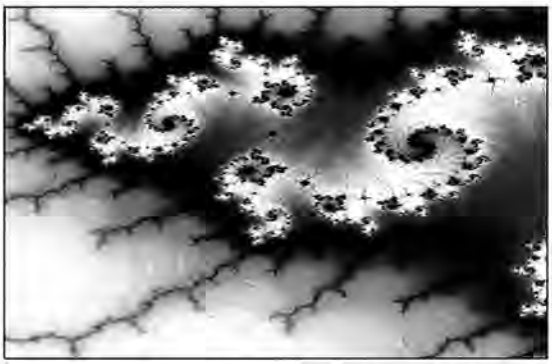
The shapes Charles Perry invents are as mathematical as Giotto's circle: loci pre-existing their equations. *Duality* (bronze, 3 feet, 1982). Perry Residence, Norwalk, Connecticut. Image used with permission.

Luckily, we're all human. Mathematics grew out of sensory data and is still connected to its roots: Most (but not all) mathematicians feel a need to clothe bare Beauty in visual, geometric trappings. Here the personal and the emotional can come into play. The ideal torus is indeed drawn nowhere, but each mathematician draws the torus in his or her own way; individual style is the way the human element enters into graphic or plastic representations of mathematical objects, the way they can turn into art.

Many of the works in Peterson's gallery do not manifest this human touch. He shows us intricate planar graphics generated by the "algorithmic artist" Bob Brill. We see startling computer images of three-dimensional loci made by Banchoff and by George Francis, both mathematicians. (He does not show us any of the hand drawn, eerily anatomical diagrams from Francis' *A Topological Picture Book* [4].) He shows us an origami lobster, complete, folded from a single sheet by the physicist Robert J. Lang. These impressive achievements will elicit a well-deserved "Wow!" from their audience, but no more: They are inert. Cliff Pickover, another of Peterson's featured artists, zooms in on one region of the Mandelbrot set, fixing the orientation, the resolution, and the palette of colors. These are

aesthetic choices, but of a very low-level, impersonal nature. Fractal art can be as beautiful as a sunset, but it cannot succeed in competition with works of art that bring us into communion, "though once only and then but far away" (Millay's words), with another human being.

Fortunately many of the images in *Fragments of Infinity* do show us such work. Sculpture has an intrinsic edge on "tactile values" in an obvious sense but also because the act of perceiving it in the round automatically engages our physical attention. (Peterson slips into his exhibition a couple of Henry Moore works, which are textbook examples of the coercive potential of sculpture, although totally innocent of mathematics.) Perhaps this is why Ferguson's, Robert Engman's, and Perry's works, even on the page, are among the most convincing and involving in Peterson's collection.



A fractal can be as beautiful as a sunset. Clifford Pickover, *Mandelbrot Madness*. Image used with permission.

Judged as an art show, *Fragments of Infinity* is uneven; one can also quibble about who got left out and especially about the almost exclusively United States East Coast provenance of the collection. In particular, there is no mention of Anatolii Fomenko [3], by far the most prominent representative of the mathematician-as-graphic-artist. But many good pieces are there to see; and for many readers, even those familiar with mathematics, it may be a first gaze at an unsuspected universe. As a book about mathematics, beyond showing us often dazzling incarnations of mathematical phenomena, it has deft sketches of background material. Here Peterson is at his best. *Fragments of Infinity* will be useful in presenting the visible, tangible, and often playful side of mathematics to a nonmathematical audience, while anchoring it to the underlying science. The publisher, John Wiley & Sons, deserves praise for the layout, which ingeniously and gracefully accommodates the huge number of illustrations: Almost every page has one, most have several, in many different formats. The dust jacket is an especially witty use of a transversely bisected Möbius strip, Escher at his wackiest, most reptilian, most mathematical, and most charming.

It may be unfair to ask a book subtitled *A Kaleidoscope of Math and Art* for sustained thought about the difference between art and mathematics, but that investigation could have set these many experiments on a broader intellectual stage. It is likely that no one person could carry off this assignment, but that it would require the unlikely collaboration of experts in art criticism, in mathematics, and in philosophy to chart the expanse between the two cultures. Meanwhile we have this attractive book to help us see across.

References

[1] Bernard Berenson, *The Florentine Painters of the Renaissance*, G. P. Putnam's Sons, New York, 1896.

[2] Michele Emmer, *L'Occhio di Horus: Itinerari nell'Immaginario Matematico*, Istituto della Enciclopedia Italiana (Treccani), Roma, 1989.

[3] Anatolii T. Fomenko and Richard Lipkin, *Mathematical Impressions*, American Mathematical Society, Providence, RI, 1990.

[4] George K. Francis, *A Topological Picturebook*, Springer-Verlag, New York, 1987.

[5] Arthur I. Miller, *Einstein, Picasso: Space, Time, and the Beauty That Causes Havoc*, Basic Books, New York, 2001.

[6] Ivars Peterson, *Islands of Truth: A Mathematical Mystery Cruise*, Freeman, New York, 1990.

[7] ____, *The Mathematical Tourist: Snapshots of Modern Mathematics*, Freeman, New York, 1988.

[8] ____, *The Jungles of Randomness: A Mathematical Safari*, John Wiley & Sons, New York, 1998.

[9] ____, *Mathematical Treks: From Surreal Numbers to Magic Circles*, Mathematical Association of America, 2001.

Gromov Receives 2002 Kyoto Prize

In June 2002 the Inamori Foundation announced the laureates for the 2002 Kyoto Prizes, international awards presented to people who have contributed greatly to the scientific, cultural, and spiritual betterment of humankind.

The Kyoto Prize for Basic Sciences, selected from the fields of the mathematical sciences, is awarded to MIKHAEL LEONIDOVICH GROMOV of the Institut des Hautes Études Scientifiques and the Courant Institute of Mathematical Sciences, New York University whose innovative ideas and establishment of a new geometry have had an immeasurable impact on all the mathematical sciences.

The Kyoto Prize presentation ceremony will be held at the Kyoto International Conference Hall on November 10, 2002. At the ceremony each laureate will be given a diploma, a Kyoto Prize Medal in gold, and prize money of 50 million yen (about US$420,000).

Gromov's work covers all areas of geometry and its relations with neighboring fields such as topology and analysis. He brings a profoundly original and expansive viewpoint to any subject he works on. This viewpoint illuminates the subject, opening spectacular vistas, and sometimes creates a whole new subject that is then explored by many other researchers for years, long after Gromov has moved on.

A hallmark of much of Gromov's work is the softening of geometry, whereby equations are replaced by inequalities or approximate or asymptotic equations. Examples include the "coarse" viewpoint on Riemannian geometry (which considers all Riemannian structures at once), the "homotopic" viewpoint on partial differential equations (which solves overdetermined systems via topology), and the "asymptotic" viewpoint on geometric group theory. Gromov has revolutionized symplectic geometry by the introduction of methods from complex analysis and has given important impulses to index theory and to sub-Riemannian (or Carnot-Carathéodory) geometry. He has introduced many important new concepts into geometry, most of which are outgrowths of his "coarse" or "soft" viewpoint: almost flatness of metrics and connections, simplicial volume, K-area, hyperbolicity of groups, etc.

Mikhael Gromov

Gromov has had, and will continue to have, a widespread influence on contemporary mathematics.

Previous recipients of the Kyoto Prize include: Rudolf E. Kalman (1985), Claude E. Shannon (1985), John McCarthy (1988), I. M. Gelfand (1989), André Weil (1994), Donald E. Knuth (1996), and Kiyosi Itô (1998).

The Inamori Foundation was established in 1984 by Kazuo Inamori, founder and chairman emeritus of the Kyocera Corporation. The Kyoto Prizes, established in 1985, have been awarded to fifty-six individuals and one group. Further information is available on the website `http://www.inamori-f.or.jp/index_e.html`.

—Allyn Jackson

2001 Morgan Prize

Ciprian Manolescu

The Frank and Brennie Morgan Prize recognizes and encourages outstanding mathematical research by undergraduate students. It was endowed by Mrs. Frank Morgan of Allentown, Pennsylvania, and carries the name of her late husband. Mrs. Morgan is the mother of Frank Morgan of Williams College. A joint committee of the AMS, the Mathematical Association of America (MAA), and the Society for Industrial and Applied Mathematics chooses the winner. The first Morgan Prize was awarded at the 1996 Joint Mathematics Meetings.

At the MAA Mathfest in Burlington, Vermont, in August 2002, the 2001 Morgan Prize was awarded to CIPRIAN MANOLESCU. Named as Honorable Mention is MICHAEL A. LEVIN. Below are the citations and biographical sketches for the awardees.

Ciprian Manolescu

Floer homology has been at the center of major advances in geometry over the past fifteen years. The traditional definition of Floer homology has been described as cumbersome and technically difficult. Manolescu's research makes a fundamental advance in the field by giving an elegant construction of Floer homology. In his construction, he associates a spectrum (in the sense of algebraic topology) with a 3-manifold. The Floer homology of the 3-manifold is determined as the homology of this spectrum. This approach to Floer homology bypasses the traditional technical difficulties, and experts predict that this construction will become the standard approach in this rapidly developing area of mathematics. The committee was impressed by the depth and quality of Manolescu's research and by his command of a large body of geometry, topology, and analysis required for his work. The quality of his research papers, the enthusiastic letters from his mentors, and the response to his work at seminars and professional meetings all confirm the outstanding nature of his research. The committee is proud to award the 2001 Frank and Brennie Morgan Prize to Ciprian Manolescu.

Biographical Sketch

Ciprian Manolescu was born in Alexandria, Romania, in 1978. Soon after that his family moved to Pitesti, Romania, where he lived until coming to the U.S. for college in 1997. During high school he participated in several mathematics contests, winning three gold medals at the International Mathematical Olympiad. As an undergraduate at Harvard University, he also took part in the Putnam Competition, winning the first prize in 1997, 1998, and 2000. Since his sophomore year he has been working as a course assistant for several mathematics classes at Harvard, obtaining certificates for distinction in teaching. In the spring of 1999 he took a reading course in differential geometry with Peter Kronheimer. This sparked Manolescu's interest in the subject, and he continued working under Kronheimer's guidance for the next few years. During the summers Manolescu benefited from grants from the Harvard College Research Program. He graduated summa cum laude in 2001 and received the Hoopes prize for his senior thesis, "Finite dimensional approximation in Seiberg-Witten theory". Currently, Manolescu is a graduate student in the mathematics department at Harvard University. His research interests include topology, differential geometry, and mathematical physics.

Michael A. Levin

The Morgan Prize Committee is pleased to award honorable mention for the 2001 Morgan Prize for Undergraduate Research to Michael Levin for his work on quadratic inequalities for the descent statistic of permutations. His prize is based on work that was done at Cornell's REU (Research Experiences for Undergraduates) program and that will appear in the *Journal of Combinatorial Theory, Series A*. The general area of Levin's work concerns statistics on the number of permutations π of the first n positive integers for which a fixed set of indices are exactly those for which $\pi(i+1) < \pi(i)$. These are difficult combinatorial problems with a long history going back to Euler. Levin developed original and surprising methods, which involve passing to a continuous limit and which experts say will open up new avenues of research related to quadratic inequalities satisfied by combinatorially defined numbers. The committee was impressed with the originality and depth of Levin's research. Letters from his teachers and collaborators all attest to his impressive problem-solving abilities and to the excellent and original nature of his work. The committee is proud to award honorable mention for the 2001 Frank and Brennie Morgan Prize to Michael Levin.

Biographical Sketch

Michael Levin grew up on the south side of Chicago. He became interested in mathematics at an early age, and in sixth grade he began attending mathematics programs during the summer. In high school he took a number of mathematics courses at the University of Chicago. He attended Harvard University, where he majored in mathematics. Levin spent the summer after his sophomore year at the Williams College REU where he worked on knot theory research. The next summer he worked on combinatorics research at the Cornell University REU. While in college, he developed an interest in theoretical physics. He is currently a first year graduate student in the physics department of the Massachusetts Institute of Technology. He has not yet chosen a research group, but he is potentially interested in both theoretical condensed matter physics and string theory.

—From an MAA Announcement

Mathematics People

MAA Writing Awards Presented

The Mathematical Association of America (MAA) presented several awards for excellence in expository writing at its Summer Mathfest in Burlington, Vermont, in August 2002.

The Carl B. Allendoerfer Awards are given for articles published in *Mathematics Magazine* and carry a cash award of $500. The award for 2002 was given to MARK MCKINZIE, Monroe Community College, and CURTIS TUCKEY, Oracle Corporation, for their article, "Higher Trigonometry, Hyperreal Numbers, and Euler's Analysis of Infinities", *Mathematics Magazine*, Vol. 74, 2001.

The Trevor Evans Award is given to authors of expository articles that are accessible to undergraduates and that were published in *Math Horizons*. This prize carries a cash award of $250. Two awards were given for 2002. JAMES TANTON, The Math Circle, was selected for his article, "A Dozen Questions about the Powers of Two", *Math Horizons*, Vol. 8, 2001. FRANK A. FARRIS, Santa Clara University, won for his article, "The Edge of the Universe", *Math Horizons*, Vol. 8, 2001.

The Lester R. Ford Award honors articles published in *The American Mathematical Monthly* and carries a cash prize of $500. Four awards were made for 2002. PETER BORWEIN and LOKI JORGENSON, both of Simon Fraser University, were honored for their joint article, "Visible Structures in Number Theory", *American Mathematical Monthly*, Vol. 108, 2001. DIRK HUYLEBROUCK was honored for his article, "Similarities in Irrationality Proofs for pi, ln2, zeta(2), and zeta(3)", *American Mathematical Monthly*, March 2001. GREG MARTIN, University of British Columbia, won for his article, "Absolutely Abnormal Numbers", *American Mathematical Monthly*, October 2001. DAVID L. ROBERTS, National Council of Teachers of Mathematics, won for his article, "Moore's Early Twentieth-Century Program for Reform in Mathematics Education", *American Mathematical Monthly*, October 2001.

The George Pólya Award is given for articles published in *The College Mathematics Journal* and has a cash prize of $500. TIMOTHY G. FEEMAN, Villanova University, was chosen for his article, "Conformality, the Exponential Function, and World Map Projections", *College Mathematics Journal*, Vol. 32, 2001.

—From an MAA announcement

SIAM Prizes Awarded

The Society for Industrial and Applied Mathematics (SIAM) awarded several prizes at its annual meeting in Philadelphia in July 2002.

GANG HU of Lehman Brothers received the Richard C. DiPrima Prize. This prize is awarded to a young scientist who has done outstanding research in applied mathematics and who has completed his or her doctoral dissertation and all other requirements for the doctorate during the period from three years to one year prior to the award date. The prize carries a cash award of $1,000.

H. THOMAS BANKS of North Carolina State University received the W. T. and Idalia Reid Prize. This prize is given for research in or other contributions to the areas of differential equations and control theory. It carries a cash award of $10,000.

ERIC LANDER of the Massachusetts Institute of Technology was awarded the John von Neumann Lectureship and a cash award of $2,500. JONATHAN CHAPMAN of Oxford University received the Julian Cole Lectureship and a cash award of $1,000. CRAIG A. TRACY of the University of California, Davis, and HAROLD WIDOM of the University of California, Santa Cruz, were both awarded the George Pólya Prize Lectureship; they will split the cash award of $20,000.

CHRISTOPH BREGLER of Stanford University received the I. E. Block Community Lectureship, which carries an honorarium of $500.

—From a SIAM announcement

Tolsa Awarded 2002 Salem Prize

The Salem Prize for the year 2002 has been awarded to XAVIER TOLSA of the Universitat Autónoma de Barcelona. Tolsa was recognized for his work on analytic capacity, particularly for the solution of the Painlevé and Vitushkin problems.

The prize, in memory of Raphaël Salem, is awarded yearly to young researchers for outstanding contributions in the field of analysis. The 2002 prize committee consisted of J. Bourgain, C. Fefferman, P. Jones, N. Nikolski, P. Sarnak, and J.-C. Yoccoz.

—Jean Bourgain, Institute for Advanced Study

PECASE Awards Announced

Sixty young researchers were chosen to receive the 2001 Presidential Early Career Awards for Scientists and Engineers (PECASE). This award is the highest honor bestowed by the U.S. government on outstanding young scientists, mathematicians, and engineers who are in the early stages of establishing their independent research careers.

Among the awardees are four who work in the mathematical sciences. RAFFAELLO D'ANDREA of Cornell University and RONALD P. FEDKIW of Stanford University were nominated by the Department of Defense. PAUL M. RICKER of the University of Chicago was nominated by the Department of Energy. BRIAN D. CONRAD of the University of Michigan was nominated by the National Science Foundation.

The recipients were selected from nominations made by nine participating federal agencies. Each recipient receives a five-year grant of up to $700,000 to further his or her research and educational efforts.

—From a White House announcement

NSF Postdoctoral Fellowships Awarded

The Mathematical Sciences Postdoctoral Research Fellowship program of the Division of Mathematical Sciences of the National Science Foundation (NSF) awards fellowships each year for postdoctoral research in pure mathematics, applied mathematics and operations research, and statistics. Listed below are the names of the fellowship recipients for 2002, together with their Ph.D. institutions (in parentheses) and the institutions where they will use their fellowships.

ANDREI H. CALDARARU (Cornell University) University of Pennsylvania; JOSEPH L. COFFEY (State University of New York at Stony Brook) Courant Institute, New York University; DOUGLAS P. ENRIGHT (Stanford University) University of California, Los Angeles; HANS C. GROMOLL (University of California, San Diego) Eurandom, The Netherlands; SAMUEL GRUSHEVSKY (Harvard University) Princeton University; MARSHALL E. HAMPTON (University of Washington) University of Minnesota; SHELLY L. HARVEY (Rice University) University of California, San Diego; TARA S. HOLM (Massachusetts Institute of Technology) University of California, Berkeley; BENJAMIN V. HOWARD (Stanford University) Harvard University; GEOFFREY C. HRUSKA (Cornell University) University of Chicago; EDWARD M. HYDE (California Institute of Technology) University of Minnesota; RUSSELL K. JACKSON (Brown University) Boston University; ADAM R. KLIVANS (Massachusetts Institute of Technology) Harvard University; CHRISTOPHER J. LEININGER (University of Texas, Austin) Columbia University; BRIAN O. LUCENA (Brown University) University of Washington; JEREMY L. MARTIN (University of California, San Diego) University of Minnesota; ROMAN G. MUCHNIK (Yale University) University of Chicago; DAVID E. NADLER (Princeton University) University of Chicago; KEVIN W. O'BRYANT (University of Illinois, Urbana-Champaign) University of California, San Diego; JAMES A. PARSON (Princeton University) University of Michigan, Ann Arbor; RODRIGO A. PEREZ (State University of New York at Stony Brook) Cornell University; NATHAN P. READING (University of Minnesota) University of Michigan, Ann Arbor; ALEXANDER RETAKH (Yale University) Massachusetts Institute of Technology; DAVID R. REVELLE (Cornell University) University of California, Berkeley; DANIEL S. ROGALSKI (University of Michigan, Ann Arbor) University of Washington; JEFFREY H. SCHENKER (Princeton University) University of California, Irvine; JESSICA S. SIDMAN (University of Michigan, Ann Arbor) University of California, Berkeley; ROBERT J. SIMS (University of Alabama, Birmingham) Princeton University; TODD M. SQUIRES (Harvard University) California Institute of Technology; TOUFIC M. SUIDAN (Princeton University) Institute for Advanced Study, Princeton; MARK L. TOMFORDE (Dartmouth College) University of Iowa; and ALEKSEY ZINGER (Massachusetts Institute of Technology) Stanford University.

—From an NSF announcement

LMS Prizes Awarded

The London Mathematical Society (LMS) has awarded a number of prizes for 2002.

N. J. HITCHIN, Oxford University, received the Pólya Prize for his contributions to geometry, the development of mathematics, and mathematical physics. The prize recognizes outstanding creativity in, imaginative exposition of, or distinguished contribution to mathematics within the United Kingdom.

The Senior Berwick Prize is awarded in recognition of an outstanding piece of mathematical research that was published by the LMS during the eight years ending December 31, 1999. JEREMY RICKARD, Bristol University, received the prize for two papers, "Idempotent modules in the stable category", published in the *Journal of the LMS*, and "Splendid equivalences: Derived categories and permutation modules", published in the *Proceedings of the LMS*.

The Naylor Prize and Lectureship in Applied Mathematics is awarded for for outstanding lecturing abilities and for work in, influence on, and contributions to applied mathematics and/or the applications of mathematics. The 2002 Naylor Prize was given to MARK H. A. DAVIS, Imperial College, for pioneering contributions to stochastic analysis, stochastic control and filtering theory, and mathematical finance.

The Whitehead Prizes are awarded to mathematicians who are under the age of forty years, who were mainly educated in the United Kingdom, and who are not already Fellows of the Royal Society. They are intended to cover all fields of mathematics, including applied mathematics, mathematical physics, and mathematical aspects of computer science. Four Whitehead Prizes have been awarded for 2002: to KEVIN M. BUZZARD, Imperial College, for work in number theory; to ALESSIO CORTI, Cambridge University, for contributions to the geometry of 3-folds; to MARIANNA CSÖRNYEI, University College, London, for work in real analysis, geometric measure

theory, and geometric nonlinear functional analysis; and to CONSTANTIN TELEMAN, Cambridge University, for contributions to the representation theory of infinite dimensional groups, especially loop groups.

—From an LMS announcement

2002 d'Alembert Prize Awarded

Every two years the Société Mathématique de France presents the d'Alembert Prize. Established in 1984, the prize is intended to encourage mathematical works in the French language and the exposition of mathematics for the general public.The prize recognizes an article, book, radio or television broadcast, film, or other project that is designed to improve understanding of mathematics and its recent developments.

The d'Alembert Prize for 2002 has been awarded jointly to JEAN BRETTE, Palais de la Découverte, CATHERINE GOLDSTEIN, Université Paris-Sud, MIREILLE CHALEYAT-MAUREL, Université Paris V, and GÉRARD TRONEL, Université Pierre et Marie Curie.

—Société Mathématique de France

2002 Paul Erdős Awards Given

BOGOLJAB MARINKOVICH of Yugoslavia, HAROLD B. REITER of the University of North Carolina, Charlotte, and WEN-HSIEN SUN of the Chiu Chang Mathematics Foundation, Taipei, are the recipients of the 2002 Paul Erdős National Award.

The award was established to recognize mathematicians' contributions that have played a significant role in the development of mathematical challenges at the national level and that have been a stimulus for the enrichment of mathematics learning. The award is given by the World Federation of National Mathematics Competitions (WFNMC).

—From a WFNMC announcement

William Rundell Appointed DMS Director

William Rundell of Texas A&M University has been appointed director of the Division of Mathematical Sciences of the National Science Foundation. He succeeds Philippe Tondeur, who was appointed in 1999 and has now returned to the University of Illinois at Urbana-Champaign as a professor emeritus. Rundell will assume his duties at the NSF in mid-September.

Rundell was born in Glasgow, Scotland, and received his Ph.D. from Glasgow University in 1974. That year he took a position at Texas A&M University, where he now holds a joint professorship in mathematics and computer science. Since 1992 he has been the head of the Texas A&M mathematics department. His research interests include inverse problems in partial differential equations (parameter identification in elliptic and parabolic equations, inverse scattering, inverse spectral problems), ill-conditioned problems in integral and differential operators, and numerical algorithms and iterative methods for nonlinear equations.

The author of about sixty publications, Rundell has been active in organizing conferences in the United States and Europe and has lectured around the world. He has had considerable experience with the NSF as a member of proposal evaluation panels, site visit teams, and other committees.

—Allyn Jackson

Visiting Mathematicians

(Supplementary List)

Mathematicians visiting other institutions internationally during the 2002–03 academic years were listed in the August 2002 issue of the *Notices*, pp. 833–5. The following is an update (home country is listed in parentheses).

JORGE ARVESU, (Spain), Utah State University, Special Functions and Applications, 8/02–12/02.

H. DABOUSSI, (France), University of Colorado at Boulder, Number Theory, 8/02–12/02.

KALYAN DAS, (India), Purdue University, Bayesian Nonparametrics; Frailty Models, 8/02–12/02.

GLORIA GARCIA (Spain), University of Pittsburgh, Analysis, 10/02–12/02.

TAE-CHANG JO (Korea), Utah State University, Dynamical Systems and Applied Differential Equations, 1/03–5/03.

JE YOON LEE (South Korea), University of Pittsburgh, Analysis and Mathematical Finance, 3/02–12/02.

ZHAOLI LIU (China), Utah State University, Nonlinear Elliptic Partial Differential Equations, 1/03–5/03.

GEORGE MCCABE (U.S.A.), National University of Ireland, Galway, Applications of Statistics, 7/02–12/02.

PAUL-ANDRE MONNEY (Switzerland), Purdue University, Dempster Theory of Evidence, Information Fusion, 8/02–5/03.

YOSHIHITO OSHITA (Japan), University of Pittsburgh, Reaction-Diffusion Systems, 9/02–12/02.

GYULA PAP (Hungary), Southern Illinois University, Carbondale, Probability Theory, 8/02–1/03.

GERALD SCHWARZ (U.S.A.), Ruhr Universitaet Bochum, Germany, Transformation Groups, 3/03–4/03; Matematische Institut Basel, Switzerland, Transformation Groups, 5/03–6/03.

DAMODAR SHANBHAG (England), Bowling Green State University, Probability and Statistics, 1/03–5/03.

YO SHEENA (Japan), Bowling Green State University, Statistical Decision Theory, 3/01–2/03.

CHARLES STUART (Switzerland), University of Pittsburgh, Applied Analysis, 10/02–12/02.

JYOTHI SUBRAMANIAN (India), Purdue University, Bioinformatics; Nonparametric Statistics, 8/02–5/03.

MICHAL TZUR (Israel), Northwestern University, Operations Research, 9/02–6/03.

Mathematics Opportunities

ONR Young Investigator Program

The Office of Naval Research (ONR) sponsors a Young Investigator Program to support academic scientists and engineers who have recently received Ph.D. or equivalent degrees and who show exceptional promise for doing creative research.

Awards of up to $100,000 per year for three years are made, and additional funds may be provided based on need. The program is open to United States citizens, nationals (native residents of a U.S. possession), and permanent residents who hold tenure-track or permanent faculty positions at U.S. universities and who received their graduate degrees on or after November 1, 1997.

Proposals in mathematical, computer, and information sciences should be sent to: Office of Naval Research, Andre M. Van Tilborg, Director, Mathematical, Computer, and Information Sciences Division, Attn. FY03-YIP, 800 N. Quincy Street, Arlington, VA 22217-5660; telephone 703-696-4312; email: Andre_VanTilborg@onr.navy.mil. Proposals must be received by 4:00 p.m. on **November 1, 2002**. For further information and instructions for proposal preparation, see the ONR website, http://www.onr.navy.mil/sci_tech/industrial/yip_announce.htm.

—From an ONR announcement

NSF Distinguished International Postdoctoral Research Fellowships

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 this fellowship 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 proposals is **October 9, 2002**. For technical and scientific information, contact Lynne Walling, Program Director, Division of Mathematical Sciences, Room 1025, National Science Foundation, 4201 Wilson Blvd., Arlington, VA 22230; telephone 703-292-8104; email: lwalling@nsf.gov. The program announcement is available at http://www.nsf.gov/pubs/2001/nsf01154/nsf01154.txt.

—From an NSF announcement

NSF IGERT Program

The Integrative Graduate Education and Research Training (IGERT) program was initiated by the National Science Foundation (NSF) to meet the challenges of educating Ph.D. scientists and engineers with the interdisciplinary backgrounds and the technical, professional, and personal skills needed for the career demands of the future. The program is intended to catalyze a cultural change in graduate education for students, faculty, and universities by establishing innovative models for graduate education in a fertile environment for collaborative research that transcends traditional disciplinary boundaries. It is also intended to facilitate greater diversity in student participation and to contribute to the development of a diverse, globally aware science and engineering work force. Supported projects must be based on a multidisciplinary research theme and administered by a diverse group of investigators from U.S. Ph.D.-granting institutions with appropriate research and teaching interests and expertise.

For the 2002 competition, the preproposal deadline is **October 2, 2002**, and the deadline for full proposals is **April 18, 2003**. Further information may be found at the Web page http://www.nsf.gov/pubsys/ods/getpub.cfm?nsf02145.

—From an NSF announcement

Humboldt Foundation Offers Fellowships

The Alexander von Humboldt Foundation awards annual fellowships to foreign scholars holding doctorates to support research projects of their own choosing in Germany. The fellowships are offered for research visits of between six and twelve months.

Applicants from all countries and in all academic disciplines may apply. The fellowships are awarded to scholars under forty years of age. Approximately 500 research fellowships are available each year. Decisions are based primarily on the quality and feasibility of the proposed research projects and on the applicants' international publications.

For more information on application requirements and procedures, consult the Foundation's website at http://www.avh.de/en/programme/stip_aus/index.htm.

—From a Humboldt Foundation announcement

Call for Applications for AMS Epsilon Fund

The AMS Epsilon Fund awards grants to summer mathematics programs that support and nurture mathematically talented high school students in the United States. The deadline for application for funding for summer 2003 programs is **December 16, 2002**. Application materials are available on the Web at http://www.ams.org/careers-edu/epsilon.html or by mail: Professional Services Department, AMS, 201 Charles Street, Providence, RI 02904; telephone 800-321-4267, ext. 4105; email: prof-serv@ams.org.

—Diane M. Boumenot, AMS Professional Services Department

Call for Nominations for Waterman Award

Congress established the Alan T. Waterman Award in August 1975 to mark the twenty-fifth anniversary of the National Science Foundation (NSF) and to honor its first director. The annual award recognizes an outstanding young researcher in any field of science or engineering supported by the NSF. In addition to a medal, the awardee receives a grant of $500,000 over a three-year period for scientific research or advanced study in the mathematical, physical, medical, biological, engineering, social, or other sciences at the institution of the recipient's choice.

Candidates must be U.S. citizens or permanent residents and must be thirty-five years of age or younger or not more than seven years beyond receipt of the Ph.D. degree by December 31 of the year in which they are nominated. Candidates should have demonstrated exceptional individual achievements in scientific or engineering research of sufficient quality to place them at the forefront of their peers. Criteria include originality, innovation, and significant impact on the field.

Nominations for the award and supporting references must be postmarked by **December 31, 2002**. For more detailed information concerning the nomination procedures or to receive a nomination form, contact Susan E. Fannoney, telephone: 703-292-8096, or email: sfannone@nsf.gov.

—From an NSF announcement

Call for Nominations for Third World Academy of Sciences Prizes

The Third World Academy of Sciences (TWAS) Prizes will be awarded to individual scientists in developing countries in recognition of outstanding contributions to knowledge in eight fields of science. This new prize was formed by merging the TWAS Awards in Basic Sciences and the Third World Network of Scientific Organizations (TWNSO) Prizes in Applied Science. Eight awards are given each year in the fields of mathematics, basic medical sciences, biology, chemistry, physics, agricultural sciences, earth sciences, and engineering sciences. Each award consists of a prize of US$10,000 and a plaque. Candidates for the awards must be nationals of developing countries and must be living and working in those countries.

Nominations for the 2003 awards are due on **March 1, 2003**. Completed nomination forms should be sent to: Helen Grant, TWAS Prizes, Third World Academy of Sciences (TWAS), c/o The Abdus Salam International Centre for Theoretical Physics (ICTP), 34014 Trieste, Italy, fax: 39 040 224559. Further information is available on the World Wide Web at http://www.ictp.trieste.it/~twas/twas_prizes.html.

—From a TWAS announcement

News from IPAM

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

Semester-Long Programs, 2002–2003

Mathematics in Nanoscale Science and Engineering, September–December 2002: Organizing Committee: Russel Caflisch (UCLA), James Heath (UCLA), Mitchell Luskin (University of Minnesota), Antonio Redondo (Los Alamos National Laboratory), Peter Shor (AT&T Laboratories). Tutorials will be held September 17–20, 2002, and workshops will be held throughout the semester.

Symplectic Geometry and Physics, March–June, 2003: Organizing Committee: Valentin Afraimovich (Mexico), Denis Auroux (École Polytechnique), Fedor Bogomolov (Courant Institute), Simon Donaldson (Imperial College), Ludmil Katzarkov (UC Irvine), Maxim Kontsevich (IHÉS), Gang Liu (UCLA), Tony Pantev (University of Pennsylvania), George Zaslavsky (New York University). Tutorials will be held March 18–21, 2003, and workshops will be held throughout the semester.

Short Programs, 2002–2003

PECS-IV International Workshop on Photonic and Electromagnetic Crystal Structures, October 28–November 1, 2002: Organizing Committee: Tony Chan (UCLA), Eilish Hathaway (IPAM).

Multiscale Geometric Analysis: Theory, Tools, and Applications, January 13–17, 2003: Organizing Committee: Emmanuel Candes (Caltech), David Donoho (Stanford), Peter Jones (Yale), Jean-Luc Starck (Saclay).

Emerging Applications of the Nonlinear Schrödinger Equation, February 3–7, 2003: Organizing Committee: Gadi Fibich (Tel Aviv), Shi Jin (University of Wisconsin-Madison), George Papanicolaou (Stanford).

Cells and Materials: At the Tissue Engineering Interface, February 18–21, 2003: Organizing Committee: James Dunn (UCLA), Ichiro Nishimura (UCLA), Michael Longaker (Stanford), Stanley Osher (UCLA), Bill Tawil (Baxter BioSciences), Howard Winet (UCLA), Ben Wu (UCLA).

Geometry of Lagrangian Submanifolds, April 14–18, 2003: Organizing Committee: M. Gross (UCSD), K. Liu (UCLA), R. Schoen (Stanford), J. Wolfson (Michigan State), E. Zaslow (Northwestern).

Applied Inverse Problems, May 18–23, 2003: Organizing Committee: Joyce McLaughlin (Rensselaer Polytechnic Institute), Bill Rundell (Texas A&M), Heinz Engl (Johannes-Kepler), Daniela Calvetti (Case Western).

Undergraduate Program, Summer 2003

Research in Industrial Projects for Students (RIPS) is a summer program based on the National Science Foundation's Research Experiences for Undergraduates program with industry-sponsored projects.

For more information and application forms, visit the IPAM website at `http://www.ipam.ucla.edu/programs/`.

—From an IPAM announcement

AWM Essay Contest

To increase awareness of women's ongoing contributions to the mathematical sciences, the Association for Women in Mathematics (AWM) is offering an essay contest for biographies of contemporary women mathematicians and statisticians in academic, industrial, and government careers. The 2002 contest is sponsored by the Simulation Enabled Product Realization Program at Sandia National Laboratories.

The contest is open to students in the following categories: 6th–8th grade, 9th–12th grade, undergraduate, and graduate. At least one winning entry will be chosen from each category. Winners will receive a prize, and their essays will be published online at the AWM website. A grand prize winner will have his or her entry published in the *AWM Newsletter* as well. The deadline for entries is **November 1, 2002**.

In addition to student entries, organizers are currently seeking women mathematicians to volunteer as the subjects of these essays.

For more information, go to `http://www.awm-math.org/biographies/contest.html` or contact Victoria Howle, the contest organizer, by email at `vehowle@sandia.gov`.

—Victoria Howle, Sandia National Laboratories

Inside the AMS

MathJobs.Org: Job Application Database for Mathematics

Last year the AMS began sponsoring a mathematics job application database system called MathJobs.Org, which was originally developed at Duke University. The system, designed to be used both by jobseekers and by mathematics departments offering positions, allows every step of the employment application process to be carried out in a paperless, online environment. MathJobs.org was used successfully to fill postdoctoral positions during the 2001–2002 hiring season. In 2002–2003 the AMS is offering the MathJobs.org service at an introductory rate for employers. The service is free to applicants.

MathJobs.org allows a jobseeker to create a personal portfolio containing cover letters, résumés, teaching and research statements, lists of publications, etc. After browsing through listings of open positions, the jobseeker can create tailored applications by selecting the appropriate documents from his or her portfolio. The applications can then be submitted directly on the system. MathJobs.org also provides a way for referees to enter letters of reference into the system.

For mathematics departments offering positions, MathJobs.org makes it easy to create a database of applicants containing information such as educational background, research area, names of referees, whether reference letters have been received, etc. Other features include automated messaging and reader note taking. MathJobs.org can manage the entire job application process without paper but can also be profitably used in conjunction with a paper folder system.

The AMS believes that MathJobs.org could greatly increase the efficiency of the job application process. Those interested in trying out the system can use a demo available at the website http://www.mathjobs.org. Employers wishing to register should fill out an electronic form on the website. Further information about subscribing to use the MathJobs.org service is available through the AMS Professional Services Department, AMS, 201 Charles Street, Providence, RI 02904; telephone 800-321-4267, ext. 4105; email: mathjobs@ams.org.

—*Allyn Jackson*

Deaths of AMS Members

HERMAN J. COHEN, retired, City College, CUNY, died on May 22, 2002. Born on September 18, 1922, he was a member of the Society for 56 years.

ERIK BENT HANSEN, of the Technical University of Denmark, died on May 14, 2002. He was a member of the Society for 34 years.

ELMAR H. THOMA, of the Technische Universität München, Germany, died on July 23, 2002. Born on September 10, 1926, he was a member of the Society for 42 years.

ALBERT WOLINSKY, of Los Angeles, CA, died on July 24, 1999. He was a member of the Society for 50 years.

Reference and Book List

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

Contacting the *Notices*

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

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

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

Upcoming Deadlines

September 15, 2002: Full proposals for REU sites. See the website http://www.nsf.gov/pubsys/ods/getpub.cfm?nsf02136.

September 15, 2002: Nominations for Sloan Research Fellowships. Contact Sloan Research Fellowships, Alfred P. Sloan Foundation, 630 Fifth Avenue, Suite 2550, New York, New York 10111, or consult the foundation's Web page: http://www.sloan.org.

September 20, 2002: Full proposals for NSF Focused Research Groups. See http://www.nsf.gov/pubs/2002/nsf02129/nsf02129.htm.

September 27, 2002: Applications for Research Professorships at MSRI. See http://www.msri.org/, or contact MSRI, 1000 Centennial Drive, Berkeley, CA 94720-5070.

October 1, 2002: Nominations for AWM Hay and Schafer Awards. Contact the Hay Award Selection Committee or the Alice T. Schafer Award

Where to Find It

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

AMS Bylaws—*November 2001, p. 1205*

AMS E-mail Addresses—*November 2001, p. 1195*

AMS Ethical Guidelines—*June/July 2002, p. 706*

AMS Officers 2000 and 2001 (Council, Executive Committee, Publications Committees, Board of Trustees)—*June/July 2002, p. 705*

AMS Officers and Committee Members—*October 2002, p. 1108*

Backlog of Mathematics Research Journals—*September 2002, p. 963*

Conference Board of the Mathematical Sciences—*September 2002, p. 955*

Information for *Notices* Authors—*June/July 2002, p. 697*

Mathematics Research Institutes Contact Information—*August 2002, p. 828*

National Science Board—*February 2002, p. 237*

New Journals for 2001—*June/July 2002, p. 698*

NRC Board on Mathematical Sciences and Staff—*April 2002, p. 492*

NRC Mathematical Sciences Education Board and Staff—*May 2002, p. 583*

NSF Mathematical and Physical Sciences Advisory Committee—*March 2002, p. 345*

Program Officers for Federal Funding Agencies—*October 2002, p. 1103 (DoD, DoE); November 2001, p. 1198 (NSF)*

Selection Committee, Association for Women in Mathematics, 4114 Computer & Space Sciences Building, University of Maryland, College Park, MD 20742-2461; telephone: 301-405-7892; email: awm@math.umd.edu.

October 1, 2002: Applications for NSF/AWM Travel Grants for Women. See http://www.awm-math.org/travelgrants.html; telephone: 301-405-7892; email: awm@math.umd.edu.

October 2, 2002: Preproposals for NSF IGERT program. See "Mathematics Opportunities" in this issue.

October 9, 2002: Proposals for NSF Distinguished International Postdoctoral Research Fellowships. See "Mathematics Opportunities" in this issue.

October 15, 2002: Proposals for NSA grant and sabbatical programs. See http://www.nsa.gov/programs/msp/grants.html, telephone: 301-688-0400; email: msp@math.umbc.edu; postal address: Mathematical Sciences Program, National Security Agency, ATTN:R51A, Suite 6557, Ft. George G. Meade, MD 20755-6557.

October 15, 2002: Applications for spring semester of Math in Moscow and for AMS scholarships. See http://www.mccme.ru/mathinmoscow or contact Math in Moscow, P.O. Box 524, Wynnewood, PA 19096; fax: +7095-291-65-01; email: mim@mccme.ru. For information about and application forms for the AMS scholarships, see http://www.ams.org/careers-edu/mimoscow.html or contact Math in Moscow Program, Professional Services Department, American Mathematical Society, 201 Charles Street, Providence RI 02904; email: prof-serv@ams.org.

October 18, 2002: Applications for NSF Postdoctoral Research Fellowships. See the NSF website at http://www.fastlane.nsf.gov/d11/D11Menu.htm.

November 1, 2002: AWM Essay Contest. See "Mathematics Opportunities" in this issue.

November 1, 2002: Proposals for ONR Young Investigator Program. See "Mathematics Opportunities" in this issue.

November 1, 2002: Applications for NSF International Research Fellow Awards. Contact Susan Parris, 703-292-8711, email: sparris@nsf.gov; or visit the website http://www.nsf.gov/sbe/int/fellows/start.htm.

November 7, 2002: Applications for NSF Graduate Fellowships. See the website http://www.orau.org/nsf/nsffel.htm; telephone (toll-free) 866-353-0905; email: nsfgrfp@orau.gov.

November 15, 2002: Applications for Postdoctoral Fellowships and General Memberships at MSRI. See http://www.msri.org/, or contact MSRI, 1000 Centennial Drive, Berkeley, CA 94720-5070.

December 1, 2002: Applications for AMS Centennial Fellowships. See http://www.ams.org/employment/centflyer.html, or contact: Professional Services Department, American Mathematical Society, 201 Charles Street, Providence, RI 02904-2294; email: prof-serv@ams.org; telephone 401-455-4107.

December 1, 2002: Submissions for Sunyer i Balaguer Prize. Contact Centre de Recerca Matemàtica, Fundació Ferran Sunyer i Balaguer, Apartat 50, E-08193 Bellaterra, Spain. World Wide Web: http://www.crm.es/info/ffsb.htm; email: crm@crm.es.

December 16, 2002: Applications for Epsilon Fund grants. See "Mathematics Opportunities" in this issue.

December 31, 2002: Nominations for Alan T. Waterman Award. See "Mathematics Opportunities" in this issue.

February 1 and May 1, 2003: Applications for NSF/AWM Travel Grants for Women. See http://www.awm-math.org/travelgrants.html; telephone: 301-405-7892; email: awm@math.umd.edu.

March 1, 2003: Nominations for Third World Academy of Science Prizes. See "Mathematics Opportunities" in this issue.

April 18, 2003: Full proposals for NSF IGERT program. See "Mathematics Opportunities" in this issue.

May 15, 2003: Applications for fall semester of Math in Moscow and for AMS scholarships. See http://www.mccme.ru/mathinmoscow, or contact Math in Moscow, P.O. Box 524, Wynnewood, PA 19096; fax: +7095-291-65-01; email: mim@mccme.ru. For information about and application forms for the AMS scholarships, see http://www.ams.org/careers-edu/mimoscow.html or contact Math in Moscow Program, Professional Services Department, American Mathematical Society, 201 Charles Street, Providence RI 02904; email: prof-serv@ams.org.

DoD Mathematics Staff

Five agencies of the Department of Defense fund research in the mathematical sciences. The names, addresses, and telephone numbers of the pertinent staff members are listed below.

Defense Advanced Research Projects Agency
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ARPA
Defense Sciences Office
3701 North Fairfax Drive
Arlington, VA 22203-1714
703-526-6630
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Anthony J. Tether, Director
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http://www.afosr.af.mil/

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http://www.sc.doe.gov/
production/octr/mics/
index.html

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Book List

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

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

Algebraic Number Theory and Fermat's Last Theorem, by Ian Stewart and David Tall. A K Peters, revised third edition, December 2001. ISBN 1-56881119-5.

The Algorithmic Beauty of Seaweeds, Sponges and Corals, by Jap Kaandorp and Janet Kübler. Springer Verlag, January 2001. ISBN 3-540-67700-3.

The Bit and the Pendulum: How the New Physics of Information Is Revolutionizing Science, by Tom Siegfried. John Wiley & Sons, February 2000. ISBN 0-47132-174-5. (Reviewed August 2002.)

The Book of Nothing: Vacuums, Voids, and the Latest Ideas about the Origins of the Universe, by John D. Barrow. Pantheon Books, April 2001. ISBN 0-375-42099-1. (Reviewed June/July 2002.)

Calculated Bets: Computers, Gambling, and Mathematical Modeling to Win, by Steven S. Skiena. Cambridge University Press, September 2001. ISBN 0-521-00962-6.

Codes and Ciphers: Julius Caesar, the Enigma, and the Internet, by Robert Churchhouse. Cambridge University Press, January 2002. ISBN 0-521-81054-X.

The Colossal Book of Mathematics: Classic Puzzles, Paradoxes, and Problems, by Martin Gardner. W. W. Norton & Company, August 2001. ISBN 0-393-02023-1. (Reviewed in this issue.)

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

Conquering Statistics: Numbers without the Crunch, by Jefferson Hane Weaver. Perseus Publishing, paperback edition, August 2001. ISBN 0-732-820495-1.

Conversations with a Mathematician: Math, Art, Science, and the Limits of Reason, by Gregory J. Chaitin. Springer, November 2001. ISBN 1-85233-549-1.

Curve Ball: Baseball, Statistics, and the Rules of Chance in the Game, by Jim Albert and Jay Bennett. Copernicus-Springer Verlag, July 2001. ISBN 0-387-98816-5.

Damned Lies and Statistics: Untangling Numbers from the Media, Politicians, and Activists, by Joel Best. University of California Press, May 2001. ISBN 0-520-21978-3.

Does God Play Dice?: The New Mathematics of Chaos, by Ian Stewart. Blackwell, revised second edition, January 2002. ISBN 0-631-23251-6.

The Difference Engine: Charles Babbage and the Quest to Build the First Computer, by Doron Swade. Viking Press, September 2001. ISBN 0-670-91020-1.

The Dream Machine: J. C. R. Licklider and the Revolution that Made Computing Personal, by M. Mitchell Waldrop. Viking Press, 2001. ISBN 0-670-89976-3.

The Essential John Nash, Harold Kuhn and Sylvia Nasar, editors. Princeton University Press, December 2001. ISBN 0-691-09527-2.

Euclid's Window: The Story of Geometry from Parallel Lines to Hyperspace, by Leonard Mlodinow. Free Press, April 2001. ISBN 0-684-86523-8. (Reviewed May 2002.)

Flatterland: Like Flatland, Only More So, by Ian Stewart. Perseus

Publishing, May 2001. ISBN 0-7382-0442-0. (Reviewed April 2002.)

Fooled by Randomness: The Hidden Role of Chance in the Markets and Life, by Nassim Nicholas Taleb. Texere, October 2001. ISBN 1-587-99071-7.

The Fractal Murders, by Mark Cohen. Muddy Gap Press, May 2002. 0-9718986-0-X.

Fragments of Infinity: A Kaleidoscope of Math and Art, by Ivars Peterson. John Wiley & Sons, October 2001. ISBN 0-471-16558-1. (Reviewed in this issue.)

A Gardner's Workout: Training the Mind and Entertaining the Spirit, by Martin Gardner. A K Peters, June 2001. ISBN 1-56881-120-9.

Geometry: Our Cultural History, by Audun Holme. Springer, April 2002. ISBN 3-540-41949-7.

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

Go To: The Story of the Math Majors, Bridge Players, Engineers, Chess Wizards, Scientists and Iconoclasts Who Were the Hero Programmers of the Software Revolution, by Steve Lohr. Basic Books, October 2001. ISBN 0-465-04225-2.

The Hilbert Challenge, by Jeremy J. Gray. Oxford University Press, December 2000. ISBN 0-198-50651-1. (Reviewed September 2002.)

The Honors Class, by Benjamin Yandell. A K Peters, December 2001. ISBN 1-568-81141-1. (Reviewed September 2002.)

How the Other Half Thinks: Adventures in Mathematical Reasoning, by Sherman Stein. McGraw-Hill, July 2001. ISBN 0-071-37339-X. (Reviewed September 2002.)

How the Universe Got Its Spots, by Janna Levin. Princeton University Press, April 2002. ISBN 0-691-09657-0.

In Code: A Mathematical Journey, by Sarah Flannery and David Flannery. Workman Publishing, May 2001. ISBN 0-761-12384-9.

It Must Be Beautiful: Great Equations of Modern Science, Graham Farmelo, editor. Granta Books, February 2002. ISBN 1-862-07479-8.

The Lady Tasting Tea: How Statistics Revolutionized Science in the Twentieth Century, by David Salsburg. W. H. Freeman & Co, April 2001. ISBN 0-716-74106-7.

Lebesgue's Theory of Integration: Its Origins and Development, by Thomas Hawkins. AMS, September 2001. ISBN 0-8218-2963-7.

The Mathematical Explorer, by Stan Wagon. Electronic book, Wolfram Research, Inc., 2001. (Reviewed June/July 2002.)

Mathematical Vistas, by Peter Hilton, Derek Holton, and Jean Pedersen. Springer-Verlag, January 2002. ISBN 0-387-95064-8.

A Mathematician Grappling with His Century: The Autobiography of Laurent Schwartz. Translated from the French by L. Schneps. Birkhäuser, 2001. ISBN 3-7643-6052-6.

The Mathematician Sophus Lie: It Was the Audacity of My Thinking, by Arild Stubhaug. Springer, 2002. ISBN 3-540-42137-8.

Mathematics and the Roots of Postmodern Thought, by Vladimir Tasic. Oxford University Press, 2001. ISBN 0-195-13967-4.

Mathematics Galore: Masterclasses, Workshops, and Team Projects in Mathematics and Its Applications, by C. J. Budd and C. J. Sangwin. Oxford University Press, June 2001. ISBN 0-198-50769-0 (hardcover), 0-198-50770-4 (paperback). (Reviewed September 2002.)

Mathematics in a Postmodern Age: A Christian Perspective, Russell W. Howell and W. James Bradley, editors. Wm. B. Eerdmans Publishing Company, May 2001. ISBN 0-802-84910-5.

The Measure of the World, by Denis Guedj. University of Chicago Press, October 2001. ISBN 0-226-31030-2.

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

A New Kind of Science, by Stephen Wolfram. Wolfram Media, Inc., May 2002. ISBN 1-579-55008-8.

Niels Hendrik Abel and His Times: Called Too Soon By Flames Afar, by Arild Stubhaug. Translated by R. Daly. Springer, May 2000. ISBN 3-540-66834-9. (Reviewed August 2002.)

Political Numeracy: Mathematical Perspectives on Our Chaotic Constitution, by Michael Meyerson. W. W. Norton & Company, March 2002. ISBN 0-393-04172-7.

Puzzlers' Tribute: A Feast for the Mind, Tom Rodgers and David Wolfe, editors. A K Peters, December 2001. ISBN 1-56881-121-7.

The Quest for the Quantum Computer, by Julian Brown. Touchstone Books, August 2001. ISBN 0-684-87004-5.

Radical Equations: Math Literacy and Civil Rights, by Robert P. Moses and Charles E. Cobb Jr. Beacon Press, February 2001. ISBN 0-807-03126-7. (Reviewed March 2002.)

The Rainbow Bridge: Rainbows in Art, Myth, and Science, by Raymond L. Lee Jr. and Alistair B. Fraser. Pennsylvania State University Press and SPIE Press, 2001. ISBN 0-271-01977-8.

The Riddle of the Compass, by Amir Aczel. Harcourt Brace, August 2001. ISBN 0-151-00506-0.

Science and an African Logic, by Helen Verran. University of Chicago Press, January 2002. ISBN 0-226-85389-6 (cloth), 0-226-85391-8 (paper).

The Science of Conjecture: Evidence and Probability before Pascal, by James Franklin. Johns Hopkins University Press, June 2001. ISBN 0-8018-6569-7.

Signs of Life: How Complexity Pervades Biology, by Richard Solé and Brian Goodwin. Basic Books, January 2001. ISBN 0-465-01927-7.

Spaceland, by Rudy Rucker. Tor Books, June 2002. ISBN 0-765-30366-3.

Statisticians of the Centuries, C. C. Heyde and E. Seneta, editors, Springer, September 2001. ISBN 0-387-953283-7.

The Story of Mathematics, by Richard Mankiewicz. Princeton University Press, February 2001. ISBN 0-691-08808-X. (Reviewed April 2002.)

Such Silver Currents: The Story of William and Lucy Clifford, 1845-1929, by M. Chisholm. Lutterworth Press, March 2002. ISBN 0-7188-3017-2.

Things a Computer Scientist Rarely Talks About, by Donald Knuth. Center for the Study of Language and Information, July 2001. ISBN 1-57586-327-8.

Thinks, by David Lodge. Viking Press, May 2001. ISBN 0-670-89984-4.

Triangle of Thoughts, by Alain Connes, André Lichnerowicz, and Marcel Paul Schützenberger. AMS, July 2001. ISBN 0-8218-2614-X. (Reviewed March 2002.)

Reference and Book List

Turing and the Universal Machine: The Making of the Modern Computer, by Jon Agar. June 2001, Totem Books. ISBN 1-840-46250-7.

Understanding Mathematics for Aircraft Navigation, by James S. Wolper. McGraw-Hill, May 2001. ISBN 0-07-137572-4.

The Unfinished Revolution: Human-Centered Computers and What They Can Do for Us, by Michael L. Dertouzos. Harperbusiness, January 2001. ISBN 0-066-62067-8.

The Universal History of Computing: From the Abacus to the Quantum Computer, by Georges Ifrah; translated from the French and with notes by E. F. Harding, assisted by Sophie Wood, Ian Monk, Elizabeth Clegg, and Guido Waldman. John Wiley & Sons, November 2000. ISBN 0-471-39671-0. (Reviewed in two parts, January 2002 and February 2002.)

The Universal History of Numbers: From Prehistory to the Invention of the Computer, by Georges Ifrah; translated from the French by David Bellos, E. F. Harding, Sophie Wood, and Ian Monk. John Wiley & Sons, December 1999. ISBN 0-471-37568-3. (Reviewed in two parts, January 2002 and February 2002.)

The Universe in a Nutshell, by Stephen Hawking. Bantam Doubleday Dell, November 2001. ISBN 0-553-80202-X. (Reviewed May 2002.)

What Is Mathematics? An Elementary Approach to Ideas and Methods, by Richard Courant and Herbert Robbins; second edition, revised by Ian Stewart. Oxford University Press, August 1996. ISBN 0-195-10519-2. (Reviewed December 2001.)

What Shape is a Snowflake?, by Ian Stewart. W. H. Freeman & Co, November 2001. ISBN 0-716-74794-4.

Where Mathematics Comes From: How the Embodied Mind Brings Mathematics into Being, by George Lakoff and Rafael Núñez. Basic Books, October 2000. ISBN 0-465-03770-4. (Reviewed November 2001.)

The Zen of Magic Squares, Circles, and Stars: An Exhibition of Surprising Structures across Dimensions, by Clifford A. Pickover. Princeton University Press, January 2001. ISBN 0-691-07041-5.

Officers and Committee Members

Numbers to the left of headings are used as points of reference in an index to AMS committees which follows this listing. Primary and secondary headings are:

1. Officers
   1.1. Liaison Committee
2. Council
   2.1. Executive Committee of the Council
3. Board of Trustees
4. Committees
   4.1. Committees of the Council
   4.2. Editorial Committees
   4.3. Committees of the Board of Trustees
   4.4. Committees of the Executive Committee and Board of Trustees
   4.5. Internal Organization of the AMS
   4.6. Program and Meetings
   4.7. Status of the Profession
   4.8. Prizes and Awards
   4.9. Institutes and Symposia
   4.10. Joint Committees
5. Representatives
6. Index

Terms of members expire on January 31 following the year given unless otherwise specified.

1. Officers

President	Hyman Bass	2002
President Elect	David Eisenbud	2002
Vice Presidents	Ingrid Daubechies	2003
	David Eisenbud	2002
	Hugo Rossi	2004
Secretary	Robert J. Daverman	2004
Associate Secretaries	John L. Bryant	2002
	Susan J. Friedlander	2003
	Michel L. Lapidus	2003
	Lesley M. Sibner	2002
Treasurer	John M. Franks	2002
Associate Treasurer	B. A. Taylor	2002

1.1. Liaison Committee

All members of this committee serve *ex officio*.

Chair	Hyman Bass
	Robert J. Daverman
	John M. Franks
	Linda Keen

2. Council

2.0.1. Officers of the AMS

President	Hyman Bass	2002
President Elect	David Eisenbud	2002
Vice Presidents	Ingrid Daubechies	2003
	David Eisenbud	2002
	Hugo Rossi	2004
Secretary	Robert J. Daverman	2004
Associate Secretaries*	John L. Bryant	2002
	Susan J. Friedlander	2003
	Michel L. Lapidus	2003
	Lesley M. Sibner	2004
Treasurer	John M. Franks	2004
Associate Treasurer	B. A. Taylor	2002

2.0.2. Representatives of Committees

Bulletin	Donald G. Saari	2004
Colloquium	Susan J. Friedlander	2004
Executive Committee	Robert L. Bryant	2003
Executive Committee	Karen Vogtmann	2002
Journal of the AMS	Bernd Sturmfels	2003
Mathematical Reviews	B. A. Taylor	2004
Mathematical Surveys and Monographs	Michael P. Loss	2002
Mathematics of Computation	Chi-Wang Shu	2004
Proceedings	Eric D. Bedford	2004
Transactions and Memoirs	William Beckner	2003

2.0.3. Members at Large

Colin C. Adams	2004	Henri A. Gillet	2004
Patricia E. Bauman	2002	Martin Golubitsky	2002
Sylvia T. Bozeman	2004	David R. Morrison	2004
Walter L. Craig	2003	Alexander Nagel	2003
Keith J. Devlin	2003	Louise A. Raphael	2003
Irene Fonseca	2003	Jonathan M. Rosenberg	2002
William Fulton	2002	Lisa M. Traynor	2002
Irene Martinez Gamba	2004		

*Only one Associate Secretary at a time is a voting member of the Council, namely the cognizant Associate Secretary for the scientific sessions.

2.1. Executive Committee of the Council

	Hyman Bass	*ex officio*
	Robert L. Bryant	2003
	Robert J. Daverman	*ex officio*
	David Eisenbud	*ex officio*
	David R. Morrison	2004
	Hugo Rossi	2005
	Karen Vogtmann	2002

3. Board of Trustees

	Roy L. Adler	2002
	Hyman Bass	*ex officio*
Secretary	John B. Conway	2005
	John M. Franks	*ex officio*
	Eric M. Friedlander	2004
Chair	Linda Keen	2003
	B. A. Taylor	*ex officio*
	Carol S. Wood	2006

4. Committees

4.1. Committees of the Council

Standing Committees

4.1.1. Editorial Boards

	Tony F. C. Chan	2003
	Clifford J. Earle	2004
Chair	Jane P. Gilman	2003
	Svetlana Y. Jitomirskaya	2004
	Palle E. T. Jorgensen	2002
	Gregory F. Lawler	2002

4.1.2. Nominating Committee

Terms begin on January 1 and end on December 31 of the year listed.

	Sheldon Axler	2004
	Ruth M. Charney	2002
	Robert M. Fossum	2004
	Ramesh A. Gangolli	2002
	Jane Hawkins	2004
	Irwin Kra	2003
	Frank Morgan	2002
	Cora S. Sadosky	2003
Chair	Steven H. Weintraub	2003

4.1.3. AMS Fellows Program Subcommittee

	Patricia E. Bauman	2002
	Walter Craig	2002
	Irene Fonseca	2002
	Robert M. Guralnick	2002
	Sheldon H. Katz	2002
	Alexander Nagel	2002
Chair	Jonathan M. Rosenberg	2002
	Ronald Stern	2002

4.2. Editorial Committees

4.2.1. Abstracts Editorial Committee

All members of this committee serve *ex officio*.

	John L. Bryant
Chair	Robert J. Daverman
	Susan J. Friedlander
	Michel L. Lapidus
	Lesley M. Sibner

4.2.2. Bulletin (New Series)

Chief Editor	Donald G. Saari	2004
	Andy R. Magid	2004

Associate Editors for Bulletin Articles

John C. Baez	2004	Haynes R. Miller	2003
Michael R. Bridson	2004	Paul H. Rabinowitz	2004
John M. Franks	2002	Panagiotis E. Souganidis	
Eric M. Friedlander	2003		2003
Craig L. Huneke	2004	Michael Wolf	2004
Douglas A. Lind	2002	_____	2004
Barry Mazur	2002		

Associate Editors for Book Reviews

Lawrence Craig Evans	2004	Philip E. Protter	2002
Andy R. Magid	2003	Audrey A. Terras	2002

4.2.3. Collected Works

Chair	Jonathan L. Alperin	2003
	Elliott H. Lieb	2002
	Cathleen S. Morawetz	2003

4.2.4. Colloquium

Chair	Susan J. Friedlander	2004
	Yuri Manin	2003
	Peter Sarnak	2002

4.2.5. Contemporary Mathematics

	Andreas Blass	2004
Chair	Dennis DeTurck	2004
	Andy R. Magid	2004
	Michael S. Vogelius	2004

4.2.6. Electronic Research Announcements

	Stuart Antman	2002
	David J. Benson	2004
	Dimitri Burago	2003
	Tobias Colding	2004
	Mark Freidlin	2002
	Ronald L. Graham	2003
Chair	Svetlana R. Katok	2003
	Yitzhak Katznelson	2004
	David Kazhdan	2004
	Alexander S. Kechris	2002
	Alexandre A. Kirillov	2002
	Frances C. Kirwan	2002
	Krystyna M. Kuperberg	2002
	Robert K. Lazarsfeld	2004
	Grigorii A. Margulis	2002
	Hugh L. Montgomery	2003
	Walter David Neumann	2003
	Klaus Schmidt	2003
	Richard M. Schoen	2001
	Masamichi Takesaki	2003
	Michael E. Taylor	2004
	Guido L. Weiss	2003
	Zhihong (Jeff) Xia	2003
	Don B. Zagier	2004
	Efim I. Zelmanov	2003

4.2.7. Graduate Studies in Mathematics

	Walter Craig	2004
	Nikolai Ivanov	2004
	Steven G. Krantz	2003
Chair	David J. Saltman	2002

4.2.8. Journal of the AMS

	Ingrid Daubechies	2004
	Robert K. Lazarsfeld	2005
	Andrei Okounkov	2005
	Richard M. Schoen	2003
Chair	Bernd Sturmfels	2003

Associate Editors

James G. Arthur	2002	Tomasz S. Mrowka	2002
F. Michael Christ	2004	Bjorn Poonen	2002
Constantine M. Dafermos	2004	Jonathan M. Rosenberg	2002
		Karen E. Smith	2002
Weinan E	2003	Richard P. Stanley	2003
Lawrence Craig Evans	2004	S. R. S. Varadhan	2004
Michael J. Hopkins	2002	W. Hugh Woodin	2002
Ehud Hrushovski	2003	Efim I. Zelmanov	2004
Robert K. Lazarsfeld	2002	Shou-Wu Zhang	2004
Grigorii A. Margulis	2003	_____	2005
Curtis T. McMullen	2002		

4.2.9. Mathematical Reviews

AMS staff contact: Jane E. Kister.

	Heinz W. Engl	2002
	Jonathan I. Hall	2003
	Yuji Ito	2003
	Joyce R. McLaughlin	2002
	Ronald J. Stern	2004
Chair	B. A. Taylor	2004

4.2.10. Mathematical Surveys and Monographs

	Peter S. Landweber	2003
Chair	Michael P. Loss	2002
	Tudor Stefan Ratiu	2003
	J. T. Stafford	2003

4.2.11. Mathematics of Computation

	René Schoof	2004
Chair	Chi-Wang Shu	2004
	Lars B. Wahlbin	2002
	Joseph Ward	2004

Associate Editors

Randolph E. Bank	2003	Harald G. Niederreiter	2002
David W. Boyd	2003	Ricardo Horacio Nochetto	2004
Susanne C. Brenner	2004		
Richard P. Brent	2003	Stanley Osher	2004
Joe P. Buhler	2003	Haesun Park	2004
Carsten Carstensen	2003	Joseph E. Pasciak	2004
Arjeh M. Cohen	2002	Lothar Reichel	2004
Ronald F. A. Cools	2002	Igor Shparlinski	2004
Howard Elman	2003	Frank Stenger	2004
Richard S. Falk	2004	Denis Talay	2003
Daniel W. Lozier	2004	Nico M. Temme	2004
Zhi-Quan Luo	2002	Hugh C. Williams	2003
Roswitha März	2002	Jinchao Xu	2003

4.2.12. Notices Editorial Board

Terms begin on January 1 and expire on December 31 of the year listed.

Editor	Harold P. Boas	2003

Associate Editors

Susanne C. Brenner	2003	Elliott H. Lieb	2003
William Casselman	2003	Andy R. Magid	2003
Robert J. Daverman		Judith Roitman	2003
	ex officio	Mark E. Saul	2003
Nathaniel Dean	2003	Karen E. Smith	2003
Richard T. Durrett	2003	Audrey A. Terras	2003
Susan J. Friedlander	2003	Lisa M. Traynor	2003
Robion C. Kirby	2003		

4.2.13. Proceedings

Coordinating	Mark J. Ablowitz	2002
	Joseph A. Ball	2002
	Dan M. Barbasch	2002
	Richard Bradley	2006
Chair	Eric D. Bedford	2004
	Jonathan Borwein	2002
	Suncica Canic	2004
	Carmen C. Chicone	2003
	Richard A. Davis	2003
	J. Dodziuk	2004
	Alan Dow	2003
Coordinating	Ronald A. Fintushel	2002
	Paul Goerss	2004
	Michael Handel	2005
	Juha M. Heinonen	2003
	Rebecca A. Herb	2002
	Carl G. Jockusch, Jr.	2004
Coordinating	Linda Keen	2005
	David R. Larson	2004
Coordinating	Wen-Ching Winnie Li	2005
	Martin Lorenz	2004
	Claudia M. Neuhauser	2002
	David Preiss	2002
	Mohan Ramachandran	2003
	David E. Rohrlich	2002
	Andreas Seeger	2004
	David H. Sharp	2003
	Mei-Chi Shaw	2004
Coordinating	Lance W. Small	2005
	Stephen D. Smith	2002
Coordinating	Christopher D. Sogge	2004
	John R. Stembridge	2005
	Michael Stillman	2002
	David S. Tartakoff	2002
	N. Tomczak-Jaegermann	2003
	Bernd Ulrich	2005
	Richard Wentworth	2005
	Wolfgang Ziller	2003

4.2.14. Proceedings of Symposia in Applied Mathematics

Chair	Peter S. Constantin	2004
	Eitan Tadmor	2002
	_____	2003

4.2.15. Transactions and Memoirs

	Peter W. Bates	2003
	Patricia E. Bauman	2005
Chair	William Beckner	2003
	Krzysztof Burdzy	2003
	Harold G. Diamond	2005
	Lawrence M. Ein	2002
	Sergey Fomin	2004
	Lisa Claire Jeffrey	2004
	D. H. Phong	2004
	Stewart B. Priddy	2003
	Theodore A. Slaman	2005
	Karen E. Smith	2005
	Robert J. Stanton	2005
	Abigail Thompson	2004
	Dan Voiculescu	2005
	Robert F. Williams	2005

4.2.16. Translation from Chinese

	Sun-Yung Alice Chang	
	S.-Y. Cheng	
Chair	Tsit-Yuen Lam	
	Tai-Ping Liu	
	Chung-Chun Yang	

4.2.17. Translation from Japanese

Chair	Shoshichi Kobayashi	1999
	Masamichi Takesaki	1999

Standing Committees

4.2.18. Conformal Geometry and Dynamics

	Kari Astala	2003
	Frederick W. Gehring	2003
Chair	Linda Keen	2002
	Misha Lyubich	2002
	Howard Masur	2004
	Lei Tan	2002

4.2.19. History of Mathematics

	George E. Andrews	2003
	Joseph W. Dauben	2003
Chair	Karen H. Parshall	2004
	Michael I. Rosen	2004

4.2.20. Representation Theory

	Anthony W. Knapp	2003
	James I. Lepowsky	2004
	George Lusztig	2003
	Dragan Milicic	2004
	Birgit Speh	2002
Chair	David A. Vogan	2002

4.2.21. Student Mathematics Library

Chair	David M. Bressoud	2003
	Robert L. Devaney	2002
	Daniel L. Goroff	2005
	Carl Pomerance	2003
	Hung-Hsi Wu	2002

4.2.22. University Lecture Series

Chair	Jerry L. Bona	2002
	Jean-Luc Brylinski	2001
	Nigel J. Hitchin	2003
	Nicolai Reshetikhin	2002

4.3. Committees of the Board of Trustees

4.3.1. Agenda and Budget

All members of this committee serve *ex officio.*

	Hyman Bass
	Robert J. Daverman
	John M. Franks
	Linda Keen
	B. A. Taylor
	Karen Vogtmann

4.3.2. Audit

All members of this committee serve *ex officio.*
AMS staff contact: Gary G. Brownell.

	John M. Franks
	Linda Keen

4.3.3. Investment

AMS staff contact: Gary G. Brownell.

	Roy L. Adler	*ex officio*
Chair	John M. Franks	*ex officio*
	B. A. Taylor	*ex officio*
	Peter Weinberger	2003

4.3.4. Salaries

All members of this committee serve *ex officio.*

Chair	John M. Franks
	Linda Keen
	B. A. Taylor

4.3.5. Staff and Services

All members of this committee serve *ex officio.*

	Roy L. Adler
	John M. Franks
Chair	B. A. Taylor

Special Committees

4.3.6. Search Committee for the Editor of the Notices

Chair	Robert J. Daverman	*ex officio*
	John H. Ewing	*ex officio*
	Jane P. Gilman	
	Gregory Lawler	

4.4. Committees of the Executive Committee and Board of Trustees

4.4.1. Long Range Planning

All members of this committee serve *ex officio.*
AMS staff contact: Ellen H. Heiser.

	Hyman Bass
Chair	Robert L. Bryant
	Robert J. Daverman
	John H. Ewing
	John M. Franks
	Linda Keen
	David R. Morrison

4.4.2. Nominating

All members of this committee serve *ex officio.*

	John B. Conway
Chair	Eric M. Friedlander
	David R. Morrison
	Karen Vogtmann
	Steven H. Weintraub

4.5. Internal Organization of the American Mathematical Society

Standing Committees

4.5.1. Archives

	Steven L. Batterson	2004
	Albert C. Lewis	2003
Chair	Karen H. Parshall	2002

4.5.2. Books and Journal Donations Steering Committee

	M. Salah Baouendi	2004
	Peter W. K. Li	2003
	James L. Rovnyak	2003

4.5.3. Committee on Committees

	Josefina Alvarez	2002
	Hyman Bass	*ex officio*
	Dave Bayer	2002
	Curtis D. Bennett	2002
	Spencer J. Bloch	2002
Chair	Jerry L. Bona	2002
	Edward B. Burger	2002
	Robert J. Daverman	*ex officio*
	David Eisenbud	*ex officio*
	Andy R. Magid	2002
	Robert Eugene Megginson	2002
	Donald St. P. Richards	2002
	Alice Silverberg	2002
	Ronald J. Stern	2002
	Carol S. Wood	2002

4.5.4. Library Committee

Co-chair	Igor Dolgachev	2002
	Robert S. Doran	2002
	John B. Garnett	2003
Co-chair	Carol Hutchins	2002
	Reinhard Laubenbacher	2003
	Robert S. Seeds	2003
	Helena F. Warburg	2003
	Molly T. White	2003

4.5.5. Publications

AMS staff contact: Raquel E. Storti.

	Hyman Bass	*ex officio*
Chair	Robert L. Bryant	2003
	Krzysztof Burdzy	2004
	Robert J. Daverman	*ex officio*
	Nathaniel Dean	2002
	Keith J. Devlin	2003
	John H. Ewing	*ex officio*
	Martin Golubitsky	2002
	Palle E. T. Jorgensen	2002
	Linda Keen	2003
	David R. Morrison	2004
	Gail D. L. Ratcliff	2002
	Jonathan M. Wahl	2004

4.6. Program and Meetings

Standing Committees

4.6.1. Meetings and Conferences

AMS staff contact: Diane Saxe

	Colin C. Adams	2004
	Edward J. Barbeau, Jr.	2004
	Hyman Bass	*ex officio*
	Dominic P. Clemence	2002
	Robert J. Daverman	*ex officio*
	John H. Ewing	*ex officio*
	Irene Fonseca	2003
	Tepper L. Gill	2004
	Craig L. Huneke	2004
	Richard Randell	2003
	Hema Srinivasan	2003
Chair	Karen Vogtmann	2002
	Carol S. Wood	2002

4.6.2. Program Committee for National Meetings

	Spencer J. Bloch	2003
	Lenore C. Blum	2004
	Robert J. Daverman	*ex officio*
	Bjorn Engquist	2002
	Susan J. Friedlander	*ex officio*
	Curtis Greene	2002
Chair	David J. Saltman	2003
	Lai-Sang Young	2003

4.6.3. Short Course Subcommittee

Chair	Annalisa Crannell	2002
	Christopher E. Heil	2003
	Susan M. Hermiller	2004
	Kirk Lancaster	2003
	Niels O. Nygaard	2004
	John R. Swallow	2002
	Michael I. Weinstein	2003

4.6.4. Central Section Program Committee

	Ruth M. Charney	2003
	Susan J. Friedlander	*ex officio*
	Irene Martinez Gamba	2002
Chair	Steve Hofmann	2002
	Dave Witte	2003

4.6.5. Eastern Section Program Committee

	Carlos A. Berenstein	2003
Chair	Gregory L. Cherlin	2002
	Walter L. Craig	2002
	Lesley M. Sibner	*ex officio*
	Gregg J. Zuckerman	2003

4.6.6. Southeastern Section Program Committee

	Krishnasawami Alladi	2003
	John L. Bryant	*ex officio*
Chair	Amassa C. Fauntleroy	2002
	Guillermo Segundo Ferreyra	2002
	Susan G. Williams	2003

4.6.7. Western Section Program Committee

Chair	James H. Curry	2002
	Neal I. Koblitz	2003
	Michel L. Lapidus	*ex officio*
	Irena Swanson	2003
	William T. Trotter	2002

4.6.8. Agenda for Business Meetings

Chair	Robert J. Daverman	*ex officio*
	D. J. Lewis	2003
	Calvin C. Moore	2003

4.6.9. Arnold Ross Lecture Series Committee

	Arthur T. Benjamin	2003
Chair	Robert L. Devaney	2002
	Victoria A. Powers	2003
	Judy L. Walker	2003

4.6.10. Colloquium Lecture

	Luis A. Caffarelli	2002
	Sergiu Klainerman	2003
Chair	Dusa McDuff	2004

4.6.11. Gibbs Lecturer for 2003 and 2004, Committee to Select

Chair	Ingrid Daubechies	
	David L. Donoho	
	Michael S. Waterman	

4.7. Status of the Profession

Standing Committees

4.7.1. Academic Freedom, Tenure, and Employment Security

	Idris Assani	2003
	James H. Curry	2004
	Murray Gerstenhaber	2004
	Robert E. Megginson	2004
	Birgit Speh	2002
Chair	Roger A. Wiegand	2003
	Jay A. Wood	2002

4.7.2. Education

AMS staff contact: Samuel M. Rankin III.

	Hyman Bass	*ex officio*
	Sylvia T. Bozeman	2004
	John B. Conway	2002
	Carl C. Cowen	2002
	Robert J. Daverman	*ex officio*
	Robert L. Devaney	2003
	John H. Ewing	*ex officio*
	Jane Hawkins	2002
Chair	Roger E. Howe	2002
	Arthur M. Jaffe	2003
	Peter Kuchment	2002
	William McCallum	2004
	Curtis C. McKnight	2002
	Alexander Nagel	2003
	Louise A. Raphael	2003
	Lisa M. Traynor	2002
	Hung-Hsi Wu	2004

4.7.3. Fan Fund

	Fan R. K. Chung-Graham	2002
	Yanyan Li	2003
	Gang Tian	2002

4.7.4. Human Rights of Mathematicians

	Haim Brezis	2002
	Charles H. Clemens	2004
	Tsit-Yuen Lam	2004
Chair	Joel L. Lebowitz	2002
	Peter W. K. Li	2004
	Louis Nirenberg	2002
	Yakov Sinai	2003
	Susan G. Staples	2003
	Michael Tom	2003

4.7.5. Profession

AMS staff contact: James W. Maxwell.

	Roy L. Adler	2002
	Charles Akemann	2004
	Hyman Bass	*ex officio*
	Patricia E. Bauman	2002
	William Beckner	2003
	Walter L. Craig	2003
	Robert J. Daverman	*ex officio*
	John H. Ewing	*ex officio*
	Henri A. Gillet	2004
Chair	Mark L. Green	2002
	Sheldon Katz	2002
	Ellen Maycock	2004
	Frank R. Meyer	2004
	Louis Pigno	2002
	Douglas C. Ravenel	2004

4.7.6. Professional Ethics

	Lisa Fastenberg	2004
	Douglas S. Kurtz	2003
	Anne M. Leggett	2003
Chair	John C. Meakin	2003
	Efton L. Park	2003
	Floyd L. Williams	2002

4.7.7. Science Policy

AMS staff contact: Samuel M. Rankin III.

	Marco Avellaneda	2004
	Hyman Bass	*ex officio*
	Robert J. Daverman	*ex officio*
	David Eisenbud	*ex officio*
	John H. Ewing	*ex officio*
	Eric M. Friedlander	2002
	Irene Martinez Gamba	2004
Chair	Jane M. Hawkins	2004
	Roger Howe	2002
	Arthur M. Jaffe	2002
	Calvin C. Moore	2004
	Carl Pomerance	2002
	Hugo Rossi	2004
	Gilbert Strang	2003
	Daniel W. Stroock	2004

them that we need a third one for 2003.

4.7.8. Young Scholars Program, Interim Committee on the

Terms expire on June 30.

	Leonore J. Cowen	2005
	Alan Edelman	2004
	Joseph A. Gallian	2005
Chair	Joel H. Spencer	2003
	_____	2005

4.8. Prizes and Awards

Standing Committees

4.8.1. Award for Distinguished Public Service, Committee to Select the Winner of the

	Frederick W. Gehring	2002
	D. J. Lewis	2003
	Calvin C. Moore	2004
	William Yslas Velez	2005
	_____	2006

4.8.2. The Stefan Bergman Trust

	John Erik Fornaess	2004
	Joseph J. Kohn	2002
	Yum Tong Siu	2003

4.8.3. Bôcher Prize

	Luis Caffarelli	2002
Chair	Sergiu Klainerman	2002
	Linda Preiss Rothschild	2002

4.8.4. Centennial Fellowships

Terms expire on June 30.

	W. Dale Brownawell	2004
	Richard Lyons	2004
	Lisa Mantini	2003
Chair	Alan W. Reid	2003
	Yuriko Y. Renardy	2004
	Tara L. Smith	2003
	———	2004

4.8.5. Conant Prize, Committee to Select the Winner of the

	Brian J. Parshall	2003
	Anthony V. Phillips	2002
	Joseph H. Silverman	2002

4.8.6. Math in Moscow Progam—Travel Support

Terms expire on June 30.

Chair	Rafe R. Mazzeo	2004
	Jack Morava	2003
	Nicolai Reshetikhin	2004

4.8.7. Menger Prize Committee

Terms expire on May 31.

	Elwyn Berlekamp	2004
Chair	Gisele R. Goldstein	2002
	Julian I. Palmore	2003

4.8.8. E. H. Moore Research Article Prize, Committee to Select the Winner of the

	L. Craig Evans	2006
	Grigorii A. Margulis	2006
	George C. Papanicolaou	2006
	Andrew Wiles	2003
	———	2006

4.8.9. National Awards and Public Representation

Chair	Hyman Bass	*ex officio*
	Robert J. Daverman	*ex officio*
	David Eisenbud	*ex officio*
	Arthur M. Jaffe	2002
	Cathleen S. Morawetz	2003

4.8.10. Satter Prize, Committee to Select the Winner of the

	Alexandra Bellow	2003
Chair	Bhama Srinivasan	2002
	Jean E. Taylor	2004

4.8.11. Steele Prizes

	M. Salah Baouendi	2003
	Andreas R. Blass	2004
	Sun-Young Alice Chang	2003
	Michael G. Crandall	2003
	Constantine M. Dafermos	2002
	Daniel J. Kleitman	2003
	Barry Simon	2002
	Lou van den Dries	2004
Chair	Herbert S. Wilf	2002

Special Committees

4.8.12. Automatic Theorem Proving, Committee to Recommend Winners of Prizes for

Chair	Ronald L. Graham	2002
	Oscar E. Lanford III	2002
	David Mumford	2002

4.8.13. Cole Prize

Chair	Michael Aschbacher	
	Armand Borel	
	J. T. Stafford	

4.9. Institutes and Symposia

Standing Committees

4.9.1. Liaison Committee with AAAS

	Douglas N. Arnold	2002
	Richard A. Askey	*ex officio*
	Lenore Blum	*ex officio*
	Carlos Castillo-Chavez	2003
	Jennifer Tour Chayes	*ex officio*
	Arthur M. Jaffe	*ex officio*
	Herbert B. Keller	*ex officio*
	Warren Page	*ex officio*
	Jeffrey R. Weeks	2002

4.10. Joint Committees

4.10.1. AMS-ASA-AWM-IMS-MAA-NCTM-SIAM Committee on Women in the Mathematical Sciences

ASA, AWM, IMS, and SIAM members' terms expire December 31 of the year given, and NCTM members' terms expire on April 1 of the year given.

	Susan R. Ackerman (ASA)	2002
	Ann S. Almgren (SIAM)	2003
	Carolee Bush (ASA)	2004
	Lisa Carbone (AMS)	2004
	Deanna B. Haunsperger (AMS)	2004
Chair	Diane L. Herrmann (AWM)	2002
	Susan Holmes (IMS)	2004
	Jean LaDuke (MAA)	2004
	Regina Liu (IMS)	2002
	Deborah Lockhart (SIAM)	2002
	Judith Olson (NCTM)	2004
	Tamar Schlick (SIAM)	2003
	Sanford Segal (MAA)	2005
	Tara L. Smith (AMS)	2003
	Elizabeth Stasny (ASA)	2003

4.10.2. AMS-ASL-IMS-SIAM Committee on Translations from Russian and Other Slavic Languages

Chair	James D. Stasheff (AMS)	1995

AMS Subcommittee Members

Consultant	V. I. Arnol'd	
	Luchezar Avramov	1994
	Igor Dolgachev	1994
Consultant	S. G. Gindikin	
Consultant	Askol'd Georgievič Khovanskiĭ	
	Robert D. MacPherson	1996
	Grigorii A. Margulis	1996
Consultant	N. K. Nikol'skiĭ	
Chair	James D. Stasheff	1995

ASL Subcommittee Members

Terms expire on January 1

	Marat Arslanov	2002
	Sergei N. Artemov	2002
	Oleg Belegradek	2002
	Elisabeth Bouscaren	2002
	Wilfried Buchholz	2002
Chair	Steffen Lempp	2002
	Mariko Yasugi	2002

IMS Subcommittee Members

Chair	M. I. Freidlin
	B. Pittel
	A. Rukhin
	W. J. Studden

4.10.3. AMS-IMS-SIAM Committee on Joint Summer Research Conferences in the Mathematical Sciences

Terms expire on June 30.

	David Brydges (AMS)	2003
	Thomas DiCiccio (IMS)	2004
	Charles R. Doering (SIAM)	2003
	Ron Donagi (AMS)	2004
	William M. Goldman (AMS)	2005
	Barbara L. Keyfitz (SIAM)	2003
	Mark Low (IMS)	2003
	Hema Srinivasan (AMS)	2004
Chair	Kenneth Stephenson (AMS)	2004
	Olof B. Widlund (SIAM)	2003
	_____(AMS)	2006
	_____(IMS)	2005

4.10.4. AMS-IMS-SIAM Summer Research Conference Advisory Panel

Terms expire on June 30.

	Percy Alec Deift (SIAM)	2004
	Prem K. Goel (IMS)	2004
	Alan F. Karr (IMS)	2002
	Bart Ng (SIAM)	2003
	Robert Osserman (AMS)	2002
	John Polking (AMS)	2003

4.10.5. AMS-MAA Committee on Cooperation

All members of this committee serve *ex officio.*

Hyman Bass (AMS)
Robert J. Daverman (AMS)
David Eisenbud (AMS)
John H. Ewing (AMS)
Ronald L. Graham (MAA)
Martha J. Siegel (MAA)
Tina H. Straley (MAA)
Ann E. Watkins (MAA)

4.10.6. AMS-MAA Committee on Mathematicians with Disabilities

	John D. Fulton (MAA)	2003
	Eileen L. Poiani (MAA)	2003
	Jack R. Porter (AMS)	2004
	Gerard Walschap (AMS)	2002
	Jon Wilkin (MAA)	2002

4.10.7. AMS-MAA Committee on Research in Undergraduate Mathematics Education (CRUME)

	Anne E. Brown (MAA)	2004
	Julie M. Clark (MAA)	2002
	Bruce N. Cooperstein (AMS)	2004
	Ed Dubinsky (MAA)	2003
	Gregory D. Foley (AMATYC)	2001
	Douglas S. Kurtz (AMS)	2002
	Jay A. Malmstrom (MAA)	2004
	David C. Manderscheid (AMS)	2003
	Louise A. Raphael (AMS)	2002
	Kay Wohlhuter (NCTM)	2004

4.10.8. AMS-MAA Committee on Teaching Assistants and Part-time Instructors (TA/PTI)

	Kelly J. Black (SIAM)	2004
	Neal Brand (AMS)	2002
	Bettye Anne Case (AMS)	2003
	Kevin E. Charlwood (MAA)	2003
	David R. Finston (AMS)	2003
Chair	Teri J. Murphy (MAA)	2004
	Bruce Reznick (MAA)	2002
	Pat Shure (AMS)	2004
	Natasha Speer (AMS)	2004
	Kris W. Stewart (SIAM)	2004
	_____(AMS)	2003

4.10.9. AMS-MAA Joint Archives Committee

	H. L. Alder (MAA)	2004
	Steven L. Batterson (AMS)	2004
	Victor Katz (MAA)	2000
	Albert C. Lewis (AMS)	2003
	Karen H. Parshall (AMS)	2002
	James J. Tattersall (MAA)	2001

4.10.10. AMS-MAA Joint Meetings Committee

All members of this committee serve *ex officio.*

Chair	Robert J. Daverman
	John H. Ewing
Consultant	Diane Saxe
	Tina H. Straley
	James J. Tattersall

4.10.11. AMS-MAA Exhibits Advisory Subcommittee

Terms begin on January 1 and end on December 31 of the year listed.

Cheryl Adams
Donald J. Albers
Collier Brown
Chair Robert J. Daverman
James Gandorf
Jim Gross
Patricia Kearney
Mary Kittell
Anne Orens
Elaine Pedreira-Sullivan
Penny Pina
Diane M. Saxe
Jackie Smith
James J. Tattersall
David Tranah
Bruce Virga
_____
_____

4.10.12. AMS-MAA Arrangements Committee for the Baltimore Meeting January 15–18, 2003

Chair	M. Elizabeth Mayfield

4.10.13. AMS-MAA Joint Program Committee for the Baltimore Meeting January 15–18, 2003

	David Bayer (AMS)	
	Aparna W. Higgins (MAA)	
Chair	Roger Horn (MAA)	
	Krystyna Kuperberg (AMS)	

4.10.14. AMS-MAA-SIAM Joint Committee on Employment Opportunities

AMS staff contact: James W. Maxwell.

Chair	Neil J. Calkin (AMS)	2003
	Min Chen (AMS)	2003
	J. Kevin Colligan (MAA)	2000
	James W. Daniel (MAA)	2003
	David A. Field (SIAM)	2001
	James W. Maxwell	*ex officio*
	David S. Ross (SIAM)	2003
	Katherine St. John (AMS)	2002
	_____(MAA)	2003

4.10.15. AMS-MAA-SIAM Joint Policy Board

MAA and SIAM members' terms expire December 31 of the year given.

	Hyman Bass (AMS)	2002
	James Crowley (SIAM)	2002
	Keith Devlin (AMS)	2003
	John Ewing (AMS)	2002
	Ronald L. Graham (MAA)	2002
	Thomas A. Manteuffel (SIAM)	2003
	Tina H. Straley (MAA)	2003
	Gilbert Strang (SIAM)	2002
	Ann E. Watkins (MAA)	2003

4.10.16. AMS-MAA-SIAM Frank and Brennie Morgan Prize for Outstanding Research in Mathematics by an Undergraduate Student

	Kelly J. Black (SIAM)	2003
	Fan R. K. Chung-Graham (MAA)	2003
Chair	Thomas C. Hales (AMS)	2003
	Svetlana Katok (AMS)	2004
	Robert O. Robson (MAA)	2002
	Kris W. Stewart (SIAM)	2002
	Robert S. Strichartz (AMS)	2002

4.10.17. AMS-SIAM Committee on Applied Mathematics

	James W. Demmel	
	Tai-Ping Liu	
	Juan C. Meza	
	Tamar Schlick	
	_____	
	_____	

4.10.18. AMS-SIAM Committee to Select the Winner of the Birkhoff Prize

	Douglas N. Arnold	2002
	Paul H. Rabinowitz	2002
Chair	Donald G. Saari	2004

4.10.19. Annual Survey Data Committee

AMS staff contact: James W. Maxwell.

	Lorraine Denby (ASA)	2003
	J. Douglas Faires (MAA)	2002
	Mary W. Gray (MAA)	2002
	Alexander J. Hahn (AMS)	2004
	Peter E. Haskell (AMS)	2002
	G. Samuel Jordon (AMS)	2003
	Stephen F. Kennedy (AMS)	2004
	Ellen E. Kirkman (AMS)	2004
Chair	Don O. Loftsgaarden (MAA)	2002
	James W. Maxwell (AMS)	*ex officio*
	_____(IMS)	2004

Special Committees

4.10.20. AMS-India Joint Program Committee, December 17–20, 2003

	Hyman Bass
	Susan Friedlander
	John W. Morgan
	Srinivasa R. S. Varadhan

4.10.21. AMS-Sociedad Mexicana Mathematica (SMM) Joint Program Committee, May 13–15, 2004

	Edward Green
	Rodrigo Banuelos

4.10.22. AMS-Real Sociedad Matemática Española (RSME) Joint Program Committee, Seville, Spain, June 2003

	Antonio J. Cordoba
	Rafael de la Llave
	Antonio J. Duran
	William G. Dwyer
	Carlos Kenig
	Antonio Ros

4.10.23. AMS-Unione Matematica Italiana Joint Program Committee, Italy, June 16–20, 2002

	Charles H. Clemens
	Victor Kac
Chair	Joseph J. Kohn
	Lesley M. Sibner
	Francois Treves

5. Representatives

5.0.1. American Association for the Advancement of Science

Terms expire on February 21.

Section A	Lenore Blum	2003
Section Q	Richard A. Askey	2003

5.0.2. Canadian Mathematical Society

	Walter Craig	2002

5.0.3. Commission on Professionals in Science and Technology

	Mary W. Gray	2002

5.0.4. Committee on the American Mathematics Competition

Term expires on June 30.

	Noam Elkies	2003

5.0.5. Conference Board of the Mathematical Sciences

Hyman Bass 2002

5.0.6. Fulkerson Prize Committee

Andrew Odlyzko 2003

5.0.7. Joint Public Service Award Committee of the AAS-AMS-APS

Hyman Bass 2002
David Eisenbud 2004

5.0.8. MAA Committee on Undergraduate Program in Mathematics (CUPM)

Amy Cohen 2002
Naomi Fisher 2002

5.0.9. U.S. National Committee on Theoretical and Applied Mechanics

Term expires on October 31.

David Kinderlehrer 2004

6. Index

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

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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

Reciprocity Agreements

Africa

Egyptian Mathematical Society

Apply to: Prof. Dr. B. I. Bayoumi (Honorary Secretary of ETMS), c/o Prof. Dr. A.-S. F. Obada, Al-Azhar Univ., Fac. of Sci., Dept. of Math., Nasr City 11884, Cairo, Egypt.

Dues: U.S. $15, payable to Egyptian Mathematical Society, Al-Azhar Univ., Fac. of Sci., Dept. of Math., Nasr City 11884, Cairo, Egypt.

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Apply to: Jerome A. Adepoju (Secretary), Nigerian Mathematical Society, Department of Mathematics, University of Lagos, Akoka-Yaba, Lagos, Nigeria; email: matdeplg@infoweb.abs.net.

Dues: U.S. $16, payable to A. U. Afuwape (Treasurer), Dept. of Maths., Obafemi Awolowo University, Ile-Ife, Osun State, Nigeria.

Privileges: *Journal of the Nigerian Mathematical Society* at the price normally charged to individual members.

Officers: J. C. Amazigo (Ag. President), G. O. S. Ekhaguere (Vice-President), A. U. Afuwape (Treasurer), J. A. Adepoju (Secretary).

South African Mathematical Society

Address for mail: Dr. M. S. Maharaj, Mathematics and Applied Mathematics, University of Durban-Westville, Private Bag X54001, Durban 4000, South Africa; email: mmaharaj@pixie.udw.ac.za.

Apply to: Prof. N. T. Bishop, Mathematics, Applied Mathematics and Astronomy, P. O. Box 392, Unisa 0003, South Africa.

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The Americas

Canadian Mathematical Society

Apply to: Membership and Publications Agent, Canadian Mathematical Society, 577 King Edward Ave., Suite 109, P. O. Box 450, Station A, Ottawa, Ontario, Canada K1N 6N5; email: office@cms.math.ca; http://www.cms.math.ca/.

Dues: 50% off applicable rate, payable in U.S. funds to the Canadian Mathematical Society.

Privileges: *CMS Notes*, access to members section on website; reductions on all CMS periodicals, publications, and meeting registration.

Officers: Jonathan Borwein (President); Christiane Rousseau (President Elect); George Bluman, Edgar Goodaire, Bernard Hodgson, James Mingo (Vice-Presidents); Arthur Sherk (Treasurer); Graham P. Wright (Executive Director/Secretary).

The American Mathematical Society has "reciprocity agreements" with a number of mathematical organizations around the world. A current list appears here.

These reciprocity agreements provide for reduced dues for members of these organizations who choose to join the AMS and who reside outside of the U.S. and Canada. Reciprocally, members of the AMS who reside in the U.S. or Canada may join these organizations at a reduced rate. Summaries of the privileges available to AMS members who join under the terms of reciprocity agreements are given on the following pages. Members of these organizations who join the AMS as reciprocity members enjoy all the privileges available to ordinary members of the Society. AMS dues for reciprocity members are $70 for 2002 and $72 for 2003. Each organization was asked to review and update its listing in the spring. An asterisk (*) after the name of an organization indicates that no response to this request had been received when the October *Notices* went to press.

Sociedad Colombiana de Matemáticas*

Address for mail: Apartado Aero 2521, Santafe de Bogotá, Colombia; email: socolmat@matematicas.unal.edu.co; http://www.icfes.gov.co/socolmat/.

Apply to: Leonardo Rendón, Sociedad Colombiana de Matemáticas, Apartado Aéreo 2521, Santafe de Bogotá, Colombia.

Dues: U.S. $27, payable to Sociedad Colombiana de Matemáticas.

Privileges: Free submission to the Society publications (*Revista Colombiana de Matimáticas y Lecturas Matematicas*) and discounts for participation in Society activities.

Officers: Leonardo Rendón (President), Carlos Mejía (Vice-President), Campo Elias Velosa (Secretary), Carlos Julio Arrieta (Treasurer).

Sociedad de Matemática de Chile*

Apply to: Sociedad de Matemática de Chile, María Luisa Santander 0363, Providencia, Santiago, Chile; email: socmat@mat.puc.cl; http://www.mat.puc.cl/socmat/.

Dues: U.S. $50, payable to Sociedad de Matemática de Chile.

Privileges: Receive *Gaceta de la Sociedad de Matemática, Notas de la Sociedad de Matemática de Chile.*

Officers: Rolando Rebolledo (President), Víctor Cortés (Vice-President), Hernán Burgos (Treasurer), Rodrigo Bamón and Sergio Plaza (Secretaries).

Sociedad Matemática de la República Dominicana

Apply to: Isidro Rodríguez, Sociedad Matemática de la República Dominicana, Apartado 797-2, Santo Domingo, República Dominicana.

Dues: U.S. $10, payable to Amado Reyes at the above address.

Privileges: Right to receive *Notimat* (bimonthly newsletter) and *Revista Matemática Dominicana* (twice a year).

Officers: Isidro Rodríguez (President), Mariana Morales (Vice-President), Amado Reyes (Treasurer), Eliseo Cabrera (Secretary).

Sociedad Matemática Mexicana

Apply to: Olivia Lazcano, Apartado Postal 70-450, México, D.F. 04510, México; email: smm@smm.org.mx/; http://www.smm.org.mx/.

Dues: U.S. $25, payable to Sociedad Matemática Mexicana.

Privileges: To be a regular member paying half of the regular fee for persons living outside of Mexico. Newsletter, *Bulletin of the Mexican Mathematical Society*, or *Miscelánea Matemática.*

Officers: Emilio Lluis-Puebla (President), Carlos Signoret (Vice-President), Eugenio Garnica (Treasurer), Pablo Padilla (General Secretary), Isidro Romero (Secretary), Lino Reséndiz and Silvia Morelos (Vocal).

Sociedad Uruguaya de Matemática y Estadística (SUME)*

Address for mail: J. Herrera y Reissig 565, CC 30, CP 11300, Fac. de Ingeniería, IMERL, Montevideo, Uruguay; email: jlvb@fing.edu.uy.

Apply to: José L. Vieitez (Presidente de SUME), at the above address.

Dues: U.S. $100, payable to Jorge Blanco at the above address.

Privileges: Receive PMU series and Predat series free.

Officers: José L. Vieitez (President), Jorge Blanco (Vice-President), Gonzalo Perera (Treasurer), F. Pelaez (Secretary).

Sociedade Brasileira de Matemática

Apply to: Fernanda Job, Diretoria da SBM, Estrada Dona Castorina-110, Jardim Botânico, Rio de Janeiro, RJ, Brasil, 22460-320; email: sbm@sbm.org.br.

Dues: U.S. $10, payable to Sociedade Brasileira de Matemática (contact: Telma Teixeira) at above address.

Privileges: *Revista Matématica Universitária* (RMU) (two issues per year); other publications can be purchased at a 25% discount.

Officers: Suely Druck (President), César Camacho (Vice-President), Carlos Frederico B. Palmeira (Treasurer), Elon Lages Lima (Secretary).

Sociedade Brasileira de Matemática Aplicada e Computacional*

Apply to: Comissão de Admissão da SBMAC, Rua Lauro Müller 455, 22290, Botafogo, Rio de Janeiro, RJ, Brasil.

Dues: U.S. $30, payable to Sociedade Brasileira de Matemática Aplicada e Computacional.

Privileges: *SBMAC Bulletin* and *SBMAC Notices.*

Officers: Ricardo S. Kubrusly (President), Cristina Cunha (Vice-President), Jaime M. Rivera (Treasurer), Rolci Cipolati (Secretary).

Sociedade Paranaense de Matemática*

Apply to: C. Pereira da Silva, Sociedade Paranaense de Matemática, Caixa Postal 1261, 80001-970, Curitiba-PR, Brasil.

Dues: U.S. $12, payable to Sociedade Paranaense de Matemática.

Privileges: *Boletim da Sociedade Paranaense de Matemática* (two issues per year), *Monografias da Sociedade Paranaense de Matemática.*

Officers: C. Pereira da Silva (President), R. J. B. De Sampaio (Vice-President), E. Andretta (Treasurer), A. Moser (Secretary).

Unión Matemática Argentina

Apply to: Alejandro Neme, IMASL, Ave. Ejercito de los Andes 950, 5700 San Luis, Argentina; email: uma@unsl.edu.ar; http://linux0@unsl.edu.ar/uma/.

Dues: U.S. $40, payable to Alejandro Neme.

Privileges: Free subscription to *Noticiero UMA* and one of either *Revista de la Unión Matemática Argentina* or *Revista de Educación Matemática.*

Officers: Felipe Zó (President), Jorge Solomin (Vice-President), Alejandro Neme (Treasurer), Hugo Alvarez (Secretary).

Asia

Allahabad Mathematical Society*

Address for mail: Allahabad Mathematical Society, 10, C. S. P. Singh Marg, Allahabad-211001, India; email: pramila@nde.vsnl.net.in.

Apply to: Allahabad Mathematical Society at the above address.

Dues: U.S. $30 for annual members, U.S. $250 for life members, payable to Allahabad Mathematical Society at the above address.

Privileges: All members receive a copy of the *Bulletin of the Allahabad Mathematical Society* (free of cost). In addition, members can purchase other publications of the Society at a discount of 50% for their personal use.

Officers: Pramila Srivastava (President), M. S. Rangachari and S. L. Singh (Vice-Presidents), Shalini Srivastava (Treasurer), Mona Khare (Secretary).

Calcutta Mathematical Society

Apply to: M. R. Adhikari, Secretary, Calcutta Mathematical Society, AE-374, Sector 1, Salt Lake City, Calcutta 700 064, India; telephone: 337-8882; telex: 021-5380 BID IN; fax: (0091) 33-3376290; email: cms@cal2.vsnl.net.in.

Dues: U.S. $40, payable to Secretary, Calcutta Mathematical Society, at the above address.

Privileges: *Bulletin of the Calcutta Mathematical Society*; *News Bulletin of the Calcutta Mathematical Society*; *Review Bulletin of the Calcutta Mathematical Society*; library, seminars/symposia, summer school, winter school, conferences, etc.

Officers: P. P. Chatterjee (President); K. Ramchandra, A. P. Baisnab, B. K. Dutta, S. Kumaresan, and A. Bandyopadhyay (Vice-Presidents); U. C. De (Treasurer); M. R. Adhikari (Secretary); H. P. Mazumdar (Editorial Secretary).

Indian Mathematical Society

Apply to: S. P. Arya, Treasurer, Maitreyi College, Bapu Dham Complex, Chanakyapuri, New Delhi 110021, India; email: drsparya@vsnl.net.

Dues: U.S. $20, payable to Indian Mathematical Society, at the above address.

Officers: M. A. Pathan (President), S. P. Arya (Treasurer), M. K. Singal (Administrative Secretary), N. K. Thakare (Academic Secretary), R. P. Agarwal (General Secretary).

The Korean Mathematical Society*

Apply to: Ms. Jung Suk Chung, The Korean Mathematical Society, Korea Science and Technology Center 214, 635-4 Yeoksam-dong, Kangnam-ku, Seoul 135-703, Korea; email: kms@kms.or.kr; http://www.kms.or.kr/.

Dues: U.S. $40, payable to The Korean Mathematical Society.

Privileges: Members will receive six volumes of *Journal of the KMS* and four volumes of *Bulletin of the KMS.*

Officers: Dong Myung Chung (President), Yong Seung Cho and Kil-Woung Jun (Vice-Presidents), Si Ho Kang (Treasurer), Young Do Chai (Secretary).

Mathematical Society of Japan

Apply to: Liang Zhang, 25-9-203, Hongo 4 chome, Bunkyo-ku, Tokyo 113-0033, Japan.

Dues: Category I: 9,000 yen; Category II: 10,800 yen, payable to Mathematical Society of Japan at the above address.

Privileges: Category I: *Journal of the Mathematical Society of Japan, Sugaku-Tsusin* (2 issues); Category II: *Journal of the Mathematical Society of Japan, Sugaku* (in Japanese), *Sugaku-Tsushin* (4 issues).

Officers: Shigeo Kusuoka (President), Yuko Mizutani (Treasurer), Liang Zhang (Secretary).

Mathematical Society of the Philippines*

Apply to: Membership Committee, Mathematical Society of the Philippines, Department of Mathematics, Ateneo de Manila University, P.O. Box 154, Manila, Philippines.

Dues: U.S. $5, payable to Mathematical Society of the Philippines.

Privileges: Publications and newsletter of the Mathematical Society of the Philippines.

Officers: Jose Marasigan (President), Rene P. Felix (Vice-President), Aurora Trance (Treasurer), Rolando Ramos (Secretary).

Mathematical Society of the Republic of China

Apply to: Kuo-Shung Cheng, c/o Department of Mathematics, National Taiwan University, #1, Roosevelt Road Section 4, Taipei 106, Taiwan; email: tms@math.ntu.edu.tw; http://www.math.nctu.edu.tw/~mathsoc/.

Dues: U.S. $45, payable to Jyh-Hao Lee at the above address.

Officers: Kuo-Shung Cheng (President), I-Liang Chern (Vice-President), Hung Chen (Treasurer), Jyh-Hao Lee (Secretary).

Mongolian Mathematical Society

Apply to: R. Enkhbat, Secretary, Mongolian Mathematical Society, P. O. Box 46/635, Ulaanbaatar, Mongolia; email: renkhbat46@yahoo.com.

Dues: U.S. $20, payable to R. Enkhbat at the above address.

Privileges: Right to receive the *Journal of MMS* for free and to publish in *Journal of MMS*, participate in activities of MMS.

Officers: Ts. Dashdorj (President), B. Bayasgalan (Vice-President), R. Enkhbat (Secretary).

Nepal Mathematical Society*

Apply to: S. R. Pant, Secretary, Nepal Mathematical Society, Department of Mathematics, Tribhuvan University, Kirtipur, Kathmandu, Nepal.

Dues: U.S. $20, payable to P. M. Bajracharya (Treasurer), Nepal Mathematical Society, at the address above.

Privileges: All privileges enjoyed by an ordinary member, which includes purchasing NMS publications and participation in seminars at concessional rates.

Officers: R. P. Manandhar (President), H. N. Bhattarai (Vice-President), P. M. Bajracharya (Treasurer), S. R. Pant (Secretary).

Persatuan Sains Matematik Malaysia*

Address for mail: Pusat Pengajian Sains Matematik, Universiti Kebangsaan Malaysia, 43600 Bangi, Selangor, Malaysia; email: maslina@pkrisc.cc.ukm.my.

Apply to: Dr. Maslina at the above address.

Dues: U.S. $7.50, payable to Bendahari, PERSAMA, at the above address.

Privileges: *Warkah Berita PERSAMA* (two issues per year), *Bulletin of the Malaysian Mathematical Society* (two issues per year), *Menemui Matematik* (two issues per year).

Officers: Shaharir b. Mohamad Zain (President), Abu Osman Md. Tap and Mohd. Ridi (Vice-Presidents), Bachok b. Taib (Treasurer), Maslina Darus (Secretary).

Punjab Mathematical Society*

Address for mail: Department of Mathematics, University of the Punjab, Quaid-i-Azam Campus, Lahore, Pakistan; email: mathdept@paknet.ptc.pk.

Apply to: Zia ul Haq, Secretary, Punjab Mathematical Society, Department of Maths., University of the Punjab, Lahore, Pakistan.

Dues: U.S. $30 for life membership, payable to Umar Farooq Qureshi, Treasurer, P.M.S.

Officers: G. Mustafa Habibullah (President), Zia Ullah Randhawa and Munir Ahmad Ch. (Vice-Presidents), Umar Farooq Qureshi (Treasurer), Nawazish Ali Shah (Secretary).

Ramanujan Mathematical Society

Apply to: Professor V. Thangaraj, Secretary, Ramanujan Institute for Advanced Study in Mathematics, University of Madras, Chennai-600005, India; email: riasm@md3.vsnl.net.in; http://rms.enmail.com/.

Dues: U.S. $20 (annual), U.S. $200 (life), payable to Professor V. Thangaraj at the above address.

Privileges: Complimentary copy of the *Journal of the Ramanujan Mathematical Society* and *Mathematics* newsletter.

Officers: Phoolan Prasad (President), S. Sri Bala (Vice-President), P. Paulraja (Treasurer), V. Thangaraj (Secretary).

Singapore Mathematical Society

Apply to: Secretary, Singapore Mathematical Society, c/o Department of Mathematics, National University of Singapore, 2 Science Drive 2, Singapore 117543, Singapore; email: smsuser@math.nus.edu.sg; http://www.sms.math.nus.edu.sg/sms.html.

Dues: 10 Singapore dollars, payable to The Honorary Treasurer, Singapore Mathematical Society, National University of Singapore, 10 Kent Ridge Crescent, Singapore 119260, Singapore.

Privileges: Complimentary copy of *Mathematical Medley*, the Society's official magazine, and discounts on the Society's publications and activities.

Officers: Tan Eng Chye (President), Peter Pang (Vice-President), Chua Seng Kee (Treasurer), Denny H. Leung (Secretary).

Southeast Asian Mathematical Society*

Apply to: Southeast Asian Mathematical Society, c/o Department of Mathematics, Chinese University of Hong Kong, Shatin, N.T., Hong Kong.

Dues: U.S. $10, payable to Southeast Asian Mathematical Society.

Privileges: *SEAMS Newsletter*, *Southeast Asian Bulletin of Mathematics*.

Officers: Mari-Jo P. Ruiz (President), Polly Wee Sy (Treasurer), Luz R. Nochefranca (Secretary).

Vijnana Parishad of India*

Apply to: H. M. Srivastava, Foriegn Secretary, VPI, Department of Mathematics, University of Victoria, Victoria, British Columbia, V8W 2Y2 Canada; or R. C. Singh Chandel, Secretary, VPI, Department of Mathematics, D. V. Postgraduate College, Orai-285001, U.P., India.

Dues: U.S. $10, payable to Vijnana Parishad of India, c/o Department of Mathematics, D. V. Postgraduate College, Orai-285001, U.P., India.

Privileges: *Jñānābha* (an interdisciplinary mathematical journal currently published once a year), back volumes available at 25% discount.

Officers: J. N. Kapur (President); G. S. Niranjan, G. C. Sharma, M. K. Singal (Vice-Presidents); R. C. Singh Chandel (Secretary-Treasurer).

Europe

Azerbaijan Mathematical Society*

Apply to: A. Ali Novruzov, Department of Mechanics and Mathematics, Baku State University, Baku, Azerbaijan, 370145.

Dues: U.S. $10, payable to Azerbaijan Mathematical Society.

Privileges: All privileges of ordinary members plus 50% discount on all AzMS publications.

Officers: O. A. Veliev (President), F. A. Abdullaev (Treasurer), V. A. Gasimov (Secretary).

Balkan Society of Geometers

Apply to: Prof. Dr. Constantin Udriste, Treasurer, Department of Mathematics, University Politehnica of Bucharest, Splaiul Independentei 313, Bucharest 77206, Romania; fax: (401) 411.53.65; email: udriste@mathem.pub.ro.

Dues: U.S. $30 (except persons of countries with financial difficulties, U.S. $10), payable to the Balkan Society of Geometers.

Privileges: Participation in meetings and all other privileges enjoyed by an ordinary member, discounts (at least 10%) on the prices of BSG publications.

Officers: Grigorios Tsagas (President), Constantin Udriste and Mihai Anastasiei (Vice-Presidents), Constantin Udriste (Treasurer), Vasile Iftode (Secretary).

Belgian Mathematical Society

Apply to: Jan van Casteren, Secretary, Campus Plaine, C.P. 218/01, Bld du Triomphe, B-1050 Brussels, Belgium; email: bms@ulb.ac.be; http://www.ulb.ac.be/assoc/bms/.

Dues: 15 euros, payable to Belgian Mathematical Society, at the above address.

Privileges: A free subscription to: *Bulletin of the Belgian Mathematical Society—Simon Stevin* (four issues per year); newsletter.

Officers: Adhemar Bultheel (President), Catherine Finet (Vice-President), Stefaan Caenepeel (Treasurer), Jan van Casteren (Secretary).

Berliner Mathematische Gesellschaft

Address for mail: Inst. Mathematik, TU Berlin, Strasse des 17, Juni 136, 10623 Berlin, Germany; email: pohst@math-tu-berlin.de.

Apply to: Prof. Dr. Michael Pohst, Inst. Mathematik, TU Berlin, Strasse des 17, Juni 135, 10623 Berlin, Germany.

Dues: DM 12, payable to Prof. Dr. Günter Ziegler at the apply to address above.

Privileges: One free copy of *Sitzungsberichte der BMG.*

Officers: Jürg Kramer (President), Ralf Kornhuber (Vice-President), Günter Ziegler (Treasurer), Michael Pohst (Secretary).

Croatian Mathematical Society*

Address for mail: Bijenička 30, 10000 Zagreb, Croatia; email: hmd@cromath.math.hr.

Apply to: Renata Svedrec at the above address.

Dues: U.S. $10, payable to HMD, Zagrebačka banka d.d. Zagreb, HR 2x, 30101-620-16-25731-3688780.

Privileges: *Vjesnik HMD* (in Croatian) plus one of four journals edited by CMS free of charge. All publications of the CMS and all fees reduced by at least 25%.

Officers: Zvonimir Šikić (President), Darko Veljan (Vice-President), Zlatko Drmać (Treasurer), Renata Svedrec (Secretary).

Cyprus Mathematical Society*

Address for mail: 36 Stasinou Street, Suite 102, Strovolos 2003, Nicosia, Cyprus; email: cms@cyearn.pi.ac.cy.

Apply to: Gregory Makrides, 36 Stasinou Str. Suite 102, Strovolos 2003, Nicosia, Cyprus.

Dues: U.S. $20, payable to Cyprus Mathematical Society at the above address.

Privileges: Receive the annual periodical *Mathematiko VEMA* in Greek. Invitations to conferences organized in Cyprus, invitations to Annual Summer Math School organized in Cyprus at the end of June.

Officers: Gregory Makrides (President), Andreas Shinis (Vice-President), Marios Antoniades (Treasurer), Savvas Antoniou (General Secretary).

Dansk Matematisk Forening (Danish Mathematical Society)

Address for mail: Department of Mathematical Sciences, University of Aarhus, Ny Munkegade, Building 530, DK-8000 Aarhus, Denmark; email: dmf@mathematics.dk/; http://www.dmf.mathematics.dk/.

Apply to: Please use the electronic form on the home page at http://www.dmf.mathematics.dk/.

Dues: DKr. 150, payable to Viggo Andreasen, Treasurer, Dept. of Mathematics, Roskilde University, DK-4000 Roskilde, Denmark.

Privileges: *Mathematica Scandinavica* (DKr. 290 per volume), *Nord. Mat. Tidss.* (*Normat*) (NKr. 260 per volume). (Members of the American Mathematical Society do not have to join Dansk Matematisk Forening to obtain the journals. Subscription orders should be sent directly to the journals: *Normat*, Universitetsforlaget, Avd. for tidsskrifter, Postbox 2959 Tøyen, Oslo 6, Norway; *Mathematica Scandinavica*, Matematisk Institut, Aarhus

Universitet, 8000 Aarhus C, Denmark.) Members of the American Mathematical Society who join the Danish Mathematical Society as reciprocity members will receive the newsletter *Matilde*.

Officers: Johan P. Hansen (President), Jan Philip Solovej (Vice-President), Viggo Andreasen (Treasurer), Jan Philip Solovej (Secretary).

Deutsche Mathematiker-Vereinigung (DMV)

Apply to: Mrs. Bertholdt, DMV, c/o WIAS, Mohrenstr. 39, D 10117 Berlin, Germany; email: dmv@wias-berlin.de.

Dues: 16 euros, payable to Volksbank Freiburg 6855002 (BLZ 680 900 00).

Privileges: *Mitteilungen der Deutschen Mathematiker-Vereinigung* and one of two publications: *Jahresbericht der Deutschen Mathematiker-Vereinigung*, EUR 19, 50; *Math. Semesterberichte*, EUR 20.

Officers: P. Gritzmann (President), P. Maass (Vice-President), J. Bruening (Treasurer), E. Behrends (Secretary).

Edinburgh Mathematical Society

Apply to: Dr. A. D. Gilbert, Honorary Secretary, Edinburgh Mathematical Society, James Clerk Maxwell Building, King's Buildings, Mayfield Road, Edinburgh EH9 3JZ, Scotland; email: edmathsoc@maths.ed.ac.uk; http://www.maths.ed.ac.uk/~ems/.

Dues: U.S. $12 (£6 sterling) without Society's proceedings, U.S. $32 (£16 sterling) with Society's proceedings, payable to the Honorary Secretary, as above.

Privileges: Society's proceedings are available at a concessionary rate; see above.

Officers: T. A. Gillespie (President), J. Howie (Vice-President), N. K. Dickson (Treasurer), A. D. Gilbert and P. Heywood (Secretaries).

European Mathematical Society

Address for mail: Department of Mathematics, University of Helsinki, P. O. Box 4, FIN-00014 Helsinki, Finland; email: tuulikki.makelainen@helsinki.fi; http://www.emis.de/.

Apply to: Tuulikki Mäkeläinen at the above address.

Dues: 30 euros payable to the European Mathematical Society.

Privileges: All privileges of a normal individual EMS member.

Officers: Rolf Jeltsch (President), Luc Lemaire and Bodil Branner (Vice-Presidents), Olli Marko (Treasurer), David Brannan (Secretary).

Gesellschaft für Angewandte Mathematik und Mechanik e.V. (GAMM)

Address for mail: V. Ulbricht, Institut für Festkörpermechanik, Technische Universität Dresden, Mommsenstraße 13, D-01062 Dresden, Germany; email: Gamm@mailbox.tu-dresden.de.

Apply to: R. Kienzler, Universität Bremen, Fachbereich Produktionstechnik, Postfach 330440, D-28334 Bremen, Germany.

Dues: 51 euros, payable to A. Frommer, Universität-GH Wuppertal, Fachbereich 7-Mathematik, Gaußstraße 20, D-42097, Wuppertal, Germany.

Privileges: Regular publications of GAMM and participation in scientific meetings at a reduced rate.

Officers: F. Pfeiffer (President), G. Alefeld (Vice-President), A. Frommer (Treasurer), V. Ulbricht (Secretary), R. Kienzler (Vice-Secretary).

Glasgow Mathematical Association

Apply to: Frances Goldman, Treasurer, Glasgow Mathematical Association, Department of Mathematics, University of Glasgow, 15 University Gardens, Glasgow G12 8QW, Scotland; email: fhg@maths.gla.ac.uk.

Dues: £7, payable to Glasgow Mathematical Association, at the above address.

Privileges: *Glasgow Mathematical Journal* at reduced rate (£44).

Officers: Fiona Macdonald (President), F. Goldman (Treasurer), Philip Moon (Secretary).

Hellenic (Greek) Mathematical Society

Apply to: Hellenic Mathematical Society, 34, Panepistimiou Street, 106 79 Athens, Greece; email: info@hms.gr; http://www.hms.gr/.

Dues: U.S. $20 payable to Hellenic Mathematical Society at the above address.

Privileges: The *Bulletin of HMS*, News-Bulletin (Enimerosi), discounts that are available to all members.

Officers: Nikolaos Alexandris (President), George Dimakos and Dionysios Anapolitanos (Vice-Presidents), Evaggelos Eustathiou (Treasurer), Ioannis Tyrlis (Secretary).

Icelandic Mathematical Society*

Address for mail: Icelandic Mathematical Society, Raunvisindastofnun Haskolans, Dunhaga 3, IS-107 Reykjavik, Iceland; email: benedikt@talnakonnun.is; http://www.raunvis.hi.is/is/.

Apply to: Dr. Benedikt Johannesson at the above address.

Dues: U.S. $10, payable to Dr. Geir Agnarsson at the above address.

Privileges: Reduced subscription rate on *Mathematica Scandinavia* and *Nordisk matematisk Tidskrift* (*Normat*); subscription orders should be sent directly to the journals.

Officers: Benedikt Johannesson (President), Gier Agnarsson (Treasurer), Eyglo Gudmundsdottir (Secretary).

Irish Mathematical Society

Apply to: David Wraith, Treasurer, Irish Mathematical Society, National University of Ireland, Maynooth, Co. Kildare, Ireland; email: russell.higgs@ucd.ie; http://www.maths.tcd.ie.pub/ims/.

Dues: U.S. $10, payable to David Wraith at the above address.

Privileges: Free copy of the *Bulletin of the Irish Mathematical Society* (two times per year), free registration at IMS annual conference (September).

Officers: E. Gath (President), G. Lessells (Vice-President), David Wraith (Treasurer).

János Bolyai Mathematical Society

Apply to: Cecilia Kulcsár, Executive Director, János Bolyai Mathematical Society, Fö utca 68, H-1027 Budapest, Hungary; email: bjmt@renyi.hu.

Dues: Are voluntary but should minimally cover duplication and mailing costs; for reciprocity members (residing outside Hungary) suggested fee is 1/8 of 1 percent of the member's net income, payable to ABN AMRO Bank, Account Number 10200830-32310243. Sponsoring members pay at least U.S. $180 or equivalent per year.

Privileges: Upon request, *Matematikai Lapok* (twice a year), *Középiskolai Matematikai Lapok* (monthly). If sufficient interest is expressed, a bulletin in English will be available. In addition, the JBMS is negotiating to obtain discounts for its reciprocity and sponsoring members on several serial publications and periodicals appearing in Hungary. Contact the JBMS secretary for more information regarding this and other privileges of membership.

Officers: Imre Csiszár (President), Cecilia Kulcsár (Executive Director), György Lippner (Treasurer), István Juhász (Secretary General), Antal Balog (Vice Secretary General).

Jednota českých matematiků a fyziků (Union of Czech Mathematicians and Physicists)*

Address for mail: Union of Czech Mathematicians and Physicists, Žitná 25, 117 10 Praha 1, Czech Republic; email: jcmf@math.cas.cz.

Apply to: Jiří Rákosník at the above address.

Dues: U.S. $20, payable to Jan Coufal.

Privileges: (i) A discount of 20% in the conference fees for conferences, symposia, summer schools, and similar events organized (or coorganized) by the JČMF; (ii) newsletter.

Officers: Jaroslav Kurzweil (President); Oldřich Lepil, Štefan Schwabik, Štefan Zajac (Vice-Presidents); Jan Coufal (Treasurer); Petr Řepa (Secretary).

Jednota slovenských matematikov a fyzikov (JSMF) (Union of Slovak Mathematicians and Physicists)*

Address for mail: Secretary of JSMF, MFF UK Pavilon F1, Mlynská dolina, 842 48 Bratislava, Slovak Republic; email: JSMF@CENTER.FMPH.UNIBA.SK; http://www.uniba.sk/~jsmf/en_jsmf.htm.

Apply to: Hilda Draškovičová, MFF UK, KATC, Mlynská dolina, 842 48 Bratislava, Slovak Republic.

Dues: U.S. $20, payable to Slovenská sporiteľňa, Záhradnicka 93, 821 08 Bratislava, Slovak Republic; č.u.: 101848-019/0900 IČO: 178705.

Privileges: A discount of 20% in conference fees for conferences, symposia, summer schools, and similar events organized by the JSMF.

Officers: Beloslav Riečan (President), Hilda Draškovičová (Vice-President), Edmund Dobročka (Treasurer), Imrich Morva (Secretary).

London Mathematical Society

Address for mail: London Mathematical Society, De Morgan House, 57–58 Russell Square, London WC1B 4HS, United Kingdom; email: lms@lms.ac.uk; http://www.lms.ac.uk/.

Apply to: Miss Susan M. Oakes at the address above.

Dues: £12.25 (U.S. $24.50) payable to London Mathematical Society at the above address.

Privileges: *LMS Newsletter*; reduced rates for the *Bulletin*, *Journal*, and *Proceedings of the LMS*; *Nonlinearity*; *Journal of Applied Probability*; *Mathematical Proceedings of the Cambridge Philosophical Society*; *Quarterly Journal of Mathematics*; *Glasgow Mathematical Journal*; LMS Lecture Notes; LMS Student Texts; LMS Monographs. (Please write to the LMS for complete details.)

Officers: J. T. Stuart (President), T. J. Lyons and A. J. Scholl (Vice-Presidents), N. M. J. Woodhouse (Treasurer), D. J. H. Garling (Executive Secretary).

Mathematical Society of Serbia

Apply to: Mathematical Society of Serbia, Knez Mihailova 35/IV, p.p. 791, 11000 Belgrade, Yugoslavia.

Dues: U.S. $12, payable to Beobanka A. D. (Swift Code: BEOBYUBG) Acct. No. 733782, Mathematical Society of Serbia (Društvo Matematičara Srbije) Acct. No. 718000-840-0708491900.

Privileges: *Matematički Vesnik, Teaching Mathematics.*

Officers: Rade Doroslovački (President), Pavle Mladenovič (Vice-President), Milica Babić (Treasurer), Mirjana Djorić (Secretary).

Norsk Matematisk Forening (Norwegian Mathematical Society)

Apply to: Erik Løw, Norsk Matematisk Forening, P. O. Box 1053, Blindern N-0316, Oslo, Norway;

email: nmf@math.uio.no; http://www.math.uio.no/~elow/nmf/hjemme.html.

Dues: NOK 50, payable to Erik Løw, Norsk Matematisk Forening.

Privileges: All regular membership privileges, including the monthly newletter *Infomat.*

Officers: Dag Normann (President), Helge Holden (Vice-President), Erik Løw (Treasurer), Open (Secretary).

Österreichische Mathematische Gesellschaft

Address for mail: Technische Universität Wien, Wiedner Hauptstraße 8-10, A-1040 Wien, Austria; email: oemg@oemg.ac.at; http://www.oemg.ac.at/.

Apply to: Heinz W. Engl, Institut für Industrie Mathematik, Universität Linz, Altenbergerstr. 69, A-4040 Linz, Austria.

Dues: 18 euros, payable to ÖMG, Diedner Hauptstr. 8-10, A-1040 Wien (PSK acct. nr. 7823.950), IBAN: AT506000000000782 3950 BIC/SWIFT Code OPSKATWW.

Privileges: *Internationale Mathematische Nachrichten* (*IMN*), reduction of fees at our congresses and meetings.

Officers: Heinz W. Engl (President), Robert F. Tichy (Vice-President), Walter Schachermayer (Treasurer), Wolfgang Woess (Secretary).

Polskie Towarzystwo Matematyczne

Apply to: President of Polish Mathematical Society, ul. Śniadeckich 8, 00-950 Warszawa, Poland; email: zgptm@impan.gov.pl.

Dues: U.S. $40, payable to Polskie Towarzystwo Matematyczne, Zarząd Główny, ul. Śniadeckich 8, 00-950 Warszawa, Poland.

Privileges: Participation in scientific conferences organized by the Polish Mathematical Society and in its scientific sessions; in addition, members receive one of the following four series of the publication *Annales Societatis Mathematicae Polonae*: *Commentationes Mathematicae* in congress languages, *Wiadomości Matematyczne* (*Mathematical News*) in Polish, *Matematyka Stosowana. Matematyka dla Społevzenstwa* (*Applied Mathematics*) in Polish and congress languages, *Dydaktyka Matematyki* (*Didactics of Mathematics*) in Polish.

Officers: Bolesława Szafirski (President), Andrzej Cegielski and Łukasz Stettner (Vice-Presidents), Adam Obtułowicz (Treasurer), Ryszarda Rempała (Secretary), Janusz Kowalski (Vice-Secretary).

Real Sociedad Matemática Española

Apply to: Secretaria de la RSME, Facultad de Matemáticas, Despacho 525, Universidad Complutense de Madrid, 28040 Madrid, Spain; email: secretaria@rsme.es; http://www.rsme.es.

Dues: 21 euros, payable to Real Sociedad Matemática Española at the above address.

Privileges: *La Gaceta de la Real Sociedad Matemática Española.*

Officers: Carlos Andradas (President), Jesús Sanz Serna (Vice-President), Alberto Elduque (Treasurer), Patricio Cifuentes (Secretary).

SEMA, Sociedad Española de Matemática Aplicada*

Apply to: Juan Luis Vázquez, President, SEMA, Departamento de Matemáticas, Univ. Autónoma de Madrid, Cantoblanco, 28049 Madrid, Spain; email: SEMA@UAM.ES; email: juanluis.vazquez@uam.es; http://www.uam.es/sema/.

Dues: 3500 PTE, payable to Bosco García Archilla, Treasurer, Departamento de Matemáticas, Univ. Autónoma de Madrid, Cantoblanco, 28049 Madrid, Spain.

Privileges: Information concerning applied mathematics in Spain through *Boletín de la SEMA*, free membership list, publications at reduced prices, reduced inscription fee for activities sponsored by SEMA.

Officers: Juan L. Vázquez (President), Juan M. Viaño (Vice-President), Bosco García Archilla (Treasurer), Enrique Fernández Cara (Secretary).

Sociedade Portuguesa de Matemática*

Address for mail: Sociedade Portuguesa de Matemática, Av. da República 37/4, 1050-187 Lisboa, Portugal; email: spm@mail.telepac.pt; http://www.spm.pt/~spm/.

Apply to: Pedro Freitas at the above address.

Dues: PTE 2500 (12.47 euros), payable to Antonieta Horta at the above address.

Privileges: *Boletim da Sociedade Portuguesa de Matemática* (2 issues per year). Additionally, members may subscribe to the following publications at reduced rates: *Portugaliae Mathematica* (4 issues) PTE 6300 (31.42 euros) and *Gazeta de Matemática* (2 issues) PTE 600 (2.99 euros).

Officers: Ana Bela Cruzeiro (President), Pedro Freitas (Vice-President), Maria Carvalho (Treasurer), Nuno Crato and Adérito Araújo (Secretaries).

Societat Catalana de Matemàtiques*

Address for mail: Carrer del Carme 47, 08001Barcelona, Spain; email: scm@iec.es; http://www.iec.es/scm/.

Apply to: Secretary, Catalan Mathematical Society, at the address above.

Dues: 2,000 pessetes, payable to the Societat Catalana de Matemàtiques.

Privileges: *Butlletí de la Societat Catalana de Matemàtiques* (two times per year) plus *SCM/Notices* (two times per year).

Officers: Sebastià Xambó (President), Anna Pol (Vice-President), Xavier Martínez (Treasurer), Anna Río (Secretary).

Societatea Matematicienilor din Romania*

Apply to: Horia I. Ene, Calea Grivitei 21, P. O. Box 1-764, 70700 Bucharest, Romania.

Dues: U.S. $10, payable to Societatea Matematicienilor din Romania at the address above.

Privileges: Reduced rates for participation in scientific conferences organized by SMR, *Bulletin Mathématiques* (four times per year) free.

Officers: Horia I. Ene (President), Nicolae Popa (Vice-President), Serban Barcanescu (Treasurer), Radu Purice (Secretary).

Societatea de Stiinte Matematice din Romania*

Address for mail: Societatea de Stiinte Mathematice din Romania, Str. Academiei 14, 70109 Bucharest, Romania.

Apply to: G. Gussi at the above address.

Dues: U.S. $15, payable to Societatea de Stiinte Matematice din Romania, Account 2511.1-489.1/ROL, at the above address.

Privileges: A free subscription to one of the Society's journals. Exempt from taxes for participation in the annual meetings of the Society.

Officers: Petru Mocanu (President), G. Gussi (Vice-President), Ana Curtasu (Treasurer), Florin Diac (Secretary).

Société Mathématique de France

Apply to: Société Mathématique de France, Attn. Claire Ropartz, Institut Henri Poincaré, 11 Rue Pierre et Marie Curie, 75231 Paris cedex 05, France; email: smf@dma.ens.fr; http://smf.emath.fr/.

Dues: U.S. $44, payable to the American Mathematical Society or SMF.

Privileges: *Officiel des Mathématiques*, U.S. $37; *Bulletin*, U.S. $103; *Memoires*, U.S. $100; *Bulletin* and *Mémoires*, U.S. $230; *Asterisque*, U.S. $378; *Histoire des Mathematiques*, U.S. $69; *Panoramas et Synthèses*, U.S. $59.

Officers: M. Waldschmidt (President); N. Berline, P.-J. Cahen, C. Sabbah (Vice-Presidents); A. Jacquemard (Treasurer); A.-M. Aubert (Secretary).

Société Mathématique du Luxembourg

Apply to: Carine Molitor-Braun, Centre Universitaire de Luxembourg, 162A, Avenue de la Faïencerie, L-1511 Luxembourg, Luxembourg; email: molitor@cu.lu.

Dues: 20 euros, payable to Société Mathématique du Luxembourg at the above address.

Privileges: Discount on membership dues (same percent as for AMS), subscription to *Travaux mathématiques* (at reduced rate), newsletter of the Society.

Officers: Carine Molitor-Braun (President), Norbert Poncin (Vice-President), Jean Schiltz (Treasurer), Guy Kass (Secretary).

Société Mathématique Suisse

Apply to: Hans-Christoph Im Hof, SMS Secretary, DMA-EPFL, CH-1015 Lausanne, Switzerland; email: imhof@math.unibas.ch.

Dues: CHF 25 for members of the AMS residing outside Switzerland, payable to SMS, Louise Wolf, Department of Mathematics University, CD-1700 Fribourg, Switzerland.

Privileges: *Commentarii Mathematici Helvetici* (reduced price), information concerning activities of SMS.

Officers: Rolf Jeltsch (President), Peter Buser (Vice-President), Hans-Christoph Im Hof (Secretary).

Société de Mathématiques Appliquées et Industrielles (SMAI)

Apply to: Société de Mathématiques Appliquées et Industrielles (SMAI), Institut Henri Poincaré, 11 rue Pierre et Marie Curie, 75231 Paris cedex 05, France; email: smai@ihp.jussieu.fr; http://smai.emath.fr/.

Dues: 34 euros, payable to Société de Mathématiques Appliquées et Industrielles at the above address.

Privileges: Free subscription to the Society's bulletin, *Matapli* (three issues per year).

Officers: M. Théra (President), G. Pages, C. Le Bris, H. Le Dret, and B. Lucquin (Vice-Presidents), C. Picard (Treasurer), C. Graffigne (Secretary).

Society of Associations of Mathematicians and Computer Scientists of Macedonia*

Apply to: Boro Piperevski, President SAMCSM, Pirinska B.B., 91000 Skopje, Macedonia.

Dues: $5, payable to SDMI na MAKEDONIA, acct. 40120-678-10217, Pirinska B.B., 91000 Skopje, Macedonia.

Privileges: Receiving the *Bulletin of SAMCSM* and taking part in SAMCSM activities.

Officers: Boro Piperevski (President), Borko Ilievski (Vice-President), Kosta Miševski (Treasurer), Vasile Marčevski (Secretary).

Society of Mathematicians, Physicists, and Astronomers of Slovenia

Address for mail: DMFA, P.P. 2964, 1001 Ljubljana, Slovenia; email: peter.legisa@fmf.uni-lj.si; http://www.dmfa.si/.

Apply to: Peter Legiša, FMF, P.P. 2964, 1001 Ljubljana, Slovenia.

Dues: U.S. $30, payable to SKB banka, Ajdovscina 4, 1000 Ljubljana, Slovenia; SKBASI2X, No. 042961.

Privileges: Subscription to *Obzornik za matematiko in fiziko* (surface mail).

Officers: Zvonko Trontelj (President), Nada Razpet (Vice-President), Andreja Jaklič (Treasurer), Janez Krušič (Secretary).

Suomen matemaattinen yhdistys (Finnish Mathematical Society)

Address for mail: Department of Mathematics, P. O. Box 4 (Yliopistonkatu 5), FIN-00014 University of Helsinki, Finland; email: pekka.pankka@helsinki.fi; http://www.math.helsinki.fi/~smy/.

Apply to: Pekka Pankka, Secretary, at the above address.

Dues: 15 euros, payable to Olof Staffans, Treasurer, at the above address.

Privileges: *Arkhimedes* (six issues per year) and *Eukleides* (newsletter), *Mathematica Scandinavica* at reduced price.

Officers: Kari Astala (President), Jari Taskinen (Vice-President), Olof Staffans (Treasurer), Pekka Pankka (Secretary).

Svenska Matematikersamfundet*

Address for mail: Dept. of Math., CTH/Göteborg Univ., SE-412 96 Göteborg, Sweden; email: sms@math.chalmers.se; http://www.math.chalmers.se/~sms/.

Apply to: Samuel Bengmark at the above address.

Dues: 50 SEK, payable to Thomas Strömberg, Dept. of Math., LUT, SE-971 87 Luleå, Sweden.

Privileges: *Mathematica Scandinavia* and *Nordisk Matematisk Tidskrift* at reduced rate. Newsletter about the activities and meetings of the Society.

Officers: Ulf Persson (President), Ari Laptev (Vice-President), Thomas Strömberg (Treasurer), Samuel Bengmark (Secretary).

Ukrainian Mathematical Society*

Apply to: A. S. Serdvuk, Ukraine, 252601, Kviv-4, Terescheukivskaja str., 3; email: ukrms@imat.gluk.ape.org.

Dues: U.S. $30, payable to N. A. Nazarenko.

Privileges: Privileges of membership that will be granted to AMS members who join UMS are analogous to privileges the AMS has granted to individual reciprocating society members.

Officers: I. V. Skripnik (President), A. M. Samoilenko (Vice-President), N. A. Nazarenko (Treasurer), A. S. Serdvuk (Secretary).

Union of Bulgarian Mathematicians*

Apply to: Sava Ivanov Grozdev, Secretary, Union of Bulgarian Mathematicians, Acad. G. Bonchev Str., Block 8, P.O. Box 155, BG-1113 Sofia, Bulgaria.

Dues: Voluntary, payable to Union of Bulgarian Mathematicians, Account #185-7808, State Savings Bank/DSK-I/code 421-121-817-001-1, BNB, Sofia City Branch.

Privileges: The right to attend all events organized by the UBM free of registration fees and to present papers at them, the right to attend other events in Bulgaria with a 30% discount on registration fees, and the right to purchase all UMB editions with the same subscription discount.

Officers: Ch. Lozanov (President), L. Davidov (Treasurer), S. Grozdev (Secretary General).

Unione Matematica Italiana

Apply to: Giuseppe Anichini, Segreteria dell'Unione Matematica Italiana, Dipartimento di Matematica, Piazza Porta S. Donato, 5, 40126 Bologna, Italy; email: umi@dm.unibo.it; http://www.dm.unibo.it~umi/.

Dues: 45 euros, payable to Unione Matematica Italiana.

Privileges: Free *Notiziario dell'UMI* (monthly), *Bollettino dell'UMI, Ser. A* (three issues a year), and membership list. 20 euros only for subscriptions to *Bollettino dell'UMI, Ser. B* (three issues per year).

Officers: Carlo Sbordone (President), Salvatore Coen (Vice-President), Barbara Lazzari (Treasurer), Giuseppe Anichini (Secretary).

Wiskundig Genootschap

Address for mail: CWI, P. O. Box 94079, 1090 GB Amsterdam, The Netherlands; email: Mark.Peletier@cwi.nl.

Apply to: M. A. Peletier at the above address.

Dues: 50 euros.

Privileges: Free periodical *Nieuw Archief voor Wiskunde.*

Officers: E. J. N. Looijenga (President), L. M. J. Florack (Treasurer), M. A. Peletier (Secretary).

Middle East

Iranian Mathematical Society

Address for mail: Iranian Mathematical Society, P.O. Box 13145-418, Tehran, Iran; email: iranmath@ims.sharif.ac.ir.

Apply to: Aziz Khanchi at the above address.

Dues: Students: U.S. $10; Others: U.S. $20, payable to Iranian Mathematical Society at the above address.

Privileges: *Bulletin of the Iranian Mathematical Society* (in English), *Farhang va Andisheh Riazi, Khabarnameh* and *Gozaresh* (in Farsi), and reduced rate for participation in the conferences and seminars organized by IMS.

Officers: Mehdi Behzad (President), A. R. Medghalchi (Treasurer).

Israel Mathematical Union

Address for mail: Israel Mathematical Union, School of Mathematical Sciences, Tel Aviv University, Tel Aviv 69978, Israel; email: imu@math.tau.ac.il; http://www.math.tau.ac.il/~imu/.

Apply to: Dan Haran, Secretary, at the above address.

Dues: U.S. $15, payable to Gadi Fibich, at the above address.

Privileges: Participation in meetings and all other privileges enjoyed by an ordinary member.

Officers: Vitali Milman (President), Gadi Fibich (Treasurer), Dan Haran (Secretary).

Palestinian Society for Mathematical Sciences*

Address for mail: Mathematics Department, Birzeit University, P. O. Box 14, West Bank, Palestine.

Apply to: Fawzi Yagoub, Department of Mathematics and Computer Science, SUNY College at Fredonia, Fredonia, NY 14063.

Dues: U.S. $30, payable to Fawzi Yagoub; see address above.

Privileges: Free issues of the *PSMS Newsletter*, 50% reduction on all PSMS conference fees, 50% reduction on all PSMS publications.

Officers: Mohammad Al-Amleh (President); Mohammad Saleh, Tahseen Mughrabi (Vice-Presidents); Raghib Abu Saris, Nur edden Rabei, Mohammad El-Atrash, Taha Abu Kaf, Saber Elaydi (Members).

Saudi Association for Mathematical Sciences*

Apply to: M. A. Alabdullatif, President, King Saud University, College of Science, P. O. Box 2455, Riyadh 11451, Saudi Arabia.

Dues: U.S. $30, payable to Saudi Association for Mathematical Sciences at the above address.

Privileges: Reduction in membership fee from U.S. $40 to U.S. $30; proceedings of conferences, symposia, and seminars arranged by the Association.

Officers: M. A. Alabdullatif (President), A. Alshihah (Vice-President), M. A. Aseerj (Treasurer), M. S. Qutaifan (Secretary).

South Pacific

Australian Mathematical Society Inc.

Address for mail: Department of Mathematics, University of Queensland, Brisbane, Queensland 4072, Australia; email: Secretary@austms.org.au; http://www.austms.org.au/.

Apply to: The Business Manager, Australian Mathematical Society, Department of Mathematics, Australian National University, Canberra ACT 0200, Australia.

Dues: $AUD 43, payable to the Australian Mathematical Society, c/o The Business Manager, at the above address.

Privileges: Complimentary issues of *The Gazette* (five issues in 2002), *Journal AustMS-Pure Mathematics and Statistics* ($AUD 50), *ANZIAM Journal* ($AUD 44), *Bulletin of AustMS* ($AUD 46). Reduced price for volumes in Lecture Series and reduced registration at conferences sponsored by AustMS.

Officers: A. L. Carey (President); A. J. Guttmann, W. R. Bloom, A. J. van der Poorten (Vice-Presidents); A. Howe (Treasurer); E. J. Billington (Secretary).

New Zealand Mathematical Society

Address for mail: NZ Mathematical Society, c/o Dr. Charles Semple (NZMS Secretary), Department of Mathematics and Statistics, University of Canterbury, Private Bag 4800, Christchurch, New Zealand; tel: +64-3-364-2987, ext. 8349; fax: +64-3-364-2587; email: C.Semple@math.canterbury.ac.nz; http://www.math.waikato.ac.nz/NZMS/NZMS.html.

Apply to: John A. Shanks, Department of Mathematics and Statistics, University of Otago, P. O. Box 56, Dunedin, New Zealand.

Dues: NZ $16, payable to John A. Shanks, Department of Mathematics and Statistics, University of Otago, P. O. Box 56, Dunedin, New Zealand.

Privileges: *Newsletter of the NZMS* (three per year).

Officers: Rod Downey (President), Graeme Wake (Immediate Past President), Rua Murray (Treasurer), Charles Semple (Secretary), John Shanks (Membership Secretary).

Mathematics Calendar

The most comprehensive and up-to-date Mathematics Calendar information is available on e-MATH at http://www.ams.org/mathcal/.

October 2002

*4-6 **Northwestern Nonlinear PDE Conference in conjunction with The 50th Midwest PDE Seminar**, Northwestern University, Evanston, Illinois.
Description: The aim of the conference is to bring together mathematical scientists with interests in nonlinear partial differential equations and their applications to present recent developments and explore new connections between PDE and other areas in mathematics and related fields in the sciences, in celebration of the 25th anniversary of the successful series of Midwest PDE seminars since Avner Friedman hosted the first Midwest PDE Seminar at Northwestern University (May 7-8, 1977). The program will consist of 45-minute plenary lectures starting at 3:00pm, October 4 (Friday), and ending about 5:30pm, October 6 (Sunday), 2002. The Friday session (October 4) will take place at 3:00pm in Room 105 of Lunt Hall, Department of Mathematics, 2033 Sheridan Road, Evanston.
Invited speakers (* confirmed): M. Salah Baouendi (UC-San Diego), J. Bona* (UI-Chicago), L. Caffarelli* (Austin), X. Chen* (Pittsburgh), M. Crandall* (Santa Barbara), C. Dafermos*(Brown), B. Engquist* (Princeton), A. Friedman* (Ohio State), J. Glimm* (Stony Brook), B. Hu* (Notre Dame), C. Kenig* (Chicago), F. Lin* (New York), T.-P. Liu* (Stanford), R. Melrose* (MIT), C. Morawetz* (New York), P. Rabinowitz* (Wisconsin), F. Reitich* (Minnesota), G. Tian (MIT), N. Trudinger* (Canberra).
Sponsors: The National Science Foundation and Northwestern University.
Organizers: G.-Qiang Chen, G. Gasper, and J. Jerome.
Information: See http://www.math.northwestern.edu/~gqchen/pde02/index.html.

*11-12 **22nd Southeastern-Atlantic Regional Conference on Differential Equations**, University of Tennesee, Knoxville, Tennesee.
Information: http://www.math.utk.edu/~vasili/searcde02/.

November 2002

*12-13 **IBERAMIA'2002 - Workshop on Multi-Agent Systems**, University of Málaga, Spain.
Description: Fourth Iberoamerican Workshop on Multi-Agent Systems Agent Technology and Software Engineering.
Call for Papers: 7-8 papers will be selected for a special issue on the subject of the workshop, Agent Technology and Software Engineering, to be published in Integrated Computer-Aided Engineering—an international journal (ICAE). Authors of selected papers will be required to provide an extended manuscript, which will be subject to another review process for originality and significance. The extended paper must not be under consideration by any other journal or publication.
ICAE is abstracted/indexed in The Engineering Index, Current Contents/Engineering, Social Sciences Citation Index, ISI Alerting Services, PaperChem, COMPENDEX PLUS, Science Citation Index, CompuMath Citation Index, Computing and Technology.
Information: http://www.lcc.uma.es/iberagents/.

*27-29 **Workshop on Semigroups and Languages**, Interdisciplinary Complex of the University of Lisbon, Portugal.
Invited lecturers: J. Almeida (Univ. Porto); J. Fountain (Univ. York); J. Howie (Univ. St. Andrews); D. McAlister (Northern Illinois Univ.); D. Munn (Univ. Glasgow); J.-E. Pin (CNRS, Univ. Paris 7); S. Pride (Univ. Glasgow); N. Ruskuc (Univ. St. Andrews); M. Volkov (Ural State Univ.) .
Organizing Committee: G. M. S. Gomes (ggomes@cii.fc.ul.pt),

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 **six months** prior to the scheduled date of the meeting.
The complete listing of the Mathematics Calendar will be published only in the September issue of the *Notices*. The March, June, and December issues will include, along with new announcements, references to any previously announced meetings and conferences occurring within the twelve-month period following the month of those issues. New information about meetings and conferences that will occur later than the twelve-month period will be announced once in full and will not be repeated until the date of the conference or meeting falls within the twelve-month period.
The Mathematics Calendar, as well as Meetings and Conferences of the AMS, is now available electronically through the AMS website on the World Wide Web. To access the AMS website, use the URL: http://www.ams.org/.

M. Branco (mbranco@lmc.fc.ul.pt), V. H. Fernandes (vhf@fct.unl.pt).
Information: For more information, see our web page (or contact us): http://caul.cii.fc.ul.pt/wsl2002/.

January 2003

*13-17 **Multiscale Geometric Analysis: Theory, Tools, and Applications**, Institute for Pure and Applied Mathematics, UCLA, Los Angeles, California.
Information: http://www.ipam.ucla.edu/programs/mga2003/.

*20-24 **Mathematical Challenges in Scientific and Engineering Computation**, Isaac Newton Institute for Mathematical Sciences, Cambridge, Massachusetts.
Organizers: M. Ainsworth (Univ. of Strathclyde), C. M. Elliott (Univ. of Sussex), E. Süli (Oxford Univ.).
Confirmed Speakers: T. Chan (UCLA), W. E (Princeton), B. Engquist (Princeton), R. Glowinski (Houston), T. McLeish (Leeds), O. Pironneau (Paris), A. Quarteroni (Lausanne/Milan), R. Rannacher (Heidelberg), A. Sutton (Oxford).
Information: http://www.newton.cam.ac.uk/programs/CPD/cpdw01.html. Completed application forms should be sent to T. Andrew at Isaac Newton Institute for Mathematical Sciences, 20 Clarkson Road, Cambridge, CB3 OEH or via email to: t.andrew@newton.cam.ac..uk.

February 2003

*13-15 **4th WSEAS International Conferences on: Neural Networks and Applications (NNA '03); Fuzzy Sets & Fuzzy Systems (FSFS '03); Evolutionary Computation (EC '03)**, Lanzarote Island, Canary Islands, Spain.
Description: After the impressive success of the previous relevant conferences of WSEAS on Soft Computing and Artificial Intelligence in Tenerife (Spain), New York (USA), Crete (Greece), Las Vegas (USA), Interlaken (switzerland), Cancun (Mexico), WSEAS is proud to announce the three joint conferences.
Call for Papers: Like in all WSEAS sponsored conferences, all the accepted papers will be simultaneously published not only in the usual conference proceedings, but also as chapters in the WSEAS Press Book Series or as papers in WSEAS Transactions (Journals) The Proceedings and WSEAS Press Book Series will be edited by WSEAS Press (Athens, Greece).
Information: http://www.wseas.org/.

March 2003

*20-22 **Spring Topology and Dynamical Systems Conference 2003**, Texas Tech University, Lubbock, Texas.
Information: http://www.math.ttu.edu/stdc/.

*17-June 13 **Symplectic Geometry and Physics**, Institute for Pure and Applied Mathematics, Los Angeles, California.
Information: http://www.ipam.ucla.edu/programs/sgp2003/.

*24-28 **Symplectic Geometry and Physics: Workshop I: Symplectic Geometry**, Institute for Pure and Applied Mathematics, UCLA, Los Angeles, California.
Information: http://www.ipam.ucla.edu/programs/sgp2003/#sgpsg/.

*27-30 **Sixth IMACS International Symposium on Iterative Methods in Scientific Computing**, University of Colorado, Denver, Colorado.
Conference History: IMACS established a series of conferences on iterative methods of which this is the sixth.
Theme: The 2003 symposium will be dedicated to providing an overview of the state of the art in the use of iterative methods for solving large sparse linear systems with an eye to contributions of the past, present and future. The emphasis will be placed upon identifying future research directions in the mainstream of modern scientific computing. Of particular interest will be talks on interdisciplinary research, applications, and open problems. This conference will highlight new applications in computational biology. Some specific topics targeted are: Applications (with new emphasis on Computational Biology), Domain Decomposition, Preconditioning, Parallel Methods, Nonsymmetric Solvers, Nonlinear Systems and Eigenvalue Solvers, Iterative Methods in Optimization, Multilevel Methods, Krylov Methods.
Timing: The IMACS conference will be followed by the Copper Mountain Conference on Multigrid, which will also be held in Colorado from March 30–April 4, 2003.
Information: http://math.cudenver.edu/IMACS03/.

April 2003

*10-13 **Louisiana Conference on Mathematical Control Theory**, Louisiana State University, Baton Rouge, Louisiana.
Scope: This interdisciplinary conference will include talks by approximately 30-35 leading researchers in control engineering and mathematical control theory. Topics will include nonsmooth analysis, Hamilton-Jacobi equations, numerical methods in control, stabilization, and engineering applications.
Plenary Speakers: F. Clarke (Univ. Claude-Bernard, France), P. Kokotovic (Univ. of California-Santa Barbara), R. T. Rockafellar (Univ. of Washington), H. J. Sussmann (Rutgers Univ.), R. Vinter (Imperial College of Science, Technology, and Medicine, UK)
Organizers: M. A. Malisoff and P. R. Wolenski.
Information: http://www.math.lsu.edu/~malisoff/LCMCT/.

May 2003

*18-23 **Applied Inverse Problems: Theoretical and Computational Aspects**, Institute for Pure and Applied Mathematics, UCLA, Los Angeles, California.
Information: http://www.ipam.ucla.edu/programs/aip2003/.

*19-23 **Symplectic Geometry and Physics: Workshop II: Chaotic Dynamics and Transport**, Institute for Pure and Applied Mathematics, UCLA, Los Angeles, California.
Information: http://www.ipam.ucla.edu/programs/sgp2003/#sgpdyn/.

*21-25 **Logic and Mathematics: connections and interactions**, University of Illinois at Urbana-Champaign.
Organizers: L. van den Dries, C. Ward Henson, A. Pillay, and S. Solecki.
Aim: The aim of the meeting is to bring together mathematicians with an interest in and sensitivity to applications of mathematical logic. The focus will be on connections between logic and areas of mathematics such as algebraic and analytic geometry (complex, real, p-adic, including topics like motivic integration and o-minimality), diophantine geometry, algebraic groups, algebraic theories of differential equations, geometric group theory, geometry of Banach spaces, stochastic analysis, Borel equivalence relations,...
Speakers: A. Buium, B. Poonen, G. Cherlin, T. Scanlon, O. Costin, Z. Sela, N. Cutland, K. Tent, A. Gabrielov, S. Thomas, A. Kechris, A. Vershik, P. Koiran, A. Wilkie, F. Loeser, M. Ziegler, T. Odell, B. Zilber.
Information: Updated versions of this announcement will be available at http://www.math.uiuc.edu/~henson/conference.html.

*28-30 **Lattices, Universal Algebra and Applications**, Centro de Algebra da Universidade de Lisboa, Lisboa, Portugal.
Invited Speakers: W. Blok (Univ. of Illinois at Chicago), M. Gehrke (New Mexico State Univ.), K. Kearnes (Univ. of Colorado), B. Monjardet (Univ. of Paris I), D. Mundici (Univ. of Milan).
Organizers: G. Bordalo (CAUL, Univ. Lisboa) I. Ferreirim (CAUL, Univ. Lisboa) M. Saramago (CAUL, Univ. Lisboa) Luis Sequeira (CAUL, Univ. Lisboa).

Information: http://www.ptmat.fc.ul.pt/~uaconf03/; email: uaconf03@ptmat.fc.ul.pt.

June 2003

2-6 **Symplectic Geometry and Physics: Workshop III: Symplectic Geometry and String Theory**, Institute for Pure and Applied Mathematics, UCLA, Los Angeles, California.
Information: http://www.ipam.ucla.edu/programs/sgp2003/#sgpstring/.

23-27 **Workshop on Extremal Graph Theory (Miklos Simonovits is 60)**, Lake Balaton, Hungary.
Information: http://www.renyi.hu/~extgr03/, email: extgr03@renyi.hu.

23-27 **Workshop on Harmonic Analysis and Partial Differential Equations**, Puerto Vallarta, Mexico.
Information: http://www.matem.unam.mx/whapde/; email: whapde@matem.unam.mx.

24-27 **DAY on DIFFRACTION - 2003 (DD'03)**, St. Petersburg Univ., St. Petersburg, Russia.
Workshop Topics: Mathematical and applied aspects of various nature wave phenomena
Organizers: Dept. Math. & Comp. Phys., St. Petersburg Univ.; St. Petersburg Division of Steklov' Math. Inst.; Euler Intern. Math. Inst.
Information: http://mph.phys.spbu.ru/DD/; email: grikurov@mph.phys.spbu.ru.

July 2003

14-18 (NEW DATE) **International Conference on Algebras, Modules and Rings**, University of Lisbon, Lisbon, Portugal.
Scientific Committee: A. Facchini (Padova), K. Fuller (Iowa), M. L. Galvão (Lisboa), J. L. Gómez Pardo (Santiago de Compostela), J. A. Green (Oxford/Warwick), C. M. Ringel (Bielefeld), D. Simson (Torun), P. F. Smith (Glasgow).
Organizing Committee: A. P. Alexandre (Nova de Lisboa), P. Carvalho Lomp (Porto), M. L. Galvco (Lisboa), C. Lomp (Porto), M. T. Nogueira (Lisboa), C. Santa-Clara (Lisboa).
Information: http://caul.cii.fc.ul.pt/lisboa2003/.

September 2003

1-6 **The Sixth International Workshop on Differential Geometry and its Applications and The Third German-Romanian Seminar on Geometry**, Cluj-Napoca, Romania.
Invited Speakers (confirmed by the end of May 2002): P. Benito (Spain), C.-H. Chu (England), J. Dorfmeister (Germany), A. Elduque (Spain), L. Funar (France), R. Grimaldi (Italy), Th. Hangan (France), E. Macias-Virgos (Spain), S. Marchiafava (Italy), A. Sambusetti (Italy), M. Schlichenmaier (Germany), S. Schmidt (Germany), V. Sergiescu (France), L. Vanhecke (Belgium).
Organizers: D. Andrica, "Babes Boyai" Univ. of Cluj-Napoca, email: dandrica@math.ubbcluj.ro; R. Iordanescu, Inst. of Math. of the Romanian Acad., Bucharest, email: Radu.Iordanescu@imar.ro; C. Pintea, "Babes Boyai" Univ. of Cluj-Napoca; C. Varga, "Babes Boyai" Univ. of Cluj-Napoca; T. Zamfirescu, Univ. of Dortmund, email: Tudor.Zamfirescu@mathematik.uni-dortmund.de.

8-10 **25th World Conference on Boundary Element Methods: BEM 25: Incoporating Electromagnetic Effects on Human Beings and Equipment Seminar**, Split, Croatia.
Organizer: Wessex Institute of Technology, UK, in collaboration with the University of Split, FESB Croatia.
Sponsor: The Croatian Ministry of Science and Technology.
Information: http://www.wessex.ac.uk/conferences/2003/bem25/.

* 8-December 13 **Inverse Problems: Computational Methods and Emerging Applications**, Institute for Pure and Applied Mathematics, UCLA, Los Angeles, California.
Information: http://www.ipam.ucla.edu/programs/inv2003/.

* 10-12 **Sixth International Conference on Computational Methods for the Solution of Electrical and Electromagnetic Engineering Problems: ELECTROCOMP 2003**, Split, Croatia.
Organizer: Wessex Institute of Technology, UK, in collaboration with the University of Split, FESB Croatia.
Information: http://www.wessex.ac.uk/conferences/2003/electrocomp03/.

* 15-19 **Colloquium on the occasion of the 200th anniversary of Charles-Franois Sturm and Workshop on Sturm-Liouville theory**, University of Geneva, Geneva, Switzerland.
Information: http://theory.physics.unige.ch/~fiteo/sturm/colloquium.html.

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

November 2003

* 3-5 **Second International Conference on Computational Methods in Multiphase Flow**, Sante Fe, New Mexico.
Organizer: Wessex Institute of Technology, UK, in collaboration with the University of Mexico.
Information: http://www.wessex.ac.uk/conferences/2003/multiphase03/.

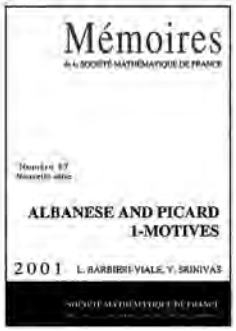
* 4-6 **Seventh International Conference on Computational Modelling of Free and Moving Boundary Problems**, Sante Fe, New Mexico.
Organizer: Wessex Institute of Technology, UK, in collaboration with the University of Mexico.
Information: http://www.wessex.ac.uk/conferences/2003/movingboundaries03/.

March 2004

* 8-June 11 **Proteomics**, Institute for Pure and Applied Mathematics, UCLA, Los Angeles, California.
Information: http://www.ipam.ucla.edu/programs/prot2004/.

New Publications Offered by the AMS

Algebra and Algebraic Geometry



Albanese and Picard 1-Motives

L. Barbieri-Viale, *Università degli Studi di Roma "La Sapienza", Rome, Italy*, and **V. Srinivas**, *Tata Institute of Fundamental Research, Mumbai, India*

A publication of the Société Mathématique de France.

This volume gives a nice summary of current work in the theory of 1-motives. The authors present the following: Let X be an n-dimensional algebraic variety over a field of characteristic zero. They describe algebraically defined Deligne 1-motives $\mathrm{Alb}^+(X)$, $\mathrm{Alb}^-(X)$, $\mathrm{Pic}^+(X)$ and $\mathrm{Pic}^-(X)$ which generalize the classical Albanese and Picard varieties of a smooth projective variety. Computed are Hodge, ℓ-adic, and De Rham realizations, proving Deligne's conjecture for H^{2n-1}, H_{2n-1}, H^1 and H_1.

Investigated are functoriality, universality, homotopical invariance and invariance under formation of projective bundles. The authors compare the cohomological and homological 1-motives for normal schemes. For proper schemes, they obtain an Abel-Jacobi map from Albanese 1-motive, which is the universal regular homomorphism to semi-abelian varieties. By using this universal property, they obtain "motivic" Gysin maps for projective local complete intersection morphisms.

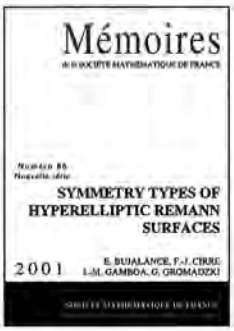
The volume is suitable for advanced graduate students and researchers interested in algebraic geometry.

Distributed by the AMS in the United States, Canada, and Mexico. Orders from other countries should be sent to the SMF, Maison de la SMF, B.P. 67, 13274 Marseille cedex 09, France, or to Institut Henri Poincaré, 11 rue Pierre et Marie Curie, 75231 Paris cedex 05, France. Members of the SMF receive a 30% discount from list.

Contents: Introduction; Preliminaries on 1-motives; Homological Picard 1-motive: Pic^-; Cohomological Albanese 1-motive: Alb^+; Cohomological Picard 1-motive: Pic^+; Homological Albanese 1-motive: Alb^-; Motivic Abel-Jacobi and Gysin maps; Rationality questions; Appendix. Picard functors; Bibliography.

Mémoires de la Société Mathématique de France, Number 87

March 2002, 104 pages, Softcover, ISBN 2-85629-113-9, 2000 *Mathematics Subject Classification*: 14F42, 14C30, 32S35, 19E15, **Individual member $30**, List $33, Order code SMFMEM/87N



Symmetry Types of Hyperelliptic Riemann Surfaces

E. Bujalance and **F.-J. Cirre**, *Universidad Nacional de Educación a Distancia, Madrid, Spain*, **J.-M. Gamboa**, *Universidad Complutense de Madrid, Spain*, and **G. Gromadzki**, *University of Gdańsk, Poland*

A publication of the Société Mathématique de France.

This monograph presents original material in the theory of Riemann surfaces. A compact Riemann surface X is symmetric if it admits an anti-analytic involution $\tau : X \to X$. Such an involution is called a real structure. Two real structures are isomorphic if they are conjugate in the full group $\mathrm{Aut}^{\pm}X$ of analytic and anti-analytic automorphisms of X. In this memoir, the authors classify the real structures of all symmetric hyperelliptic Riemann surfaces of genus $g \geq 2$ up to isomorphism. The topological invariants of each isomorphism class are also computed. They also give the list of groups which act as the full group of analytic and anti-analytic automorphisms of such surfaces. Moreover, the complex algebraic curve associated to any such Riemann surface is described in terms of polynomial equations. They also find an explicit formula for a real structure in each isomorphism class.

The book is suitable for advanced graduate students and researchers interested in algebraic geometry and Riemann surfaces.

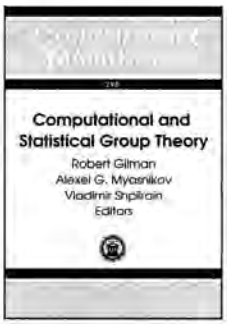
This item will also be of interest to those working in geometry and topology.

Distributed by the AMS in the United States, Canada, and Mexico. Orders from other countries should be sent to the SMF, Maison de la SMF, B.P. 67, 13274 Marseille cedex 09, France, or to Institut Henri Poincaré, 11 rue Pierre et Marie Curie, 75231 Paris cedex 05, France. Members of the SMF receive a 30% discount from list.

Contents: Introduction; Preliminaries; Automorphism groups of symmetric hyperelliptic Riemann surfaces; Symmetry types of hyperelliptic Riemann surfaces; Bibliography.

Mémoires de la Société Mathématique de France, Number 86

March 2002, 122 pages, Softcover, ISBN 2-85629-112-0, 2000 *Mathematics Subject Classification*: 14Hxx, 30Fxx; 20Fxx, 20Hxx, **Individual member $30**, List $33, Order code SMFMEM/86N



Computational and Statistical Group Theory

Robert Gilman, *Stevens Institute of Technology, Hoboken, NJ*, **Alexei G. Myasnikov**, *New York City*, and **Vladimir Shpilrain**, *City College of New York (CUNY)*, Editors

This book gives a nice overview of the diversity of current trends in computational and statistical group theory. It presents the latest research and a number of specific topics, such as growth, black box groups, measures on groups, product replacement algorithms, quantum automata, and more. It includes contributions by speakers at AMS Special Sessions at The University of Nevada (Las Vegas) and the Stevens Institute of Technology (Hoboken, NJ).

It is suitable for graduate students and research mathematicians interested in group theory.

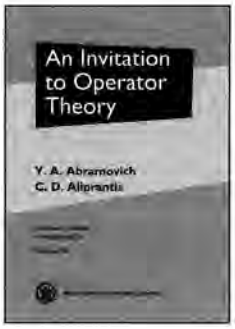
Contents: **R. C. Alperin** and **G. A. Noskov**, Uniform growth, actions on trees and GL_2; **A. V. Borovik**, Centralisers of involutions in black box groups; **A. V. Borovik**, **A. G. Myasnikov**, and **V. Shpilrain**, Measuring sets in infinite groups; **E. M. Freden**, Quantum one-way automata and finitely generated groups; **R. I. Grigorchuk** and **A. Żuk**, Spectral properties of a torsion-free weakly branch group defined by a three state automaton; **T. Jitsukawa**, Malnormal subgroups of free groups; **C. R. Leedham-Green** and **S. H. Murray**, Variants of product replacement; **D. V. Osin**, Weakly amenable groups; **C. C. Sims**, The Knuth-Bendix procedure for strings and large rewriting systems.

Contemporary Mathematics, Volume 298

September 2002, 124 pages, Softcover, ISBN 0-8218-3158-5, LC 2002074632, 2000 *Mathematics Subject Classification*: 20-XX, 43A05, 43A07, 57Mxx, 60B15, 68Wxx, **Individual member $23**, List $39, Institutional member $31, Order code CONM/298N

Analysis

Recommended Text



An Invitation to Operator Theory

Y. A. Abramovich, *Indiana University–Purdue University, Indianapolis*, and **C. D. Aliprantis**, *Purdue University, West Lafayette, IN*

This book offers a comprehensive and reader-friendly exposition of the theory of linear operators on Banach spaces and Banach lattices using their topological and order structures and properties. Abramovich and Aliprantis give a unique presentation that includes many new and very recent developments in operator theory and also draws together results which are spread over the vast literature. For instance, invariant subspaces of positive operators and the Daugavet equation are presented in monograph form for the first time.

The authors keep the discussion self-contained and use exercises to achieve this goal. The book contains over 600 exercises to help students master the material developed in the text. The exercises are of varying degrees of difficulty and play an important and useful role in the exposition. They help to free the proofs of the main results of some technical details but provide students with accurate and complete accounts of how such details ought to be worked out. The exercises also contain a considerable amount of additional material that includes many well-known results whose proofs are not readily available elsewhere.

The companion volume, *Problems in Operator Theory*, also by Abramovich and Aliprantis, is available from the AMS as Volume 51 in the Graduate Studies in Mathematics series, and it contains complete solutions to all exercises in *An Invitation to Operator Theory*.

The solutions demonstrate explicitly technical details in the proofs of many results in operator theory, providing the reader with rigorous and complete accounts of such details. Finally, the book offers a considerable amount of additional material and further developments. By adding extra material to many exercises, the authors have managed to keep the presentation as self-contained as possible. The best way of learning mathematics is by doing mathematics, and the book *Problems in Operator Theory* will help achieve this goal.

Prerequisites to each book are the standard introductory graduate courses in real analysis, general topology, measure theory, and functional analysis. *An Invitation to Operator Theory* is suitable for graduate or advanced courses in operator theory, real analysis, integration theory, measure theory, function theory, and functional analysis. *Problems in Operator Theory* is a very useful supplementary text in the above areas. Both books will be of great interest to researchers and students in mathematics, as well as in physics, economics, finance, engineering, and other related areas, and will make an indispensable reference tool.

Contents: Odds and ends; Basic operator theory; Operators on AL- and AM-spaces; Special classes of operators; Integral operators; Spectral properties; Some special spectra; Positive

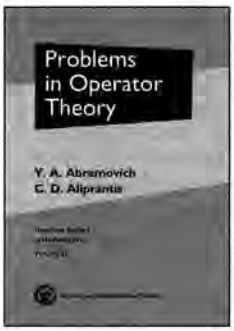
matrices; Irreducible operators; Invariant subspaces; The Daugavet equation; Bibliography; Index.

Graduate Studies in Mathematics, Volume 50

October 2002, 530 pages, Hardcover, ISBN 0-8218-2146-6, LC 2002074420, 2000 *Mathematics Subject Classification*: 46Axx, 46Bxx, 46Gxx, 47Axx, 47Bxx, 47Cxx, 47Dxx, 47Lxx, 28Axx, 28Exx, 15A48, 15A18, **All AMS members $55**, List $69, Order code GSM/50N

Set: Volume 50 and Volume 51, 916 pages, Hardcover, ISBN 0-8218-3333-2, **All AMS members $79**, List $99, Order code GSMSETN

Supplementary Reading



Problems in Operator Theory

Y. A. Abramovich, *Indiana University-Purdue University, Indianapolis,* and **C. D. Aliprantis**, *Purdue University, West Lafayette, IN*

This is one of the few books available in the literature that contains problems devoted entirely to the theory of operators on Banach spaces and Banach lattices. The book contains complete solutions to the more than 600 exercises in the companion volume, *An Invitation to Operator Theory*, Volume 50 in the AMS series Graduate Studies in Mathematics, also by Abramovich and Aliprantis.

The exercises and solutions contained in this volume serve many purposes. First, they provide an opportunity to the readers to test their understanding of the theory. Second, they are used to demonstrate explicitly technical details in the proofs of many results in operator theory, providing the reader with rigorous and complete accounts of such details. Third, the exercises include many well-known results whose proofs are not readily available elsewhere. Finally, the book contains a considerable amount of additional material and further developments. By adding extra material to many exercises, the authors have managed to keep the presentation as self-contained as possible.

The book can be very useful as a supplementary text to graduate courses in operator theory, real analysis, function theory, integration theory, measure theory, and functional analysis. It will also make a nice reference tool for researchers in physics, engineering, economics, and finance.

Contents: Odds and ends; Basic operator theory; Operators on *AL*- and *AM*-spaces; Special classes of operators; Integral operators; Spectral properties; Some special spectra; Positive matrices; Irreducible operators; Invariant subspaces; The Daugavet equation; Bibliography; Index.

Graduate Studies in Mathematics, Volume 51

October 2002, 386 pages, Hardcover, ISBN 0-8218-2147-4, LC 2002074421, 2000 *Mathematics Subject Classification*: 46Axx, 46Bxx, 46Gxx, 47Axx, 47Bxx, 47Cxx, 47Dxx, 47Lxx, 28Axx, 28Exx, 15A48, 15A18, **All AMS members $39**, List $49, Order code GSM/51N

Set: Volume 50 and Volume 51, 916 pages, Hardcover, ISBN 0-8218-3333-2, **All AMS members $79**, List $99, Order code GSMSETN

Recommended Text

The Cauchy-Riemann Complex

Integral Formulae and Neumann Problem

Ingo Lieb, *Universität Bonn, Germany*, and **Joachim Michel**, *Université du Littoral, Calais, France*

A publication of the Vieweg Verlag.

Distributed by the AMS for the respected publishing house of Vieweg Verlag, this book presents complex analysis of several variables from the point of view of Cauchy-Riemann equations and integral representations. Some of the material has not yet been covered in other texts.

The method of integral representations is developed to establish classical results of complex analysis, both elementary and advanced, as well as subtle existence and regularity theorems for Cauchy-Riemann equations on complex manifolds. These results are applied to important questions in function theory.

Prerequisites for reading the text are basic theory of functions of several complex variables and a strong background in classical analysis, in particular distributions and integration theory. The book is a suitable text for advanced graduate courses and research seminars on several complex variables.

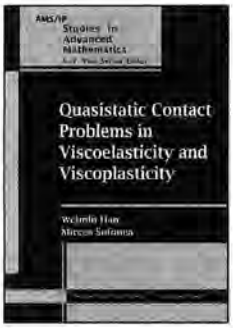
The AMS is exclusive distributor in North America. Vieweg Verlag Publications are available worldwide from the AMS outside of Germany, Switzerland, Austria, and Japan.

Contents: Introduction; The Bochner-Martinelli-Koppelman formula; Cauchy-Fantappiè forms; Strictly pseudoconvex domains in $\mathbb{C}^n$; Strictly pseudoconvex manifolds; The $\overline{\partial}$-Neumann problem; Integral representations for the $\overline{\partial}$-Neumann problem; Regularity properties of admissible operators; Regularity of the $\overline{\partial}$-Neumann problem and applications; Bibliography; Notations; Index.

Vieweg Aspects of Mathematics

June 2002, 362 pages, Hardcover, ISBN 3-528-06954-6, 2000 *Mathematics Subject Classification*: 32Wxx; 32A26, **All AMS members $62**, List $69, Order code VWAM/34N

Applications



Quasistatic Contact Problems in Viscoelasticity and Viscoplasticity

Weimin Han, *University of Iowa, Iowa City*, and **Mircea Sofonea**, *Université de Perpignan, France*

Phenomena of contact between deformable bodies or between deformable and rigid bodies abound in industry and in everyday life. A few simple examples are brake pads with wheels, tires on roads, and pistons with skirts. Common industrial processes such as metal forming and metal extrusion involve contact evolutions. Because of the importance of contact processes in structural and mechanical systems, considerable effort has been put into modeling and numerical simulations.

This book introduces readers to a mathematical theory of contact problems involving deformable bodies. It covers mechanical modeling, mathematical formulations, variational analysis, and the numerical solution of the associated formulations. The authors give a complete treatment of some contact problems by presenting arguments and results in modeling, analysis, and numerical simulations.

Variational analysis of the models includes existence and uniqueness results of weak solutions, as well as results of continuous dependence of the solution on the data and parameters. Also discussed are links between different mechanical models.

In carrying out the variational analysis, the authors systematically use results on elliptic and evolutionary variational inequalities, convex analysis, nonlinear equations with monotone operators, and fixed points of operators.

Prerequisites include basic functional analysis, variational formulations of partial differential equation problems, and numerical approximations. The text is suitable for graduate students and researchers in applied mathematics, computational mathematics, and computational mechanics.

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

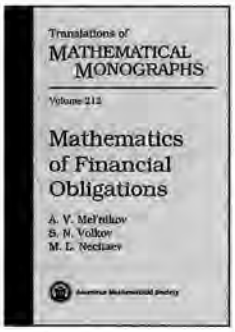
Titles in this series are copublished with International Press, Cambridge, MA.

Contents: *Nonlinear variational problems and numerical approximation:* Preliminaries of functional analysis; Function spaces and their properties; Introduction to finite difference and finite element approximations; Variational inequalities; *Mathematical modelling in contact mechanics:* Preliminaries of contact mechanics of continua; Constitutive relations in solid mechanics; Background on variational and numerical analysis in contact mechanics; Contact problems in elasticity; *Contact problems in viscoelasticity:* A frictionless contact problem; Bilateral contact with slip dependent friction; Frictional contact with normal compliance; Frictional contact with normal damped response; Other viscoelastic contact problems; *Contact problems in visocplasticity:* A Signorini contact problem; Frictionless contact with dissipative potential; Frictionless contact between two viscoplastic bodies; Bilateral contact with Tresca's friction law; Other viscoelastic contact problems; Bibliography; Index.

AMS/IP Studies in Advanced Mathematics, Volume 30

November 2002, 442 pages, Hardcover, ISBN 0-8218-3192-5, LC 2002027716, 2000 *Mathematics Subject Classification*: 74-02, 74M15, 74M10, 74S05, 74B05, 74B20, 74Cxx, 74Dxx; 65M06, 65M12, 65M15, 65M60, 65N12, 65N15, 65N30, 49J40, **All AMS members $63**, List $79, Order code AMSIP/30N

Independent Study



Mathematics of Financial Obligations

A. V. Mel′nikov, **S. N. Volkov**, and **M. L. Nechaev**, *Steklov Institute of Mathematics, Moscow, Russia*

Contemporary finance and actuarial calculations have become so mathematically complex that a rigorous exposition is required for an accurate and complete presentation. This volume delivers just that. It gives a comprehensive and up-to-date methodology for financial pricing and modelling. Also included are special cases useful for practical applications.

Beyond the traditional areas of hedging and investment on complete markets (the Black-Scholes and Cox-Ross-Rubinstein models), the book includes topics that are not currently available in monograph form, such as incomplete markets, markets with constraints, imperfect forms of hedging, and the convergence of calculations in finance and insurance.

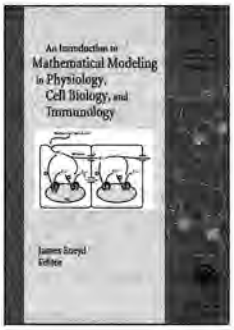
The book is geared toward specialists in finance and actuarial mathematics, practitioners in the financial and insurance business, students, and post-docs in corresponding areas of study. Readers should have a foundation in probability theory, random processes, and mathematical statistics.

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

Contents: Financial systems: Innovations and the risk calculus; Random processes and the stochastic calculus; Hedging and investment in complete markets; Hedging and incomplete markets; Markets with structural constraints and transaction costs; Imperfect forms of hedging; Dynamic contingent claims and American options; Analysis of "bond" contingent claims; Economics of insurance and finance: Convergence of quantitative methods of calculations; Bibliographical notes; Bibliography; Subject index.

Translations of Mathematical Monographs, Volume 212

September 2002, 194 pages, Hardcover, ISBN 0-8218-2945-9, LC 2002074395, 2000 *Mathematics Subject Classification*: 91-02, 91B24, 91B28, 91B26; 91B30, 91B82, 60H30, 60G40, 60G44, 60G42, 62P20, 60G48, **Individual member $47**, List $79, Institutional member $63, Order code MMONO/212N



An Introduction to Mathematical Modeling in Physiology, Cell Biology, and Immunology

James Sneyd, *Massey University, Auckland, New Zealand*, Editor

In many respects, biology is the new frontier for applied mathematicians. This book demonstrates the important role mathematics plays in the study of some biological problems. It introduces mathematicians to the biological sciences and provides enough mathematics for bioscientists to appreciate the utility of the modelling approach.

The book presents a number of diverse topics, such as neurophysiology, cell biology, immunology, and human genetics. It examines how research is done, what mathematics is used, what the outstanding questions are, and how to enter the field. Also given is a brief historical survey of each topic, putting current research into perspective.

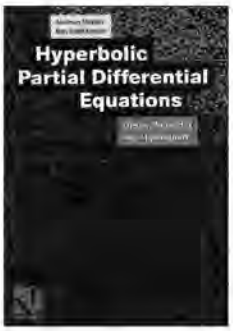
The book is suitable for mathematicians and biologists interested in mathematical methods in biology.

Contents: D. Terman, Dynamics of singularly perturbed neuronal networks; **D. Tranchina**, Mathematics in visual neuroscience: The retina; **J. P. Keener**, Arrhythmias by dimension; **J. Sneyd**, Calcium excitability; **K. Lange** and **B. Redelings**, Disease gene dynamics in a population isolate; **A. S. Perelson** and **P. W. Nelson**, Modeling viral infections; Index.

Proceedings of Symposia in Applied Mathematics, Volume 59

November 2002, approximately 192 pages, Hardcover, ISBN 0-8218-2816-9, LC 2002071734, 2000 *Mathematics Subject Classification*: 92C05, 92C20, 92C30, 92C37; 92D10, 92D30, **All AMS members $39**, List $49, Order code PSAPM/59N

Differential Equations



Hyperbolic Partial Differential Equations

Theory, Numerics and Applications

Andreas Meister, *Medical University of Lübeck, Germany*, and **Jens Struckmeier**, *University of Hamburg, Germany*

A publication of the Vieweg Verlag.

This book introduces the fundamental properties of hyperbolic partial differential equations with applications to mathematical modelling. Based on a summer school held at the Technical University of Hamburg-Harburg (Germany), it includes articles from leading experts in mathematics, physics, and engineering. It gives a unique presentation of concepts regarding the numerical treatment of hyperbolic partial differential equations—from basic algorithms through actual research. Numerical methods discussed include central and upwind schemes for structured and unstructured grids based on ENO and WENO reconstructions, pressure corrections methods like SIMPLE and PISO, as well as asymptotic-induced algorithms for low Mach number flows.

This book is another top selection available through the AMS for the renowned publisher, Vieweg Verlag. It is written for graduate students, mathematicians, physicists, and engineers interested in partial differential equations and related applications.

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

The AMS is exclusive distributor in North America. Vieweg Verlag Publications are available worldwide from the AMS outside of Germany, Switzerland, Austria, and Japan.

Contents: Hyperbolic conservation laws and industrial applications; Bibliography; Central schemes and systems of balance laws; Bibliography; Methods on unstructured grids, WENO and ENO recovery techniques; Bibliography; Pressure-correction methods for all flow speeds; Bibliography; Computational fluid dynamics and aeroacoustics for low Mach number flow; Bibliography.

Vieweg Monographs

June 2002, 320 pages, Hardcover, ISBN 3-528-03188-3, 2000 *Mathematics Subject Classification*: 65-01; 35-01, 35Lxx, 65Mxx, 65Nxx, **All AMS members $36**, List $40, Order code VW/10N

Discrete Mathematics and Combinatorics

Supplementary Reading

Linear and Network Optimization

A Bilingual Textbook

Horst W. Hamacher, *University of Kaiserslautern, Germany*, and **Kathrin Klamroth**, *University of Applied Sciences, Dresden, Germany*

A publication of the Vieweg Verlag.

This book outlines the basic concepts of linear optimization and some classic, polynomially solvable network optimization problems. Principal topics include the simplex method, Karmarkar's algorithm, and network flow problems.

One unique feature is that it is written in both German and English. So teaching mathematical optimization can be combined with introducing English as a technical language or vice versa. This is particularly useful for students preparing

for a language exam in a Ph.D. program. This bilingual edition also allows readers of either language to read this book.

Another addition to the respected Vieweg Verlag titles available from the AMS, this book would make a nice supplementary text for courses in operations research, network optimization, or linear optimization. It is geared toward advanced undergraduates, graduate students, and research mathematicians.

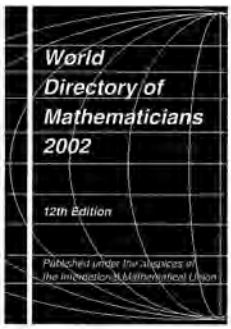
The AMS is exclusive distributor in North America. Vieweg Verlag Publications are available worldwide from the AMS outside of Germany, Switzerland, Austria, and Japan.

Contents: Introduction and applications; The simplex method; Duality and further variations of the simplex method; Interior point methods: Karmarkar's projective algorithm; Introduction to graph theory and shortest spanning trees; Shortest path problems; Network flow problems; Matchings; References; Stichwortverzeichnis; Index.

Vieweg Monographs

June 2002, 240 pages, Softcover, ISBN 3-528-03155-7, 2000 *Mathematics Subject Classification*: 90-01; 90B10, 90C05, 90C35, **All AMS members $19**, List $21, Order code VW/11N

General and Interdisciplinary



World Directory of Mathematicians 2002

A publication of the International Mathematical Union.

From a review for a previous edition:

What is most impressive about this directory is its scope and size. It includes worldwide organizations of every type in the mathematical sciences. This title will be especially useful to academic libraries that support graduate programs in mathematics.

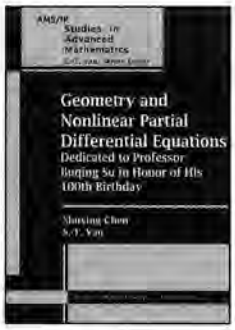
—American Reference Books Annual

This edition of the *World Directory of Mathematicians* incorporates updates and corrections to the 1998 edition and includes over 3,300 more names. This valuable reference tool contains the names and addresses of over 57,000 mathematicians from 71 countries. This edition includes an appendix for the first time. Listings for the directory are arranged both alphabetically and geographically and are based on information supplied by National Committees for Mathematics (or corresponding organizations). Libraries, mathematics departments, and individuals will find this most recent edition to be a valuable resource for its extensive coverage of the international mathematical community.

Published by the International Mathematical Union.

June 2002, 1248 pages, Softcover, 2000 *Mathematics Subject Classification*: 00-XX, **All AMS members $56**, List $70, Order code WRLDIR/12N

Geometry and Topology



Geometry and Nonlinear Partial Differential Equations

Shuxing Chen, *Fudan University, Shanghai, People's Republic of China*, and **S.-T. Yau**, *Harvard University, Cambridge, MA*, Editors

This book presents the proceedings of a conference on geometry and nonlinear partial differential equations dedicated to Professor Buqing Su in honor of his one-hundredth birthday. It offers a look at current research by Chinese mathematicians in differential geometry and geometric areas of mathematical physics.

It is suitable for advanced graduate students and research mathematicians interested in geometry, topology, differential equations, and mathematical physics.

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

Titles in this series are copublished with International Press, Cambridge, MA.

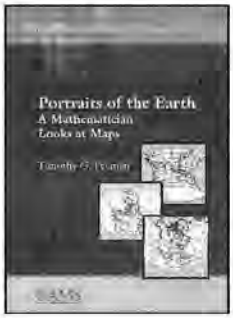
Contents: **C. Gu**, The address on the celebration for the 100th birthday of Professor Su Buqing; **B.-L. Chen** and **X.-P. Zhu**, A property of Kähler-Ricci solitons on complete complex surfaces; **S. Chen** and **Y.-G. Wang**, Propagation of singularities in compressible viscous fluids; **Q. Ding**, The Landau-Lifshitz equation and its gauge equivalent structure; **Z. Jiang, D. Fang, H. Liu**, and **D. Moss**, General flattened Jaffe models for galaxies; **L. Ji**, Scattering matrices and geodesics of locally symmetric spaces; **J. Li**, A note on enumerating rational curves in a K3 surface; **S. Jin** and **X. Li**, Multi-phase computations of the semiclassical limit of the Schrödinger equation; **B. Lian, K. Liu**, and **S.-T. Yau**, Towards a mirror principle for higher genus; **F. Lin** and **T.-C. Lin**, Vortices in two-dimensional Bose-Einstein condensates; **Z. Lin**, Sample path properties of Gaussian processes; **L. Peng**, Wavelets on the Heisenberg group; **Y.-B. Shen**, On complete submanifolds with parallel mean curvature vector; **S.-L. Tan**, Triple covers on smooth algebraic varieties; **W. Wang**, Osculating CR manifolds by nilpotent Lie groups in the theory of several complex variables; **Y. Wang**, Dynamics of commuting holomorphic maps; **Y. Yang, H. Chen**, and **W. Liu**, Different behaviour for the solutions of 1-dimensional chemotaxis model with exponential growth; **S. T. Yau**, Some progress in classical general relativity; **H. Yin**, Long shock for supersonic flow past a curved cone; **X. Zhang**, A compactness theorem for Yang-Mills connections; **X. Zhang**, The positive mass theorem in general relativity; **X.-Y. Zhou**, Extension theorems for special holomorphic functions.

AMS/IP Studies in Advanced Mathematics, Volume 29

September 2002, 237 pages, Softcover, ISBN 0-8218-3294-8, LC 2002027761, 2000 *Mathematics Subject Classification*: 34Axx, 47Jxx, 76Bxx, 70Kxx, **All AMS members $47**, List $59, Order code AMSIP/29N

Recommended Text

Supplementary Reading



Portraits of the Earth

A Mathematician Looks at Maps

Timothy G. Feeman, *Villanova University, PA*

Every map is a tool, a product of human effort and creativity, that represents some aspects of our world or universe ... [This] course was powered by the belief that by exploring the mathematical ideas involved in creating and analyzing maps, students would see how mathematics could help them to understand and explain their world.

—***from the* Preface**

Portraits of the Earth exemplifies the AMS's mission to bring the power and vitality of mathematical thought to the nonexpert. It is designed to teach students to think logically and to analyze the technical information that they so readily encounter every day.

Maps are exciting, visual tools that we encounter on a daily basis: from street maps to maps of the world accompanying news stories to geologic maps depicting the underground structure of the earth. This book explores the mathematical ideas involved in creating and analyzing maps, a topic that is rarely discussed in undergraduate courses. It is the first modern book to present the famous problem of mapping the earth in a style that is highly readable and mathematically accessible to most students. Feeman's writing is inviting to the novice, yet also interesting to readers with more mathematical experience. Through the visual context of maps and mapmaking, students will see how contemporary mathematics can help them to understand and explain the world.

Topics explored are the shape and size of the earth, basic spherical geometry, and why one can't make a perfect flat map of the planet. The author discusses different attributes that maps can have and determines mathematically how to design maps that have the desired features. The distortions that arise in making world maps are quantitatively analyzed. There is an in-depth discussion on the design of numerous map projections—both historical and contemporary—as well as conformal and equal-area maps. Feeman looks at how basic map designs can be modified to produce maps with any center, and he indicates how to generalize methods to produce maps of arbitrary surfaces of revolution. Also included are end-of-chapter exercises and laboratory projects. Particularly interesting is a chapter that explains how to use Maple® add-on software to make maps from geographic data points.

This book would make an excellent text for a basic undergraduate mathematics or geography course and would be especially appealing to the teacher who is interested in exciting visual applications in the classroom. It would also serve nicely as supplementary reading for a course in calculus, linear algebra, or differential geometry. Prerequisites include a solid grasp of trigonometry and basic calculus.

This item will also be of interest to those working in applications and general and interdisciplinary areas.

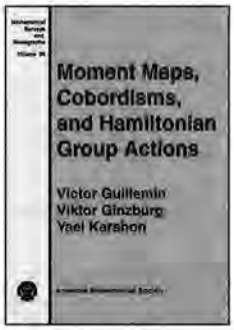
®Waterloo Maple, Inc., Ontario, Canada.

Contents: Geodesy—measuring the earth; Map projections; Scale factors; Distances and shortest paths on the sphere; Angles, triangles, and area on a sphere; Curvature of surfaces; Classical projections; Equal-area maps; Conformal maps; Analysis of map distortion; Oblique perspectives; Other worlds: Maps of surfaces of revolution; Appendix A. Aspects of thematic cartography: Symbolization, data classification, and thematic maps; Appendix B. Laboratory projects; Appendix C. Portraits of the earth: How the maps in this book were produced; Bibliography; Index.

Mathematical World, Volume 18

October 2002, approximately 136 pages, Softcover, ISBN 0-8218-3255-7, LC 2002027950, 2000 *Mathematics Subject Classification*: 00-01, 26A06, 51M09, 86A30; 00A69, 51-01, 51M25, 86-04, **All AMS members $21**, List $26, Order code MAWRLD/18N

Supplementary Reading



Moment Maps, Cobordisms, and Hamiltonian Group Actions

Victor Guillemin, *Massachusetts Institute of Technology, Cambridge*, **Viktor Ginzburg**, *University of California, Santa Cruz*, and **Yael Karshon**, *The Hebrew University of Jerusalem, Israel*

This research monograph presents many new results in a rapidly developing area of great current interest. Guillemin, Ginzburg, and Karshon show that the underlying topological thread in the computation of invariants of G-manifolds is a consequence of a linearization theorem involving equivariant cobordisms. The book incorporates a novel approach and showcases exciting new research.

During the last 20 years, "localization" has been one of the dominant themes in the area of equivariant differential geometry. Typical results are the Duistermaat-Heckman theory, the Berline-Vergne-Atiyah-Bott localization theorem in equivariant de Rham theory, and the "quantization commutes with reduction" theorem and its various corollaries. To formulate the idea that these theorems are all consequences of a single result involving equivariant cobordisms, the authors have developed a cobordism theory that allows the objects to be non-compact manifolds. A key ingredient in this non-compact cobordism is an equivariant-geometrical object which they call an "abstract moment map". This is a natural and important generalization of the notion of a moment map occurring in the theory of Hamiltonian dynamics.

The book contains a number of appendices that include introductions to proper group-actions on manifolds, equivariant cohomology, Spin^c-structures, and stable complex structures. It is geared toward graduate students and research mathematicians interested in differential geometry. It is also suitable for topologists, Lie theorists, combinatorists, and theoretical physicists. Prerequisite is some expertise in calculus on mani-

folds and basic graduate-level differential geometry. physicists. Prerequisite is some expertise in calculus on manifolds and basic graduate-level differential geometry.

Contents: Introduction; *Part 1. Cobordism:* Hamiltonian cobordism; Abstract moment maps; The linearization theorem; Reduction and applications; *Part 2. Quantization:* Geometric quantization; The quantum version of the linearization theorem; Quantization commutes with reduction; *Part 3. Appendices:* Signs and normalization conventions; Proper actions of Lie groups; Equivariant cohomology; Stable complex and Spin^c structures; Assignments and abstract moment maps; Assignment cohomology; Non-degenerate abstract moment maps; Characteristic numbers, non-degenerate cobordisms, and non-virtual quantization; The Kawasaki Riemann-Roch formula; Cobordism invariance of the index of a transversally elliptic operator; Bibliography; Index.

Mathematical Surveys and Monographs, Volume 98

October 2002, 350 pages, Hardcover, ISBN 0-8218-0502-9, LC 2002074590, 2000 *Mathematics Subject Classification*: 53Dxx, 57Rxx, 55N91, 57S15, **Individual member $47**, List $79, Institutional member $63, Order code SURV/98N

Higher Franz-Reidemeister Torsion

Kiyoshi Igusa, *Brandeis University, Waltham, MA*

The book is devoted to the theory of topological higher Franz-Reidemeister torsion in K-theory. The author defines the higher Franz-Reidemeister torsion based on Volodin's K-theory and Borel's regulator map. He describes its properties and generalizations and studies the relation between the higher Franz-Reidemeister torsion and other torsions used in K-theory: Whitehead torsion and Ray-Singer torsion. He also presents methods of computing higher Franz-Reidemeister torsion, illustrates them with numerous examples, and describes various applications of higher Franz-Reidemeister torsion, particularly for the study of homology of mapping class groups.

Packed with up-to-date information, the book provides a unique research and reference tool for specialists working in algebraic topology and K-theory.

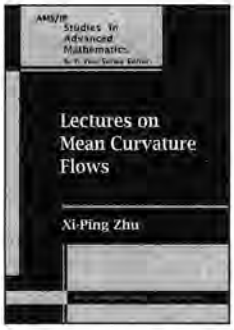
Titles in this series are copublished with International Press, Cambridge, MA.

Contents: Cocycles in Volodin K-theory; Spaces of matrices and higher Franz-Reidemeister torsion; A model for the Whitehead spaces; Morse theory and filtered chain complexes; Homotopy type of the Whitehead space; The framing principle and Bökstedt's theorem; Proof of complexified Bökstedt theorem; Framed graphs; Bibliography; Index.

AMS/IP Studies in Advanced Mathematics, Volume 31

October 2002, approximately 392 pages, Hardcover, ISBN 0-8218-3170-4, LC 2002027975, 2000 *Mathematics Subject Classification*: 19D10; 55R40, 57R45, 19F27, **All AMS members $63**, List $79, Order code AMSIP/31N

Supplementary Reading



Lectures on Mean Curvature Flows

Xi-Ping Zhu, *Zhongshan University, Guangzhou, People's Republic of China*

"Mean curvature flow" is a term that is used to describe the evolution of a hypersurface whose normal velocity is given by the mean curvature. In the simplest case of a convex closed curve on the plane, the properties of the mean curvature flow are described by Gage-Hamilton's theorem. This theorem states that under the mean curvature flow, the curve collapses to a point, and if the flow is diluted so that the enclosed area equals π, the curve tends to the unit circle.

In this book, the author gives a comprehensive account of fundamental results on singularities and the asymptotic behavior of mean curvature flows in higher dimensions. Among other topics, he considers in detail Huisken's theorem (a generalization of Gage-Hamilton's theorem to higher dimension), evolution of non-convex curves and hypersurfaces, and the classification of singularities of the mean curvature flow.

Because of the importance of the mean curvature flow and its numerous applications in differential geometry and partial differential equations, as well as in engineering, chemistry, and biology, this book can be useful to graduate students and researchers working in these areas. The book would also make a nice supplementary text for an advanced course in differential geometry.

Prerequisites include basic differential geometry, partial differential equations, and related applications.

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

Titles in this series are copublished with International Press, Cambridge, MA.

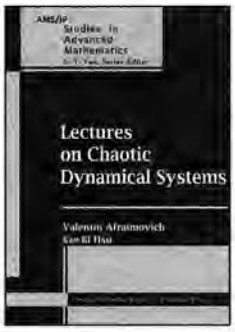
Contents: The curve shortening flow for convex curves; The short time existence and the evolution equation of curvatures; Contraction of convex hypersurfaces; Monotonicity and self-similar solutions; Evolution of embedded curves or surfaces (I); Evolution of embedded curves and surfaces (II); Evolution of embedded curves and surfaces (III); Convexity estimates for mean convex surfaces; Li-Yau estimates and type II singularities; The mean curvature flow in Riemannian manifolds; Contracting convex hypersurfaces in Riemannian manifolds; Definition of center of mass for isolated gravitating systems; References; Index.

AMS/IP Studies in Advanced Mathematics, Volume 32

October 2002, approximately 160 pages, Hardcover, ISBN 0-8218-3311-1, 2000 *Mathematics Subject Classification*: 53C44; 35K55, 52A20, 53C20, 53C21, 58J35, **All AMS members $31**, List $39, Order code AMSIP/32N

Mathematical Physics

Independent Study



Lectures on Chaotic Dynamical Systems

Valentin Afraimovich, *San Luis Potosi State University, Mexico*, and **Sze-Bi Hsu**, *Tsing-Hua University, Hsinchu, Taiwan*

This book is devoted to chaotic nonlinear dynamics. It presents a consistent, up-to-date introduction to the field of strange attractors, hyperbolic repellers, and nonlocal bifurcations. The authors keep the highest possible level of "physical" intuition while staying mathematically rigorous. In addition, they explain a variety of important nonstandard algorithms and problems involving the computation of chaotic dynamics.

The book will help readers who are not familiar with nonlinear dynamics to understand and enjoy sophisticated modern monographs on dynamical systems and chaos. Intended for courses in either mathematics, physics, or engineering, prerequisites are calculus, differential equations, and functional analysis.

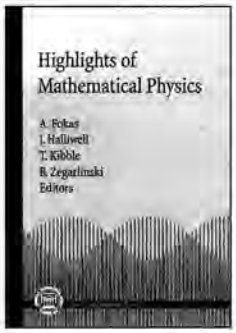
Titles in this series are copublished with International Press, Cambridge, MA.

Contents: Basic concepts; Zero-dimensional dynamics; One-dimensional dynamics; Two-dimensional dynamics; Systems with 1.5 degrees of freedom; Systems generated by three-dimensional vector fields; Lyapunov exponents; Appendix; Bibliography; Index.

AMS/IP Studies in Advanced Mathematics, Volume 28

November 2002, approximately 288 pages, Hardcover, ISBN 0-8218-3168-2, LC 2002074423, 2000 *Mathematics Subject Classification*: 37-XX, **All AMS members $39**, List $49, Order code AMSIP/28N

Supplementary Reading



Highlights of Mathematical Physics

A. Fokas, *Cambridge University, UK*, and **J. Halliwell**, **T. Kibble**, and **B. Zegarlinski**, *Imperial College, London, UK*, Editors

This volume presents state-of-the-art research in mathematical physics addressed to a broad spectrum of readers, including graduate students, researchers, and others interested in this topic. Contributors to the volume participated in the 13th International Congress on Mathematical Physics held at Imperial College (London, UK). The contributions include, in particular, pedagogical lectures presented at the Young Researchers Symposium (YRS) held in association with the Congress, as well as public lectures given at the Congress, and the contributions from the winners of the Henri Poincaré prize.

Contents: **A. Ashtekar**, The second black body problem: interface of general relativity, quantum theory and statistical mechanics; **M. Atiyah**, On the unreasonable effectiveness of physics in mathematics; **L. J. Biven**, Weak-wave turbulence: a tragic super-hero of turbulence theory; **A. Connes**, Noncommutative geometry year 2000; **A. Ekert**, Quantum computation; **L. Faddeev**, Advent of the Yang-Mills field; **G. Jona-Lasinio**, Cross fertilization in theoretical physics: the case of condensed matter and particle physics; **J. P. Keating**, Random matrices and the Riemann zeta-function; **V. V. Kisil**, Meeting Descartes and Klein somewhere in a noncommutative space; **R. Kotecky**, Phase transitions: on a crossroads of probability and analysis; **S. A. Levin**, Exploring the complex adaptive nature of ecosystems; **H. A. Posch** and **W. Thirring**, The classical three-body problem - where is abstract mathematics, physical intuition, computational physics most powerful?; **D. Ruelle**, Irreversibility revisited; **G. 't Hooft**, A confrontation with infinity; **H.-T. Yau**, Quantum dynamics of many-body systems.

November 2002, 271 pages, Hardcover, ISBN 0-8218-3223-9, LC 2002027669, 2000 *Mathematics Subject Classification*: 00B15; 70-01, 81-01, 92-01, **All AMS members $39**, List $49, Order code HMPN

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Applications are invited for an assistant professor in mathematics beginning August 2003. Responsibilities include teaching a wide range of undergraduate courses, mentoring students, developing curriculum, and sustaining scholarly activity. Excellence in teaching and scholarship, an understanding of liberal arts education, the ability to teach using educational technology, and a commitment to engaging students in research projects will be hallmarks of the outstanding candidate. A Ph.D. in the mathematical sciences is required; strong preference will be given to applicants whose Ph.D. is in probability, statistics, differential equations, mathematical physics, or numerical analysis, or who have had significant teaching experience in these fields.

CLU is a selective liberal arts university, enrolling 1,800 undergraduates and 1,000 graduate students. It is located in Thousand Oaks, California, midway between Los Angeles and Santa Barbara. CLU can be found at http://www.clunet.edu/.

Interested applicants should submit a letter of application, a CV, a brief statement of teaching philosophy and research interests, graduate transcripts (may be unofficial), and arrange for the submission of three letters of recommendation, at least one specifically addressing teaching experience and effectiveness. Please send all correspondence to:

Mathematics Search
c/o Ms. Vicki Wright, MC 3700
California Lutheran University
60 W. Olsen Road
Thousand Oaks, CA 91360-2787

Priority will be given to applications completed by November 1, 2002.

CLU is an Equal Opportunity Employer. The university encourages candidates who will contribute to the cultural diversity of CLU to apply.

UNIVERSITY OF CALIFORNIA AT BERKELEY
Department of Mathematics
Berkeley, CA 94720
Charles B. Morrey Jr.
Assistant Professorships

We invite applications for these special (non-tenure-track) positions, effective July 1, 2003. The terms of these appointments may range from two to three years. Applicants should have a recent Ph.D. or the equivalent in an area of pure or applied mathematics. Applicants should send a résumé, reprints, preprints and/or dissertation abstract, and ask three people to send letters of evaluation to the Vice Chair for Faculty Affairs at the above address. All letters of evaluation are subject to Berkeley campus policies on confidentiality of letters of evaluation, a summary of which can be found on our homepage, http://math.berkeley.edu/, by clicking on Available Teaching Positions and then Confidentiality Policy. We request that applicants use the AMS standardized application form and indicate their subject area using the AMS subject classification numbers. The form is the Academic Employment in Mathematics, Application Cover Sheet, available courtesy of the American Mathematical Society.

Applications must be postmarked by December 1, 2002. Applications postmarked after the deadline will not be considered.

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 2002 rate is $100 per inch or fraction thereof on a single column (one-inch minimum), calculated from top of headline. Any fractional text of $\frac{1}{2}$ inch or more will be charged at the next inch rate. No discounts for multiple ads or the same ad in consecutive issues. For an additional $10 charge, announcements can be placed anonymously. Correspondence will be forwarded.

Advertisements in the "Positions Available" classified section will be set with a minimum one-line headline, consisting of the institution name above body copy, unless additional headline copy is specified by the advertiser. Headlines will be centered in boldface at no extra charge. Ads will appear in the language in which they are submitted.

There are no member discounts for classified ads. Dictation over the telephone will not be accepted for classified advertising.

Upcoming deadlines for classified advertising are as follows: November 2002 issue–August 27, 2002; December 2002 issue–September 26, 2002; January 2003 issue–October 28, 2002; February 2003 issue–November 22, 2002; March 2003 issue–January 8, 2003; April 2003 issue–January 28, 2003.

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 02904. Advertisers will be billed upon publication.

The University of California is an Equal Opportunity/Affirmative Action Employer.

UNIVERSITY OF CALIFORNIA AT BERKELEY
Department of Mathematics
Berkeley, CA 94720
Temporary Postdoctoral Positions

Several temporary positions beginning in fall 2003 are anticipated for new and recent Ph.D.'s of any age, in any area of pure or applied mathematics. The terms of these appointments may range from one to three years. Applicants for NSF or other postdoctoral fellowships are encouraged to apply for these positions. Mathematicians whose research interests are close to those of regular department members will be given some preference. Applicants should send a résumé and reprints, preprints, and/or dissertation abstract, and ask three people to send letters of evaluation to the Vice Chair for Faculty Affairs at the above address. All letters of evaluation are subject to Berkeley campus policies on confidentiality of letters of evaluation, a summary of which can be found on our homepage, `http://math.berkeley.edu/`, by clicking on Available Teaching Positions and then Confidentiality Policy. We request that applicants use the AMS standardized application form and indicate their subject area using the AMS subject classification numbers. The form is the Academic Employment in Mathematics, Application Cover Sheet, available courtesy of the American Mathematical Society.

Applications must be postmarked by December 1, 2002. Applications postmarked after the deadline will not be considered. The University of California is an Equal Opportunity/Affirmative Action Employer.

UNIVERSITY OF CALIFORNIA AT BERKELEY
Department of Mathematics
Berkeley, CA 94720
Tenured or Tenure-Track Position

Pending budget approval, we invite applications for one or more positions effective July 1, 2003, at either the tenure-track (assistant professor) or tenured (associate or full professor) level in the general areas of pure or applied mathematics.

Tenure-track applicants are expected to have demonstrated outstanding research potential, normally including major contributions beyond the doctoral dissertation. Such applicants should send a résumé, reprint, preprints, and/or dissertation abstract, and ask three people to send letters of evaluation to the Vice Chair for Faculty Affairs at the above address. It is the responsibility of the tenure-track applicants to make sure that letters of evaluation are sent. All letters of evaluation are subject to Berkeley campus policies on confidentiality of letters of evaluation, a summary of which can be found on our homepage, `http://math.berkeley.edu/`, by clicking on Available Teaching Positions and then Confidentiality Policy.

Tenure applicants are expected to demonstrate leadership in research and should send a curriculum vitae, list of publications, a few selected reprints or preprints, and the names and addresses of three references to the Vice Chair for Faculty Affairs at the above address. Applicants should indicate whether they are applying for an associate professor or a full professor position. The department will assume responsibility to solicit letters of evaluation and will provide evaluators with a copy of the summary of policies on confidentiality of letters of evaluation.

All applicants are requested to use the AMS standardized application form and to indicate their subject area using the AMS subject classification numbers. The form is the Academic Employment in Mathematics, Application Cover Sheet, available courtesy of the American Mathematical Society.

Both tenure-track and tenure applications must be postmarked by November 15, 2002. Applications postmarked after the deadline will not be considered. The University of California is an Equal Opportunity/Affirmative Action Employer.

UNIVERSITY OF CALIFORNIA, LOS ANGELES
Department of Mathematics

Subject to availability of resources and administrative approval, the following positions are available for the 2003–04 academic year.

(1) Several tenure-track and senior positions in all areas of mathematics.

(2) Several E. R. Hedrick Assistant Professorships. Salary is $53,200. Three-year appointment. Teaching load: four quarter-courses per year, which may include one advanced course in the candidate's field.

(3) Several Research Assistant Professorships in Computational and Applied Mathematics (CAM). Salary is $53,200. Three-year appointment. Teaching load: normally reduced to two or three quarter-courses per year by research funding as available; may include one advanced course in the candidate's field.

(4) Several Adjunct Assistant Professorships or Lectureships in the Program in Computing (PIC). Applicants for the adjunct position must show very strong promise in teaching and research in an area related to computing. Teaching load: four one-quarter programming courses each year and one seminar every two years. One-year initial appointment, with the option of applying for renewal for a second year and possibly longer, up to a maximum service of four years. Salary is $56,800. Applicants for the lectureship must show very strong promise in the teaching of programming. An M.S. in computer science or equivalent degree is preferred. Teaching load: six one-quarter programming courses per year. One-year appointment, probably renewable one or more times, depending on the needs of the program. Salary is $43,152 or more, depending on experience.

(5) Several VIGRE Assistant Professorships. Hedrick, CAM, or PIC applicants who are U.S. citizens or permanent residents may also apply for a VIGRE Assistant Professor position. Three-year appointment. Salary is $53,200. The successful recipient will receive a summer stipend of $6,500 for two summers and $2,500 per year for travel, equipment, and supplies for three years. Teaching load: 3 courses per year.

(6) Several Adjunct Assistant Professorships and Research Postdocs. Up to one-year appointment, with the possibility of renewal. Strong research and teaching background required. Salary $48,900-$53,200. Teaching load for adjuncts: five quarter-courses per year.

(7) Several visiting instructorships.

For more details, see `http://www.math.ucla.edu/~search/`. To apply, complete the application on the website, or send e-mail to `search@math.ucla.edu`, or write to: Staff Search, Department of Mathematics, University of California, Los Angeles, CA 90095-1555. Preference will be given to applications completed by January 6, 2003.

UCLA is an Equal Opportunity/Affirmative Action Employer. Under federal law, the University of California may employ only individuals who are legally authorized to work in the United States as established by providing documents specified in the Immigration Reform and Control Act of 1986.

UNIVERSITY OF CALIFORNIA, SANTA CRUZ
Mathematics Department

The Mathematics Department at UCSC expects to have one or more Youngs Visiting Assistant Professorships effective summer or fall 2003

We invite applications from qualified mathematicians in all fields. Appointees are expected to teach and pursue their research. Available for periods of two years, with a possible extension to a third year depending on teaching performance. Minimum qualifications: Ph.D. (or equivalent expected by 6/30/03) in mathematics or a closely related field. Demonstrated excellence in research and teaching. Salary range: $46,300–$51,700 (subject to range adjustment). Deadline: January 13, 2003. Applicants should send curriculum vitae, a summary of research and teaching experi-

ence and three letters of recommendation with at least one letter addressing teaching experience and ability (all letters will be treated as confidential documents).

All applications should be sent to: Recruitment Committee, Mathematics Department, Kerr Hall, University of California, Santa Cruz, CA 95064. Please refer to provision #T03-02. Inquiries [not applications] can be sent to mathrcr@cats.ucsc.edu. UCSC is an EEO/AA employer.

CONNECTICUT

YALE UNIVERSITY
Department of Mathematics

Yale University applications accepted for Gibbs Instructorships/Assistant Professorships for Ph.D. with outstanding promise in research in pure mathematics. Appointments are for two/three years, starting July 2003. The teaching load for Gibbs Instructors/Assistant Professors will be kept light so as to allow ample time for research. This will consist of 3 one-semester courses per year. Part of the duties may consist of a one-semester course at the graduate level in the general area of the instructor's research. Applications and supporting materials must be received by January 1, 2003. Offers will be made during February. Salary at least $51,800. Applications are available at: http://www.math.yale.edu/. Applications and supporting materials may be sent via U.S. mail to: The Gibbs Committee, Department of Mathematics, Yale University, P.O. Box 208283, New Haven, CT 06520-8283; or via email to: gibbs.committee@math.yale.edu. Applications from women and members of minority groups are welcome. Yale is an Affirmative Action/Equal Opportunity Employer.

GEORGIA

GEORGIA INSTITUTE OF TECHNOLOGY
School of Mathematics

The School of Mathematics at Georgia Tech expects to have several tenure-track and visiting positions available beginning fall 2003, and will consider applications in pure and applied mathematics and statistics at all ranks. Preference will be given to candidates who complement existing strengths in the School of Mathematics, while adding expertise in new areas consistent with the goals and directions of the school. Candidates should have strong research and teaching records or potential. The school will also consider applications for NSF VIGRE Postdoctoral Fellowships. These are non-tenure-track positions, normally renewable annually to a maximum of three years. Eligibility is limited to U.S. citizens, nationals, and permanent residents who will have a Ph.D. and not be beyond 18 months from the completion of their degree at the time of the appointment. The academic year salary for these positions is $45,000, with an additional $6,500 for research support in each of the first and second summers, and a $7,500 travel allowance over the term of the appointment. Preference will be given to applicants deemed likely to benefit from a mentoring relationship with one or more members of the current faculty of the school. Review of applications for all positions will begin in September 2002 and continue until all positions have been filled. Candidates should arrange for a résumé, at least three letters of reference, and a summary of future research plans to be sent to the Hiring Committee, School of Mathematics, Georgia Institute of Technology, Atlanta, GA, 30332-0160, USA. Georgia Tech, an institution of the University System of Georgia, is an Equal Opportunity/Affirmative Action Employer.

ILLINOIS

ILLINOIS WESLEYAN UNIVERSITY
Bloomington, Illinois 61701
Department of Mathematics and Computer Science

The Department of Mathematics and Computer Science at Illinois Wesleyan University invites applications for a tenure-track assistant professor in mathematics. Employment would begin in August 2003 and the teaching load would be six courses per year. All candidates should have a Ph.D. in statistics or probability and a dedication to excellent teaching in a liberal arts environment where undergraduate research is encouraged. We are seeking candidates who have an interest in working with students who want to become actuaries. The opportunity to participate in university-wide general education programs is available for interested faculty.

Illinois Wesleyan University is a highly selective undergraduate university of approximately 2,000 students located in Bloomington, Illinois, a community of about 120,000. This year the average ACT for Illinois Wesleyan's entering class of freshmen was 28. In recent years as many as 4% of the undergraduate population at Illinois Wesleyan University have declared majors in mathematics. The department maintains a healthy balance between applied mathematics and pure mathematics. Faculty areas of professional expertise include algebra, approximation theory, differential equations, number theory, dynamical systems, electrical engineering, linear algebra, logic, operations research, topology, topos theory, numerical analysis and wavelet analysis. The Department of Mathematics and Computer Science is located in the Center for Natural Science Learning and Research, a $25,000,000 facility opened in 1995. The department operates five computer labs for students, which have around 80 SunSPARC and iMac computers. For additional information on the mathematics curriculum, facilities, and faculty interests see http://www.iwu.edu/~mathcs/.

Candidates for the position should submit a letter of application, a curriculum vitae, an AMS Standard Cover Sheet, a teaching statement and a research statement, and have three letters of recommendation sent separately to Melvyn Jeter, Department of Mathematics and Computer Science, Illinois Wesleyan University, P.O. Box 2900, Bloomington, IL 61702-2900. Preliminary interviews for this position will be held at the Joint Mathematics Meetings in Baltimore, Maryland (January 2003). Applications received after December 13, 2002, may not receive full consideration. Women and minorities are encouraged to apply. Illinois Wesleyan is an Equal Opportunity Employer. For further information see our Jobs Web Page at http://www.iwu.edu/~iwujobs/.

NORTHWESTERN UNIVERSITY
Department of Mathematics
2033 Sheridan Road
Evanston, Illinois 60208-2730
Boas Assistant Professor

Applications are solicited from people whose research is in geometry and geometric topology for two Ralph Boas assistant professorships of three years each starting in September 2003. These positions are connected to the Emphasis Year in Geometry and Topology of String Theory. They are non-tenure track.

Applications should be sent to the Emphasis Year Committee at the department address and include: (1) the American Mathematical Society's Application Cover Sheet for Academic Employment, (2) a curriculum vitae, and (3) three letters of recommendation including one which discusses in some detail the candidate's teaching qualifications. Inquiries may be sent via e-mail to: hiring@math.northwestern.edu.

Applications are welcomed at any time, but the review process starts December 1, 2002. Northwestern University is an Affirmative Action, Equal Opportunity Employer committed to fostering a diverse faculty; women and minority candidates are especially encouraged to apply.

NORTHWESTERN UNIVERSITY
Department of Mathematics
2033 Sheridan Road,
Evanston, Illinois 60208-2730

Applications are invited for anticipated

tenure-track or tenured positions starting September 2003, pending final approval. Priority will be given to exceptionally promising research mathematicians. Fields of interest within the department include Algebra, Algebraic Geometry, Analysis, Dynamical Systems, Mathematical Physics, Probability, Partial Differential Equations, and Topology.

Application material should be sent to Personnel Committee, at the department address and include: (1) the American Mathematical Society's Application Cover Sheet for Academic Employment, (2) a curriculum vitae, and (3) at least four letters of recommendation including one which discusses in some detail the candidate's teaching qualifications. Inquiries may be sent via email to: hiring@math.northwestern.edu. Applications are welcome at any time, but the review process starts in October 2002. Northwestern University is an Affirmative Action, Equal Opportunity Employer committed to fostering a diverse faculty; women and minority candidates are especially encouraged to apply.

KENTUCKY

UNIVERSITY OF LOUISVILLE
Department of Mathematics
Assistant Professor

Pending administrative approval, the Department of Mathematics at the University of Louisville invites applications for two tenure-track positions, at the assistant professor level, to begin July 1, 2003. Ph.D. required. Preference will be given to applicants who can strengthen the department's new Ph.D. program and applicable mathematics offerings. Candidates must show strong potential in research and teaching and have effective communications skills. Applications should include: (1) the American Mathematical Society's Standard Cover Sheet, (2) curriculum vitae, (3) summary of research interests, (4) statement of teaching qualifications and (5) at least four letters of recommendation, including letters which discuss, in some detail, the candidate's teaching and research qualifications. Applications should be sent to: Search Committee, Department of Mathematics, University of Louisville, Louisville, KY 40292. Review of applications will begin November 15, 2002, and continue until the position is filled. Email questions to math@louisville.edu. The University of Louisville is an Affirmative Action/Equal Opportunity Employer and encourages women and underrepresented minorities to apply. Applicants must comply with the provisions of the Immigration Reform and Control Act.

MARYLAND

JOHNS HOPKINS UNIVERSITY
Department of Mathematics

The Department of Mathematics invites applications for the Director of Undergraduate Studies at the non-tenure-track rank of lecturer beginning fall 2003. The position is renewable depending on performance. Required qualifications include an M.A. or Ph.D. in mathematics, creative teacher with college teaching experience, ability to work well with others and to play a leading role in curriculum development, and ability to use technology in teaching. The duties will involve administering the basic elementary mathematics courses: Pre-calculus; Calculus I, II, III; Linear Algebra; and Differential Equations. Responsibilities include supervision and training of teaching assistants, advising undergraduates, and coordinating course enrollment and scheduling with the registrar and Office of Academic Advising. Applicants should send a cover letter, curriculum vitae, and contact information for three professional references to: Department Chair, Lecturer Hiring, Johns Hopkins University, 3400 N. Charles Street, Krieger 404, Baltimore, MD 21218. First-round preference will be given to applications received by November 15, 2002. The Johns Hopkins University is an Affirmative Action/Equal Opportunity Employer and actively encourages interest from minorities and women.

JOHNS HOPKINS UNIVERSITY
Department of Mathematics

The Department of Mathematics invites applications for two positions at the associate or full professor level in the general areas of analysis, algebra, topology, number theory, and mathematical physics beginning fall 2003 or later. Targeted areas of hiring are number theory and mathematical physics. Applicants should send a cover letter, curriculum vitae, and contact information for three professional references to: Chair, Hiring Committee, Johns Hopkins University, 3400 N. Charles Street, Krieger 404, Baltimore, MD 21218. First-round preference will be given to applications received by January 1, 2003. The Johns Hopkins University is an Affirmative Action/Equal Opportunity Employer and actively encourages interest from minorities and women.

MASSACHUSETTS

WILLIAMS COLLEGE
Department of Mathematics and Statistics

The department invites applications for two positions in mathematics and one position in statistics, beginning fall 2003, all at the rank of assistant professor (in exceptional cases, more advanced appointments may be considered). We are seeking highly qualified candidates who have 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 25 and will continue until the positions are 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 underrepresented minorities. For more information on the Department of Mathematics and Statistics, visit http://www.williams.edu/Mathematics/.

MICHIGAN

HILLSDALE COLLEGE
Mathematics and Computer Science

Two positions available 1.) Applied Mathematics and 2.) Mathematics.
Applications are invited for positions in applied mathematics and in mathematics. Entry-level, tenure-track positions with initial appointments made at the assistant professor level beginning in August 2003.

1.) Candidates for applied mathematics position required to have a Ph.D. in mathematics with specialty in applied mathematics and be willing to teach especially mathematical modeling, differential equations, numerical analysis, and vector analysis, in addition to other undergraduate mathematics courses.

2.) Candidates for mathematics position required to have a Ph.D. in mathematics and be willing to teach various undergraduate mathematics courses.

Candidates for either position must have a strong commitment to excellence in teaching undergraduate mathematics. Duties for each position include a 12-hour (3 course) teaching load per semester which will include teaching all levels of undergraduate mathematics, academic advising,

college service, and continued mathematical activity.

Hillsdale College, founded in 1844, is an independent, coeducational, four-year liberal arts college of 1,200 students. Hillsdale has traditionally upheld two concepts: academic excellence and institutional independence. For additional college information check our web site: http://www.hillsdale.edu/.

Send a letter of application, which should include a personal statement addressing the applicant's teaching philosophy and qualifications for the position, curriculum vitae, graduate transcript, a short summary of teaching evaluations, and at least three letters of recommendation to: Professor Mark J. Watson, Chair, Department of Mathematics and Computer Science, Hillsdale College, Hillsdale, Michigan 49242. Review of applications will begin November 1, 2002, and will continue until the positions are filled. EOE.

MICHIGAN STATE UNIVERSITY
proMSc Program in Industrial Mathematics
East Lansing, MI 48824

Direct your students toward one of the professional M.Sc. programs. Industry needs business-savvy mathematicians. See http://www.sciencemasters.com/.

NEW JERSEY

INSTITUTE FOR ADVANCED STUDY
School of Mathematics

The School of Mathematics has a limited number of memberships, some with financial support, for research in mathematics at the Institute during the 2003-2004 academic year. Candidates must have given evidence of ability in research comparable at least with that expected for the Ph.D. degree. The special program for the year will focus on analysis and nonlinear PDE's. Carlos Kenig will be the Distinguished Visiting Professor, and he will be in residence for the year. For a brief description of the program and information about application materials and deadline, please consult "Activities" and "How To Apply" on our homepage at http://www.math.ias.edu/.

NEW YORK

THE COURANT INSTITUTE
Department of Mathematics

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 write to: Visiting Membership Committee, Courant Institute of Mathematical Sciences, 251 Mercer Street, New York, NY 10012-1185. Forms may also be obtained directly from the web at http://www.cims.nyu.edu/information/brochure/visiting.html or 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.

OHIO

THE OHIO STATE UNIVERSITY
Department of Mathematics

The Department of Mathematics at The Ohio State University expects to have tenure-track/tenured positions and several visiting positions available, effective Autumn Quarter 2003. Candidates in all areas of pure and applied mathematics are invited to apply. Significant mathematical research accomplishment and evidence of excellent teaching ability are required.

The department will also have several Hans J. Zassenhaus Assistant Professorships and VIGRE Arnold Ross Assistant Professorships available. These term positions are renewable annually for up to a total of three years. Candidates are expected to present evidence of excellence in research and teaching.

Please send a CV and have at least three letters of recommendation sent to:

Professor Peter March, Chair
Department of Mathematics
The Ohio State University
231 W. 18th Avenue
Columbus, OH 43210

The Ohio State University is an Equal Opportunity, Affirmative Action employer. Women, minorities, veterans, and individuals with disabilities are encouraged to apply.

OREGON

UNIVERSITY OF OREGON
Department of Mathematics

Applications are invited for one tenure-track assistant or associate professor in the Department of Mathematics, beginning September 2003. Qualifications are a Ph.D. in the mathematical sciences, an excellent record of research accomplishment, and evidence of teaching ability. Applicants from all parts of the mathematical sciences are encouraged to apply. See http://darkwing.uoregon.edu/~math/employment.html.

Competitive salary with excellent fringe benefits. Mail complete vita and at least three letters of recommendation to Search Committee, 1222 Department of Mathematics, University of Oregon, Eugene, OR 97403-122, Attention: J. Perkins. Application materials may NOT be submitted electronically.

Closing date is January 6, 2003. Women and minorities are encouraged to apply. The University of Oregon is an EO/AA/ADA Institution committed to diversity.

UNIVERSITY OF OREGON
Department of Mathematics

Applications are invited for one tenure-track assistant or associate professor in the Department of Mathematics in the areas of numerical analysis and/or applied analysis, beginning September 2003. Qualifications are a Ph.D. in the mathematical sciences, an excellent record of research accomplishment in the required fields, and evidence of teaching ability. See http://darkwing.uoregon.edu/~math/employment.html.

Competitive salary with excellent fringe benefits. Mail complete vita and at least three letters of recommendation to Professor Yuan Xu, Chair of Applied Analysis Search Committee, 1222 Department of Mathematics, University of Oregon, Eugene, OR 97403-122. Application materials may NOT be submitted electronically.

Closing date is January 6, 2003. Women and minorities are encouraged to apply. The University of Oregon is an EO/AA/ADA Institution committed to diversity.

UNIVERSITY OF OREGON
Department of Mathematics

The Department of Mathematics at the University of Oregon announces a tenure-track position in mathematics education at the assistant or associate professor level, starting fall 2003. Qualifications: either a Ph.D. in mathematics and documented interest in mathematics education at the elementary or secondary level; or

a Ph.D. or Ed.D. in mathematics education with a very strong background and interest in mathematics. In addition the candidate must have some involvement in the education of future school teachers, and excellence in teaching undergraduate mathematics. See http://darkwing.uoregon.edu/~math/employment.html.

Please send your application materials, including full C.V. and at least three letters of recommendation from people well acquainted with your qualifications, to: Professor J. Brundan, Mathematics Education Hiring Committee, Department of Mathematics, 1222 University of Oregon, Eugene, OR 97403-1222. Application materials may NOT be submitted electronically.

Closing date for applications is January 13, 2003. Women and minorities are encouraged to apply. The University of Oregon is an EO/AA/ADA Institution committed to diversity.

PENNSYLVANIA

LA SALLE UNIVERSITY
Department of Mathematics & Computer Science
Tenure-Track Position

La Salle University invites applications for a tenure-track position at the assistant professor level beginning in August 2003. A Ph.D. in mathematics is required by the commencement of the appointment. The successful candidate will possess a strong commitment to excellence in teaching and continued scholarly activity. Duties include teaching a wide variety of undergraduate courses (12 hours each semester), student advising, curriculum development, and committee work.

La Salle University is a Roman Catholic university in the tradition of the La Salle Christian Brothers and welcomes applicants from all backgrounds who can contribute to its unique educational mission. For a complete mission statement, please visit our website at http://www.lasalle.edu/.

Please submit a curriculum vitae, statement of teaching philosophy, and three letters of recommendation, at least one of which addresses the applicant's teaching experience and effectiveness, to: Linda J. Elliott, Chair, Department of Mathematics and Computer Science, La Salle University, 1900 West Olney Avenue, Philadelphia, PA 19141-1199 (elliott@lasalle.edu). Priority will be given to applications received by November 1, 2002. Women and minorities are strongly encouraged to apply. AA/EOE.

RHODE ISLAND

BROWN UNIVERSITY

Up to three professorships at the associate professor level with tenure, the appointment to begin July 1, 2003. Exceptionally qualified candidates may be considered for appointment at the level of professor. Candidates should have a distinguished research record and a strong commitment to excellence in undergraduate and graduate teaching. Preference will be given to applicants with research interests consonant with those of the present members of the department (for a list of faculty members and their fields, see http://www.math.brown.edu/faculty/faculty.html). For one of the positions, preference will be given to applicants whose field is analysis. Applicants who wish to be considered for these positions should send a letter of application together with a curriculum vitae and arrange to have at least five letters of recommendation sent to: Senior Search Committee, Department of Mathematics, Box 1917, Brown University, Providence, Rhode Island 02912. **Applications must be postmarked by December 13, 2002**, in order to receive full consideration. Later applications will be accepted and considered to the extent feasible. Email inquiries can be addressed to srsearch@math.brown.edu. Brown University is an Equal Opportunity/Affirmative Action employer and encourages applications from women and minorities.

TEXAS

RICE UNIVERSITY
Department of Mathematics

Griffith Conrad Evans Instructorships. Postdoctoral appointments for two to three years for promising research mathematicians with research interests in common with the active research areas at Rice, particularly geometric topology, geometric analysis, differential geometry, wavelets, combinatorics, and ergodic theory. Duties will include research and classroom teaching. Applications received by December 31, 2002, will receive full consideration. Rice University is an Equal Opportunity Affirmative Action Employer and strongly encourages applications from women and minority group members. Inquiries and applications should be addressed to Chair, Evans Committee, Department of Mathematics, Rice University, P.O. Box 1892, Houston, TX 77251-1892.

SOUTHERN METHODIST UNIVERSITY
DEDMAN COLLEGE
Department of Mathematics

Applications are invited for two positions at either the senior level (tenured) or junior level (tenure-track), to begin in the fall semester of 2003. Applicants must have a Ph.D., provide evidence of outstanding research, and have a strong commitment to teaching at all levels. The Department of Mathematics' active doctoral program is in computational and applied mathematics. Current research includes numerical analysis of ordinary and partial differential equations, mathematical software, dynamical systems, fluid dynamics, and nonlinear optics. Applications in other areas of computational and applied mathematics such as numerical linear algebra, geometric integration, inverse problems, nonlinear waves, and mathematical biology are encouraged. Visit http://www.smu.edu/math/ for more information about the department.

To apply, send a letter of application with a curriculum vitae, a list of publications, and a research and teaching statement to: The Faculty Search Committee, Department of Mathematics, Southern Methodist University, P.O. Box 750156, Dallas, Texas 75275-0156. Applicants must also arrange for three letters of recommendation to be forwarded to the Faculty Search Committee. The Search Committee can be contacted by sending email to mathsearch@mail.smu.edu. [Tel: (214) 768-2506; Fax: (214) 768-2355].

To ensure full consideration for the positions, the application must be postmarked on or before December 9, 2002, but the committee will continue to accept applications until the positions are filled. The committee will notify applicants of its employment decision after the positions are filled.

SMU will not discriminate on the basis of race, color, religion, national origin, sex, age, disability, or veteran status. SMU is also committed to nondiscrimination on the basis of sexual orientation.

TEXAS A&M UNIVERSITY
Department of Mathematics

Applications are invited for tenured and tenure-eligible faculty positions beginning fall 2003. The field is open, but we particularly seek applications from individuals whose mathematical interests would augment and build upon existing strengths both within the Mathematics Department as well as other departments in the university. Salary, teaching loads, and start-up funds are competitive.

For a tenured position the applicant should have an outstanding research reputation and would be expected to fill a leadership role in the department. An established research program, including success in attracting external funding and supervision of graduate students, and a demonstrated ability and interest in teach-

ing are required. Informal inquiries are welcome.

For an assistant professorship, we seek strong research potential and evidence of excellence in teaching. Research productivity beyond the doctoral dissertation will normally be expected.

In order to expedite the application process we request that the "AMS Application Cover Sheet" be used. Applicants should send the completed form, a vita, and arrange to have letters of recommendation sent to:

Faculty Hiring
Department of Mathematics
Texas A&M University
College Station, Texas 77843-3368

Further information can be obtained from: http://www.math.tamu.edu/hiring/.

TEXAS A&M UNIVERSITY
Department of Mathematics

The Department will have several visiting appointments available beginning fall 2003.

Senior positions may be for a semester or one year period and the number available will depend on funding.

The Visiting Assistant Professor positions are for a three year period. They are intended for those who have recently received their Ph.D. and preference will be given to mathematicians whose research interests are close to those of our regular faculty members. Salary and teaching loads are competitive. In addition, as part of our VIGRE grant, we expect to have up to four positions carrying a one-course-per-semester teaching load.

In order to expedite the application process we request that the "AMS Application Cover Sheet" be used. Applicants should send the completed form, a vita, and arrange to have letters of recommendation sent to:

Visiting Faculty Hiring
Department of Mathematics
Texas A&M University
College Station, Texas 77843-3368

For full consideration, the complete dossier should be received by January 15, 2003. Further information can be obtained from our website: http://www.math.tamu.edu/hiring/.

Texas A&M University is an EOE/AA employer and the department encourages applications from women and minorities.

UTAH

UNIVERSITY OF UTAH
Department of Mathematics

The Department of Mathematics at the University of Utah invites applications for the following positions. Availability of positions is contingent upon funding. The hiring committee will select candidates based on excellence in research and teaching.

1. One full-time tenure-track or tenure appointment at the level of assistant or associate professor. The department is primarily interested in applicants who work in the research areas represented in the department and who received their Ph.D. degrees prior to 2002.

2. One or more nonrenewable three-year Scott, Wyle, Burgess or VIGRE Assistant Professorships. Persons of any age receiving Ph.D. degrees in 2001 or later, are eligible. Starting salary will be at least $43,000. Increases are given annually but amounts vary from year to year. Teaching duties for the Scott Assistant Professorship for the entire three years will be nine one-semester courses. Wylie and Burgess Assistant Professors receive a $2,000/year research fund and teach eight courses in three years. VIGRE Assistant Professors receive annual research funds and teach two courses per year.

Completed applications for faculty positions will be considered starting October 1, 2002, and positions may be offered from that date on. Applications will be accepted until positions are filled with a closing date of May 1, 2003. Scott Assistant Professorship applications should be completed by December 1, 2002. Review of applications will begin on December 8, 2002.

To apply for any of these positions, you are strongly encouraged to fill out an application at http://www.math.utah.edu/pos/ or at http://www.mathjobs.org/.

Alternatively, you may send the AMS cover sheet. To complete your application, send a curriculum vitae, bibliography, and three letters of recommendation. Incomplete files will not be considered.

Please send this information to Committee on Staffing, Department of Mathematics, University of Utah, 155 S. 1400 E., JWB 233, Salt Lake City, UT 84112. The University of Utah is an Equal Opportunity, Affirmative Action Employer and encourages applications from women and minorities, and provides reasonable accommodation to the known disabilities of applicants and employees.

WEST VIRGINIA

WEST VIRGINIA UNIVERSITY
Department of Mathematics

Applications and nominations are invited for up to two faculty positions starting August 16, 2003, to be part of the "Institute for Math Learning". The Department of Mathematics seeks mathematicians, or mathematics educators, with excellent teaching skills and strong commitment to extending and developing effective, efficient ways of teaching mathematics students, generating new initiatives with the K-12 community, conducting mathematics education research supporting change, and aggressively competing for nationally-awarded grants that support the pedagogical dimension of the institute. We are working toward an institute that is regarded for its national leadership in innovative, effective, research-based math learning models. The institute is a part of the Department of Mathematics in the Eberly College of Arts & Sciences, with its own director, and with operational governance that allows tenured and tenure-track faculty to be rewarded and recognized for their roles in teaching excellence, in research and scholarship associated with the goals of the Institute, and in pedagogy associated with math learning. All applicants should have professional credentials qualifying for a tenure-track appointment at least at the rank of assistant professor. A truly outstanding individual with the capacity to provide research leadership will be considered for appointment at the rank of associate/full professor as an Eberly Professor, with benefits accorded to the Eberly Family Distinguished Professors in the Eberly College of Arts and Sciences.

West Virginia University is a Land Grant institution in the State of West Virginia, enrolling 22,000 students. It is Doctoral/Research University-Extensive in the Carnegie Classification of Institutions of Higher Education, based on the complexity and breadth of the Institution's mission. The Department of Mathematics has 26 full-time faculty members and approximately 30 M.S. and Ph.D. students. The department is housed in newly refurbished facilities which include networked offices and the university's Mathematics Library. The university is located in Morgantown, an award-winning city with a metropolitan population of 80,000. Morgantown has diverse cultural and recreational opportunities, excellent medical facilities, and a favorable location with ready access to the urban areas of Pittsburgh, PA, and Washington, D.C.

Applicants should provide a letter of application, a statement of teaching philosophy and any experience and vision you may have related to achieving the goals of the institute, a vita, and the names and contact information of three references. Please send applications, references, and inquiries to:

Sherman D. Riemenschneider
Chair, Department of Mathematics
320 Armstrong Hall, P.O. Box 6310
West Virginia University
Morgantown, WV 26506-6310
(sherm@math.wvu.edu)

Priority will be given to applications received by November 15, 2002.

West Virginia University is an Equal

Opportunity/Affirmative Action Employer. Minorities, disabled, and women candidates are urged to apply.

WISCONSIN

UNIVERSITY OF WISCONSIN-MADISON
Mathematical Physics/String Theory Cluster Hiring

The Departments of Mathematics and Physics anticipate openings for one or two positions to begin August 25, 2003, at either the tenure-track (assistant professor) or tenured (associate/full professor) level. This cluster hiring is a part of the Madison Initiative and is intended to establish a prominent research group connecting the existing groups in particle physics phenomenology in the Physics Department and topology/geometry in the Mathematics Department. Applications are especially encouraged from theorists pursuing innovative research in string theory, quantum gravity, physics with extra dimensions, quantum field theory, supersymmetry, and unification theories; as well as from mathematicians working on aspects of string theory or related topics. Successful candidates will be encouraged to participate in interdisciplinary research which will strengthen ties between the two departments. Joint appointments in the Mathematics and Physics Departments are contemplated.

Candidates should exhibit evidence of outstanding research records, normally including achievements significantly beyond the doctoral dissertation. A strong commitment to excellence in instruction at both undergraduate and graduate levels is also expected. Applicants should send a curriculum vitae which includes a publication list, and brief descriptions of research and teaching accomplishments and goals to:

Math/Physics Cluster
Hiring Committee
Dept. of Mathematics, Van Vleck Hall
University of Wisconsin-Madison
480 Lincoln Drive
Madison, WI 53706-1388

Applicants should also arrange to send to the above address, three letters of recommendation, which should address the applicant's research potential and teaching experiences. Review of applications will begin on November 1, 2002. Applications will be accepted until the positions are filled. Additional letters will be solicited by the hiring committee for senior appointments.

The Departments of Mathematics and Physics are committed to increasing the number of women and minority faculty. The University of Wisconsin is an Affirmative Action, Equal Opportunity Employer and encourages applications from women and minorities. Unless confidentiality is requested in writing, information regarding the applicants must be released upon request. Finalists cannot be guaranteed confidentiality.

Additional departmental information is available on the websites `http://www.math.wisc.edu/`; `http://www.physics.wisc.edu/`.

Information about the cluster hiring initiative is available at `http://wiscinfo.doit.wisc.edu/cluster/`.

CANADA

QUEEN'S UNIVERSITY
Department of Mathematics and Statistics

The Department of Mathematics and Statistics invites applications for a tenure-track appointment at the assistant professor level to begin July 2003, and a Tier II Canada Research Chair in Pure Mathematics. Successful applicants for the tenure-track position must have a strong research record and the ability to develop an independent research programme; applicants for the Canada Research Chair must have international stature. All candidates must have the ability to teach a range of mathematics or statistics courses and supervise graduate students. Salary will be commensurate with qualifications and experience.

Candidates should have a Ph.D. in pure or applied mathematics, statistics, or a related area and will have begun an active research program in algebra and number theory, analysis, dynamical systems, or probability and statistics.

Interested candidates should arrange for a curriculum vitae, a description of research interests, up to five publications or preprints, a statement on teaching or a teaching dossier, and at least four letters of reference, one of which should comment on the candidate's teaching, to be sent to the address below by December 1, 2002. Applications will be considered until the position is filled. More details are available at `http://www.mast.queensu.ca/jobs/`. James A. Mingo, Associate Head Department of Mathematics and Statistics Queen's University, Kingston Ontario K7L 3N6; fax: (613) 533-2964; email: `position@mast.queensu.ca`; `http://www.mast.queensu.ca/`. Canadian citizens and permanent residents will be considered first for this position. Queen's University is committed to employment equity and welcomes applications from all qualified women and men, including visible minorities, aboriginal people, persons with disabilities, gay men and lesbians.

SWEDEN

MID SWEDEN UNIVERSITY
Department of Engineering, Physics and Mathematics
Sundsvall, Sweden

The department invites applications for Lecturer in Discrete Mathematics.

Mid Sweden University invites applications from people with a qualification and experience in any area of discrete mathematics, in particular graph theory. An interest in developing courses in cryptology and coding theory would also be advantageous.

The post involves research, delivery of courses (mostly in discrete mathematics), supervision of students, and some administration. For the first three years the department is offering the post with 50% research.

The successful candidate will have a Ph.D. and both a keen interest and ability in teaching. During the selection procedure equal importance will be attached to the research and teaching records of applicants. Strong communication and facilitation skills are also important. Mid Sweden University is an Equal Opportunities Employer. Female applicants are particularly encouraged as these are currently underrepresented in the department.

The main center for mathematical research at Mid Sweden University is at the Sundsvall campus where there are currently three professors in the fields of complex analysis and system analysis. The post may involve teaching at another campus.

Further particulars regarding the post may be obtained from Prof. Urban Cegrell, `urban.cegrell@math.umu.se`; tel. +46 70 2285935, Dr. Frank Wisktrom, `frank.wikstrom@mh.se`, tel. +46 60 148744 or Head of Department, Dr. Olof Bjorkqvist, `olof.bjorkqvist@mh.se`; tel. +46 611 86111.

Application is by letter and should be accompanied by a comprehensive CV containing details about academic qualifications, research interests, teaching and administrative experience, salary requirements and a complete list of scientific publications. Applications should be submitted in three identical copies to Registrator, Mid Sweden University, S-851 70 Sundsvall, Sweden. Closing date: 31 October 2002.

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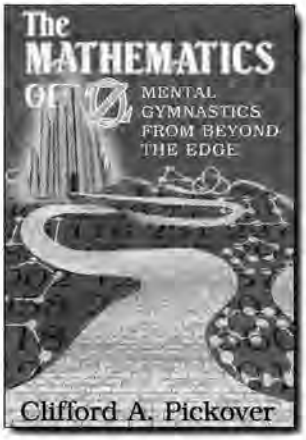

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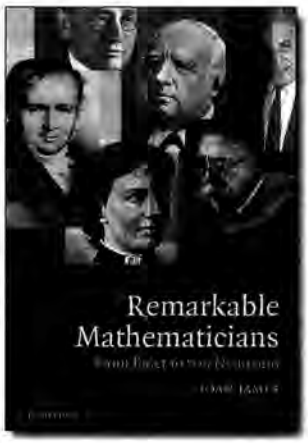

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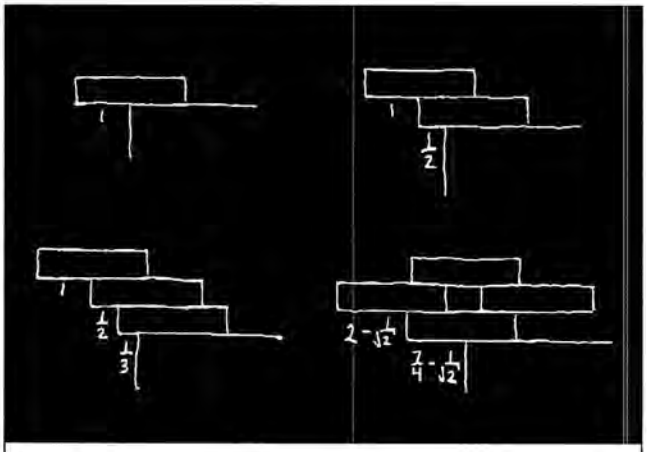

MATHEMATICAL SCIENCES RESEARCH INSTITUTE

1000 Centennial Drive, Berkeley, California 94720-5070

The Institute solicits applications for membership during the 2003-2004 year, which will feature three programs:

DIFFERENTIAL GEOMETRY (August 11, 2003 - May 15, 2004)

As classical as the subject is, it is currently undergoing a very vigorous development, interacting strongly with theoretical physics, mechanics, topology, algebraic geometry, partial differential equations, the calculus of variations, integrable systems, and many other subjects. The five main topics to be concentrated on during the year are areas that have shown considerable growth in the last ten years: Complex geometry, calibrated geometries and special holonomy; Geometric analysis; Symplectic geometry and gauge theory; Geometry and physics; and Riemannian and metric geometry.

Program committee: Robert Bryant, Frances Kirwan, Peter Petersen, Richard Schoen, Isadore Singer, and Gang Tian.

DISCRETE AND COMPUTATIONAL GEOMETRY (August 11 - December 19, 2003)

Discrete and Computational Geometry deals with the structure and complexity of discrete geometric objects as well with the design of efficient computer algorithms for their manipulation. This area is by its nature interdisciplinary and has relations to many other vital mathematical fields, such as algebraic geometry, topology, combinatorics, and probability theory; at the same time it is on the cutting edge of modern applications such as geographic information systems, mathematical programming, coding theory, solid modeling, and computational structural biology.

Program committee: Jesús A. De Loera, Herbert Edelsbrunner, Jacob E. Goodman, János Pach, Micha Sharir, Emo Welzl, and Günter M. Ziegler.

TOPOLOGICAL ASPECTS OF REAL ALGEBRAIC GEOMETRY (January 2 - May 14, 2004)

The topological approach to real algebraic geometry is due to Hilbert who realized the advantages of considering topological properties of real algebraic plane curves. Much progress on Hilbert's work was achieved in the 1970's by the schools of Rokhlin and Arnold, including new objects and questions on complexification and complex algebraic geometry, relation to piecewise linear geometry and combinatorics, and enumerative geometry. This continues today with new topics such as amoebas, new connections such as that with symplectic geometry, and new challenges such as those posed by real polynomial systems.

Program committee: Selman Akbulut, Grisha Mikhalkin, Victoria Powers, Boris Shapiro, Frank Sottile, and Oleg Viro.

In addition to these programs, MSRI also continues the COMPLEMENTARY PROGRAM, in which applications from candidates working in any field of mathematics are welcome. Candidates should specify why a fellowship at MSRI at this time is particularly relevant for their research, for example, by describing potential interactions with one of the above fields, or indicating interest in one or more of MSRI's joint industrial fellow/internships.

MSRI has three award categories available to applicants:

Research Professorships. These awards, which provide partial salary support for a visit of at least three months, are intended for mathematicians with Ph.D.s awarded in 1997 or earlier. **Application Deadline: Sept. 27, 2002.**

Postdoctoral Fellowships. These awards, which provide support for five or ten months, are intended for mathematicians with Ph.D.s awarded in 1998 or later. There will be several one-semester awards for participants in half-year programs, as well as several 10-month awards, particularly for participants in the Differential Geometry program. In addition, MSRI will make fellowship/intern awards together with **Hewlett-Packard** and **Microsoft Research**. **Application Deadline: Nov. 15, 2002.**

General Memberships. These awards may provide partial support toward living and travel expenses. It is generally expected that General Members will come with partial or full support from other sources. **Application Deadline: Nov. 15, 2002.**

Further information and application forms are available at

http://www.msri.org

MICHIGAN STATE
UNIVERSITY

Lappan-Phillips-Fitzgerald Chair in Mathematics Education

DEPARTMENT OF MATHEMATICS, MICHIGAN STATE UNIVERSITY

The Department of Mathematics at Michigan State University is seeking a distinguished scholar to become the Lappan-Phillips-Fitzgerald Professor of Mathematics Education. This position includes an academic appointment in the Department at the level of full professor, a nationally competitive salary, and a fund for research expenses. The newly established Lappan-Phillips-Fitzgerald Chair in Mathematics Education is endowed by the Michigan State University Mathematics Education Endowment Fund established by the University and the Connected Mathematics Project.

We seek a senior mathematics educator whose scholarship has significantly benefited K-12 mathematics education through curriculum, teaching, student learning, teacher education, teacher professional development or policy. Candidates should have an outstanding record of research, and/or development productivity that is based in and generates research, and a strong background in mathematics. We seek a scholar whose achievements and professional interests are compatible with the land-grant mission of Michigan State University.

The Lappan-Phillips-Fitzgerald Chair will be expected to engage the broad talents of MSU's mathematics education, mathematics, and education faculty; graduate and undergraduate students; and K-12 teachers in efforts to improve mathematics teaching and learning. The applicant must contribute to advancing the research profile and national reputation of the mathematics education endeavors at Michigan State University. This will involve providing intellectual leadership in the Department of Mathematics, the College of Natural Science, and the College of Education, and with faculty from other institutions, to create and sustain research opportunities. We seek a scholar who also has a record of working effectively as a mentor for junior faculty members and doctoral students, and who is a dedicated teacher with a commitment to teaching as an essential component of scholarship.

Inquiries and nominations, including self-nominations, should be sent to Jean Beland, Assistant to Dr. Joan Ferrini-Mundy, MSU, College of Natural Science, 211 N. Kedzie Lab, East Lansing, MI 48824-1031, (lpfchair@msu.edu). Please include the candidate's vita with the letter of nomination. Review of nominations will begin September 1, 2002. The intention is to appoint a person to assume the Chair in the summer or fall of 2003. Women, minorities, and persons with disabilities are especially encouraged to apply.

MSU is an affirmative-action, equal opportunity employer.

AMS APPLICATION FOR MEMBERSHIP 2003

AMERICAN MATHEMATICAL SOCIETY

JANUARY—DECEMBER

WWW.AMS.ORG/MEMBERSHIP

Please read the "Membership Categories" section of this form to determine the membership category for which you are eligible. Then fill out this application and return it as soon as possible.

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If you wish to be on the mailing lists to receive information about publications in fields of mathematics in which you have an interest, please consult the list of major headings below. These categories will be added to your computer record so that you will be informed of new publications or special sales in the fields you have indicated.

00 General
01 History and biography
03 Mathematical logic and foundations
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06 Order, lattices, ordered algebraic structures
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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
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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
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Please read the following to determine what membership category you are eligible for, and then indicate below the category for which you are applying.

Members can purchase a ***multi-year membership*** by prepaying their current dues rate for either two, three, four or five years. This option is not available to category-S, unemployed, or student members.

Introductory ordinary member rate applies to the first five ***consecutive*** years of ordinary membership. Eligibility begins with the first year of membership in any category other than student and nominee. Dues are $54.

For ***ordinary members*** whose annual professional income is below $75,000, the dues are $108; for those whose annual professional income is $75,000 or more, the dues are $144.

Minimum dues for ***contributing members*** are $216. The amount paid which exceeds the higher ordinary dues level and is purely voluntary may be treated as a charitable contribution.

For a ***joint family membership,*** one member pays ordinary dues, based on his or her income; the other pays ordinary dues based on his or her income, less $20. (Only the member paying full dues will receive the *Notices* and the *Bulletin* as a privilege of membership, but both members will be accorded all other privileges of membership.)

The annual dues for ***reciprocity members*** who reside outside the U.S. are $72. To be eligible for this classification, members must belong to one of those foreign societies with which the AMS has established a reciprocity agreement. Annual verification is required. Reciprocity members who reside in the U.S. must pay ordinary member dues ($108 or $144).

The annual dues for ***category-S members,*** those who reside in developing countries, are $16. Members can chose only one privilege journal. Please indicate your choice below.

For either ***students*** or ***unemployed individuals,*** dues are $36, and annual verification is required.

2003 Dues Schedule (January through December)

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Unemployed member (please verify)[2]			☐$36
Reciprocity member (please verify)[3]	☐$72	☐$108	☐$144
Category-S member [4]			☐$16
Multi-year membership	$	for	years

[1] ***Student Verification*** (sign below)
I am a full-time student at _____

_____ currently working toward a degree.

[2] ***Unemployed Verification*** (sign below) I am currently unemployed and actively seeking employment.

[3] ***Reciprocity Membership Verification*** (sign below) I am currently a member of the society indicated on the right and am therefore eligible for reciprocity membership.

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Signature

[4] ☐ ***send*** **NOTICES** ☐ ***send*** **BULLETIN**

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- ☐ Azerbaijan Mathematical Society
- ☐ Balkan Society of Geometers
- ☐ Belgian Mathematical Society
- ☐ Berliner Mathematische Gesellschaft
- ☐ Calcutta Mathematical Society
- ☐ Canadian Mathematical Society
- ☐ Croatian Mathematical Society
- ☐ Cyprus Mathematical Society
- ☐ Danish Mathematical Society
- ☐ Deutsche Mathematiker-Vereinigung
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- ☐ Glasgow Mathematical Association
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- ☐ Mathematical Society of the Philippines
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Conferences

AMS Short Courses

Public-Key Cryptography

Baltimore, Maryland
January 13–14, 2003

This entry-level course is under the direction of Daniel B. Lieman, University of Georgia. It will survey both mathematical and practical considerations in modern cryptography. Topics will include basic cryptographic techniques and how they are used today, along with the limitations of those techniques, and some goals of current cryptographic research. The course will also incorporate a survey of some real-world attacks on widely used cryptographic protocols, as well as areas of current and future research.

No prior knowledge of finite fields or computational number theory is required or expected. The course will be self-contained and will include suggested undergraduate research projects.

Speakers (subject to change) include Daniel Bailey, Brown University; William D. Banks, University of Missouri, Columbia; Paul Garrett, University of Minnesota; Igor E. Shparlinski, Macquarie University; William Whyte, NTRU Cryptosystems, Inc.; and the organizer.

It is planned that lecture notes will be available to those who register for this course. Advance registration fees are $80 for AMS/MAA members, $110 for nonmembers, and $35 for students/unemployed/emeritus; on-site registration fees are $100 AMS/MAA members, $130 for nonmembers, and $50 for students/unemployed/emeritus. Registration and housing information can be found in this issue of the *Notices*; see the section "Registering in Advance and Hotel Accommodations" in the announcement for the meetings in Baltimore. The registration form is at the back of this issue.

1. Public-key and Symmetric-key Cryptography

This talk will cover the basic constructions of public-key and symmetric cryptography and will give some examples of basic encryption, decryption, signature and verification primitives. We will also cover the key ideas of "randomness" and probabilistic encryption, which are extremely important in subsequent security discussions.

2. Cryptography in the Real World Today

This lecture will survey how cryptography and cryptographic algorithms are used today and current proposals for next generation security architectures. Topics will include SSL/TLS and the Internet (i.e., secure Web browsing—what that really means), WAP (and other next generation cell phone architectures, etc.), as well as the cryptographic needs of "new" devices (e.g., RFID tokens, like the Mobil Speedpass) and applications. We will also discuss the limitations of current cryptographic technologies and what new innovations are needed.

3. Towards Faster Cryptosystems, I

This talk will cover elliptic curve cryptography (briefly!), along with a comparison to older techniques such as RSA and Diffie-Hellman. This talk will cover mathematical techniques for speeding up some "classical" algorithms: for example, the use of optimal extension fields to speed up the Diffie-Hellman and elliptic curve cryptosystems.

4. Attacks, I

This talk will use mathematical techniques to show that being able to recover even a small amount of data is enough to crack some cryptosystems. The combination of techniques from exponential sums and lattice reduction has a number of cryptographic applications, helping to make rigorous several heuristic approaches. It provides a two-edged sword which can be used both to prove important security results and also to create powerful rigorously proved attacks.

5. Attacks, II

This talk will focus on more "cryptographic" attacks. We will introduce the notion of an oracle and discuss adaptive chosen ciphertext attacks, etc. We will consider some of the security properties (particularly with respect to randomness) that a "safe" cryptosystem must possess.

6. Towards Faster Cryptosystems, II

This final talk will survey some current research in mathematical cryptography today—including new cryptosystems based on lattices (NTRU), along with interesting research into cryptosystems based on the (conjectured) rarity of zeroes of sparse polynomials.

Meetings & Conferences of the AMS

IMPORTANT INFORMATION REGARDING MEETINGS PROGRAMS: AMS Sectional Meeting programs do not appear in the print version of the *Notices*. However, comprehensive and continually updated meeting and program information with links to the abstract for each talk can be found on the AMS website. See `http://www.ams.org/meetings/`. Programs and abstracts will continue to be displayed on the AMS website in the Meetings and Conferences section until about three weeks after the meeting is over. Final programs for Sectional Meetings will be archived on the AMS website in an electronic issue of the *Notices* as noted below for each meeting.

Boston, Massachusetts

Northeastern University

October 5–6, 2002

Meeting #979

Eastern Section
Associate secretary: Lesley M. Sibner
Announcement issue of *Notices*: August 2002
Program first available on AMS website: August 22, 2002
Program issue of electronic *Notices*: October 2002
Issue of *Abstracts*: Volume 23, Issue 4

Deadlines

For organizers: Expired
For consideration of contributed papers in Special Sessions: Expired
For abstracts: Expired

Invited Addresses

Lou P. van den Dries, University of Illinois, Urbana-Champaign, *Title to be announced.*

Hillel Furstenberg, Einstein Institute of Mathematics, *Title to be announced* (Erdős Memorial Lecture).

Diane Henderson, Pennsylvania State University, *Mathematical modelling and experiments on water waves.*

Christopher K. King, Northeastern University, *Information capacity of quantum channels.*

Xiaobo Liu, University of Notre Dame, *Solving universal equations in Gromov-Witten invariants.*

Special Sessions

Convex Geometry, **Daniel A. Klain**, University of Massachusetts, Lowell, and **Elisabeth Werner**, Case Western Reserve University.

Developments and Applications in Differential Geometry, **Chuu-Lian Terng**, Northeastern University, and **Xiaobo Liu**, University of Notre Dame.

Elliptic Operators on Noncompact Manifolds, **Maxim Braverman**, Northeastern University, **Victor Nistor**, Pennsylvania State University, and **Mikhail A. Shubin**, Northeastern University.

Ergodic Theory and Dynamical Systems, **Stanley J. Eigen**, Northeastern University, and **Vidhu S. Prasad**, University of Massachusetts, Lowell.

Geometric Group Theory, **Sean T. Cleary**, City College, CUNY, **Murray Elder**, Tufts University, and **Jennifer Taback**, University of Albany.

Hilbert Schemes, **Mark De Cataldo**, SUNY at Stony Brook, and **Anthony A. Iarrobino**, Northeastern University.

Modern Schubert Calculus, **Frank Sottile**, University of Massachusetts, Amherst, and **Christopher T. Woodward**, Rutgers University.

Number Theory and Arithmetic Geometry, **Matthew A. Papanikolas**, Brown University, and **Siman Wong**, University of Massachusetts, Amherst.

Quantum Information Theory, **Christopher K. King**, Northeastern University, and **Mary Beth Ruskai**, University of Massachusetts, Lowell.

Quivers and Their Generalizations, **Alex Martsinkovsky**, **Gordana G. Todorov**, **Jerzy M. Weyman**, and **Andrei V. Zelevinsky**, Northeastern University.

Recent Developments in the Orbit Method for Real and p-adic Groups, **Donald R. King**, Northeastern University, and **Alfred G. Noel**, University of Massachusetts, Boston.

Singularities in Algebraic and Analytic Geometry, **Terence Gaffney** and **David B. Massey**, Northeastern University, and **Caroline Grant Melles**, U. S. Naval Academy.

The History of Mathematics, **Adrian C. Rice**, Randolph-Macon College, and **Amy E. Shell-Gellasch**, U. S. Military Academy.

The Mathematics of Water Waves, **Diane Henderson**, Pennsylvania State University, and **Gene Wayne**, Boston University.

Madison, Wisconsin

University of Wisconsin-Madison

October 12–13, 2002

Meeting #980

Central Section
Associate secretary: Susan J. Friedlander
Announcement issue of *Notices*: August 2002
Program first available on AMS website: August 29, 2002
Program issue of electronic *Notices*: October 2002
Issue of *Abstracts*: Volume 23, Issue 4

Deadlines

For organizers: Expired
For consideration of contributed papers in Special Sessions: Expired
For abstracts: Expired

Invited Addresses

Lawrence Ein, University of Illinois at Chicago, *Title to be announced.*

Eleny Ionel, University of Wisconsin, *Title to be announced.*

Mikhail Safonov, University of Minnesota, *Title to be announced.*

John Sullivan, University of Illinois, Urbana-Champaign, *Title to be announced.*

Special Sessions

Arithmetic Algebraic Geometry, **Ken Ono** and **Tonghai Yang**, University of Wisconsin-Madison.

Arrangements of Hyperplanes, **Daniel C. Cohen**, Louisiana State University, **Peter Orlik**, University of Wisconsin-Madison, and **Anne Shepler**, University of California Santa Cruz.

Biological Computation and Learning in Intelligent Systems, **Shun-ichi Amari**, RIKEN, **Amir Assadi**, University of Wisconsin-Madison, and **Tomaso Poggio**, Massachusetts Institute of Technology.

Characters and Representations of Finite Groups, **Martin Isaacs**, University of Wisconsin, Madison, and **Mark Lewis**, Kent State University.

Combinatorics and Special Functions, **Richard Askey** and **Paul Terwilliger**, University of Wisconsin-Madison.

Dynamical Systems, **Sergey Bolotin** and **Paul Rabinowitz**, University of Wisconsin-Madison.

Effectiveness Questions in Model Theory, **Charles McCoy**, **Reed Solomon**, and **Patrick Speissegger**, University of Wisconsin-Madison.

Geometric Methods in Differential Equations, **Gloria Mari Beffa**, University of Wisconsin-Madison, and **Peter Olver**, University of Minnesota.

Geophysical Waves and Turbulence, **Paul Milewski**, **Leslie Smith**, and **Fabian Waleffe**, University of Wisconsin-Madison.

Group Cohomology and Homotopy Theory, **Alejandro Adem**, University of Wisconsin-Madison, and **Jesper Grodal**, Institute for Advanced Study.

Harmonic Analysis, **Alex Ionescu** and **Andreas Seeger**, University of Wisconsin-Madison.

Hyperbolic Differential Equations and Kinetic Theory, **Shi Jin**, **Marshall Slemrod**, and **Athanassios Tzavaras**, University of Wisconsin-Madison.

Lie Algebras and Related Topics, **Georgia Benkart** and **Arun Ram**, University of Wisconsin-Madison.

Lie Groups and Their Representations, **R. Michael Howe**, University of Wisconsin, Eau Claire, and **Gail D. Ratcliff**, University of Missouri, St. Louis.

Multiresolution Analysis and Data Presentation, **Amos Ron**, University of Wisconsin-Madison.

Optimal Geometry of Curves and Surfaces, **Jason H. Cantarella**, University of Georgia, and **John M. Sullivan**, University of Illinois, Urbana.

Partial Differential Equations and Geometry, **Sigurd Angenent** and **Mikhail Feldman**, University of Wisconsin-Madison.

Probability, **David Griffeath** and **Timo Seppalainen**, University of Wisconsin-Madison.

Ring Theory and Related Topics, **Don Passman**, University of Wisconsin-Madison.

Several Complex Variables, **Pat Ahern**, **Xianghong Gong**, **Alex Nagel**, and **Jean-Pierre Rosay**, University of Wisconsin-Madison.

Salt Lake City, Utah

University of Utah

October 26–27, 2002

Meeting #981

Western Section
Associate secretary: Michel L. Lapidus
Announcement issue of *Notices*: September 2002
Program first available on AMS website: September 16, 2002
Program issue of electronic *Notices*: October 2002
Issue of *Abstracts*: Volume 23, Issue 4

Deadlines

For organizers: Expired
For consideration of contributed papers in Special Sessions: Expired
For abstracts: Expired

Invited Addresses

Yakov Eliashberg, Stanford University, *Comparing symplectic and contact topologies.*

Hart F. Smith, University of Washington, *The wave equation and harmonic analysis.*

Michael Ward, University of British Columbia, *The dynamics and stability of localized patterns for a reaction-diffusion system.*

Amie Wilkinson, Northwestern University, *Partially hyperbolic dynamics on 3-manifolds.*

Special Sessions

Analytic Number Theory, **Roger Baker**, **Xian-Jin Li**, and **Andrew D. Pollington**, Brigham Young University.

Area-Minimization and Minimal Surfaces, **Michael Dorff**, **Denise Halverson**, and **Gary R. Lowler**, Brigham Young University.

Geometry and Topology, **Mladen Bestvina**, **Michael Kapovich**, and **Grigory Mikhalkin**, University of Utah.

Nonlinear Elliptic Partial Differential Equations, **David A. Hartenstine**, University of Utah, and **Jon T. Jacobsen**, Harvey Mudd College.

Numerical Solutions of Modeling Problems, **Sun Chow**, Brigham Young University, and **Joseph V. Koebbe**, Utah State University.

Recent Trends in Algebraic Geometry, **Aaron J. Bertram**, University of Utah, and **Christopher Derek Hacon**, University of California Riverside.

Representation Theory of Semisimple Lie Groups, **Dragan Milicic** and **Peter Trapa**, University of Utah.

Time Series, Heavy Tails, and Applications, **Davar Khoshnevisan**, University of Utah, and **Piotr Kokozska**, Utah State University.

Orlando, Florida

University of Central Florida

November 9–10, 2002

Meeting #982

Southeastern Section
Associate secretary: John L. Bryant
Announcement issue of *Notices*: September 2002
Program first available on AMS website: September 26, 2002
Program issue of electronic *Notices*: November 2002
Issue of *Abstracts*: Volume 23, Issue 4

Deadlines

For organizers: Expired
For consideration of contributed papers in Special Sessions: Expired
For abstracts: September 17, 2002

Invited Addresses

Steven J. Cox, Rice University, *Decoding the dance of your dendritic spines.*

James Haglund, University of Pennsylvania, *The q,t-Catalan numbers and the space of diagonal harmonics.*

Marius Mitrea, University of Missouri-Columbia, *Elliptic and parabolic boundary problems in Sobolev-Besov spaces on nonsmooth domains.*

Ricardo H. Nochetto, University of Maryland, College Park, *Title to be announced.*

Special Sessions

Algebraic and Enumerative Combinatorics (Code: AMS SS A1), **James Haglund**, University of Pennsylvania, and **Jeff B. Remmel**, University of California San Diego.

Asymptotics of Integrable Partial Differential Equations, Riemann-Hilbert Problem and Related Topics (Code: AMS SS M1), **Ken T. R. McLaughlin**, University of North Carolina at Chapel Hill and University of Arizona, and **Alexander Tovbis**, University of Central Florida.

Commutative Algebra (Code: AMS SS B1), **Heath M. Martin**, University of Central Florida, and **Stephanie A. Fitchett**, Florida Atlantic University.

Computational Mathematics (Code: AMS SS C1), **Ricardo H. Nochetto**, University of Maryland, and **Bernardo Cockburn**, University of Minnesota.

Computational Methods in Analysis (Code: AMS SS P1), **George A. Anastassiou**, University of Memphis.

Financial Mathematics (Code: AMS SS D1), **Craig A. Nolder** and **Alec N. Kercheval**, Florida State University.

Function Spaces, Singular Integrals and Applications to PDEs (Code: AMS SS N1), **Marius Mitrea** and **Dorina Mitrea**, University of Missouri-Columbia.

Functional and Harmonic Analysis of Wavelets, Frames and their Applications (Code: AMS SS E1), **Deguang Han**,

University of Central Florida, and **Manos I. Papadakis**, University of Houston.

Graph Theory (Code: AMS SS F1), **Robert C. Brigham**, University of Central Florida, **Cun-Quan Zhang**, West Virginia University, and **Yue Zhoa**, University of Central Florida.

Homotopy Theory and Geometric Topology (Code: AMS SS J1), **Alexander N. Dranishnikov**, **James E. Keesling**, and **Yuli B. Rudyak**, University of Florida.

Invariants of Knots and Low-Dimensional Manifolds (Code: AMS SS H1), **J. Scott Carter**, University of South Alabama, and **Masahico Saito**, University of South Florida.

Mathematical Neuroscience (Code: AMS SS G1), **Steve J. Cox**, Rice University, and **Richard Bertram**, Florida State University.

Nonlinear Waves (Code: AMS SS L1), **Min Chen**, Purdue University, and **Roy Choudhury** and **David J. Kaup**, University of Central Florida.

The Likelihood Inferences in Statistics (Code: AMS SS K1), **Jian-Jian Ren**, University of Central Florida.

Baltimore, Maryland

Baltimore Convention Center

January 15–18, 2003

Meeting #983

Joint Mathematics Meetings, including the 109th Annual Meeting of the AMS, 86th Annual Meeting of the Mathematical Association of America (MAA), annual meetings of the Association for Women in Mathematics (AWM) and the National Association of Mathematicians (NAM), the winter meeting of the Association for Symbolic Logic (ASL), with sessions contributed by the Society for Industrial and Applied Mathematics (SIAM).
Associate secretary: Susan J. Friedlander
Announcement issue of *Notices*: October 2002
Program first available on AMS website: November 1, 2002
Program issue of electronic *Notices*: January 2003
Issue of *Abstracts*: Volume 24, Issue 1

Deadlines

For organizers: Expired
For consideration of contributed papers in Special Sessions: Expired
For abstracts: October 1, 2002
For summaries of papers to MAA organizers: September 10, 2002

Joint Invited Addresses

Noam D. Elkies, Harvard University, *Some novel uses of lattice reduction*, Friday, 11:10 a.m. (AMS-MAA Invited Address).

Edward R. Scheinerman, Johns Hopkins University, *Discrete mathematics and mechanical engineering*, Wednesday, 11:10 a.m. (AMS-MAA Invited Address).

AMS Committee on Science Policy-MAA Science Policy Committee Government Speaker, Friday, 4:20 p.m. Speaker to be announced.

Joint Special Sessions

Computability and Models (Code: AMS SS T1), **Douglas Cenzer**, University of Florida, and **Valentina S. Harizanov**, The George Washington University (AMS-ASL); Wednesday and Thursday mornings and Wednesday afternoon.

Dynamical Systems and Oceanography (Code: AMS SS H1), **Reza Malek-Madani** and **Peter A. McCoy**, U.S. Naval Academy (AMS-SIAM); Wednesday and Thursday mornings and afternoons.

Interactions Between Logic, Group Theory and Computer Science (Code: AMS SS Q1), **Alexandre V. Borovik**, UMIST, and **Alexei Myasnikov**, City College of CUNY (AMS-ASL); Wednesday and Thursday mornings and Wednesday afternoon.

Mathematics and Education Reform (Code: AMS SS N1), **Naomi Fisher**, University of Illinois at Chicago, **William H. Barker**, Bowdoin College, **Jerry L. Bona**, University of Illinois at Chicago, and **Kenneth C. Millett**, University of California Santa Barbara (AMS-MAA-MER); Wednesday and Thursday mornings and afternoons.

Research in Mathematics by Undergraduates (Code: AMS SS P1), **Darren A. Narayan**, **Carl V. Lutzer**, and **Tamara A. Burton**, Rochester Institute of Technology (AMS-MAA-SIAM); Friday and Saturday mornings and afternoons.

The History of Mathematics (Code: AMS SS S1), **Joseph W. Dauben**, Lehman College, and **David E. Zitarelli**, Temple University (AMS-MAA); Friday and Saturday mornings and afternoons.

Other Joint Sessions

Implementing Preparation and Development Programs for College Mathematics Instructors, Wednesday, 2:00 p.m.–4:00 p.m., organized by **Teri J. Murphy**, University of Oklahoma, and **Natasha Speer**, Michigan State University. An increasing number of institutions have experience with designing and implementing professional development opportunities for instructors. In an effort to learn from each other's efforts, during this session audience members will be able to discuss their experiences, ideas, and goals with contributors and with each other. This poster session will begin with opening remarks by the organizers, followed by time for participants to view the posters and engage in discussion with the individual presenters. The session will conclude with a whole-group discussion about issues and ideas generated by the posters. This session is intended for participants from a range of programs that target graduate teaching assistants, postdocs, adjuncts, and new faculty, at two-year as well as four-year colleges. Applications should be submitted to Teri Jo Murphy (`tjmurphy@math.ou.edu`) by December 10, 2002. The session is sponsored by AMS-MAA Joint Committee on Teaching Assistants and Part-Time Instructors.

Prize Session and Reception: In order to showcase the achievements of the recipients of various prizes, the AMS

and MAA are cosponsoring this event at 4:25 p.m. on Thursday. A cash bar reception will immediately follow. All participants are invited to attend. The AMS, MAA, and SIAM will award the Frank and Brennie Morgan Prize for Outstanding Research in Mathematics by an Undergraduate Student. The MAA prizes include the Deborah and Franklin Tepper Haimo Awards for Distinguished College or University Teaching of Mathematics, the Chauvenet Prize, the Beckenbach Book Prize, the Yueh-gin Gung and Dr. Charles Y. Hu Award for Distinguished Service to Mathematics, and Certificates of Meritorious Service. The AMS will announce the winners of the George David Birkhoff Prize in Applied Mathematics, Frank Nelson Cole Prize in Algebra, Levi L. Conant Prize, Ruth Lyttle Satter Prize in Mathematics, and the Leroy P. Steele Prizes. The AWM will present the Louise Hay Award for Contributions to Mathematics Education and the Alice T. Schafer Prize for Excellence in Mathematics by an Undergraduate Woman.

109th Annual Meeting of the AMS

AMS Invited Addresses

Weinan E, Princeton University, *Title to be announced,* Thursday, 3:20 p.m.

David B. Mumford, Brown University, *The shape of objects in two and three dimensions: Mathematics meets computer vision* (AMS Josiah Willard Gibbs Lecture), Wednesday, 8:30 p.m.

Andrei Okounkov, University of California Berkeley, *Dimer model and geometry,* Thursday, 2:15 p.m.

Charles C. Pugh, University of California Berkeley, *Partial hyperbolicity,* Wednesday, 10:05 a.m.

Dana Randall, Georgia Institute of Technology, *Efficient algorithms for finding a random needle in a combinatorial haystack,* Friday, 9:00 a.m.

Peter Sarnak, Courant Institute and Princeton University, *Spectra of hyperbolic surfaces and applications* (AMS Colloquium Lectures), Wednesday, Thursday, and Friday, 1:00 p.m.

Vladimir Voevodsky, Institute for Advanced Study, *Motivic homotopy theory,* Friday, 10:05 a.m.

AMS Special Sessions

Advances in Spherical Designs and Codes (Code: AMS SS A1), **Béla Bajnok**, Gettysburg College, and **Neil J. A. Sloane**, AT&T Shannon Labs; Wednesday and Thursday mornings and afternoons.

Algebraic Topology Based on Knots (Code: AMS SS F1), **Mark E. Kidwell**, U.S. Naval Academy, and **Jozef H. Przytycki** and **Yongwu Rong**, The George Washington University; Friday and Saturday mornings and afternoons.

Algebras, Actions, and Algorithms (Code: AMS SS CC1), **Edward S. Letzter** and **Martin Lorenz**, Temple University; Wednesday and Thursday mornings and Wednesday afternoon.

Banach Space Theory and Convex Geometry (Code: AMS SS L1), **Teck-Cheong Lim**, Mason University, and **Mikhail Ostrovskii**, The Catholic University of America; Thursday and Friday afternoons and Friday morning.

C-Extensions and Classifications of C*-Algebras* (Code: AMS SS C1), **Shuang Zhang**, University of Cincinnati, and **Huaxin Lin**, University of Oregon; Friday and Saturday afternoons and Friday morning.

Computational Algebraic and Analytic Geometry for Low-Dimensional Varieties (Code: AMS SS G1), **Mika K. Seppälä**, Florida State University, and **Emil J. Volcheck**, Baltimore, Maryland; Thursday and Friday afternoons and Friday morning.

Discrete Dynamics and Difference Equations (Code: AMS SS D1), **Saber N. Elaydi**, Trinity University, and **Gerasimos Ladas**, University of Rhode Island; Friday and Saturday mornings and Saturday afternoon.

Discrete Models (Code: AMS SS K1), **Cris Moore**, University of New Mexico and Santa Fe Institute, and **Dana Randall**, Georgia Institute of Technology; Wednesday and Thursday mornings and afternoons.

Dynamics, Physics, and Probability: The Work of the 2002 Nemmers Prize Winner, Yakov Sinai (Code: AMS SS W1), **John M. Franks** and **Jeff Xia**, Northwestern University; Wednesday afternoon.

Highlights of Recent Workshops Held by the Board on Mathematical Sciences and their Applications (Code: AMS SS DD1), **David Eisenbud**, Mathematical Sciences Research Institute, and **Scott T. Weidman**, National Research Council; Thursday afternoon.

Homotopy Theory (Code: AMS SS E1), **Kristine Baxter Bauer**, **J. Michael Boardman**, **Nitu Kitchloo**, **Jean-Pierre Meyer**, **Jack Morava**, and **W. Stephen Wilson**, Johns Hopkins University; Friday and Saturday mornings and afternoons.

Inverse Problems and Sampling Theory in Signal Analysis (Code: AMS SS Z1), **M. Zuhair Nashed**, University of Delaware; Thursday and Friday afternoons and Thursday morning.

Mathematical Current Events: Expository Reports (Code: AMS SS Y1), **David Eisenbud**, Mathematical Sciences Research Institute; Friday morning.

Modular Forms, Elliptic Curves, and Related Topics (Code: AMS SS J1), **Cristina M. Ballantine** and **Sharon M. Frechette**, College of the Holy Cross, and **Holly J. Rosson**, St. Mary's College of Maryland; Thursday afternoon and Friday and Saturday mornings.

Nonstandard Models of Arithmetic and Set Theory (Code: AMS SS X1), **Ali Enayat**, American University, and **Roman Kossak**, CUNY Graduate Center; Wednesday and Thursday afternoons and Wednesday morning.

Operator Algebras, Quantization, and Noncommutative Geometry: A Centennial Celebration in Honor of J. V. Neumann and M. H. Stone (Code: AMS SS U1), **Robert S. Doran**, Texas Christian University, and **Richard V. Kadison**,

University of Pennsylvania; Wednesday and Thursday mornings and afternoons.

Primes and Knots (Code: AMS SS R1), **Jack Morava**, Johns Hopkins University, **Stavros Garoufalidis**, Georgia Institute of Technology, and **Masanori Morishita**, Kanazawa University; Wednesday and Thursday mornings and afternoons.

Quantum Computation and Information: Mathematical Challenges (Code: AMS SS EE1), **Samuel J. Lomonaco, Jr.**, University of Maryland Baltimore County, **Howard E. Brandt**, Army Research Laboratory, and **Louis H. Kauffman**, University of Illinois at Chicago; Wednesday and Thursday mornings and afternoons.

Recent Advances in Riemannian and Lorentzian Geometries (Code: AMS SS M1), **Krishan L. Duggal**, University of Windsor, and **Ramesh Sharma**, University of New Haven; Wednesday and Thursday mornings and Wednesday afternoon.

Special Functions and q-Series (Code: AMS SS V1), **Mourad E. H. Ismail**, University of South Florida; Wednesday and Thursday mornings and Wednesday afternoon.

Stochastic and Multiscale Problems in the Sciences (Code: AMS SS AA1), **Weinan E**, Princeton University, **Shiyi Chen**, Johns Hopkins University, and **Eric Vanden-Eijnden**, New York University-Courant Institute; Friday and Saturday mornings and afternoons.

The Many Lives of Lattice Theory and the Theory of Ordered Sets, with Connections to Combinatorics (Code: AMS SS BB1), **Jonathan D. Farley**, University of Oxford, and **Stefan E. Schmidt** and **Alex J. Pogel**, New Mexico State University; Friday and Saturday afternoons and Saturday morning.

Wavelets, Frames and Operator Theory (Code: AMS SS B1), **Christopher Heil**, Georgia Institute of Technology, **Palle Jorgensen**, University of Iowa, and **David Larson**, Texas A&M University; Friday and Saturday mornings and afternoons.

AMS Contributed Papers

There will be sessions for contributed papers of ten minutes' duration. Contributed papers will be grouped by related Mathematics Subject Classification into sessions insofar as possible. The author(s) and their affiliation(s) and the title of each paper accepted will be listed in the program along with the date and time of presentation. Abstracts will be published in *Abstracts Presented to the American Mathematical Society* and should be submitted electronically. Send a blank message to `abs-submit@ams.org` and type `help` as the subject to see your electronic options. See the beginning of this announcement for pertinent deadlines.

Other AMS Sessions

Committee on the Profession Presentation, Wednesday, 4:30 p.m.–6:00 p.m.

Committee on Science Policy Panel Discussion, Friday, 2:30 p.m.–4:00 p.m.

Who Wants to be a Mathematician?, Thursday, 10:00 a.m.–11:00 a.m., organized by **Michael A. Breen** and **Annette W. Emerson**, AMS, and **William T. Butterworth**, Barat College. Come watch ten of the Baltimore area's top high school students as they have the chance to compete for cash and prizes by answering questions about mathematics. There is no partial credit to agonize over, and the top prize is $2,000. Contestants can ask for help from the audience, so the more people in the audience who know mathematics, the better it is for the contestants. You are invited to come and take part in this educational and fun presentation.

Committee on Education Panel Discussion, Saturday, 8:30 a.m.–10:00 a.m.

Other AMS Events

Council Meeting, Tuesday, 1:00 p.m.–6:00 p.m.

Business Meeting, Saturday, 11:45 a.m.–12:15 p.m. The secretary notes the following resolution of the Council: Each person who attends a business meeting of the Society shall be willing and able to identify himself as a member of the Society. In further explanation, it is noted that each person who is to vote at a meeting is thereby identifying himself as and claiming to be a member of the American Mathematical Society. The Society has a Committee on the Agenda for Business Meetings. The purpose is to make business meetings orderly and effective. The committee does not have legal or administrative power. It is intended that the committee consider what may be called "quasipolitical" motions. The committee has several possible courses of action on a proposed motion, including but not restricted to:

(a) doing nothing,

(b) conferring with supporters and opponents to arrive at a mutually accepted amended version to be circulated in advance of the meeting,

(c) recommending and planning a format for debate to suggest to a business meeting,

(d) recommending referral to a committee, and

(e) recommending debate followed by referral to a committee.

There is no mechanism that requires automatic submission of a motion to the committee. However, if a motion has not been submitted through the committee, it may be thought reasonable by a business meeting to refer it rather than to act on it without benefit of the advice of the committee.

In order that a motion for this business meeting receive the service offered by the committee in the most effective manner, it should be in the hands of the secretary by December 16, 2002.

AMS Short Course

This two-day course on *Public-Key Cryptography* is organized by **Daniel B. Lieman**, University of Georgia, and takes place on Monday and Tuesday, January 13 and 14. Please see the complete description beginning on page 1162. Talks include *Public-key and symmetric-key cryptography*; *Cryptography in the real world today*; *Towards faster cryptosystems*; and *Attacks*. There are separate

registration fees to participate. See the fee schedule on the registration form at the back of this issue.

86th Annual Meeting of the MAA

MAA Invited Addresses

David H. Fowler, University of Warwick, *Some comments on early Greek mathematics; Wednesday, 3:20 p.m.*

Paul J. Sally Jr., University of Chicago, *Is teaching about mathematics the same as teaching mathematics?; Saturday, 10:05 p.m*

Joseph H. Silverman, Brown University, *The ubiquity of elliptic curves; Saturday, 9:00 a.m.*

Richard A. Tapia, Rice University, *Some mathematical insights into car and bicycle racing; Thursday, 10:05 a.m.*

Robin Wilson, The Open University, *Four colors suffice: A history and proof of the four-color problem; Wendesday, 2:15 p.m.*

MAA Minicourses

Minicourses are open only to persons who register for the Joint Meetings and pay the Joint Meetings registration fee in addition to the appropriate minicourse fee. If the only reason for registering for the Joint Meetings is to gain admission to a minicourse, please make a notation on your registration form. If the minicourse is fully subscribed or cancelled, a full refund of the Joint Meetings advance registration fee (otherwise subject to the 50% rule) will be made. The MAA reserves the right to cancel any minicourse that is undersubscribed.

Minicourse #1: *Teaching Introductory Statistics Using a Workshop Approach*, organized by **James H. Albert**, Bowling Green State University; Part A: Wednesday, 9:00 a.m. to 11:00 a.m.; Part B: Friday, 9:00 a.m. to 11:00 a.m. This minicourse will help instructors teach introductory statistics conforming to recent ASA/MAA recommendations to emphasize statistical thinking with an increased emphasis on data and concepts and with fewer recipes. A workshop approach will be illustrated where students explore topics in data analysis, probability, and inference by means of directed activities in the classroom. Traditional and Bayesian methods will be compared from the viewpoint of communicating basic tenets of statistical inference. The use of Fathom and web-based software will be illustrated, and a student survey project will be described as a useful method of assessing the student's learning of statistics. No previous computer experience is necessary to attend this minicourse. Cost is $90; enrollment limit is 30.

Minicourse #2: *Java Applets in Teaching Mathematics*, organized by **Joe Yanik**, Emporia State University, and **David M. Strong**, Pepperdine University; Part A: Wednesday, 2:15 p.m to 4:15 p.m.; Part B: Friday, 1:00 p.m. to 3:00 p.m. This minicourse will introduce the participants to the Java Programming language and its use in creating mathematical activities. No previous experience in Java programming will be assumed. Through the use of a Visual Development Environment and a MathToolkit that was developed with the support of an NSF grant, this hands-on workshop will lead the participants through the creation of some sample applets and introduce them to the MathToolkit. In addition they will be provided with a more complete tutorial that they can take home that will teach them the Java Programming language and its use in creating mathematical applets. Cost is $90; enrollment limit is 30.

Minicourse #3: *Optimization of Technology in the Geometry Classroom*, organized by **Subhash C. Saxena**, Coastal Carolina University; Part A: Wednesday, 4:30 p.m. to 6:30 p.m.; Part B: Friday, 3:15 p.m. to 5:15 p.m. The latest version of "Dynamic Geometry Software" empowers us to teach a lot more geometry in an enhanced pedagogical environment, especially topics like affine transformations. This minicourse will provide hands-on experience to participants in the optimal use of technology in diverse college geometry classrooms. We will discuss plane isometries, dilations, affine transformations, equiareal transformations, inversions, and various custom tools; and time permitting, non-Euclidean models and fractals. An abbreviated guide will be available to participants. Cost is $90; enrollment limit is 30.

Minicourse #4: *Visual Linear Algebra*, organized by **Eugene A. Herman**, Grinnell College; **Michael D. Pepe**, Seattle Central Community College; and **Eric P. Schulz**, Walla Walla Community College; Part A: Thursday, 8:00 a.m. to 10:00 a.m.; Part B: Saturday, 9:00 a.m. to 11:00 a.m. This minicourse will introduce participants to a new, visual approach to teaching linear algebra. The primary objective is to create a dynamic learning environment in which students are actively engaged in learning the central concepts of linear algebra. Course materials cover the entire first course in linear algebra; they stress the development of visualization skills to acquire strong geometric intuition. Participants will have the option of working with the materials in Maple, Mathematica, or webMathematica. Cost is $90; enrollment limit is 30.

Minicourse #5: *Using and Adapting Online Materials*, organized by **David A. Smith** and **Lang Moore**, Duke University; **Douglas E. Ensley**, Shippensburg University; and **Franklin A. Wattenberg**, U. S. Military Academy; Part A: Thursday, 10:15 a.m. to 12:15 p.m.; Part B: Saturday, 1:00 p.m. to 3:00 p.m. The minicourse will begin with a short survey of useful mathematical sites, with emphasis on materials available in the Mathematical Sciences Digital Library (MathDL). This will be followed by a brief introduction/review of the basics of HTML. Then we will show how to use and adapt a new set of tools developed by MathDL to create short online learning activities. Cost is $90; enrollment limit is 30.

Minicourse #6: *WeBWorK, an Internet-Based System for Generating and Delivering Homework Problems to Students*, organized by **Arnold K. Pizer**, **Michael E. Gage**, and **Vicki Roth**, University of Rochester; Part A: Thursday, 1:00 p.m. to 3:00 p.m.; Part B: Saturday, 3:15 p.m. to 5:15 p.m. This minicourse introduces participants to WeBWorK, a freely available web-based homework system that comes with an extensive library of problems. WeBWorK won the ICTCM Award for Excellence and Innovation with the Use of Technology in Collegiate Mathematics. Supported by grants from the NSF, WeBWorK has already been adopted

by many colleges and universities. Participants will actively participate in using WeBWorK and writing WeBWorK problems. Readers can lean more about WeBWorK by connecting to `http://www.math.rochester.edu/webwork`. Cost is $90; enrollment limit is 30.

Minicourse #7: *The Mathematics of Presidential and Other Elections*, organized by **Steven J. Brams**, New York University; Part A: Wednesday, 9:00 a.m. to 11:00 a.m.; Part B: Friday, 9:00 a.m. to 11:00 a.m. This course will emphasize modeling presidential campaigns and elections and, more generally, the theoretical problems underlying voting and social choices. Topics will include modeling position-taking in two-candidate and multicandidate races, bandwagon and underdog effects in primaries, voting power in the Electoral College, and election reforms like approval voting. Cost is $60; enrollment limit is 50.

Minicourse #8: *Mathematical Finance*, organized by **Walter R. Stromquist**; Part A: Wednesday, 2:15 p.m. to 4:15 p.m.; Part B: Friday, 1:00 p.m. to 3:00 p.m. We will examine market price statistics to test the validity of the "standard model" for stock prices (Geometric Brownian Motion). We will then cover two main ideas of modern finance: portfolio optimization and option valuation. Portfolio optimization means allocating a fixed investment fund among instruments (such as stocks) in order to maximize return and minimize risk. Option valuation includes the well-known Black-Scholes formula, and we will show how the technique is extended to oil field valuation. The presenter will draw on practical examples from the organizer's consulting experience. Cost is $60; enrollment limit is 50.

Minicourse #9: *Fair Enough? Mathematics of Equity*, organized by **John C. Maceli** and **Stanley E. Seltzer**, Ithaca College; Part A: Wednesday, 4:30 p.m. to 6:30 p.m.; Part B: Friday, 3:15 p.m. to 5:15 p.m. Topics of fairness make terrific subject matter for a contemporary mathematics course. This minicourse introduces some fairness topics—apportionment, voting power, elections, fair allocation and equity, the Census—with the goals of helping participants learn about these topics, see and use activities that support a course in fairness, and prepare to teach such a course. We will provide sample activities, projects, and a list of resources, including original papers accessible to undergraduates. Active participation is expected. Cost is $60; enrollment limit is 50.

Minicourse #10: *Turning a Nonscience or Developmental Course into a Capstone Mathematical Experience*, organized by **James T. Sandefur**, Georgetown University, and **Rosalie A. Dance**, University of the Virgin Islands; Part A: Thursday, 9:00 a.m. to 11:00 a.m.; Part B: Saturday, 9:00 a.m. to 11:00 a.m. Many college freshmen struggle with mathematics without realizing that the mathematics is either useful or important. In this minicourse, participants learn to introduce interesting applications with high algebraic content into precalculus and intermediate algebra courses and courses with titles like "Excursions in Mathematics". We will discuss how to 1) identify and revise appropriate investigations, 2) present investigations to students with a variety of needs, and 3) use technology appropriately. We will use investigations set in high interest contexts (e.g., protection of a local natural resource) or issues of social importance (e.g., teenage binge drinking). Cost is $60; enrollment limit is 50.

Minicourse #11: *Symmetry for All*, organized by **George Baloglou**, SUNY at Oswego; Part A: Thursday, 1:00 p.m. to 3:00 p.m.; Part B: Saturday, 1:00 p.m. to 3:00 p.m. We offer an elementary, strictly geometrical approach to wallpaper patterns. Two-colored patterns provide opportunities for both mathematical exploration and artistic creativity, while compositions of isometries are investigated in the context of multicolored tilings. This low-tech minicourse parallels a general education course developed at SUNY at Oswego over the last ten years. Participants will actually go through the group-work labs that introduce new topics in class and will receive additional materials sufficient for creating a similar course. Cost is $60; enrollment limit is 50.

Minicourse #12: *Getting Students Involved in Undergraduate Research*, organized by **Aparna W. Higgins**, The University of Dayton, and **Joseph A. Gallian**, University of Minnesota, Duluth; Part A: Wednesday, 9:00 a.m. to 11:00 a.m.; Part B: Friday, 9:00 a.m. to 11:00 a.m. This course will cover many aspects of facilitating research by undergraduates, such as finding appropriate problems, deciding how much help to provide, and presenting and publishing the results. Examples will be presented of research in summer programs and research that can be conducted during the academic year. Although the examples used will be primarily in the area of discrete mathematics, the strategies discussed can be applied to any area of mathematics. Cost is $60; enrollment limit is 50.

Minicourse #13: *Incorporating Discrete Mathematics in the Preparation of K–12 Mathematics Teachers*, organized by **Lolina Alvarez**, New Mexico State University; Part A: Wednesday, 2:15 p.m. to 4:15 p.m.; Part B: Friday, 1:00 p.m. to 3:00 p.m. More than a fixed set of topics, discrete mathematics is a way of thinking that deals with important and interesting problems in contemporary mathematics. We will start by picking up some simple situations from art, biology, computer science, social psychology, just to name a few. We will expose, at different levels of sophistication, the mathematics related to each situation. We will emphasize the interplay between mathematical content and methods of teaching and learning. Each course participant will receive a collection of materials, including an extensive list of resources. Cost is $60; enrollment limit is 50.

Minicourse #14: *Teaching a Course in the History of Mathematics*, organized by **V. Frederick Rickey**, U. S. Military Academy, and **Victor J. Katz**, University of the District of Columbia; Part A: Wednesday, 4:30 p.m to 6:30 p.m.; Part B: Friday, 4:30 p.m. to 6:30 p.m. Many schools are introducing courses in the history of mathematics and asking faculty who may never have taken such a course to teach them. This minicourse will assist those teaching history by introducing participants to numerous resources, discussing differing approaches and sample syllabi, providing suggestions for student projects and assessments, and giving those teaching such courses for the first time the confidence to master the subject themselves and to present the material to their students. Cost is $60; enrollment limit is 50.

Minicourse #15: *Real Fun Exploring Basic Mathematics*, organized by **Shawnee L. McMurran** and **Robert G. Stein**, California State University, San Bernardino; Part A: Thursday, 9:00 a.m. to 11:00 a.m.; Part B: Saturday, 9:00 a.m. to 11:00 a.m. Intended for college instructors wishing to enhance math courses for preservice teachers, this course models teaching mathematical content using methods that carry over to schools. The course shows how to take discovery learning beyond isolated activities to build basic skills. Lessons, on topics central to the K–8 curriculum, are open-ended, encouraging deep involvement. Participants will get new ideas and establish mathematical connections that make for a rich experience. Cost is $60; enrollment limit is 50.

Minicourse #16: *Cwatsets: A Research Experience for Undergraduates*, organized by **Gary J. Sherman**, Rose-Hulman Institute of Technology; Part A: Thursday, 1:00 p.m. to 3:00 p.m.; Part B: Saturday, 1:00 p.m. to 3:00 p.m. Cwatsets are group-like subsets of binary n-space with surprising algebraic and combinatorial properties whose applications range from statistics to graph theory. We will survey the evolving undergraduate-driven theory of cwatsets, present an extensive inventory of research questions suitable for undergraduates and their teachers, and discuss cwatsets as a capstone topic for a discrete mathematics or abstract algebra course. Participants will receive a packet of technical reports, papers, examples, and questions. See `http://www.rose-hulman.edu/~sherman/Cwatsets` for more details. Cost is $60; enrollment limit is 50.

MAA Contributed Paper Sessions

See the complete descriptions and instructions on how to participate in these sessions beginning on page 22 in the May/June issue of *FOCUS* or at `http://www.ams.org/amsmtgs/2074_maacontrib.html`. Please note that the days and times listed are tentative.

Innovative Uses of the World Wide Web in Teaching Mathematics (MAA CP A1), Wednesday morning and Thursday afternoon. **Brian E. Smith,** McGill University; **Marcelle Bessman**, Jacksonville University; **Marcia P. Birken**, Rochester Institute of Technology; **Thomas E. Leathrum**, Jacksonville State University; **David M. Strong**, Pepperdine University; and **Joe Yanik**, Emporia State University.

Classroom Demonstrations and Course Projects That Make a Difference (MAA CP B1), Wednesday morning and Thursday afternoon. **David R. Hill,** Temple University; **Sarah L. Mabrouk**, Framingham State College; and **Lila F. Roberts**, Georgia Southern University.

The History of Mathematics in the Americas (MAA CP C1), Wednesday morning. **Amy E. Shell-Gellasch,** U. S. Military Academy; and **Daniel E. Otero**, Xavier University.

Getting Students to Discuss and to Write about Mathematics (MAA CP D1), Wednesday afternoon. **Sarah L. Mabrouk,** Framingham State College.

Quantitative Literacy in Practice: What Is It and What Works? (MAA CP E1), Wednesday afternoon. **Richard A. Gillman,** Valparaiso University.

Environmental Mathematics in the Classroom (MAA CP F1), Wednesday afternoon. **Karen D. Bolinger**, Clarion University, and **Ben Fusaro**, Florida State University.

Incorporating History of Mathematics in the Mathematics Classroom (MAA CP G1), Thursday morning. **Victor J. Katz**, University of the District of Columbia; **Edith Prentice Mendez**, Sonoma State University; and **Eisso J. Atzema**, University of Maine.

Helping Students Give Effective Mathematics Presentations (MAA CP H1), Thursday morning. **Suzanne Dorée**, Augsburg College, and **Thomas Linton**, Central College.

Mathematics Experiences in Business, Industry, and Government (MAA CP I1), Thursday morning. **Philip E. Gustafson**, Mesa State College.

Applications of Abstract Algebra (MAA CP J1), Thursday morning. **Robert E. Lewand**, Goucher College; and **George Mackiw**, Loyola College, Maryland.

The Special Interest Group of the MAA on Research in Undergraduate Mathematics Education (MAA CP K1), Friday and Saturday mornings. **James F. Cottrill**, Illinois State University, and **Anne E. Brown**, Indiana University South Bend.

Best Statistics Projects/Activities (MAA CP L1), Friday and Saturday mornings. **Carolyn K. Cuff**, Westminster College, and **Mary M. Sullivan**, Rhode Island College.

Rethinking the Courses Below Calculus (MAA CP M1), Friday and Saturday mornings. **Mary Robinson**, University of New Mexico, Valencia Campus; **Sheldon P. Gordon**; SUNY at Farmingdale; **Florence S. Gordon**; New York Institute of Technology; and **Arlene H. Kleinstein**; SUNY at Farmingdale.

Assessment of Student Learning: Models and Methodology (MAA CP N1), Friday and Saturday mornings. **Jay A. Malmstrom**, Oklahoma City Community College; **Linda Martin**, Albuquerque-TVI; and **Mercedes A. McGowen**, William Rainey Harper College.

Initiating and Sustaining Undergraduate Research Projects and Programs (MAA CP O1), Thursday afternoon. **James A. Davis**, University of Richmond; **Suzanne M. Lenhart**, University of Tennessee; and **Daniel J. Schaal**, South Dakota State University.

Encouraging Underrepresented Groups of Students in Math Contests (MAA CP P1), Friday afternoon. **Harold B. Reiter**, University of North Carolina Charlotte; **Ruth G. Favro**, Lawrence Technological University; **David M. Wells**, Pennsylvania State University; **Susan Schwartz Wildstrom**, Walt Whitman High School; and **Jeff J. Dodd**, Jacksonville State University.

Strategies for Increasing the Diversity of Students in Mathematics (MAA CP Q1), Friday morning. **Marjorie Enneking**, Portland State University; **Wade Ellis**, West Valley College; **William Hawkins**, SUMMA; **Robert E. Megginson**, University of Michigan; **Kenneth C. Millett**, University of California, Santa Barbara; and **William Y. Velez**, University of Arizona.

Mathematical Modeling in and out of the Classroom (MAA CP R1), Friday afternoon. **Brian J. Winkel**, U. S. Military Academy; **Tanya L. Leise**, Rose-Hulman Institute of Technology; and **Amy E. Radunskaya**, Pomona College.

Philosophy of Mathematics (MAA CP S1), Friday afternoon. **Bonnie Gold,** Monmouth University.

Integrating Undergraduate Research with the Mathematics Curriculum (MAA CP T1), Friday afternoon. **David**

Brown and **Osman Yurekli**, Ithaca College.

Courses and Projects Addressing the Shortage of K–12 Teachers (MAA CP U1), Saturday afternoon. **Harel Barzilai**, Salisbury University; **Maria G. Fung**, Western Oregon University; and **Jay M. Jahangiri**, Kent State University.

Creative Visualization Labs (MAA CP V1), Saturday afternoon. **Sarah J. Greenwald**, Appalachian State University; **Catherine A. Gorini**, Maharishi University of Management; and **Mary L. Platt**, Salem State College.

Linking Mathematics with Other Disciplines (MAA CP W1), Saturday afternoon. **Stephanie A. Fitchett** and **Blake Mellor**, Honors College, Florida Atlantic University; and **Gavin P. LaRose**, University of Michigan.

Mathematical Connections in Art, Music, and Science (MAA CP X1), Saturday afternoon. **John M. Sullivan**, University of Illinois at Urbana-Champaign; **Douglas E. Norton**, Villanova University; and **Reza Sarhangi**, Towson University.

Computation Mathematics in Linear Algebra and Differential Equations (MAA CP Y1), Saturday afternoon. **Richard J. Marchand**, SUNY at Fredonia; **Elias Deeba**, University of Houston-Downtown; and **Timothy J. McDevitt**, Millersville University.

General Contributed Paper Session (MAA CP Z1), Wednesday, Thursday, Friday, and Saturday mornings. **Michael A. Jones**, Montclair State University; **Jill Dietz**, St. Olaf College; **Steven M. Hetzler**, Salisbury University; and **Shawnee L. McMurran**, California State University at San Bernardino.

Other MAA Sessions

Reflections on the Conference to Improve College Algebra, Wednesday, 9:00 a.m.–10:20 a.m., organized by **Donald B. Small**, U.S. Military Academy. Traditional college algebra is not working. That was the strong consensus of the participants in the National Conference to Improve College Algebra held at the U.S. Military Academy. This conclusion was based on the high FDW rates, outdated curriculum, small percentage of students who eventually take Calculus I, and the negative impact these courses have on student perceptions of mathematics. In order to make college algebra work, the participants recommended refocusing the courses on the needs of other disciplines, society, and the workplace. In particular, they recommended revising college algebra courses to be real-world problem-based and to include modeling with power and exponential functions, systems of equations, graphing, and difference equations. They also strongly emphasized communication skills, small group projects, and appropriate use of technology to enhance conceptual understanding, visualization, and inquiry as well as computation. Panelists include **John C. Maceli**, Ithaca College; **Philip H. Mahler**, Middlesex Community College; **Alexander H. Fluellen**, Clark Atlanta University; and **Norma M. Agras**, Miami-Dade Community College. The panel will be moderated by **Bernard L. Madison**, University of Arkansas, and is sponsored by the MAA CUPM Subcommittee on Curriculum Reform Across the First Two Years (CRAFTY).

The Impact of Technology in Calculus Courses on Long-Term Student Performance and Employment, Wednesday, 2:15 p.m.–3:35 p.m., organized by **Susan L. Ganter**, Clemson University, and **Jack Bookman**, Duke University. More than ten years after the funding of the first NSF calculus reform projects, there is very little consensus about the degree to which these efforts, and particularly technology, have succeeded in improving the postcalculus achievement of the participating students. This panel will address this issue by discussing a multi-institutional project that is collecting data for the purpose of: (1) comparing the performance of reform and traditional calculus students in courses beyond calculus; (2) examining students prior to graduation from college to determine these students' fundamental notions of calculus; (3) determining the extent to which potential employers value the ideals supported by calculus reform efforts; and, (4) training a group of on-site evaluators capable of developing and sustaining a viable evaluation plan on multiple campuses beyond this project. Panelists include **Betsy Darken**, University of Tennessee at Chattanooga; **Elton Graves**, Rose-Hulman Institute of Technology; **Glenn W. Ledder**, University of Nebraska; **Howard L. Penn**, U.S. Naval Academy; and **Debra L.Wood**, University of Arizona. The panel is sponsored by the MAA Committee on the Undergraduate Program in Mathematics (CUPM) and the MAA CUPM Subcommittee on Curriculum Reform Across the First Two Years (CRAFTY).

An Overview of Interviews, Wednesday, 2:15 p.m.–3:35 p.m., organized by **Dov N. Chelst**, DeVry College of Technology, and **John A. Vano**, University of Wisconsin. This will be a useful session for those going through the Employment Center for the first time.

Expanding Your Research Horizons, Wednesday, 3:30 p.m.–5:00 p.m., organized by **Jennifer Hontz**, Meredith College, and **Philip K. Hotchkiss**, Westfield State College. Changing research agendas can be a daunting task. How do you enter into a new field of research? What strategies might be useful for learning about a new field? The panelists will offer their experience and expertise on how one might successfully change research agendas. These speakers include active mathematicians who are working in different research areas as well as representatives from DIMACS and MSRI. This session was organized by the 1994–98 Project NExT Fellows to address issues of concern to faculty who have four to ten years of teaching experience. Panelists include **John W. Emert**, Ball State University; **Rochelle Leibowitz**, DIMACS; and **Neil Portnoy**, California State University, Chico. Sponsored by MAA Project NExT.

Doctorates in Mathematics Education: Why the Shortage? Where Do They Go? What Do They Do?, Wednesday, 3:45 p.m.–4:45 p.m., organized by **Robert E. Reys**, University of Missouri-Columbia, and **Robert Glasgow**, Southwest Baptist University. There is an acute shortage of doctorates in mathematics education. One of the reasons is that people completing doctorates in mathematics education pursue many different career options. Some of these options and career directions taken by recent graduates will be presented. Time will be allowed for interaction with participants attending the session.

Small Group Projects in College Algebra, Wednesday, 3:45–5:05 p.m., organized by **Donald B. Small**, U.S. Military Academy. The movement to improve college algebra has focused on revising both content and pedagogy to address the needs of other disciplines, society, and the workplace.

The issue of incorporating small group projects is central to revising college algebra courses. Faculty in partner disciplines as well as employers look to mathematics to provide students with experience working in small groups. Assessment, time involvement, faculty development, and objectives are some of the issues that will be discussed. Panelists include **Laurette B. Foster**, Prairie View A&M University; **Richard D. West**, Francis Marion College; **Paul Dirks**, Miami-Dade Community College; and **Regina D. Aragon**, Eastern New Mexico University. The session will be moderated by **Kathleen Snook**, U.S. Military Academy and COMAP, and is sponsored by the MAA CUPM Subcommittee on Curriculum Reform Across the First Two Years (CRAFTY).

A Workshop on Student Writing: A Hands-on Approach, Wednesday, 4:30 p.m.–6:30 p.m., organized by **Mary Ellen Foley**, Louisiana State University in Shreveport; **Kirk E. Weller**, Bethel College; **Douglas Kurtz**, New Mexico State University; and **Ahmed I. Zayed**, DePaul University. This session will introduce and elaborate on the main points of employing writing assignments in mathematics classes. These points include creating appropriate assignments, effectively communicating instructors' expectations, and assessing students' work. The audience will have an opportunity to practice these ideas with sample assignments and student papers. The session is sponsored by the MAA Committee on the Teaching of Undergraduate Mathematics (CTUM).

Truth in Using the History of Mathematics in Teaching Mathematics, Wednesday, 5:15–6:45 p.m., organized by **Victor J. Katz**, University of the District of Columbia, and **Eisso J. Atzema**, University of Maine. The history of mathematics has long been accepted as a scholarly activity for its own sake. Increasingly, historical research is called upon by a wide variety of professionals within the mathematical community to serve a broad range of agendas. This panel aims to assess this development by opening up a dialogue between the history of mathematics community and the users of history. Questions to be discussed include, but are not limited to, the following: What resources in history do the users of history of mathematics use and why? Specifically, what is the attraction of myth and legend for those who use history? Is it reasonable to expect that all users use state-of-the-art research in history? Should the history of mathematics community be more accommodating toward the users of history of mathematics? What should the role of myth and legend be in the community's own teaching of the history of mathematics? Panelists include **Joseph W. Dauben**, City University of New York; **Fernando Q. Gouvêa**, Colby College; and **Anthony V. Piccolino**, Montclair State University. The session is sponsored by the MAA History of Mathematics SIGMAA.

Writing and Publishing Expository Articles about Mathematics, Thursday, 8:30 a.m.–10:00 a.m., organized by **T. Christine Stevens**, St. Louis University; **Joseph A. Gallian**, University of Minnesota Duluth; and **Aparna W. Higgins**, University of Dayton. The panelists will provide advice about writing and publishing expository articles in mathematics. They will discuss how to identify suitable topics, how to organize and write such articles, and how to choose a suitable journal. The panelists include experienced authors of expository articles and current or former editors of MAA or AMS publications. Panelists include **Edward G. Dunne**, AMS; **Deanna B. Haunsperger**, Carleton College; **Martha J. Siegel**, Towson University; and **Francis E. Su**, Harvey Mudd College.

Undergraduate Programs and Courses in the Mathematical Sciences: A CUPM Curriculum Guide, Thursday, 9:00 a.m.–10:20 a.m., organized by **Harriet S. Pollatsek**, Mount Holyoke College, and **Susanna S. Epp**, DePaul University. The MAA Committee on the Undergraduate Program in Mathematics (CUPM) periodically reviews its curricular recommendations for college and university departments and revises them as needed to fit new circumstances. "Undergraduate Programs and Courses in the Mathematical Sciences: A CUPM Curriculum Guide" will appear in the fall of 2003; it will be the first guide explicitly to address the needs of nonmajors as well as majors. Panelists will describe the latest draft of the Curriculum Guide, and there will be an opportunity for comments and questions from the audience. The chief writer of this draft is Barry Cipra, working under the direction of CUPM. This draft is also informed by the Curriculum Foundations Project of CRAFTY, as well as work on the first college course, on quantitative literacy, and on the mathematical preparation of teachers. After revisions prompted by MathFest 2002 discussion, a near-final draft Curriculum Guide will circulate widely in 2002-2003, with a final version slated for publication in fall 2003. CUPM and the MAA acknowledge funding from the NSF and the CCHE in support of the writing, production and distribution of the new Curriculum Guide. Consult `http://www.maa.org/news/cupm.html` for past interim reports and drafts, as well as the most recent version. Panelists include **Susan L. Ganter**, Clemson University; **William E. Haver**, Virginia Commonwealth University; **Harriet S. Pollatsek**, and **Susanna S. Epp**. The session is sponsored by the MAA Committee on the Undergraduate Program in Mathematics (CUPM).

Sample Mathematics Lessons Integrating Environmental Issues, Thursday, 9:00 a.m.–10:20 a.m., organized by **Patricia Clark Kenschaft**, Montclair State University. Three authors of mathematics texts that integrate environmental issues into their writing will present sample lessons from their creative work. These lessons will illustrate how mathematics can be taught more effectively by also, at the same time, exploring environmental challenges that can be better understood and remedied by using mathematics. Panelists include **Greg A. Langkamp**, Quantitative Environmental Learning Project and Seattle Central Community College; **Martin E. Walter**, University of Colorado at Boulder; and **Nancy E. Zumoff**, Kennesaw State University. The session is sponsored by the MAA Committee on Mathematics and the Environment.

NSF Funding Opportunities for Learning and Teaching in the Mathematical Sciences, Thursday, 9:00 a.m.–10:20 a.m., organized by **Elizabeth J. Teles** and **Lee L. Zia**, NSF/Division of Undergraduate Education; and **James H. Lightbourne**, NSF/Division of Graduate Education. The NSF Division of Undergraduate Education and sister NSF divisions offer a variety of grant programs to support innovations in learning and teaching in the mathematical sciences. These programs will be discussed along with examples of successful projects. In addition, anticipated budget

highlights and other new initiatives for the next fiscal year will be presented.

First College-Level Mathematics Courses, Thursday, 9:00 a.m.–11:00 a.m., organized by **Donald B. Small**, U.S. Military Academy; **Sarah Bush**, Wiley College; and **Dorothy Hunter**, Huston-Tillotson College. The majority of students enrolled in mathematics are enrolled in "first year" courses: algebra, college algebra, college algebra and trig, elementary statistics, finite mathematics, liberal arts mathematics, elementary modeling, precalculus, etc. There is a growing movement to refocus these courses on the needs of partner disciplines, society, and the workplace. Problem solving (in the modeling sense), appropriate use of technology, small group projects, real-world problems, elementary data analysis, development of communication skills, and student-centered pedagogy characterize these new approaches to first year courses. Several of these new approaches will be displayed at this poster session. Applications should be submitted to Don Small don-small@usma.edu by December 10, 2002. The session is sponsored by the MAA Committee on the Undergraduate program in Mathematics (CUPM).

How Can Placement Testing Be Improved?, Thursday, 10:45 a.m.–12:05: pm, organized by **Susan L. Forman,** Bronx Community College (CUNY), and **Bernard L. Madison**, University of Arkansas. Criticism of college placement tests has increased significantly in recent years, focusing mostly on the lack of alignment with curricula and pedagogy of school mathematics. Some of this criticism is based in differences between what students learn in school mathematics and what mathematical knowledge and skills are necessary for success in first college mathematics courses. Other criticism is rooted in differing visions of what students should know and be able to do. Beyond these tensions lie differences in the backgrounds of entering students; for example, some come directly from high school and others have been away from school and college for several years. Panelists from high schools, two-year colleges, and four-year colleges will discuss these criticisms and ways to make college mathematics placement tests better understood and more effective. Panelists include **Judy E. Ackerman**, Montgomery College, AMATYC President Elect; **Judy Marwick**, Morton College; **Johnny W. Lott**, University of Montana, NCTM President Elect; **Susan L. Forman**, and **Bernard L. Madison**.

The Nature of Mathematics Knowledge and Knowledge of Mathematics Learning Needed by Secondary School Mathematics Teachers in an Era of Technology and Reform-oriented Curricula, Thursday, 10:45 a.m.–12:05 p.m., organized by **M. Kathleen Heid**, The Pennsylvania State University. The CBMS MET Report along with recent research and surveys have pointed out the need to know more about what mathematics high school teachers need to function effectively with reform-oriented curricula. Several projects are underway creating materials that address these needs. One such project is centered at Berkeley and the University of Chicago on creating materials that examine problems, concepts, and results of high school mathematics in depth and from a more advanced point of view. The Mid-Atlantic Center for Mathematics Teaching and Learning is investigating and developing ways to deepen understandings that prospective and practicing high school mathematics teachers have of the mathematics featured in emerging high school mathematics curricula. Making Mathematical Connections in Programs for Prospective Teachers at the University of New Hampshire is providing prospective teachers the opportunity to make connections between prior knowledge and future tasks and to enable them to construct new mathematical and pedagogical knowledge. Panelists include **Karen J. Graham**, University of New Hampshire; **Walter Seaman**, University of Iowa; **Richard J. Stanley**, University of California Berkeley; **Zalman P. Usiskin**, University of Chicago; **Skip Wilson**, Virginia Polytechnic Institute and State University; **James T. Fey**, University of Maryland; and **M. Kathleen Heid**. The session is sponsored by the MAA Committee on the Mathematical Education of Teachers (COMET).

Keeping the Platters Spinning: Effective Time Management, Thursday, 10:45 a.m.–12:05 p.m., organized by **Karrolyne Fogel**, California Lutheran University, and **J. Lyn Miller**, Slippery Rock University. You have got papers to grade, three classes to prepare, the committee needs your feedback on the proposal, and you wanted to submit your new result to a journal. Meanwhile five students are knocking on your door for help. Sometimes it just seems like there are not enough hours in the day. This panel discussion will focus on ways to negotiate the maze of teaching, service, and research to become successful, competent, and remain sane. The session is cosponsored by Project NExT and the Young Mathematicians' Network.

How to Assess a Mathematics Program, Thursday, 1:00 p.m.–2:30 p.m., organized by **Mary D. Shepherd**, Northwest Missouri State University. Many universities/colleges and, thus, individual departments are faced with the prospect of implementing assessment plans to assess student learning and really do not know where to start. In the undergraduate mathematics community for the past ten years local, regional, and national efforts have been underway to assist faculty in developing assessment programs to assess student learning and to improve the undergraduate major (outcomes assessment). All the panelists have been involved with assessment at some level and will discuss a number of the ongoing initiatives, provide a few ideas as to what makes for a good assessment program, and describe some of their own experiences. This session was organized by the 1994–98 Project NExT Fellows to address issues of concern to faculty who have four to ten years of teaching experience. Panelists include **Michael Button**, The Master's College; **Bernard L. Madison**, University of Arkansas; **William A. Marion Jr.**, Valparaiso University; **William Martin**, North Dakota State University; and **Barbara M. Moskal**, Colorado School of Mines. Sponsored by MAA Project NExT.

Integrating Calculus, Precalculus, and Algebra, Thursday, 1:00 p.m.–2:20 p.m., organized by **Laura A. Taalman**, James Madison University. Many students enter college with insufficient algebra and precalculus backgrounds to succeed in college calculus, regardless of whether or not they have had a high school calculus course. These students are unlikely to enroll in precalculus courses in college if they have already taken calculus, and those that do take a precalculus course to prepare for calculus are often unsuccessful in making the jump between the two courses.

One solution is to offer a two-semester course that combines first-semester calculus with precalculus and algebra material. Such combined, or "integrated", courses are currently being offered or developed at many institutions around the country. Integrated calculus courses can be effective in a "traditional" or a "reform" setting, as well as for lower-level "business" calculus and upper-level "majors" calculus courses. This session brings together a diverse group of people whohave developed (or are planning to develop) integrated or combined calculus courses. Panelists include **Nancy Baxter Hastings**, Dickinson College; **Robert P. Hostetler**, Pennsylvania State University Erie, The Behrend College; **Dennis C. Ebersole**, Northampton Community College; **Robin J. Gottlieb**, Harvard University; **Jack Bookman**, Duke University; and **Laura A. Taalman**.

Successful Strategies for Implementing a Texas-Style (Modified Moore Method) Course, Thursday, 1:00 p.m.–2:20 p.m., organized by **W. Ted Mahavier**, Lamar University, and **James P. Ochoa**, Hardin-Simmons University. Panelists will discuss the mechanics of implementing a Texas-style (Moore method) mathematics course. Topics will include gaining administrative support, developing materials, class goals and objectives, a typical day in the classroom, and how to measure the success of such a course. The information should be useful to anyone interested in using the method for the first time as well as experienced Texas-style instructors. Panelists include **E. Lee May**, Salisbury University; **David McRae**, Woodberry Forest School; **G. Edgar Parker**, James Madison University; and **Shing S. So**, Central Missouri University.

Improving Graduate Education: Lessons Learned on What Works, Thursday 1:00 p.m.–2:20 p.m., organized by **James H. Lightbourne** and **Deborah F. Lockhart**, NSF. The purpose of this session is to identify approaches that are proving effective to recruit and retain students for graduate study, improve various aspects of graduate education, and, specifically, improve preparation for academic and nonacademic positions. Panelists will provide lessons learned in NSF-funded projects at their institution. Information will also be provided about activities in graduate education being conducted by national organizations and the resources they have available. NSF staff will provide information about funding opportunities.

MAA Project NExT and YMN Poster Session, Thursday, 2:00 p.m.–4:00 p.m., organized by **Kenneth A. Ross**, University of Oregon, and **Kevin E. Charlwood**, Washburn University. We encourage exhibits from new or recent Ph.D.s in the mathematical sciences or from those still pursuing graduate study. Applications should be submitted to Kevin Charlwood `zzcharlw@washburn.edu` or Ken Ross `ross@math.uoregon.edu` by December 10, 2002.

The Role of Logic in Learning to Write Proofs, Thursday, 2:45 p.m.–4:05 p.m., organized by **Jeff L. Hirst**, Appalachian State University, and **Daniel Velleman**, Amherst College. The session will address the role of mathematical logic in learning to write mathematical proofs. Questions that pertain to this topic include: Should mathematical logic be a significant topic in transition and bridge courses? What topics in mathematical logic should be included in proof writing courses? How should logic topics be presented? How can logic be linked to other mathematical topics? What role can technology play in this setting? How do students use logical training in proof writing? The session will consist of four short presentations followed by periods for discussion, questions, and panel interaction. Participants include **Susanna S. Epp**, DePaul University; **Connie M. Campbell**, Millsaps College; **Jeff L. Hirst** and **Daniel Velleman**. Sponsored by the MAA and the Association for Symbolic Logic.

Session for Chairs, Thursday, 2:45–4:05 p.m., organized by **Daniel P. Maki**, Indiana University, and **Catherine P. Murphy**, Purdue University Calumet.This session will feature a presentation by attorney **Michael Anselmi**.

The History of Curricular Change: Linear Algebra 1950–2000, Thursday, 3:00 p.m.–4:20 p.m., organized by **Walter J. Meyer**, Adelphi University; **Jack Winn**, SUNY at Farmingdale; and **Joseph Malkevitch**, York College (CUNY). Some curricular innovations catch on and some do not. We have little way of judging in advance. We might be wiser in our efforts if there were a better history of curricular changes. Linear algebra is a good subject for study because it has undergone many changes in the last half-century: splitting off from abstract algebra, becoming more applied, moving down to freshman and sophomore levels, adding technology, etc. Subjects for discussion may include: the reasons for the changes just mentioned, the changing relation of "linear algebra" to "matrix theory", the role of internal versus external influences, the relation to "theory of equations". Panelists will be curricular leaders who lived through these changes, which are mostly undocumented. The aim is to stimulate recollection and discussion, rather than to be definitive. Besides being of interest for curriculum innovators, this will provide useful raw material for students of the history of curriculum. Panelists include **Philip J. Davis**, Brown University; **Harold M. Ewards**, NYU-Courant Institute; **Carl C. Cowen**, Purdue University; and **Kenneth M. Hoffman** and **Gilbert Strang**, Massachusetts Institute of Technology. The session is sponsored by the History of Mathematics SIGMAA.

Eine Kleine (Mathematische) Nachtmusik, Thursday, 7:30 p.m.–9:00 p.m., presented by **Erich Neuwirth**, University of Vienna. Mathematical principles of musical tuning systems will be demonstrated, beginning with simple frequency ratios for musical intervals known to the Greeks. Pythagorean mean tone and well-tempered scales with accompanying melodies and chords will be constructed on the piano. A few different pieces by well-known composers will be performed to show the connection between the mathematical and physical aspects of the problem. How much the musical expression of a piece of music changes when played in different tunings will be demonstrated.

Can This Graduate Student Be Saved?, Friday, 9:00 a.m.–10:20 a.m., organized by **Carolyn C. Connell**, Westminster College. This session will present actual case studies of graduate students who have seriously considered dropping out. Attendees will be asked to meet in groups to discuss these cases and to find ways to make the community of mathematicians more open to all students. The session is sponsored by the MAA Committee on the Participation of Women.

Proposal Writing Workshop for Grant Applications to the NSF Division of Undergraduate Education, Friday, 9:00 a.m.–10:20 a.m., organized by **Elizabeth J. Teles** and **Lee L. Zia**, NSF/Division of Undergraduate Education. Presenters will describe the general NSF grant proposal process and consider particular details relevant to programs in the Division of Undergraduate Education. Attendees of this session will have an opportunity to read sample proposals and take part in a "mock" panel review of proposals.

Special Programs to Encourage Young Women in Mathematics, Friday, 9:00 a.m.–11:00 a.m., organized by **Elizabeth G. Yanik**, Emporia State University, and **Kathleen A. Sullivan**, Seattle University. This poster session is designed to highlight special programs which have been developed to encourage young women to maintain an interest in and commitment to succeeding in mathematics. These programs might include such activities as after school clubs, weekend activities, mentoring opportunities with women professionals, summer camps, etc. Poster presentations should convey information such as recruitment strategies, a typical schedule of events of the program, program financial support, and methods used for assessment. We encourage everyone involved offering outreach programs to consider making a submission. Exhibitors are asked to submit to the organizer a one-page abstract describing the subject of the poster presentation. Application should be submitted to Betsy Yanik (yanikeli@emporia.edu) by December 10, 2002. The session is sponsored by the MAA Women and Mathematics Network.

Undergraduate Seminars in Mathematics, Friday, 1:00 p.m.–2:30 p.m., organized by **Jed Herman**, University of St. Thomas, and **Hieu D. Nguyen**, Rowan University. This panel session will focus on issues that faculty face when teaching a mathematics seminar course for the first time and how faculty can use such a course to enhance their teaching skills and further their research. This includes the preparation and expectations that are involved in teaching such a course and the personal rewards and possible drawbacks. There will be a panel discussion during the first half of the session followed by small group discussions led by panelists during the second half. The session was organized by the 1994–1998 Project NExT Fellows to address issues of concern to faculty who have four to ten years of teaching experience. Panelists include **William P. Abrams**, Longwood College; **Karen D. Bolinger**, Clarion University; **Philip K. Hotchkiss**, Westfield State College; and **Daniel L. King**, Sarah Lawrence College. Sponsored by MAA Project NExT.

Mathematics Educators, Computer Science Educators: Working Together, Friday 1:00 p.m.–2:20 p.m., organized by **William A. Marion**, Valparaiso University. Two recent reports have provided the impetus for undergraduate mathematics and computer science educators to initiate a dialogue concerning the mathematical preparation of computer science majors: the Curriculum Foundations Project (CFP) of CUPM and the ACM/IEEE Computing Curricular 2001 Guidelines (CC2001). In both, the importance to computer science majors of receiving a strong grounding in discrete mathematics early in their four-year program is stressed. The purpose of this panel is to promote an open exchange of information between mathematicians and computer scientists and to broaden the opportunity to participate in ongoing discussions out of which will come the CUPM curriculum recommendations for programs in the mathematical sciences. Panelists include **William H. Barker**, Bowdoin College; **Susanna S. Epp**, DePaul University; **Peter B. Henderson**, Butler University; and **Henry M. Walker**, Grinnell College. Of the panelists, Barker, Epp, Henderson, and Marion have participated at some level in the CFP, and Marion and Walker have been involved in crafting the mathematics recommendations in the CC2001 Report. **William Marion** will moderate the panel. The session is sponsored by the MAA Committee on the Undergraduate Program in Mathematics (CUPM) and the Mathematics Across the Disciplines Subcommittee of the Committee on Professional Development and of CUPM.

Projects Supported by the NSF Division of Undergraduate Education, Friday, 1:00 p.m.–3:00 p.m., organized by **Jon W. Scott**, Montgomery Community College. This poster session will feature principal investigators (PIs) presenting progress and outcomes from various NSF funded projects in the Division of Undergraduate Education. The poster session format will permit ample opportunity for attendees to engage in small group discussions with the PIs and to network with each other.

Presentations by Teaching Award Recipients, Friday, 2:30 p.m.–4:00 p.m. Winners of the Deborah and Franklin Tepper Haimo Awards for Distinguished College or University Teaching will give presentations on the secrets of their success.

SIGMAA on Research on Undergraduate Mathematics Education Business Meeting, Friday, 4:00 p.m.-6:00 p.m., organized by **Anne E. Brown**, Indiana University South Bend. This SIGMAA is a group formed for mathematics educators and professional mathematicians interested in research on undergraduate mathematics education. There will be welcoming comments, the business meeting, the election of officers, and an invited address by **Rina Zazkis** of Simon Fraser University exemplifying research on undergraduate mathematics education.

Informal Session on Actuarial Education, Friday, 5:00 p.m.–7:00 p.m., organized by **Krzysztof M. Ostaszewski**, Illinois State University. This informal session sponsored by the Actuarial Faculty Forum provides an opportunity for those involved in actuarial education, interested in it, or curious about it, to get together to discuss common concerns such as the major changes in the actuarial exam systems that will have just taken place.

SIGMAA on Statistics Education, 2003 Business Meeting, and Lecture, Thursday, 600 p.m. to 8:00 p.m., organized by **Mary Sullivan**, Rhode Island College. The SIGMAA for Statistics Education will hold its third annual business meeting, including an invited talk. After some necessary formalities, we will hear the chair's report and results of the fall elections, and discuss new business. Topics of discussion will include outreach, membership services, and suggestions from the membership related to statistics education.

Rethinking the Courses Below Calculus, Saturday, 9:00 a.m.–10:20 a.m., organized by **Sheldon P. Gordon**, SUNY at Farmingdale. In the past year, four important invited conferences have taken place to rethink each of the entry level mathematics experiences below calculus—college algebra,

precalculus, quantitative literacy, and the needs of the quantitative disciplines. Subsequently, key individuals from each of the four conferences came together to identify the common elements in the four movements and to plan for a national initiative to rethink all the courses at this level. In this session, panelists will provide an overview of each of the four special conferences and discuss the results and recommendations for the different courses that emerged from the conferences. They will also indicate the commonalities among the three movements, as well as any significant differences, and the action plan for future activities. Panelists include **Nancy Baxter Hastings**, Dickinson College; **Susan L. Ganter**, Clemson University; and **Mercedes A. McGowen**, William Rainey Harper College. The session is sponsored by the MAA Committee for Curriculum Renewal Across the First Two Years (CRAFTY) and the MAA Task Force on the First College Level Mathematics Course.

The Intersection of the Life Sciences, Mathematical Sciences, and Computer Science: Implications for the Undergraduate Curriculum, Saturday, 9:00 a.m.–10:20 a.m., organized by **Elizabeth J. Teles** and **Lee L. Zia**, NSF/Division of Undergraduate Education. This panel will feature an interdisciplinary group of faculty and NSF staff who will discuss the emerging opportunities and challenges associated with new curriculum models that lie at the intersection of the life sciences, mathematical sciences, and computer science. Possible future NSF programmatic directions will also be presented.

Forging Relationships Between Professional Organizations to Improve Mathematics Teaching and Learning from Kindergarten through Graduate School, Saturday, 1:00 p.m.–2:20 p.m., organized by **Johnny W. Lott**, University of Montana, President of NCTM, and **James M. Rubillo**, NCTM. There are various professional societies related to mathematics: AMS, MAA, AMATYC, NCTM, and AWM to name a few. While these organizations may serve a diverse group of individuals, they all share many common goals which include: ensuring a high quality mathematics education that will prepare students for daily life as well as the scientific and technical community; increasing public support and appreciation for mathematics; and supporting the professional development of those involved in mathematics and mathematics education. This interactive session will offer ideas and ways we can all work together through coordinated and collaborative efforts to achieve our goals.

Open Discussion on First College-Level Mathematics Courses, Saturday, 1:00 p.m.–2:20 p.m., organized by **Donald B. Small**, U.S. Military Academy. The panelists will reflect on the work of the MAA's Task Force on First Year College Level Courses, and then the moderator will open the floor for discussion. Approximately 70% of college students enrolled in mathematics courses are enrolled in first year courses. Discussion is invited on both content and pedagogical issues, on the role of technology for teaching and learning, and on the purpose of these courses. Panelists include **Mercedes A. McGowen**, William Harper Rainy College, and **Sheldon P. Gordon**, SUNY at Farmingdale. The session will be moderated by **Donald B. Small** and is sponsored by the MAA Committee on the Undergraduate program in Mathematics (CUPM).

The State of Statistics Education, Saturday, 2:45 p.m.–4:05 p.m., organized by **Mary M. Sullivan**, Rhode Island College. This panel will address the current state of statistics education as it affects statistics courses on the college level. Efforts over the past ten years to encourage faculty who teach the introductory statistics course have resulted in courses that are more interactive. As a consequence of NCTM's "Principles and Standards for School Mathematics" published in 2000, statistics has a greater presence in the K–12 curriculum. Recently published curriculum materials suitable for K–12 embody many activity-based learning ideas of concepts contained in the first course. College level introductory course instructors may find that their students have previously studied many topics contained in their first course. Panelists will address how K–12 mathematics curriculum changes affect college introductory statistics courses, the introduction of a calculus-based data analysis course, and the increased prominence of assessment. Panelists include **Gail F. Burrill**, MSEB; **Allan J. Rossman**, California Polytechnic State University, San Luis Obispo; and **Joan Garfield**, University of Minnesota. **Thomas L. Moore**, Grinnell College, will be the moderator. The panel is sponsored by the SIGMAA on Statistics Education.

SUMMA Special Presentation, Saturday, 2:45 p.m.–4:05 p.m., organized by **William A. Hawkins Jr.**, MAA and the University of the District of Columbia. Presenters will discuss their enrichment programs for precollege or college students. The session will be moderated by **William A. Hawkins Jr.**, director of the SUMMA Program and is sponsored by the MAA SUMMA (Strengthening Underrepresented Minority Mathematics Achievement) Program and the MAA Committee on Minority Participation in Mathematics. There will be ample time for discussion.

MAA Student Activities

Student Lecture, Friday, 1:00 p.m., **Donna L. Beers**, Simmons College, *What drives mathematics and where is mathematics driving innovation?*

Undergraduate Student Poster Session, Friday, 4:00 p.m.–6:30 p.m., organized by **Mario U. Martelli**, Claremont McKenna College. Send title and an abstract (not more than a half page) to Mario Martelli by email at `martelli@mckenna.edu` or by regular mail at Mathematics Department, Claremont McKenna College, Claremont CA 91711, by December 6, 2002. Include author's name, address, phone number, email, affiliation, and name and affiliation of the faculty advisor. Notification of acceptance will be emailed two weeks after the abstract has been received. Apply early! Space is limited. The session is restricted to undergraduates and first-year graduate students submitting posters on work done while undergraduates. Posters' content should not be purely expository. The best posters will be awarded a monetary prize with funds provided by the MAA, AMS, AWM, and CUR. Tri-fold, self-standing 48" x 36" tabletop posters will be provided. Additional material or equipment is the responsibility of each presenter. The session is sponsored by the CUPM Committee and the Committee on Student Chapters of the MAA.

Other student opportunities appear under the "Social Events" section.

MAA Short Course

Mathematics in the Ancient World, Monday and Tuesday, Janaury 13 and 14, organized by **V. Frederick Rickey**, U. S. Military Academy.

Nearly everyone who has taken an interest in the history of mathematics becomes fascinated with some facet of ancient mathematics. But only a few have the mathematical preparation, historical sensitivities, and linguistic skills to do original work. The speakers at this short course will give an expository survey of their special area of ancient mathematics. They will discuss some areas of current research, point out open questions, and provide guidelines to help you delve into the expository and research literature. Those of you who have taught history of mathematics will undoubtedly learn that some of what you read in older literature has been superseded by modern scholarship. Thus you will have much to carry back to your classroom. Speakers and their talks include **Eleanor Robson**, The Oriental Institute, All Souls College, Oxford University, *Mesopotamian Mathematics*; **Will Noel,** The Walters Art Museum, *The Archimedes Palimpsest and Its Restoration*; **Reviel Netz**, Department of Classics, Stanford University, *Archimedes*; **Kim Plofker**, Department of the History of Mathematics, Brown University, *Mathematics in India*; **Joseph W. Dauben**, Herbert H. Lehman College (CUNY), *Mathematics in China*; and **Len Berggren**, Simon Fraser University, *Islamic Mathematics*.

Please note that there is a separate registration fee for this Short Course. To register in advance, please use the Advance Registration/Housing Form found at the back of this issue, or see `http://www.ams.org/amsmtgs/2074_registration.html`. Advance registration fees are $125/member; $175/nonmember; and $50/student, unemployed, emeritus. On-site registration fees are $140/member; $190/nonmember; and $60/student, unemployed, emeritus.

Other MAA Events

Board of Governors, Tuesday, 8:30 a.m.–4:00 p.m.

Section Officers,Wednesday, 4:30 p.m.–6:30 p.m.

Joint PME and MAA Student Chapter Advisors' Breakfast, Friday, 7:00 a.m.–8:00 a.m., organized by **Robert S. Smith**, Miami University; **Richard Neal**, University of Oklahoma; and **Jean B. Chan**, Sonoma State University.

Business Meeting, Saturday, 11:10 a.m.–11:40 a.m.

See the listings for various receptions in the "Social Events" section.

Activities of Other Organizations

Several organizations or special groups are having receptions or other social events. Please see the "Social Events" section of this announcement for details.

Association for Symbolic Logic (ASL)

This two-day program on Friday and Saturday will include Invited Addresses and sessions of contributed papers.

See also the Special Sessions jointly sponsored by the ASL in the "Joint Special Sessions" section, as well as a presentation jointly sponsored with MAA on Thursday afternoon (see the listing in the *Other MAA Sessions* section).

Association for Women in Mathematics (AWM)

Twenty-Third Annual Emmy Noether Lecture, Thursday, 9:00 a.m.–9:50 a.m. will be given by **Jean E. Taylor**, Rutgers University, on *Five little crystals and how they grew*.

A dinner in honor of the lecturer will be held on Wednesday evening. See the "Social Events" section for details on how to participate.

Mathematics Educators and Mathematicians Working Together, Wednesday, 4:00 p.m.–5:00 p.m., organized by **Bettye Anne Case**, Florida State University; **Suzanne M. Lenhart**, University of Tennessee; and **Elizabeth G. Yanik**, Emporia State University. This panel will include mathematics educators and mathematicians. The idea for this forum has been developed by the National Council of Teachers of Mathematics affiliate, Women and Mathematics Education, and the AWM. The discussion will address how mathematics educators and mathematicians can collaborate to assist each other and to improve mathematics teaching at all levels. Panelists include **Deborah Loewenberg Ball**, University of Michigan; **Hyman Bass,** University of Michigan; **Karen Dee Michalowicz**, The Langley School (McLean, VA); and **Edith Prentice Mendez**, Sonoma State University.

At the conclusion of the panel discussion, AWM will recognize the Alice T. Schafer prizewinner, runner-up, and honorable mention honorees. Note that formal prizewinner announcements are made at the Joint Prize Session on Monday afternoon (see the AWM inclusion in the "Joint Sessions" section at the beginning of this announcement).

Business Meeting, Wednesday, 5:00 p.m.–5:30 p.m.

Workshop, Saturday, 8:30 a.m.–5:00 p.m. With funding from the Office of Naval Research and the National Science Foundation (pending final funding approval), AWM will conduct its workshop for women graduate students and women who have received the Ph.D. within the last five years.

Twenty women mathematicians have been selected in advance of this workshop to present their research. The selected graduate students will present posters, and the recent Ph.D.'s will give 20-minute talks. Travel funds are provided to the twenty selected presenters. The workshop will also include a panel discussion on issues of career development and a luncheon. Participants will have the opportunity to meet with other women mathematicians at all stages of their careers. All mathematicians (female and male) are invited to attend the entire program. Departments are urged to help graduate students and recent Ph.D.'s who do not receive funding to obtain some institutional support to attend the workshop and the associated meetings. The deadline for applications for presenting and funding has expired. Inquiries regarding future workshops may be made to AWM by

telephone: 301-405-7892, by email: awm@math.umd.edu, or by visiting http://www.awm-math.org/.

AWM seeks volunteers to lead discussion groups and to act as mentors for workshop participants. If you are interested in volunteering, please contact the AWM office.

Reception, Wednesday, 9:30 p.m.–11:00 p.m. See the listing in the "Social Events" section of this announcement.

National Association of Mathematicians (NAM)

Granville-Brown-Haynes Session of Presentations by Recent Doctoral Recipients in the Mathematical Sciences, Tuesday, 2:15 p.m.–4:00 p.m.

Cox-Talbot Address, to be given Friday after the banquet; speaker and title to be announced.

Panel Discussion on Saturday, 9:00 a.m.–9:50 a.m.

Business Meeting, Saturday, 10:00 a.m.–10:50 a.m.

Claytor-Woodard Lecture: Wednesday, 1:00 p.m., speaker and title to be announced.

See details about the banquet on Friday in the "Social Events" section.

National Science Foundation (NSF)

The NSF will be represented at a booth in the exhibit area. NSF staff members will be available to provide counsel and information on NSF programs of interest to mathematicians. The booth is open the same days and hours as the exhibits. Times that staff will be available will be posted at the booth.

Pi Mu Epsilon (PME)

Council Meeting, Friday, 8:00 a.m.–11:00 a.m.

Rocky Mountain Mathematics Consortium (RMMC)

Board of Directors Meeting, Friday, 2:15 p.m.–4:10 p.m.

Society for Industrial and Applied Mathematics (SIAM)

This two-day program on Wednesday and Thursday will include an Invited Address and minisymposia. The Invited Address will be given by **John A. Burns,** Virginia Polytechnic Institute and State University, title to be announced, at 11:10 a.m. on Thursday. Minisymposia and their organizers include: *Life Sciences*, **Tim Elston,** North Carolina State University and the University of North Carolina at Chapel Hill, Wednesday morning; *Optimization*, **Ariela Sofer,** George Mason University, Wednesday morning; *Stability of Nonlinear Dispersive Waves*, **Robert L. Pego,** University of Maryland, Wednesday and Thursday afternoons; *Mathematical Problems in Image Analysis*, **John Goutsias,** Johns Hopkins University, Thursday morning; and *Dynamical Systems*, **Yury Grabovsky,** Temple University, Thursday morning.

Young Mathematicians Network (YMN)

Concerns of Young Mathematicians: A Town Meeting, Wednesday, 7:15 p.m.–8:15 p.m., organized by **Kevin E. Charlwood,** Washburn University. This panel discussion will focus on the current primary concerns of young mathematicians, with emphasis on audience participation.

Also see details about the poster session (Thursday afternoon) and a panel discussion (Thursday morning at 10:45 a.m.) cosponsored by YMN under the *Other MAA Sessions* section.

Ancillary Conference

American Statistical Association (ASA): A two-day course will be offered January 13 and 14 preceding the Joint Mathematics Meetings in Baltimore. Visit the LearnSTAT site at http://www.amstat.org/education/learnstat.html for more details as they are developed. Inquiries can be directed to learnstat@amstat.org.

Social Events

It is strongly recommended that for any event requiring a ticket, tickets should be purchased through advance registration. Only a very limited number of tickets, if any, will be available for sale on site. If you must cancel your participation in a ticketed event, you may request a 50% refund by returning your ticket(s) to the Mathematics Meetings Service Bureau (MMSB) **by December 30.** After that date no refunds can be made. Special meals are available at banquets upon advance request, but this must be indicated on the Advance Registration/Housing Form.

Student Hospitality Center, Wednesday–Friday, 9:00 a.m.– 5:00 p.m., and Saturday, 9:00 a.m.–3:00 p.m., organized by **Richard Neal,** University of Oklahoma.

Graduate Student Reception, Wednesday, 5:00 p.m.–6:00 p.m., organized by Betty Mayfield, Hood College, and Shawnee McMurran, California State University San Bernardino. Mathematicians representing a wide range of disciplines will join interested graduate students at an informal reception. Complimentary food and beverages will be served. NOTE: This event is only for students who sign up on the Advance Registration/Housing Form.

Mathematical Sciences Institutes Reception, Wednesday, 5:30 p.m.–7:30 p.m.

Reception for First-Time Participants, Wednesday, 6:00 p.m.–7:00 p.m. The AMS and the MAA Committee on Membership are cosponsoring this social hour. All participants (especially first-timers) are encouraged to come and meet some old-timers and pick up a few tips on how to survive the environment of a large meeting. Refreshments will be served.

All participants are invited to a **dinner to honor AWM's Noether Lecturer** on Wednesday. A sign-up sheet for those interested will be located at the AWM table in the exhibit area and also at the AWM panel discussion.

AWM Reception: There is an open reception on Wednesday at 9:30 p.m. after the AMS Gibbs Lecture. This has been a popular, well-attended event in the past.

Lehigh University Reception, Thursday, 5:45 p.m.–7:00 p.m. All friends and graduates of the Lehigh Mathematics Department are invited.

New Mexico State University Mathematics Association, Thursday, 6:00 p.m. to 7:00 p.m. Alumni, current and former faculty, and friends of New Mexico State University are invited to this reception sponsored by the NMSU-MATH Association.

Association of Lesbian, Gay, Bisexual, and Transgendered Mathematicians Reception, Thursday, 6:00 p.m.–7:00 p.m. All are welcome to attend this open reception. Last year's event, the first ever on site, was very successful.

MER Banquet: The Mathematicians and Education Reform (MER) Forum welcomes all mathematicians who are interested in precollege, undergraduate, and/or graduate educational reform to attend the MER banquet on Thursday evening. This is an opportunity to make or renew contacts with other mathematicians who are involved in education projects and to engage in lively conversation about educational issues. The after-dinner discussion is an open forum for participants to voice their impressions, observations, and analyses of the current education scene. There will be a cash bar beginning at 6:30 p.m. Dinner will be served at 7:30 p.m. Tickets are $42 each, including tax and gratuity.

Knitting Circle, Thursday, 8:15 p.m. to 9:45 p.m. Bring a project (knitting/crochet/tatting/beading/etc.) and chat with other mathematical crafters.

Reception for Mathematicians in Business, Industry, and Government, Friday, 5:00 p.m.-6:00 p.m., organized by **Philip E. Gustafson**, Mesa State College. This welcome reception is open to all conference participants and in particular those interested in the mathematics of business, government, and industry (BIG). The reception will be a great opportunity to interact with BIG mathematicians and learn more about BIG mathematics. The reception is sponsored by the BIG SIGMAA.

University of Illinois at Urbana-Champaign Department of Mathematics Reception, Friday 5:15 p.m.–7:15 p.m.

NAM Banquet, Friday, 5:30 p.m. to 8:00 p.m. The National Association of Mathematicians will host a banquet on Friday evening. A cash bar reception will be held at 5:30 p.m., and dinner will be served at 6:00 p.m. Tickets are $45 each, including tax and gratuity.

***Mathematical Reviews* Reception**, Friday, 6:00 p.m.-7:00 p.m. All friends of Mathematical Reviews (MR) are invited to join reviewers and MR editors and staff (past and present) for a reception in honor of all the efforts that go into the creation and publication of the Mathematical Reviews Database. Refreshments will be served. The prize in an exhibit booth contest will be awarded.

MAA Project NExT Reception, Friday, 8:30 p.m. to 10:30 p.m. All MAA Project NExT national and Section NExT Fellows, consultants, and other friends of MAA Project NExT are invited.

AMS Banquet: As a fitting culmination to the meetings, the AMS banquet provides an excellent opportunity to socialize with fellow participants in a relaxed atmosphere. The participant who has been a member of the Society for the greatest number of years will be recognized and will receive a special award. The banquet will be held on Saturday, with a cash bar reception at 6:30 p.m. and dinner at 7:30 p.m. Tickets are $45, including tax and gratuity.

Other Events of Interest

AMS Information Booth: All meeting participants are invited to visit the AMS Information Booth during the meeting. Complimentary coffee and tea will be served. A special gift will be available for participants, compliments of the AMS. The membership manager of the Society will be at the booth to answer questions about membership.

Book Sales and Exhibits: All participants are encouraged to visit the book, education media, and software exhibits from noon to 5:30 p.m. on Wednesday, 9:30 a.m. to 5:30 p.m. on Thursday and Friday, and 9:00 a.m. to noon on Saturday. Books published by the AMS and MAA will be sold at discounted prices somewhat below the cost for the same books purchased by mail. These discounts will be available only to registered participants wearing the official meetings badge. Most major credit cards will be accepted for book sale purchases at the meetings. Also, AMS electronic products and the AMS website will be demonstrated. Participants visiting the exhibits will be asked to display their meetings badge or acknowledgment of advance registration from the Mathematics Meetings Service Bureau (MMSB) in order to enter the exhibit area.

Mathematical Sciences Employment Center: Those wishing to participate in the Mathematical Sciences Employment Center should read carefully the important article about the Center beginning on page 1203 in this issue of *Notices* or at `http://www.ams.org/emp-reg/`.

Networking Opportunities: There are many opportunities to meet new friends and greet old acquaintances in addition to the vast array of scientific sessions offered at these meetings. Newcomers may want to investigate the many receptions listed in the "Social Events" section, the Student Hospitality Center, and the Employment Center. On site a Networking Center featuring casual seating and lists of registered participants sorted by school and math subject classification will be available for your perusal. This is a great place to relax between sessions and forge new friendships.

Registering in Advance and Obtaining Hotel Accommodations

How to Register in Advance: The importance of advance registration cannot be overemphasized. Advance registration fees are considerably lower than the fees that will be charged for registration at the meeting. Participants registering by November 15 will receive their badges, programs, and tickets purchased in advance by mail approximately three weeks before the meetings, unless they check the appropriate box to the contrary on the Advance Registration/Housing Form. Because of delays that occur in U.S. mail to Canada, it is strongly suggested that advance registrants from Canada choose to pick up their materials at the meetings. Because of delays that occur in U.S.

mail to overseas, materials are never mailed overseas. There will be a special Registration Assistance Desk at the Joint Meetings to assist individuals who either do not receive this mailing or who have a problem with their registration. Please note that a $5 replacement fee will be charged for programs and badges that are mailed but not taken to Baltimore. Acknowledgments of registrations will be sent by email to the email addresses given on the Advance Registration/Housing Form. If you do not wish your registration acknowledged by email, please mark the appropriate box on the form.

Email Advance Registration: This service is available for advance registration and housing arrangements by requesting the forms via email from `meetreg-request@ams.org` or by visiting `http://www.ams.org/amsmtgs/2074_reghsg.html`. VISA, MasterCard, Discover, and American Express are the only methods of payment which can be accepted for email advance registration, and charges to credit cards will be made in U.S. funds. Completed e-mail forms should be sent to `meetreg-submit@ams.org`. All advance registrants will receive acknowledgment of payment prior to the meetings.

Internet Advance Registration: This service is available for advance registration and housing arrangements at `http://www.ams.org/amsmtgs/2074_reghsg.html`. VISA, MasterCard, Discover, and American Express are the only methods of payment which are accepted for Internet advance registration, and charges to credit cards will be made in U.S. funds. All Internet advance registrants will receive acknowledgment of payment upon submission of this form.

Cancellation Policy: Those who cancel their advance registration for the meetings, MAA Minicourses, or Short Courses by January 10 (the deadline for refunds for banquet tickets is December 30) will receive a 50% refund of fees paid. No refunds will be issued after this date.

Joint Mathematics Meetings Registration Fees

	by Dec. 19	at meeting
Member of AMS, ASL, Canadian Mathematical Society, MAA, SIAM	$190	$247
Emeritus Member of AMS, MAA; Graduate Student; Unemployed; Librarian; High School Teacher; Developing Countries Special Rate	35	45
Undergraduate Student	20	26
Temporarily Employed	150	172
Nonmember	295	383
High School Student	2	5
One-Day Member of AMS, ASL, CMS, MAA, SIAM	n/a	136
One-Day Nonmember	n/a	211
Nonmathematician Guest	5	5
Employment Center		
Employer (first table)	$220	$300
Employer (each additional table)	65	100
Employer Posting Fee	50	N/A
Applicants (all services)	40	75
Applicants (*Winter List* & message center only)	20	20
AMS Short Course		
Member of AMS or MAA	$ 80	$100
Nonmember	110	130
Student/Unemployed/Emeritus	35	50
MAA Minicourses		
Minicourses #7–16	$60	$60*
Minicourses #1–6	90	90*
*if space is available		
MAA Short Course		
MAA Member	$125	$140
Nonmember	175	190
Student/Unemployed/Emeritus	50	60

Full-Time Students: Those currently working toward a degree or diploma. Students are asked to determine whether their status can be described as graduate (working toward a degree beyond the bachelor's), undergraduate (working toward a bachelor's degree), or high school (working toward a high school diploma) and to mark the Advance Registration/Housing Form accordingly.

Emeritus: Persons who qualify for emeritus membership in either the Society or the Association. The emeritus status refers to any person who has been a member of the AMS or MAA for twenty years or more and who retired because of age or long-term disability from his or her latest position.

Librarian: Any librarian who is not a professional mathematician.

Unemployed: Any person currently unemployed, actively seeking employment, and not a student. It is not intended to include any person who has voluntarily resigned or retired from his or her latest position.

Developing Country Participant: Any person employed in developing countries where salary levels are radically noncommensurate with those in the U.S.

Temporarily Employed: Any person currently employed but who will become unemployed by June 1, 2003, and who is actively seeking employment.

Nonmathematician Guest: Any family member or friend who is not a mathematician and who is accompanied by a participant of the meetings. These official guests will receive a badge and may attend all sessions and the exhibits.

Participants who are not members of the AMS and register for the meetings as a nonmember will receive mailings after the meetings are over with a special membership offer.

Advance registration and on-site registration fees only partially cover the expenses of holding meetings. All mathematicians who wish to attend sessions are expected to register and should be prepared to show their badges if so requested. Badges are required to enter the exhibit area, to obtain discounts at the AMS and MAA Book Sales, and to cash a check with the Joint Meetings cashier. If a registrant should arrive too late in the day to pick up his/her badge, he/she may show the acknowledgment of

advance registration received from the MMSB as proof of registration.

Advance registration forms accompanied by insufficient payment either will be returned, thereby delaying the processing of any housing request, or a $5 charge will be assessed if an invoice must be prepared to collect the delinquent amount. Overpayments of less than $5 will not be refunded.

For each invalid check or credit card transaction that results in an insufficient payment for registration or housing, a $5 charge will be assessed. Participants should check with their tax preparers for applicable deductions for education expenses as they pertain to these meetings.

If you wish to be included in a **list of individuals sorted by mathematical interest**, please provide the one mathematics subject classification number of your major area of interest on the Advance Registration/Housing Form. (A list of these numbers is available by sending an empty e-mail message to `abs-submit@ams.org`; include the number 983 as the subject of the message.) Copies of this list will be available for your perusal in the Networking Center.

If you do not wish to be included in any mailing list used for promotional purposes, please indicate this in the appropriate box on the Advance Registration/Housing Form.

Advance Registration Deadlines

There are four separate advance registration deadlines, each with its own advantages and benefits.

EMPLOYMENT CENTER advance registration (inclusion in the *Winter Lists*)	**October 25**
EARLY meetings advance registration (room lottery)	**November 1**
ORDINARY meetings advance registration (hotel reservations, materials mailed)	**November 15**
FINAL meetings advance registration (advance registration, Short Courses, Employment Center, MAA Minicourses, banquets)	**December 19**

Employment Center Advance Registration: Applicant and employer forms must be received by October 25 in order to appear in the publications distributed to all participants. For detailed information on the Employment Center, see the separate article on page 1203.

Early Advance Registration: Those who register by the **early** deadline of November 1 will be included in a random drawing to select winners of complimentary hotel rooms in Baltimore. Multiple occupancy is permissible. The location of rooms to be used in this lottery will be based on the number of complimentary rooms available in the various hotels. Therefore, the free room may not necessarily be in the winner's first-choice hotel. The winners will be notified by mail prior to December 25. So register early! (See the list of the winners in San Diego on the hotel page.) Also, applicant and employer forms must be received by November 1 in order to be reproduced in the *Winter Lists* for the Employment Center.

Ordinary Advance Registration: Those who register after November 1 and by the **ordinary** deadline of November 15 may use the housing services offered by the MMSB but are not eligible for the room lottery. You may also elect to receive your badge and program by mail in advance of the meetings.

Final Advance Registration: Those who register after November 15 and by the **final** deadline of December 19 must pick up their badges, programs, and any tickets for social events at the meetings. Unfortunately, it is not possible to provide **final** advance registrants with housing. Please note that the **December 19 deadline is firm**; any forms received after that date will be returned and full refunds issued. Please come to the registration desk in Hall A of the Baltimore Convention Center to register on site.

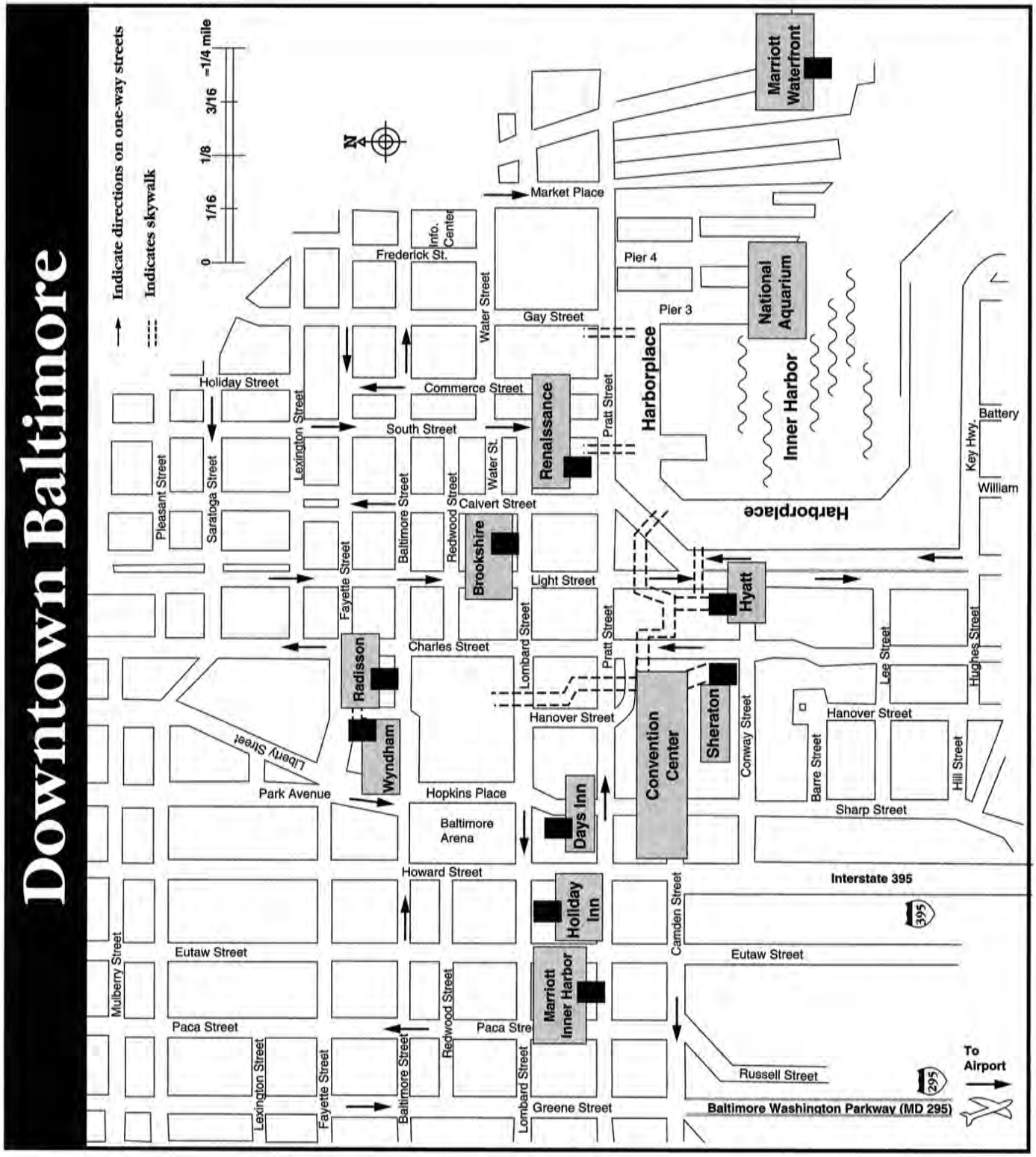
Hotel Reservations

Participants should be aware that the AMS and MAA contract only with facilities who are working toward being in compliance with the public accommodations requirements of the ADA.

Participants requiring hotel reservations should read the instructions on the following hotel pages. Participants who did not reserve a room during advance registration and would like to obtain a room at one of the hotels listed on the following pages should call the hotels directly after December 29. However, after that date the MMSB can no longer guarantee availability of rooms or special convention rates. Participants should be aware that most hotels are starting to charge a penalty fee to guests for departure changes made after guests have checked into their rooms. Participants should inquire about this at check-in and make their final plans accordingly.

Participants should also be aware that it is general hotel practice in most cities to hold a nonguaranteed reservation until 6:00 p.m. only. When one guarantees a reservation by paying a deposit or submitting a credit card number as a guarantee in advance, however, the hotel usually will honor this reservation up until checkout time the following day. If the individual holding the reservation has not checked in by that time, the room is then released for sale, and the hotel retains the deposit or applies one night's room charge to the credit card number submitted.

If you hold a guaranteed reservation at a hotel but are informed upon arrival that there is no room for you, there are certain things you can request the hotel do. First, they should provide for a room at another hotel in town for that evening at no charge. (You already paid for the first night when you made your deposit.) They should pay for taxi fares to the other hotel that evening and back to the meetings the following morning. They should also pay for one telephone toll call so that you can let people know you are not at the hotel you expected. They should make every effort to find a room for you in their hotel the following day and, if successful, pay your taxi fares to and from the second hotel so that you can pick up your baggage and bring it to the first hotel. Not all hotels in all cities follow this


Downtown Baltimore
Indicate directions on one-way streets
Indicates skywalk
0 1/16 1/8 3/16 =1/4 mile
N
Marriott Waterfront
Market Place
Info. Center
Frederick St.
Pier 4
National Aquarium
Pier 3
Water Street
Gay Street
Harborplace
Inner Harbor
Holiday Street
Commerce Street
Renaissance
Pratt Street
Battery
Key Hwy.
William
Lexington Street
South Street
Pleasant Street
Saratoga Street
Water St.
Calvert Street
Redwood Street
Baltimore Street
Brookshire
Light Street
Fayette Street
Hyatt
Charles Street
Lombard Street
Pratt Street
Lee Street
Hughes Street
Radisson
Hanover Street
Convention Center
Sheraton
Conway Street
Barre Street
Hill Street
Sharp Street
Liberty Street
Wyndham
Park Avenue
Hopkins Place
Baltimore Arena
Days Inn
Howard Street
Interstate 395
Holiday Inn
Camden Street
Eutaw Street
Mulberry Street
Marriott Inner Harbor
Paca Street
Russell Street
To Airport
Lexington Street
Fayette Street
Baltimore Street
Lombard Street
Greene Street
Baltimore Washington Parkway (MD 295)

How to Obtain Hotel Accommodations

Room Lottery: (See the ***How to Register in Advance*** section to learn how to qualify for this year's room lottery.) Last year's winners were Deanna Caveny, Matthew Gould, Mara Neusel, Christy Finch, Shelly Harvey, Alan Levine, Jerold Mathews, Kyle Siegrist, and Nancy Zumoff.

General Instructions: Participants must register in advance in order to obtain hotel accommodations through the Mathematics Meetings Service Bureau (MMSB). Special meeting rates have been negotiated at the following hotels. These rates apply exclusively to reservations made through the MMSB. Hotels will start accepting reservations directly after **December 23,** at which time rooms and rates will be based on availability. **A higher rate will be applied to any rooms reserved directly with any of the hotels before December 23.**

To make a reservation, please submit a completed housing section of the Advance Registration/Housing (ARH) Form (paper or electronic) with a guarantee by **November 15. Sorry, reservations cannot be taken by phone.** Participants interested in reserving suites should contact the MMSB for further information.

Deadlines:
- Room lottery qualification: **November 1, 2002**
- Reservations through MMSB: **November 15, 2002**
- Changes/cancellations through MMSB: **December 13, 2002**

Rates:
- Subject to 12.5% state tax
- Only certified students or unemployed mathematicians qualify for student rates.
- See ARH Form for detailed rate structure of each property.

General Information:
- Check-in: 4:00 p.m./checkout: noon – Renaissance, Marriott Waterfront, and Wyndham (For all others, check-in is at 3:00 p.m., checkout is noon, with the exception of the Days Inn whose checkout is 11:00 a.m.)
- **Windows do not open** in rooms unless otherwise indicated.
- Children at different ages are free in existing beds only.
- Limited availability of cribs, free of charge
- All hotels have a limited environmental policy regarding linens where all requests for a limited change of linens will be honored.
- Distance from hotel to Baltimore Convention Center is indicated in each listing.
- All hotels are in acceptable compliance with ADA. The following hotels have TTYs/TDDs text telephones on premise: the Days Inn, Holiday Inn, Marriott Inner Harbor, Marriott Waterfront, Radisson, Renaissance, Sheraton, and Wyndham.

Guarantee Requirements:
- One night deposit by check, or
- Credit cards accepted: VISA, MC, AMEX, and Diners (cards may be charged one night deposit.)

Baltimore Marriott Waterfront
(.69 mile across the harbor—closer by water taxi)

700 Aliceanna Street
Baltimore, MD 21202
(410) 385-3000
Regular—$135 single/double

Restaurant; Lounge; Bakery and deli; Business Center; Health club; Solarium; Indoor pool; Sauna; Gift shop; Parking $23 (valet), $17 (self); All rooms have full amenities including 2-line phones; Children under 18 years free; **$100 early departure fee enforced**

Brookshire Suites
(3 blocks—.40 mile)

120 E. Lombard Street
Baltimore, MD 21202
(410) 625-1300
(410) 625-0912
Regular—$129 single/double (includes daily full breakfast)

Restaurant; Fitness room; Business services; Parking $20 (valet); All rooms have full amenities including high speed internet capability, data ports, wet bar, robes, and windows that open a maximum of 2 inches; Children under 18 years free; Daily charge of $4 available for unlimited 800 and local calls

Hyatt Regency Baltimore (HEADQUARTERS)
(connected by skywalk—.10 mile)

300 Light Street
Baltimore, MD 21202
(410) 528-1234
Regular—$124 single/double
Student—$114 single/double

Glass elevators; Restaurants; Lounges; Gift shop; Health Club with jogging path; Outdoor pool; Tennis courts; Basketball courts; Putting green; Parking $21 (valet), $17 (self); All rooms have full amenities including data ports; Children under 18 years free

Baltimore Marriott Inner Harbor
(1 block—.25 mile)

110 South Eutaw Street
Baltimore, MD 21201
(410) 962-0202
Regular—$124 single/$134 double
Student—$99 single/$105 double

Restaurants; Lounge; Business Center; Health club; Indoor pool; Golfing; Whirlpool; Sauna; Gift shop; Parking $17 (valet), $12 (self); All rooms have full amenities including 2-line phones, high speed internet access capabilities, data ports, safe, and mini bar; Children under 18 years free; **$100 early departure fee enforced**

Renaissance Harborplace
(2 blocks—.25 mile)

202 East Pratt Street
Baltimore, MD 21202
(410) 547-1200
Regular—$124 single/double
Student—$113 single/double

Attached to mall; Restaurant; Lounges; Fitness center; Sauna; Jacuzzi; Indoor pool; Gift shop; Parking $25 (valet), $21 (self); All rooms have full amenities including 2-line phones and data ports; Some windows open slightly; Children under 13 years free

Sheraton Inner Harbor
(connected by skywalk—.05 mile)

300 South Charles Street
Baltimore, MD 21201
(410) 962-8300
Regular—$122 single/double
Student—$110 single/double

Restaurants; Lounge; Fitness center; Indoor pool; Gift shop; Parking $19 (valet), $14 (self); All rooms have full amenities including 2-line phones and mini bar; Children under 18 years free; **$50 early departure fee enforced**

Continued →

Holiday Inn Inner Harbor *(1 block—.20 mile)*	Wyndham Baltimore Inner Harbor *(2 blocks—.35 mile)*	Radisson Plaza Lord Baltimore *(2 blocks—.35 mile)*	Days Inn Inner Harbor *(across the street—.10 mile)*	**Attention Students**
301 W. Lombard Street Baltimore, MD 21201 (410) 685-3500 Regular—$115 single/$123 double Student—$89 single/double Restaurant; Lounge; Gift shop; Parking $11 (self); Guest laundry; All rooms have full amenities including data ports; Children under 18 years free	101 West Fayette Street Baltimore, MD 21201 (410) 752-1100 Regular—$114 single/$124 double Student—$91 single/$101 double Restaurants; Lounge; Business Center; Gift shop; Fitness center; Outdoor pool; Parking $22 (valet), $16 (self); All rooms have full amenities including high speed internet access capability, cordless phones, and mini bar; Children under 18 years free	20 West Baltimore Street Baltimore, MD 21201 (410) 539-8400 Regular—$113 single/double Student—$90 single/double Restaurant; Lobby bar; Gift shop; Health club; Whirlpool; Sauna; Parking $25 (valet); All rooms have full amenities including modems and windows that open; Children under 18 years free; **$50 early departure fee enforced**	100 Hopkins Place Baltimore, MD 21201 (410) 576-1000 Regular—$109 single/$119 double Student—$87 single/$95 double Restaurant; Lounge; Business Center; Outdoor pool (heated); Parking $12 (self); All rooms have full amenities including data ports and safe; Children under 17 years free	Each year, we include information on a local hostel as an alternative housing choice. However, the Baltimore hostel has been closed since 1999. The Friends of the Baltimore Hostel have been working to re-open the hostel but at the time of this printing, the hostel is not open. If you're looking for other hostels in or accessible to Baltimore, we encourage you to contact the Washington, D.C., International hostel (www.hiwashingtondc.org) at (202) 737-2333. Please contact them directly for reservations or information. During the week, there are frequent, inexpensive commuter trains between Baltimore and Washington which take less than an hour, one way.

practice, so your request for these services may bring mixed results or none at all.

Miscellaneous Information

Audio-Visual Equipment: Standard equipment in all session rooms is one overhead projector and screen. (Invited 50-minute speakers are automatically provided with two overhead projectors.) Blackboards are not available. Organizers of sessions that by their nature demand additional equipment (e.g., VCR and monitor or projection panel) and where the majority of speakers in the session require this equipment should contact the audio-visual coordinator for the meetings at the AMS office in Providence at 401-455-4140 or by email at wsd@ams.org to obtain the necessary approvals. Individual speakers must consult with the session organizer(s) if additional equipment or services are needed. If your session has no organizer, please contact the audio-visual coordinator directly. All requests should be received by November 4.

Equipment requests made at the meetings most likely will not be granted because of budgetary restrictions. Unfortunately no audio-visual equipment can be provided for committee meetings or other meetings or gatherings not on the scientific program.

Childcare: Many hotels will provide recommendations for in-room childcare for guests through their concierge or front desks. Call as early as possible for the best service, and at least one day in advance. Arrangements represent a contractual agreement between each individual and the child-care provider. The Joint Meetings assumes no responsibility for the services rendered.

Email Services: Limited email access for all Joint Meeting participants will be available. The hours of operation will be published in the program.

Information Distribution: Tables are set up in the exhibit area for dissemination of general information of possible interest to the members and for the dissemination of information of a mathematical nature not promoting a product or program for sale.

If a person or group wishes to display information of a mathematical nature promoting a product or program for sale, they may do so in the exhibit area at the Joint Books, Journals, and Promotional Materials exhibit for a fee of $55 (posters are slightly higher) per item. Please contact the exhibits manager, MMSB, P.O. Box 6887, Providence, RI 02940, for further details.

The administration of these tables is in the hands of the AMS-MAA Joint Meetings Committee, as are all arrangements for Joint Mathematics Meetings.

Local Information: See http://www.baltimore.org/index2.htm for information about the city.

Petition Table: At the request of the AMS Committee on Human Rights of Mathematicians, a table will be made available in the exhibit area at which petitions on behalf of named individual mathematicians suffering from human rights violations may be displayed and signed by meetings participants acting in their individual capacities. For details contact the director of meetings in the Providence office at 401-455-4137 or by email at dms@ams.org.

Signs of moderate size may be displayed at the table but must not represent that the case of the individual in question is backed by the Committee on Human Rights unless it has, in fact, so voted. Volunteers may be present at the table to provide information on individual cases, but notice must be sent at least seven days in advance of the meetings to the director of meetings in the Providence office. Since space is limited, it may also be necessary to limit the number of volunteers present at the table at any one time. The Committee on Human Rights may delegate a person to be present at the table at any or all times, taking precedence over other volunteers.

Any material that is not a petition (e.g., advertisements, résumés) will be removed by the staff. At the end of the exhibits on Saturday, any material on the table will be discarded, so individuals placing petitions on the table should be sure to remove them prior to the close of exhibits.

Telephone Messages: The most convenient method for leaving a message is to do so with the participant's hotel. Another method would be to leave a message at the meetings registration desk from January 14 through 18 during the hours that the desk is open. These messages will be posted on the Math Meetings Message Board; however, staff at the desk will try to locate a participant in the event of a bona fide emergency. The telephone number will be published in the program.

Travel

Baltimore is on Eastern Standard Time. The Baltimore-Washington International Airport (BWI) is located ten miles south of the city and is served by all major airlines.

Official airlines for the meetings are **US Airways** and **Southwest Airlines**. Given the volatility in airfares because of "fare wars", we cannot guarantee that these will be the lowest fares when you make your arrangements. However, we strongly urge participants to make use of this special deal if at all possible, since the AMS and MAA can earn complimentary tickets. These tickets are used to send meetings' staff (not officers or other staff) to the Joint Mathematics Meetings, thereby keeping the costs of the meetings (and registration fees) down.

The following specially negotiated rates are available only for these meetings and exclusively to mathematicians and their families for the period January 10–21, 2003. Other restrictions/discounts may apply, and seats are limited.

Southwest Airlines is offering a 10% discount on most of its already low fares for air travel to and from the event. You or your travel agent may call Southwest Airlines Group and Meetings Reservations at 1-800-433-5368 and reference the **ID Code R7701**. Reservations sales agents are available 7:00 a.m.–8:00 p.m. Monday–Friday, or 8:30 a.m.–3:30 p.m. Saturday and Sunday, Central Standard Time. You must make reservations five or more days prior to travel to take advantage of this offer.

US Airways offers a 5% discount off First or Envoy Class and any published US Airways promotional round-trip fare. By purchasing your ticket 60 days or more prior to departure, you can receive an additional 5% bonus discount. Or choose a 10% discount off unrestricted coach

fares with seven-day advance purchase. By purchasing your ticket 60 days or more prior to departure, you can receive an additional 5% bonus discount.

For reservations call (or have your travel agent call) the US Airways Group and Meeting Reservation Office toll free at 1-877-874-7687 between 8:00 a.m. and 9:30 p.m. Eastern Standard Time. Refer to **Gold File number 18612072**.

Ground Transportation from the Airport: The **SuperShuttle** (800-258-3826 or 410-859-0800) provides service to the downtown area; reservations are not necessary. Fares are $11 one way or $18 round trip. The SuperShuttle Ground Transportation counter is located between carousels 6 and 7, pier C. Taxi fare is about $20; taxis can be found on the lower level near each exit. The trip takes about 20 minutes.

Railway Transportation: Baltimore is a major station in the Northeast Corridor and is served by frequent Amtrak trains from Boston, New York, Philadelphia, and Washington. Trains arrive either at the airport or the Baltimore station For information call 800-872-7245 or see `http://www.amtrak.com`.

Avis Rent A Car is the official car rental company for the meeting. All car rentals include unlimited free mileage and are available to renters 25 years and older. Avis offers special convention rental rates effective January 8–25, 2003:

Car Type	Daily	Weekly	Weekend Daily
Subcompact	$41.99	$175.99	$23.99
Compact	42.99	184.99	24.99
Intermediate	44.99	195.99	26.99
Full-Size 2-Door	46.99	204.99	29.99
Full-Size 4-Door	48.99	214.99	31.99
Premium	51.99	223.99	33.99
Luxury, Minivan, Convertible, or Sport Utility	64.99	279.99	65.99

Should a lower qualifying rate become available, Avis is pleased to present a 5% discount on that rate, or if a car size is selected that is not available above, Avis will discount the best available rate by 5%. Rates do not include any state or local surcharges, tax, optional coverages, or gas refueling charges. Renters must meet Avis' age, driver, and credit requirements. The 24-hour toll-free reservation number is 800-331-1600; cite **group ID number J098887**. Reservations can also be made online at `www.avis.com`.

Weather

The temperature ranges from about 28° F. to 41° F. Average precipitation in January is 3.1 inches. Visit your favorite weather site for up-to-the-minute forecasts, or see `http://www.usatoday.com/weather/cityforecast.aspx?LocationID=USMD0018`.

Baton Rouge, Louisiana

Louisiana State University

March 14–16, 2003

Meeting #984

Southeastern Section
Associate secretary: John L. Bryant
Announcement issue of *Notices*: January 2003
Program first available on AMS website: January 30, 2003
Program issue of electronic *Notices*: March 2003
Issue of *Abstracts*: Volume 24, Issue 2

Deadlines

For organizers: Expired
For consideration of contributed papers in Special Sessions: November 26, 2002
For abstracts: January 22, 2003

Bloomington, Indiana

Indiana University

April 4–6, 2003

Meeting #985

Central Section
Associate secretary: Susan J. Friedlander
Announcement issue of *Notices*: February 2003
Program first available on AMS website: February 20, 2003
Program issue of electronic *Notices*: April 2003
Issue of *Abstracts*: Volume 24, Issue 2

Deadlines

For organizers: Expired
For consideration of contributed papers in Special Sessions: December 17, 2002
For abstracts: February 11, 2003

Invited Addresses

Daniel J. Allcock, University of Texas, *Title to be announced.*

Brian D. Conrad, University of Michigan, *Title to be announced.*

Robin A. Pemantle, Ohio State University, *Title to be announced.*

Sijue Wu, University of Maryland, *Title to be announced.*

Special Sessions

Applications of Teichmueller Theory to Dynamics and Geometry (Code: AMS SS K1), **Christopher M. Judge** and **Matthias Weber**, Indiana University.

Differential Geometry (Code: AMS SS L1), **Jiri Dadok**, **Bruce Solomon**, and **Ji-Ping Sha**, Indiana University.

Ergodic Theory and Dynamical Systems (Code: AMS SS A1), **Roger L. Jones** and **Ayse A. Sahin**, DePaul University.

Geometric Topology (Code: AMS SS D1), **Paul A. Kirk** and **Charles Livingston**, Indiana University.

Harmonic Analysis in the 21st Century (Code: AMS SS E1), **Winston C. Ou** and **Alberto Torchinsky**, Indiana University.

Holomorphic Dynamics (Code: AMS SS B1), **Eric D. Bedford** and **Kevin M. Pilgrim**, Indiana University.

Mathematical and Computational Problems in Fluid Dynamics and Geophysical Fluid Dynamics (Code: AMS SS H1), **Roger Temam** and **Shouhong Wang**, Indiana University.

Operator Algebras and Free Probability (Code: AMS SS J1), **Hari Bercovici**, Indiana University, and **Marius Dadarlat**, Purdue University.

Particle Models and their Fluid Limits (Code: AMS SS F1), **Robert T. Glassey** and **David C. Hoff**, Indiana University.

Probability (Code: AMS SS G1), **Russell D. Lyons**, Indiana University, and **Robin A. Pemantle**, Ohio State University.

Recent Trend in the Analysis and Computations of Functional Differential Equations (Code: AMS SS M1), **Paul W. Eloe** and **Qin Sheng**, University of Dayton.

Weak Dependence in Probability and Statistics (Code: AMS SS C1), **Richard C. Bradley** and **Lanh T. Tran**, Indiana University.

New York, New York

Courant Institute

April 12–13, 2003

Meeting #986

Eastern Section
Associate secretary: Lesley M. Sibner
Announcement issue of *Notices*: February 2003
Program first available on AMS website: February 27, 2003
Program issue of electronic *Notices*: April 2003
Issue of *Abstracts*: Volume 24, Issue 3

Deadlines

For organizers: September 12, 2002
For consideration of contributed papers in Special Sessions: December 24, 2002
For abstracts: February 18, 2003

Invited Addresses

Matthias Aschenbrenner, University of California Berkeley, *Title to be announced.*

John Etnyre, University of Pennsylvania, *Title to be announced.*

Hans Foellmer, Humboldt University Berlin, *Title to be announced.*

Wilfrid Gangbo, Georgia Institute of Technology, *Title to be announced.*

Special Sessions

Combinatorial and Statistical Group Theory (Code: AMS SS B1), **Alexei Myasnikov** and **Vladimir Shpilrain**, City College, New York.

Hopf Algebras and Quantum Groups (Code: AMS SS A1), **M. Susan Montgomery**, University of Southern California, **Earl J. Taft**, Rutgers University, and **Sarah J. Witherspoon**, Amherst College.

San Francisco, California

San Francisco State University

May 3–4, 2003

Meeting #987

Western Section
Associate secretary: Michel L. Lapidus
Announcement issue of *Notices*: March 2003
Program first available on AMS website: March 20, 2003
Program issue of electronic *Notices*: May 2003
Issue of *Abstracts*: Volume 24, Issue 3

Deadlines

For organizers: October 3, 2002
For consideration of contributed papers in Special Sessions: January 14, 2003
For abstracts: March 11, 2003

Invited Addresses

Joe P. Buhler, Reed College, *Title to be announced.*

Raymond C. Heitmann, University of Texas at Austin, *Title to be announced.*

Alexei Y. Kitaev, California Institute of Technology, *Title to be announced.*

Arkady Vaintrob, University of Oregon, *Title to be announced.*

Seville, Spain

June 18–21, 2003

Meeting #988

First Joint International Meeting between the AMS and the Real Sociedad Matematica Española (RSME).
Associate secretary: Susan J. Friedlander
Announcement issue of *Notices*: To be announced
Program first available on AMS website: Not applicable

Program issue of electronic *Notices*: Not applicable
Issue of *Abstracts*: Not applicable

Deadlines

For organizers: Expired
For consideration of contributed papers in Special Sessions: To be announced
For abstracts: To be announced

Invited Addresses

Xavier Cabre, Universidad Politécnica de Cataluña, Barcelona, *Title to be announced.*

Charles Fefferman, Princeton University, *Title to be announced.*

Michael Hopkins, Massachusetts Institute of Technology, *Title to be announced.*

Ignacio Sols, Universidad Complutense, Madrid, *Title to be announced.*

Luis Vega, Universidad del Pais Vasco, Bilbao, *Title to be announced.*

Efim Zelmanov, Yale University, *Title to be announced.*

Special Sessions

Affine Algebraic Geometry, **Jaime Gutierrez**, University of Cantabria, **Vladimir Shpilrain**, City College of New York, and **Jie-Tai Yu**, University of Hong Kong.

Algebraic Geometry, **Felix Delgado**, Universidad de Valladolid, and **Andrey N. Todorov**, University of California Santa Cruz.

Algebraic Toplogy, **Alejandro Adem**, University of Wisconsin, **J. Aguade**, Universitat Autónoma de Barcelona, and **Eric M. Friedlander**, Northwestern University.

Banach Spaces of Analytic Functions, **Daniel Girela**, University of Malaga, and **Michael Stessin**, SUNY at Albany.

Biomolecular Mathematics, **Thomas J. Head** and **Fernando Guzman**, SUNY at Binghamton, **Mario Perez**, Universidad de Sevilla, and **Carlos Martin-Vide**, Rovira i Virgili University.

Classical and Harmonic Analysis, **Nets Katz**, Washington University, **Carlos Perez**, Universidad de Sevilla, and **Ana Vargas**, Universidad Autonoma de Madrid.

Combinatorics, **Joseph E. Bonin**, George Washington University, and **Marc Noy**, Universitat Politecnica de Catalunya.

Commutative Algebra: Geometric, Homological, Combinatorial and Computational Aspects, **Alberto Corso**, University of Kentucky, **Philippe Gimenez**, Universidad de Valladolid, and **Santiago Zarzuela**, Universitat de Barcelona.

Computational Methods in Algebra and Analysis, **Eduardo Cattani**, University of Massachusetts, Amherst, and **Francisco Jesus Castro-Jimenez**, Universidad de Sevilla.

Constructive Approximation Theory, **Antonio Duran**, University de Sevilla, and **Edward B. Saff**, Vanderbilt University.

Control and Geometric Mechanics, **Manuel de Leon**, Instituto de Matemáticas y Física Fundamental, **Alberto Ibort**, Universidad Carlos III, and **Francesco Bullo**, University of Illinois, Urbana.

Differential Galois Theory, **Teresa Crespo** and **Zbigniew Hajto**, Universitat de Barcelona, and **Andy R. Magid**, University of Oklahoma.

Differential Structures and Homological Methods in Commutative Algebra and Algebraic Geometry, **Gennady Lyubeznik**, University of Minnesota, and **Luis Narvaez-Macarro**, Universidad de Sevilla.

Discrete and Computational Geometry, **Ferran Hertado**, Universitat Politècnica de Catalunya, and **William Steiger**, Rutgers University.

Dynamical Systems, **George Haller**, Massachusetts Institute of Technology, **Zbigniew H. Nitecki**, Tufts Univesity, **Enrique Ponce**, Universidad de Sevilla, **Tere M. Seara**, Universitat Politècnica de Catalunya, and **Xavier Jarque**, Universitat Autónoma de Barcelona.

Effective Analytic Geometry Over Complete Fields, **Luis-Miguel Pardos**, Universidad de Cantabria, and **J. Maurice Rojas**, Texas A&M University.

Geometric Methods in Group Theory, **José Burillo**, Universitat Politècnica de Catalunya, **Jennifer Tayback**, University of Albany, and **Enric Ventura**, Universitat Politècnica de Catalunya.

History of Modern Mathematics—Gauss to Wiles, **Jose Ferreiros**, Universidad de Sevilla, and **David Rowe**, Universitat Mainz.

Homological Methods in Banach Space Theory, **Jesus M. F. Castillo**, Universidad de Extremadura, and **N. J. Kalton**, University of Missouri.

Homotopy Algebras, **Pedro Real**, Universidad de Sevilla, **Thomas J. Lada**, North Carolina State University, and **James Stasheff**, University of North Carolina.

Interpolation Theory, Function Spaces and Applications, **Fernando Cobos**, University Complutense de Madrid, and **Pencho Petrushev**, University of South Carolina.

Lorentzian Geometry and Mathematical Relativity, **Luis J. Alias**, Universidad de Murcia, and **Gregory James Galloway**, University of Miami.

Mathematical Aspects of Semiconductor Modeling and Nano-technology, **Irene Martinez Gamba**, University of Texas, Austin, and **Jose Antonio Carrillo**, Universidad de Granada.

Mathematical Fluid Dynamics, **Diego Cordoba**, CSIC, Madrid, and Princeton University, **Susan Friedlander**, University of Illinois, Chicago, and **Marcos Antonio Fontelos**, Universidad Rey Juan Carlos.

Mathematical Methods in Finance and Risk Management, **Santiago Carrillo Menendez**, Universidad Autonoma de Madrid, **Antonio Falcos Montesinos**, Universidad Cardenal Herrera CEU, **Antonio Sanchez-Calle**, Universidad Autonoma de Madrid, and **Luis A. Seco**, University of Toronto at Mississauga.

Moduli Spaces in Geometry and Physics, **Steven B. Bradlow**, University of Illinois, Urbana-Champaign, and **Oscar Garcia-Prada**, Universidad Autonoma de Madrid.

Nonassociative Algebras and Their Applications, **Efim I. Zelmanov**, Yale University, **Santos Gonzalez**, Universidad de Oviedo, and **Alberto Elduque**, Universidad de Zaragoza.

Nonlinear Dispersive Equations, **Gustavo Ponce**, University of California Santa Barbara, and **Luis Vega**, Universidad del Pais Vascos.

Numerical Linear Algebra, **Lothar Reichel**, Kent State University, and **Francisco Marcellan**, University Carlos III de Madrid.

Operator Theory and Spaces of Analytic Functions, **Jose Bonet**, Universidad Politecnica de Valencia, **Pedro Paul**, Universidad de Sevilla, and **Cora S. Sadosky**, Howard University.

PDE Methods in Continuum Mechanics, **Juan L. Vazquez**, Universidad Autonoma de Madrid, and **J. W. Neuberger**, University of North Texas.

Polynomials and Multilinear Analysis in Infinite Dimensions, **Richard M. Aron**, Kent State University, **J. A. Jaramillo** and **Jose G. Llavona**, Universidad Complutense de Madrid, and **Andrew M. Tonge**, Kent State University.

Quantitative Results in Real Algebra and Geometry, **Carlos Andradas** and **Antonio Diaz-Cano**, Universidad Complutense, **Victoria Powers**, Emory University, and **Frank Sottile**, University of Massachusetts, Amherst.

Recent Developments in the Mathematical Theory of Inverse Problems, **Russell Brown**, University of Kentucky, **Alberto Ruiz**, Universidad Autonoma de Madrid, Spain, and **Gunther Uhlmann**, University of Washington.

Riemannian Foliations, **Jesus Antonio Alvarez Lopez**, Universidade de Santiago de Compostela, and **Efton L. Park**, Texas Christian University.

Ring Theory and Related Topics, **Jose Gomez-Torrecillas**, University of Granada, **Pedro Antonio Guil Asensio**, University of Murcia, **Sergio R. Lopez-Permouth**, Ohio University, and **Blas Torrecillas**, University of Almeria.

The Mathematics of Electronmicroscopic Imaging, **Jose-Maria Carazo**, Centro Nacional de Biotecnologia-CSIC, and **Gabor T. Herman**, City University of New York.

Variational Problems for Submanifolds, **Frank Morgan**, Williams College, and **Antonio Ros**, Universidad de Granada.

Boulder, Colorado

University of Colorado

October 2–4, 2003

Meeting #989

Joint Central/Western Section
Associate secretary: Susan J. Friedlander
Announcement issue of *Notices*: August 2003
Program first available on AMS website: August 21, 2003
Program issue of electronic *Notices*: October 2003
Issue of *Abstracts*: Volume 24, Issue 4

Deadlines

For organizers: March 3, 2003
For consideration of contributed papers in Special Sessions: June 6, 2003
For abstracts: August 12, 2003

Invited Addresses

J. Brian Conrey, American Institute of Mathematics, *Title to be announced.*

Giovanni Forni, Northwestern University, *Title to be announced.*

Juha M. Heinonen, University of Michigan, *Title to be announced.*

Joseph D. Lakey, New Mexico State University, *Title to be announced.*

Albert Schwarz, University of California Davis, *Title to be announced.*

Avi Wigderson, Institute for Advanced Study, *Title to be announced* (Erdős Memorial Lecture).

Binghamton, New York

SUNY-Binghamton

October 11–12, 2003

Meeting #990

Eastern Section
Associate secretary: Lesley M. Sibner
Announcement issue of *Notices*: August 2003
Program first available on AMS website: August 28, 2003
Program issue of electronic *Notices*: October 2003
Issue of *Abstracts*: Volume 24, Issue 4

Deadlines

For organizers: March 10, 2003
For consideration of contributed papers in Special Sessions: June 24, 2003
For abstracts: August 19, 2003

Invited Addresses

Zlil Sela, Einstein Institute of Mathematics, *Title to be announced.*

Zoltan Szabo, University of Michigan, Ann Arbor, *Title to be announced.*

Jeb F. Willenbring, Yale University, *Title to be announced.*

Special Sessions

Biomolecular Mathematics (Code: AMS SS A1), **Thomas J. Head** and **Dennis G. Pixton**, SUNY at Binghamton,

Mitsunori Ogihara, University of Rochester, and **Carlos Martin-Vide**, Universitat Rovira i Virgili.

Chapel Hill, North Carolina

University of North Carolina at Chapel Hill

October 24–25, 2003

Meeting #991

Southeastern Section
Associate secretary: John L. Bryant
Announcement issue of *Notices*: August 2003
Program first available on AMS website: September 11, 2003
Program issue of electronic *Notices*: October 2003
Issue of *Abstracts*: Volume 24, Issue 4

Deadlines

For organizers: March 24, 2003
For consideration of contributed papers in Special Sessions: July 19, 2003
For abstracts: September 3, 2003

Bangalore, India

India Institute of Science

December 17–20, 2003

Meeting #992

First Joint International Meeting with Various Indian Mathematical Societies
Associate secretary: Susan J. Friedlander
Announcement issue of *Notices*: To be announced
Program first available on AMS website: Not applicable
Program issue of electronic *Notices*: Not applicable
Issue of *Abstracts*: Not applicable

Deadlines

For organizers: To be announced
For consideration of contributed papers in Special Sessions: To be announced
For abstracts: To be announced

Phoenix, Arizona

Phoenix Civic Plaza

January 7–10, 2004

Joint Mathematics Meetings, including the 110th Annual Meeting of the AMS, 87th 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 2003
Program first available on AMS website: To be announced
Program issue of electronic *Notices*: January 2004
Issue of *Abstracts*: To be announced

Deadlines

For organizers: April 2, 2003
For consideration of contributed papers in Special Sessions: To be announced
For abstracts: To be announced
For summaries of papers to MAA organizers: To be announced

Tallahassee, Florida

Florida State University

March 12–13, 2004

Southeastern Section
Associate secretary: John L. Bryant
Announcement issue of *Notices*: To be announced
Program first available on AMS website: To be announced
Program issue of electronic *Notices*: To be announced
Issue of *Abstracts*: To be announced

Deadlines

For organizers: August 13, 2003
For consideration of contributed papers in Special Sessions: To be announced
For abstracts: To be announced

Athens, Ohio

Ohio University

March 26–27, 2004

Central Section
Associate secretary: Susan J. Friedlander
Announcement issue of *Notices*: To be announced
Program first available on AMS website: To be announced
Program issue of electronic *Notices*: To be announced
Issue of *Abstracts*: To be announced

Deadlines

For organizers: August 26, 2003
For consideration of contributed papers in Special Sessions: To be announced
For abstracts: To be announced

Lawrenceville, New Jersey

Rider University

April 17–18, 2004

Eastern Section
Associate secretary: Lesley M. Sibner
Announcement issue of *Notices*: To be announced
Program first available on AMS website: To be announced
Program issue of electronic *Notices*: To be announced
Issue of *Abstracts*: To be announced

Deadlines

For organizers: September 17, 2003
For consideration of contributed papers in Special Sessions: To be announced
For abstracts: To be announced

Pittsburgh, Pennsylvania

University of Pittsburgh

November 6–7, 2004

Eastern Section
Associate secretary: Lesley M. Sibner
Announcement issue of *Notices*: To be announced
Program first available on AMS website: To be announced
Program issue of electronic *Notices*: To be announced
Issue of *Abstracts*: To be announced

Deadlines

For organizers: April 7, 2004
For consideration of contributed papers in Special Sessions: To be announced
For abstracts: To be announced

Atlanta, Georgia

Atlanta Marriott Marquis and Hyatt Regency Atlanta

January 5–8, 2005

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: To be announced
Program issue of electronic *Notices*: January 2005
Issue of *Abstracts*: To be announced

Deadlines

For organizers: April 5, 2004
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 Antonio, Texas

Henry B. Gonzalez Convention Center

January 12–15, 2006

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

New Orleans, Louisiana

New Orleans Marriott and Sheraton New Orleans Hotel

January 4–7, 2007

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

Joint Mathematics Meetings
Baltimore • January 15–18, 2003

Baltimore, Maryland

Timetable

Baltimore Convention Center

MONDAY, JANUARY 13	
9:00 a.m. — 5:00 p.m.	**AMS SHORT COURSE ON PUBLIC-KEY CRYPTOGRAPHY**
9:00 a.m. — 5:00 p.m.	**MAA SHORT COURSE ON MATHEMATICS IN THE ANCIENT WORLD**
TUESDAY, JANUARY 14	
8:30 a.m. — 4:00 p.m.	**MAA BOARD OF GOVERNORS**
9:00 a.m. — 5:00 p.m.	**AMS SHORT COURSE ON PUBLIC-KEY CRYPTOGRAPHY**
9:00 a.m. — 5:00 p.m.	**MAA SHORT COURSE ON MATHEMATICS IN THE ANCIENT WORLD**
1:00 p.m. — 6:00 p.m.	**AMS COUNCIL**
3:00 p.m. — 7:00 p.m.	**JOINT MEETINGS REGISTRATION**
WEDNESDAY, JANUARY 15	
7:30 a.m. — 4:00 p.m.	**JOINT MEETINGS REGISTRATION**
7:30 a.m. — 5:00 p.m.	**EMPLOYMENT CENTER**
8:00 a.m. — 10:55 a.m.	**AMS-MAA-MER SPECIAL SESSION ON MATHEMATICS AND EDUCATION REFORM, I**
8:00 a.m. — 10:55 a.m.	**AMS-SIAM SPECIAL SESSION ON DYNAMICAL SYSTEMS AND OCEANOGRAPHY, I**
8:00 a.m. — 10:55 a.m.	**AMS-ASL SPECIAL SESSION ON INTERACTIONS BETWEEN LOGIC, GROUP THEORY AND COMPUTER SCIENCE, I**
8:00 a.m. — 10:55 a.m.	**AMS-ASL SPECIAL SESSION ON COMPUTABILITY AND MODELS, I**
	AMS SPECIAL SESSIONS
8:00 a.m. — 10:55 a.m.	*Advances in Spherical Designs and Codes, I*
8:00 a.m. — 10:55 a.m.	*Algebras, Actions, and Algorithms, I*
8:00 a.m. — 10:55 a.m.	*Quantum Computation and Information: Mathematical Challenges, I*
8:00 a.m. — 10:55 a.m.	*Discrete Models, I*
8:00 a.m. — 10:55 a.m.	*Recent Advances in Riemannian and Lorentzian Geometries, I*
8:00 a.m. — 10:55 a.m.	*Primes and Knots, I*
8:00 a.m. — 10:55 a.m.	*Operator Algebras, Quantization, and Noncommutative Geometry: A Centennial Celebration in Honor of J. V. Neumann and M. H. Stone, I*
8:00 a.m. — 10:55 a.m.	*Special Functions and q-Series, I*
8:00 a.m. — 10:55 a.m.	*Nonstandard Models of Arithmetic and Set Theory, I*
8:00 a.m. — 10:55 a.m.	**SIAM MINISYMPOSIUM ON LIFE SCIENCES**
8:00 a.m. — 10:55 a.m.	**SIAM MINISYMPOSIUM ON OPTIMIZATION**

MAA CONTRIBUTED PAPER SESSIONS

8:00 a.m. — 10:55 a.m. *Innovative Use of the World Wide Web in Teaching Mathematics, I*
8:00 a.m. — 10:55 a.m. *Classroom Demonstrations and Course Projects that Make a Difference, I*
8:00 a.m. — 10:55 a.m. *The History of Mathematics in the Americas*
8:00 a.m. — 10:55 a.m. *General Contributed Paper Session, II*

8:00 a.m. — 10:55 a.m. **AMS SESSIONS FOR CONTRIBUTED PAPERS**

9:00 a.m. — 11:00 a.m. **MAA MINICOURSE #12: PART A** *Getting students involved in undergraduate research.*

9:00 a.m. — 11:00 a.m. **MAA MINICOURSE #1: PART A** *Teaching introductory statistics using a workshop approach.*

9:00 a.m. — 11:00 a.m. **MAA MINICOURSE #7: PART A** *The mathematics of presidential and other elections.*

9:00 a.m. — 10:20 a.m. **MAA CUPM SUBCOMMITTEE ON CURRICULUM REFORM ACROSS THE FIRST TWO YEARS PANEL DISCUSSION** *Reflections on the Conference to Improve College Algebra.*

10:05 a.m. — 10:55 a.m. **AMS INVITED ADDRESS** *Partial hyperbolicity.* **Charles C. Pugh**

11:10 a.m. — 12:00 p.m. **AMS-MAA INVITED ADDRESS** *Discrete mathematics and mechanical engineering.* **Edward R. Scheinerman**

12:00 p.m. — 5:00 p.m. **EXHIBITS AND BOOK SALES**, Exhibit Halls A & B, Baltimore Convention Center

1:00 p.m. — 2:00 p.m. **AMS COLLOQUIUM LECTURES:LECTURE I** *Spectra of hyperbolic surfaces and applications, I.* **Peter Sarnak**

2:15 p.m. — 3:05 p.m. **MAA INVITED ADDRESS** *Four colors suffice: A history and proof of the four-color problem.* **Robin Wilson**

2:15 p.m. — 6:05 p.m. **AMS-MAA-MER SPECIAL SESSION ON MATHEMATICS AND EDUCATION REFORM, II**

2:15 p.m. — 6:05 p.m. **AMS-SIAM SPECIAL SESSION ON DYNAMICAL SYSTEMS AND OCEANOGRAPHY, II**

2:15 p.m. — 6:05 p.m. **AMS-ASL SPECIAL SESSION ON INTERACTIONS BETWEEN LOGIC, GROUP THEORY AND COMPUTER SCIENCE, II**

2:15 p.m. — 6:05 p.m. **AMS-ASL SPECIAL SESSION ON COMPUTABILITY AND MODELS, II**

AMS SPECIAL SESSIONS

2:15 p.m. — 6:05 p.m. *Advances in Spherical Designs and Codes, II*
2:15 p.m. — 6:05 p.m. *Algebras, Actions, and Algorithms, II*
2:15 p.m. — 6:05 p.m. *Quantum Computation and Information: Mathematical Challenges, II*
2:15 p.m. — 6:05 p.m. *Discrete Models, II*
2:15 p.m. — 6:05 p.m. *Recent Advances in Riemannian and Lorentzian Geometries, II*
2:15 p.m. — 6:05 p.m. *Primes and Knots, II*
2:15 p.m. — 6:05 p.m. *Operator Algebras, Quantization, and Noncommutative Geometry: A Centennial Celebration in Honor of J. V. Neumann and M. H. Stone, II*
2:15 p.m. — 6:05 p.m. *Special Functions and q-Series, II*
2:15 p.m. — 6:00 p.m. *Dynamics, Physics, and Probability: The Work of the 2002 Nemmers Prize Winner, Yakov Sinai*
2:15 p.m. — 6:05 p.m. *Nonstandard Models of Arithmetic and Set Theory, II*

2:15 p.m. — 4:15 p.m. **MAA MINICOURSE #13: PART A** *Incorporating discrete mathematics in the preparation of K-12 mathematics teachers.*

2:15 p.m. — 4:15 p.m. **MAA MINICOURSE #2: PART A** *Java applets in teaching mathematics.*

2:15 p.m. — 4:15 p.m. **MAA MINICOURSE #8: PART A** *Mathematical finance.*

2:15 p.m. — 6:00 p.m. **SIAM MINISYMPOSIUM ON THE STABILITY OF NONLINEAR DISPERSIVE WAVES, I**

MAA CONTRIBUTED PAPER SESSIONS

2:15 p.m. — 6:00 p.m. *Getting Students to Discuss and to Write About Mathematics*
2:15 p.m. — 6:00 p.m. *Quantitative Literacy in Practice: What Is it and What Works?*
2:15 p.m. — 6:00 p.m. *Environmental Mathematics in the Classroom*

WEDNESDAY, JANUARY 15 (cont'd)

2:15 p.m. — 4:15 p.m. **AMS-MAA JOINT COMMITTEE ON TEACHING ASSISTANTS AND PART-TIME INSTRUCTORS POSTER SESSION** *Implementing preparation and development programs for college mathematics instructors.*

2:15 p.m. — 6:00 p.m. **AMS SESSIONS FOR CONTRIBUTED PAPERS**

2:15 p.m. — 3:35 p.m. **MAA COMMITTEE ON THE UNDERGRADUATE PROGRAM IN MATHEMATICS AND THE CUPM SUBCOMMITTEE ON CURRICULUM REFORM ACROSS THE FIRST TWO YEARS PANEL DISCUSSION** *The impact of technology in calculus courses on long-term student performance and employment.*

2:15 p.m. — 3:35 p.m. **MAA SPECIAL PRESENTATION** *An overview of interviews.*

3:20 p.m. — 4:10 p.m. **MAA INVITED ADDRESS** *Some comments on early Greek mathematics.* **David H. Fowler**

3:30 p.m. — 5:00 p.m. **MAA PROJECT NEXT PANEL DISCUSSION** *Expanding your research horizons.*

3:45 p.m. — 4:45 p.m. **MAA SPECIAL PRESENTATION** *Doctorates in mathematics education: Why the shortage? Where do they go? What do they do?*

3:45 p.m. — 5:05 p.m. **MAA CUPM SUBCOMMITTEE ON CURRICULUM REFORM ACROSS THE FIRST TWO YEARS PANEL DISCUSSION** *Small group projects in college algebra.*

4:00 p.m. — 5:00 p.m. **AWM PANEL DISCUSSION** *Mathematics educators and mathematicians working together.*

4:30 p.m. — 6:30 p.m. **MAA MINICOURSE #14: PART A** *Teaching a course in the history of mathematics.*

4:30 p.m. — 6:30 p.m. **MAA MINICOURSE #3: PART A** *Optimization of technology in the geometry classroom.*

4:30 p.m. — 6:30 p.m. **MAA MINICOURSE #9: PART A** *Fair enough? Mathematics of equity.*

4:30 p.m. — 6:00 p.m. **AMS COMMITTEE ON THE PROFESSION PRESENTATION**

4:30 p.m. — 6:30 p.m. **MAA COMMITTEE ON THE TEACHING OF UNDERGRADUATE MATHEMATICS WORKSHOP** *Student writing: A hands-on approach.*

4:30 p.m. — 6:30 p.m. **MAA SECTION OFFICERS**

5:00 p.m. — 6:00 p.m. **GRADUATE STUDENT RECEPTION**

5:00 p.m. — 5:30 p.m. **AWM BUSINESS MEETING**

5:15 p.m. — 6:45 p.m. **MAA HISTORY OF MATHEMATICS SIGMAA PANEL DISCUSSION** *Truth in using the history of mathematics in teaching mathematics.*

5:30 p.m. — 7:30 p.m. **MATHEMATICAL SCIENCES INSTITUTES RECEPTION**

6:00 p.m. — 7:00 p.m. **RECEPTION FOR FIRST-TIME PARTICIPANTS**

7:15 p.m. — 8:15 p.m. **YOUNG MATHEMATICIANS NETWORK TOWN MEETING**

8:30 p.m. — 9:30 p.m. **AMS JOSIAH WILLARD GIBBS LECTURE** *The shape of objects in two and three dimensions: Mathematics meets computer vision.* **David B. Mumford**

9:30 p.m. — 11:00 p.m. **AWM RECEPTION**

THURSDAY, JANUARY 16

7:00 a.m. — 7:00 p.m. **EMPLOYMENT CENTER**

7:30 a.m. — 4:00 p.m. **JOINT MEETINGS REGISTRATION**

8:00 a.m. — noon **AMS-MAA-MER SPECIAL SESSION ON MATHEMATICS AND EDUCATION REFORM, III**

8:00 a.m. — noon **AMS-SIAM SPECIAL SESSION ON DYNAMICAL SYSTEMS AND OCEANOGRAPHY, III**

8:00 a.m. — noon **AMS-ASL SPECIAL SESSION ON INTERACTIONS BETWEEN LOGIC, GROUP THEORY AND COMPUTER SCIENCE, III**

8:00 a.m. — noon **AMS-ASL SPECIAL SESSION ON COMPUTABILITY AND MODELS, III**

AMS SPECIAL SESSIONS

8:00 a.m. — noon *Advances in Spherical Designs and Codes, III*
8:00 a.m. — noon *Algebras, Actions, and Algorithms, III*
8:00 a.m. — noon *Quantum Computation and Information: Mathematical Challenges, III*
8:00 a.m. — noon *Discrete Models, III*
8:00 a.m. — noon *Recent Advances in Riemannian and Lorentzian Geometries, III*
8:00 a.m. — noon *Primes and Knots, III*
8:00 a.m. — noon *Operator Algebras, Quantization, and Noncommutative Geometry: A Centennial Celebration in Honor of J. V. Neumann and M. H. Stone, III*
8:00 a.m. — noon *Special Functions and q-Series, III*
8:00 a.m. — noon *Inverse Problems and Sampling Theory in Signal Analysis, I*

8:00 a.m. — 10:00 a.m. **MAA MINICOURSE #4: PART A** *Visual linear algebra.*

8:00 a.m. — noon **SIAM MINISYMPOSIUM ON MATHEMATICAL PROBLEMS IN IMAGE ANALYSIS**

8:00 a.m. — noon **SIAM MINISYMPOSIUM ON DYNAMICAL SYSTEMS**

MAA CONTRIBUTED PAPER SESSIONS

8:00 a.m. — noon *Incorporating History of Mathematics in the Mathematics Classroom*
8:00 a.m. — noon *Helping Students Give Effective Mathematics Presentations*
8:00 a.m. — noon *Mathematics Experiences in Business, Industry, and Government*
8:00 a.m. — noon *Applications of Abstract Algebra*
8:00 a.m. — noon *General Contributed Paper Session, II*

8:00 a.m. — noon **AMS SESSIONS FOR CONTRIBUTED PAPERS**

8:30 a.m. — 10:00 a.m. **MAA PROJECT NEXT PANEL DISCUSSION** *Writing and publishing expository articles about mathematics.*

9:00 a.m. — 9:50 a.m. **AWM EMMY NOETHER LECTURE** *Five little crystals and how they grew.* **Jean E. Taylor**

9:00 a.m. — 11:00 a.m. **MAA MINICOURSE #10: PART A** *Turning a nonscience or developmental course into a capstone mathematical experience.*

9:00 a.m. — 11:00 a.m. **MAA MINICOURSE #15: PART A** *Real fun exploring basic mathematics.*

9:00 a.m. — 10:20 a.m. **MAA COMMITTEE ON MATHEMATICS AND THE ENVIRONMENT PANEL DISCUSSION** *Sample mathematics lessons integrating environmental issues.*

9:00 a.m. — 10:20 a.m. **MAA PANEL DISCUSSION** *NSF funding opportunities for learning and teaching in the mathematical sciences.*

9:00 a.m. — 10:20 a.m. **MAA COMMITTEE ON THE UNDERGRADUATE PROGRAM IN MATHEMATICS PANEL DISCUSSION** *Undergraduate Programs and Courses in the Mathematical Sciences: A CUPM curriculum guide.*

9:00 a.m. — 11:00 a.m. **MAA COMMITTEE ON THE UNDERGRADUATE PROGRAM IN MATHEMATICS POSTER SESSION** *First college-level mathematics courses.*

9:30 a.m. — 5:30 p.m. **EXHIBITS AND BOOK SALES**

10:00 a.m. — 11:00 a.m. **AMS SPECIAL PRESENTATION** *Who wants to be a mathematician?*

10:05 a.m. — 10:55 a.m. **MAA INVITED ADDRESS** *Some mathematical insights into car and bicycle racing.* **Richard A. Tapia**

10:15 a.m. — 12:15 p.m. **MAA MINICOURSE #5: PART A** *Using and adapting online materials.*

10:45 a.m. — 12:05 p.m. **MAA PROJECT NEXT-YOUNG MATHEMATICIANS NETWORK PANEL DISCUSSION** *Keeping the platters spinning: Effective time management.*

10:45 a.m. — 12:05 p.m. **MAA PANEL DISCUSSION** *How can placement testing be improved?*

10:45 a.m. — 12:05 p.m. **MAA COMMITTEE ON THE MATHEMATICAL EDUCATION OF TEACHERS PANEL DISCUSSION** *The nature of mathematics knowledge and knowledge of mathematics learning needed by secondary school mathematics teachers in an era of technology.*

11:10 a.m. — noon **SIAM INVITED ADDRESS** *Title to be announced* **John A. Burns**

1:00 p.m. — 2:00 p.m. **AMS COLLOQUIUM LECTURES:LECTURE II** *Spectra of hyperbolic surfaces and applications, II.* **Peter Sarnak,**

1:00 p.m. — 4:10 p.m. **AMS-MAA-MER SPECIAL SESSION ON MATHEMATICS AND EDUCATION REFORM, IV**

1:00 p.m. — 4:10 p.m. **AMS-SIAM SPECIAL SESSION ON DYNAMICAL SYSTEMS AND OCEANOGRAPHY, IV**

AMS SPECIAL SESSIONS

1:00 p.m. — 4:10 p.m. *Advances in Spherical Designs and Codes, IV*
1:00 p.m. — 4:10 p.m. *Highlights of Recent Workshops Held by the Board on Mathematical Sciences and their Applications*
1:00 p.m. — 4:10 p.m. *Quantum Computations and Information: Mathematical Challenges, IV*
1:00 p.m. — 4:10 p.m. *Computational Algebraic and Analytic Geometry for Low-Dimensional Varieties, I*
1:00 p.m. — 4:10 p.m. *Modular Forms, Elliptic Curves, and Related Topics, I*
1:00 p.m. — 4:10 p.m. *Discrete Models, IV*
1:00 p.m. — 4:10 p.m. *Banach Space Theory and Convex Geometry, I*
1:00 p.m. — 4:10 p.m. *Primes and Knots, IV,*
1:00 p.m. — 4:10 p.m. *Operator Algebras, Quantization, and Noncommutative Geometry: A Centennial Celebration in Honor of J. V. Neumann and M. H. Stone, IV*
1:00 p.m. — 4:10 p.m. *Nonstandard Models of Arithmetic and Set Theory, III*
1:00 p.m. — 4:10 p.m. *Inverse Problems and Sampling Theory in Signal Analysis, II*

1:00 p.m. — 3:00 p.m. **MAA MINICOURSE #11: PART A** *Symmetry for all.*

1:00 p.m. — 3:00 p.m. **MAA MINICOURSE #16: PART A** *Cwatsets: A research experience for undergraduates.*

1:00 p.m. — 3:00 p.m. **MAA MINICOURSE #6: PART A** *WeBWorK, an internet-based system for generating and delivering homework problems to students.*

1:00 p.m. — 4:10 p.m. **SIAM MINISYMPOSIUM ON THE STABILITY OF NONLINEAR DISPERSIVE WAVES, II**

MAA CONTRIBUTED PAPER SESSIONS

1:00 p.m. — 4:10 p.m. *Innovative Use of the World Wide Web in Teaching Mathematics, II*
1:00 p.m. — 4:10 p.m. *Classroom Demonstrations and Course Projects that Make a Difference, II*
1:00 p.m. — 4:10 p.m. *Initiating and Sustaining Undergraduate Research Projects and Programs*

1:00 p.m. — 4:10 p.m. **AMS SESSIONS FOR CONTRIBUTED PAPERS**

1:00 p.m. — 2:20 p.m. **MAA PANEL DISCUSSION** *Improving graduate education: Lessons learned on what works.*

1:00 p.m. — 2:20 p.m. **MAA PANEL DISCUSSION** *Successful strategies for implementing a Texas-style (modified Moore method) course.*

1:00 p.m. — 2:30 p.m. **MAA PROJECT NEXT PANEL DISCUSSION** *How to assess a mathematics program.*

1:00 p.m. — 2:20 p.m. **MAA PANEL DISCUSSION** *Integrating calculus, precalculus, and algebra.*

2:00 p.m. — 4:00 p.m. **MAA PROJECT NEXT-YOUNG MATHEMATICIANS NETWORK POSTER SESSION**

2:15 p.m. — 3:05 p.m. **AMS INVITED ADDRESS** *Dimer model and geometry.* **Andrei Okounkov**

2:45 p.m. — 4:05 p.m. **MAA-ASL PANEL DISCUSSION** *The role of logic in learning to write proofs.*

2:45 p.m. — 4:05 p.m. **MAA SESSION FOR CHAIRS**

3:00 p.m. — 4:20 p.m. **MAA HISTORY OF MATHEMATICS SIGMAA PANEL DISCUSSION** *The history of curricular change: Linear algebra 1950–2000.*

THURSDAY, JANUARY 16 (cont'd)

3:20 p.m. — 4:10 p.m. **AMS INVITED ADDRESS** *Title to be announced.* **Weinan E**

4:25 p.m. — 6:30 p.m. **AMS-MAA JOINT PRIZE SESSION AND RECEPTION**

5:45 p.m. — 7:00 p.m. **LEHIGH UNIVERSITY RECEPTION**

6:00 p.m. — 8:00 p.m. **SIGMAA ON STATISTICS EDUCATION** *2003 business meeting and lecture.*

6:00 p.m. — 8:00 p.m. **ASSOCIATION OF GAY, LESBIAN, BISEXUAL AND TRANSGENDERED MATHEMATICIANS RECEPTION**

6:00 p.m. — 7:00 p.m. **NEW MEXICO STATE UNIVERSITY MATHEMATICS ASSOCIATION RECEPTION**

6:30 p.m. — 9:30 p.m. **MER BANQUET**

7:30 p.m. — 9:00 p.m. **MAA SPECIAL PRESENTATION** *Eine Klein (Mathematische) Nachtmusik*

8:15 p.m. — 9:45 p.m. **KNITTING NETWORK**

FRIDAY, JANUARY 17

7:00 a.m. — 8:00 a.m. **PME AND MAA STUDENT CHAPTER ADVISORS' BREAKFAST**

7:00 a.m. — 7:30 p.m. **EMPLOYMENT CENTER**

7:30 a.m. — 4:00 p.m. **JOINT MEETINGS REGISTRATION**

8:00 a.m. — 10:55 a.m. **AMS-MAA-SIAM SPECIAL SESSION ON RESEARCH IN MATHEMATICS BY UNDERGRADUATES, I**

8:00 a.m. — 10:55 a.m. **AMS-MAA SPECIAL SESSION ON THE HISTORY OF MATHEMATICS, I**

AMS SPECIAL SESSIONS

8:00 a.m. — 10:55 a.m. *Stochastic and Multiscale Problems in the Sciences, I*
8:00 a.m. — 10:55 a.m. *Wavelets, Frames and Operator Theory, I*
8:00 a.m. — 10:55 a.m. *Discrete Dynamics and Difference Equations, I*
8:00 a.m. — 10:55 a.m. *Homotopy Theory, I*
8:00 a.m. — 10:55 a.m. *Algebraic Topology Based on Knots, I*
8:00 a.m. — 10:55 a.m. *Computational Algebraic and Analytic Geometry for Low-Dimensional Varieties, II*
8:00 a.m. — 10:55 a.m. *Modular Forms, Elliptic Curves, and Related Topics, II*
8:00 a.m. — 10:55 a.m. *Banach Space Theory and Convex Geometry, II*

MAA CONTRIBUTED PAPER SESSIONS

8:00 a.m. — 10:55 a.m. *SIGMAA on Research in Undergraduate Mathematics Education, I*
8:00 a.m. — 10:55 a.m. *Best Statistics Projects/Activities, I*
8:00 a.m. — 10:55 a.m. *Rethinking the Courses Below Calculus, I*
8:00 a.m. — 10:55 a.m. *Assessment of Student Learning: Models and Methodology, I*
8:00 a.m. — 10:55 a.m. *Strategies for Increasing the Diversity of Students in Mathematics*
8:00 a.m. — 10:55 a.m. *General Contributed Paper Session, III*

8:00 a.m. — 10:55 a.m. **AMS SESSIONS FOR CONTRIBUTED PAPERS**

8:00 a.m. — 5:00 p.m. **ASL INVITED ADDRESSES AND CONTRIBUTED PAPERS**

8:00 a.m. — 11:00 a.m. **PME COUNCIL**

9:00 a.m. — 9:50 a.m. **AMS INVITED ADDRESS** *Efficient algorithms for finding a random needle in a combinatorial haystack.* **Dana Randall**

9:00 a.m. — 11:00 a.m. **MAA MINICOURSE #12: PART B** *Getting students involved in undergraduate research.*

9:00 a.m. — 11:00 a.m. **MAA MINICOURSE #1: PART B** *Teaching introductory statistics using a workshop approach.*

9:00 a.m. — 11:00 a.m. **MAA MINICOURSE #7: PART B** *The mathematics of presidential and other elections.*

9:00 a.m. — 10:20 a.m. **MAA COMMITTEE ON THE PARTICIPATION OF WOMEN SPECIAL PRESENTATION** *Can this graduate student be saved?*

9:00 a.m. — 10:20 a.m. **MAA SPECIAL PRESENTATION** *Proposal writing workshop for grant applications to the NSF Division of Undergraduate Education.*

9:00 a.m. — 11:00 a.m. **MAA WOMEN AND MATHEMATICS NETWORK POSTER SESSION** *Special programs to encourage young women in mathematics.*

9:30 a.m. — 5:30 p.m. **EXHIBITS AND BOOK SALES**

10:05 a.m. — 10:55 a.m. **AMS INVITED ADDRESS** *Motivic homotopy theory.* **Vladimir Voevodsky**

11:10 a.m. — noon **AMS-MAA INVITED ADDRESS** *Some novel uses of lattice reduction.* **Noam D. Elkies**

1:00 p.m. — 2:00 p.m. **AMS COLLOQUIUM LECTURES:LECTURE III** *Spectra of hyperbolic surfaces and applications, III.* **Peter Sarnak**

1:00 p.m. — 1:50 p.m. **MAA STUDENT LECTURE** *What drives mathematics and where is mathematics driving innovation?* **Donna L. Beers**

1:00 p.m. — 5:00 p.m. **AMS-MAA-SIAM SPECIAL SESSION ON RESEARCH IN MATHEMATICS BY UNDERGRADUATES, II**

1:00 p.m. — 6:00 p.m. **AMS-MAA SPECIAL SESSION ON THE HISTORY OF MATHEMATICS, II**

AMS SPECIAL SESSIONS

1:00 p.m. — 6:00 p.m. *Stochastic and Multiscale Problems in the Sciences, II*
1:00 p.m. — 6:00 p.m. *Wavelets, Frames and Operator Theory, II*
1:00 p.m. — 6:00 p.m. *The Many Lives of Lattice Theory and the Theory of Ordered Sets, with Connections to Combinatorics, I*
1:00 p.m. — 6:00 p.m. *C*-Extensions and Classifications of C*-Algebras, I*
1:00 p.m. — 6:00 p.m. *Homotopy Theory, II*
1:00 p.m. — 6:00 p.m. *Algebraic Topology Based on Knots, II*
1:00 p.m. — 6:00 p.m. *Computational Algebraic and Analytic Geometry for Low-Dimensional Varieties, III*
1:00 p.m. — 6:00 p.m. *Banach Space Theory and Convex Geometry, III*
1:00 p.m. — 6:00 p.m. *Mathematical Current Events: Expository Reports,*
1:00 p.m. — 6:00 p.m. *Inverse Problems and Sampling Theory in Signal Analysis, III*

1:00 p.m. — 3:00 p.m. **MAA MINICOURSE #13: PART B** *Incorporating discrete mathematics in the preparation of K-12 mathematics teachers.*

1:00 p.m. — 3:00 p.m. **MAA MINICOURSE #2: PART B** *Java applets in teaching mathematics.*

1:00 p.m. — 3:00 p.m. **MAA MINICOURSE #8: PART B** *Mathematical finance.*

1:00 p.m. — 3:00 p.m. **MAA POSTER SESSION ON PROJECTS SUPPORTED BY THE NSF DIVISION OF UNDERGRADUATE EDUCATION**

MAA CONTRIBUTED PAPER SESSIONS

1:00 p.m. — 3:30 p.m. *Encouraging Underrepresented Groups of Students in Math Contests*
1:00 p.m. — 3:30 p.m. *Mathematical Modeling In and Out of the Classroom*
1:00 p.m. — 3:30 p.m. *Philosophy of Mathematics*
1:00 p.m. — 3:30 p.m. *Integrating Undergraduate Research with the Mathematics Curriculum*

1:00 p.m. — 5:00 p.m. **AMS SESSIONS FOR CONTRIBUTED PAPERS**

1:00 p.m. — 2:30 p.m. **MAA PROJECT NEXT PANEL DISCUSSION** *Undergraduate seminars in mathematics.*

1:00 p.m. — 2:20 p.m. **MAA COMMITTEE ON THE UNDERGRADUATE PROGRAM IN MATHEMATICS AND THE CUPM SUBCOMMITTEE ON MATHEMATICS ACROSS THE DISCIPLINES PANEL DISCUSSION** *Mathematics educators, computer science educators: Working together.*

2:15 p.m. — 4:00 p.m. **NAM GRANVILLE-BROWN-HAYNES SESSION OF PRESENTATIONS BY RECENT DOCTORAL RECIPIENTS IN THE MATHEMATICAL SCIENCES**

FRIDAY, JANUARY 17 (cont'd)

2:30 p.m. — 4:00 p.m. **PRESENTATIONS BY MAA TEACHING AWARD RECIPIENTS**

2:30 p.m. — 4:00 p.m. **AMS COMMITTEE ON SCIENCE POLICY PANEL DISCUSSION**

3:15 p.m. — 5:15 p.m. **MAA MINICOURSE #9: PART B** *Fair enough? Mathematics of equity.*

3:15 p.m. — 5:15 p.m. **MAA MINICOURSE #3: PART B** *Optimization of technology in the geometry classroom.*

4:00 p.m. — 6:30 p.m. **MAA COMMITTEE ON THE UNDERGRADUATE PROGRAM IN MATHEMATICS AND THE COMMITTEE ON STUDENT CHAPTERS UNDERGRADUATE POSTER SESSION**

4:00 p.m. — 6:00 p.m. **SIGMAA ON RESEARCH ON UNDERGRADUATE MATHEMATICS EDUCATION** *Business meeting and invited address by Rina Zazkis.*

4:20 p.m. — 5:10 p.m. **AMS COMMITTEE ON SCIENCE POLICY-MAA SCIENCE POLICY COMMITTEE GOVERNMENT SPEAKER** *Speaker and title to be announced*

4:30 p.m. — 6:30 p.m. **MAA MINICOURSE #14: PART B** *Teaching a course in the history of mathematics.*

5:00 p.m. — 7:00 p.m. **MAA INFORMAL SESSION ON ACTUARIAL EDUCATION**

5:00 p.m. — 6:00 p.m. **MAA BIG SIGMAA RECEPTION** *Welcome reception for mathematicians in business, industry, and government.*

5:15 p.m. — 7:15 p.m. **UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN DEPARTMENT OF MATHEMATICS RECEPTION**

5:30 p.m. — 9:30 p.m. **NAM RECEPTION, BANQUET, AND COX-TALBOT ADDRESS** *Speaker and title to be announced.*

6:00 p.m. — 7:00 p.m. ***MATHEMATICAL REVIEWS* RECEPTION**

8:30 p.m. — 10:30 p.m. **MAA PROJECT NEXT RECEPTION**

SATURDAY, JANUARY 18

7:30 a.m. — 2:30 p.m. **JOINT MEETINGS REGISTRATION**

8:00 a.m. — 10:55 a.m. **AMS-MAA-SIAM SPECIAL SESSION ON RESEARCH IN MATHEMATICS BY UNDERGRADUATES, III**

8:00 a.m. — 10:55 a.m. **AMS-MAA SPECIAL SESSION ON THE HISTORY OF MATHEMATICS, III**

AMS SPECIAL SESSIONS

8:00 a.m. — 10:55 a.m. *Stochastic and Multiscale Problems in the Sciences, III*
8:00 a.m. — 10:55 a.m. *Wavelets, Frames and Operator Theory, III*
8:00 a.m. — 10:55 a.m. *The Many Lives of Lattice Theory and the Theory of Ordered Sets, with Connections to Combinatorics, II*
8:00 a.m. — 10:55 a.m. *C*-Extensions and Classifications of C*-Algebras, II*
8:00 a.m. — 10:55 a.m. *Discrete Dynamics and Difference Equations, II*
8:00 a.m. — 10:55 a.m. *Homotopy Theory, III*
8:00 a.m. — 10:55 a.m. *Algebraic Topology Based on Knots, III*
8:00 a.m. — 10:55 a.m. *Modular Forms, Elliptic Curves, and Related Topics, III*

MAA CONTRIBUTED PAPER SESSIONS

8:00 a.m. — 10:55 a.m. *SIGMAA on Research in Undergraduate Mathematics Education, II*
8:00 a.m. — 10:55 a.m. *Best Statistics Projects/Activities, II*
8:00 a.m. — 10:55 a.m. *Rethinking the Courses Below Calculus, II*
8:00 a.m. — 10:55 a.m. *Assessment of Student Learning: Models and Methodology, II*
8:00 a.m. — 10:55 a.m. *General Contributed Paper Session, IV*

8:00 a.m. — 10:55 a.m. **AMS SESSIONS FOR CONTRIBUTED PAPERS**

8:00 a.m. — 5:00 p.m. **ASL INVITED ADDRESSES AND CONTRIBUTED PAPERS**

8:30 a.m. — 10:00 a.m. **AMS COMMITTEE ON EDUCATION PANEL DISCUSSION**

9:00 a.m. — 9:55 a.m. **MAA INVITED ADDRESS** *The ubiquity of elliptic curves.* **Joseph H. Silverman**

9:00 a.m. — 11:00 a.m. **MAA MINICOURSE #10: PART B** *Turning a nonscience or developmental course into a capstone mathematical experience.*

9:00 a.m. — 11:00 a.m. **MAA MINICOURSE #15: PART B** *Real fun exploring basic mathematics.*

9:00 a.m. — 11:00 a.m. **MAA MINICOURSE #4: PART B** *Visual linear algebra.*

9:00 a.m. — 10:20 a.m. **MAA COMMITTEE FOR CURRICULUM REFORM ACROSS THE FIRST TWO YEARS AND THE MAA TASK FORCE ON THE FIRST COLLEGE-LEVEL MATHEMATICS COURSE PANEL DISCUSSION** *Rethinking the courses below calculus.*

9:00 a.m. — 10:20 a.m. **MAA PANEL DISCUSSION** *The intersection of the life sciences, mathematical sciences, and computer science: Implications for the undergraduate curriculum.*

9:00 a.m. — 10:00 a.m. **NAM PANEL DISCUSSION**

9:00 a.m. — noon **EMPLOYMENT CENTER**

9:30 a.m. — noon **EXHIBITS AND BOOK SALES**

10:00 a.m. — 10:55 a.m. **NAM BUSINESS MEETING**

10:05 a.m. — 10:55 a.m. **MAA INVITED ADDRESS** *Is teaching about mathematics the same as teaching mathematics?* **Paul J. Sally Jr.**

11:10 a.m. — 11:40 a.m. **MAA BUSINESS MEETING**

11:45 a.m. — 12:15 p.m. **AMS BUSINESS MEETING**

1:00 p.m. — 1:50 p.m. **NAM CLAYTOR-WOODARD LECTURE** *Speaker and title to be announced.*

1:00 p.m. — 5:30 p.m. **AMS-MAA-SIAM SPECIAL SESSION ON RESEARCH IN MATHEMATICS BY UNDERGRADUATES, IV**

1:00 p.m. — 5:30 p.m. **AMS-MAA SPECIAL SESSION ON THE HISTORY OF MATHEMATICS, IV**

AMS SPECIAL SESSIONS

1:00 p.m. — 5:30 p.m. *Stochastic and Multiscale Problems in the Sciences, IV*
1:00 p.m. — 5:30 p.m. *Wavelets, Frames and Operator Theory, II*
1:00 p.m. — 5:30 p.m. *The Many Lives of Lattice Theory and the Theory of Ordered Sets, with Connections to Combinatorics, III*
1:00 p.m. — 5:30 p.m. *C*-Extensions and Classifications of C*-Algebras, III*
1:00 p.m. — 5:30 p.m. *Discrete Dynamics and Difference Equations, III*
1:00 p.m. — 5:30 p.m. *Homotopy Theory, II*
1:00 p.m. — 5:30 p.m. *Algebraic Topology Based on Knots, II*

1:00 p.m. — 3:00 p.m. **MAA MINICOURSE #11: PART B** *Symmetry for all.*

1:00 p.m. — 3:00 p.m. **MAA MINICOURSE #16: PART B** *Cwatsets: A research experience for undergraduates.*

1:00 p.m. — 3:00 p.m. **MAA MINICOURSE #5: PART B** *Using and adapting online materials.*

MAA CONTRIBUTED PAPER SESSIONS

1:00 p.m. — 5:30 p.m. *Courses and Projects Addressing the Shortage of K–12 Teachers*
1:00 p.m. — 5:30 p.m. *Creative Visualization Labs*
1:00 p.m. — 5:30 p.m. *Linking Mathematics with Other Disciplines*
1:00 p.m. — 5:30 p.m. *Mathematical Connections in Art, Music, and Science*
1:00 p.m. — 5:30 p.m. *Computation Mathematics in Linear Algebra and Differential Equations*

1:00 p.m. — 5:00 p.m. **AMS SESSIONS FOR CONTRIBUTED PAPERS**

1:00 p.m. — 2:20 p.m. **MAA INTERACTIVE DISCUSSION** *Forging relationships between professional organizations to improve mathematics learning from kindergarten through graduate school.*

1:00 p.m. — 2:20 p.m. **MAA COMMITTEE ON THE UNDERGRADUATE PROGRAM IN MATHEMATICS OPEN DISCUSSION** *First college-level mathematics courses.*

2:45 p.m. — 4:05 p.m. **SIGMAA ON STATISTICS EDUCATION PANEL DISCUSSION** *The state of statistics education.*

2:45 p.m. — 4:05 p.m. **SUMMA SPECIAL PRESENTATION**

3:15 p.m. — 5:15 p.m. **MAA MINICOURSE #6: PART B** *WeBWorK, an internet-based system for generating and delivering homework problems to students.*

Mathematical Sciences Employment Center

Baltimore Convention Center, Baltimore, Maryland
January 15, 16, 17, and 18, 2003

2003 Employment Center Schedule

Wednesday, January 15

7:30 a.m.–4:00 p.m. Registration and materials pick-up.

9:00 a.m.–9:30 a.m. Short (optional) orientation session.

9:30–4:00 p.m. Submission of Scheduled Employment Register interview request forms for both Thursday and Friday interviews. No request forms can be accepted after 4:00 p.m. Wednesday.

9:30 a.m.–6 p.m. Interview Center open.

No Scheduled Employment Register interviews are held on Wednesday.

Thursday, January 16

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 17

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 18

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). Use of the center overall by employers has gone up in recent years. At the 2002 Employment Center, 370 candidates and 151 employers participated, giving an overall applicant-to-employer ratio of 2.4:1 (compared with 341 applicants and 139 employers in 2001, a ratio of 2.5:1). Each applicant ends up with roughly 5 to 15 interviews of various types. Those with the most interviews are those requested most by employers, usually as a result of a careful application process during the months before the Employment Center takes place.

At the January 2003 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, 2002) 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 15, 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. 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 15, 2003, 9:30 a.m.–6:00 p.m.
Thursday, January 16, 2003, 8:00 a.m.–7:30 p.m.
Friday, January 17, 2003, 8:00 a.m.–7:30 p.m.
Saturday, January 18, 2003, 9:00 a.m.–noon

The fee for use of this area is the same as the normal employer fee, $220. 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 Baltimore, leave messages for Employment Center applicants in the Employment Message Center. Paper forms will be provided to help speed the invitation process. Each employer will be provided with a box in the Message Center where applicants can leave items.

Employers should have at most two interviewers per table at any time due to space limitations. There will be no outlets or electricity available at the interviewing tables.

About the *Winter List of Applicants*

This booklet contains hundreds of résumés of applicants registered by October 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 after September 2, 2002, at `www.ams.org/amsmtgs/2074_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 19 for the normal fees or on site in Baltimore at the on-site rates. Call 800-321-4267, ext. 4105, with any questions or deadline problems.

Any number of interviewers can sit at a table together or in shifts (however, the limit is two at one time), and 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 $220 for the first table and $65 for each additional table. On-site registration fees (any registrations after 12/19/02) are $300 for the first table and $100 for each additional table. Employers must also register for the Joint Meetings and pay the appropriate Joint Meetings fee.

Employers: Registration on Site

Employers who do not register for the Joint Mathematics Meetings and the Employment Center by December 19 may register on site in Baltimore 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 15, 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 2003 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 2003 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.

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.

Interviews

Applicants should understand that the Employment Center provides no guarantees of interviews or jobs. It is simply a convenient meeting place for candidates and employers who are attending the Joint Meetings. Those who have not yet begun their job search efforts may go unnoticed at the Employment Center (although applicants will likely receive a minimum of between one and three interviews in the scheduled program). Attention generally goes to candidates who already have applied for open positions or to those who are well suited for teaching positions at liberal arts colleges.

Data from recent Employment Centers show that women represent about half of the most sought-after applicants, although they make up less than half of the total Employment Center applicant pool. Those without permanent authorization to work in the United States will find themselves far less requested than U.S. citizens or permanent residents. Newer Ph.D.'s tend to be invited for more interviews than those who have been working longer. Most jobs listed require a doctorate.

Preparations

Candidates just beginning a job search should realize that employers have no method to judge their credentials other than the brief résumé form, and they should make an effort to make it distinct and interesting.

Applicants who register in advance will receive the *Winter List of Employers* in mid-December. If time permits, they should apply for suitable open positions they notice in the *Winter List of Employers* after they receive it. Applicants are advised to bring a number of copies of their vita or résumé so that they may leave them with prospective employers. It is a good idea in the fall for applicants to alert any employer to whom applications are made that they plan to be present at the Joint Meetings. Also, they should bring enough materials with them to accompany requests for interviews they may want to leave in the Message Center boxes of the Interview Center employers.

Applicants are also encouraged to leave some extra copies of their résumés in their own message folders so that interested employers may find them there. Photocopying costs at a convention are high, so applicants should come prepared with a reasonably large number of copies. A brightly colored form in each folder gives applicants an opportunity to present 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.

Applicants: Register Early

Applicants need to complete the following steps by the advance deadline of October 25, 2002.

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 after September 2, 2002, at www.ams.org/amsmtgs/2074_intro.html). You cannot participate in the Employment Center unless you are a meetings participant. Mark one of the two "Employment Center Applicant Fee" boxes on the Joint Meetings registration form and make payments. The fee in advance for applicants is $40; "Message Center and *Winter List* ONLY" registration is $20.

2. Send form

Submit the Applicant Form (a brief résumé form) electronically at `www.ams.org/emp-reg/`, or use the print version in the back of this issue.

After Registration

Submission of the Applicant Form electronically will result in an 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 19. 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 19 must register on site at the Joint Meetings registration desk and pay higher fees ($75 Employment Center fee; however, the "Message Center and *Winter List* ONLY" fee is always just $20).

It is worthwhile to submit the applicant form even if you miss the October 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 15, 2003, 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. This year registering on site for a mailbox only is possible, at the $20 rate, on Wednesday and Thursday.

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, 2002**, 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 CENTER
JANUARY 15–18, 2003
BALTIMORE, MARYLAND

1. Forms should be accessed and submitted electronically if possible. The URL for accessing Employment Center information and forms is `http://www.ams.org/emp-reg/`.
2. Paper or electronic forms are due, along with payment and your Advance Registration/ Housing Form, by October 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 ☐ Possible ☐ Impossible

Tenure-track position ☐ Yes ☐ No

Teaching hours per week _____

Degree preferred _____ Degree accepted _____

Duties _____

_____

_____

Experience preferred _____

_____

_____

Significant other requirements, needs, or restrictions which will influence hiring decisions _____

_____

_____

This position will be subject to a security clearance which will require U.S. citizenship: ☐ Yes ☐ No

THE EMPLOYER PLANS TO USE THE FOLLOWING SERVICES (check all that apply):

☐ One or more computer-scheduled Interview Tables

☐ One or more self-scheduled Interview Tables

☐ Placing this form for information only (not using a table)

APPLICANT RÉSUMÉ FORM

MATHEMATICAL SCIENCES EMPLOYMENT CENTER
JANUARY 15–18, 2003
BALTIMORE, MARYLAND

1. Forms should be accessed and submitted electronically if possible. The URL for accessing Employment Center information and forms is `http://www.ams.org/emp-reg/`.
2. Paper or electronic forms are due, along with payment and your Advance Registration/ Housing Form, by October 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

Baltimore Joint Meetings Advance Registration/Housing Form

Name _____
(please write name as you would like it to appear on your badge)

Mailing Address _____

_____

Telephone _____ Fax _____

Email Address _____
(Acknowledgment of this registration will be sent to the email address given here, unless you check this box: *Send by U.S. Mail* ☐)

Badge Information: Affiliation for badge _____

Nonmathematician guest badge name _____
(please note charge below)

Membership
✓ all that apply

AMS	☐
ASA	☐
ASL	☐
AWM	☐
CMS	☐
MAA	☐
NAM	☐
SIAM	☐
YMN	☐

Joint Mathematics Meetings
Baltimore • January 15–18, 2003

☐ **I DO NOT want my program and badge to be mailed to me on 12/13/02.**

Registration Fees

Joint Meetings	**by Dec 19**	**at mtg**	**Subtotal**
☐ Member AMS, ASL, CMS, MAA, SIAM	$190	$247	
☐ Nonmember	$295	$383	
☐ Graduate Student	$ 35	$ 45	
☐ Undergraduate Student	$ 20	$ 26	
☐ High School Student	$ 2	$ 5	
☐ Unemployed	$ 35	$ 45	
☐ Temporarily Employed	$150	$172	
☐ Developing Countries Special Rate	$ 35	$ 45	
☐ Emeritus Member of AMS or MAA	$ 35	$ 45	
☐ High School Teacher	$ 35	$ 45	
☐ Librarian	$ 35	$ 45	
☐ Nonmathematician Guest	$ 5	$ 5	

$ _____

AMS Short Course: *Public Key Cryptography (1/13–1/14)*

☐ Member of AMS or MAA	$ 80	$100	
☐ Nonmember	$110	$130	
☐ Student, Unemployed, Emeritus	$ 35	$ 50	

$ _____

MAA Short Course:
Mathematics in the Ancient World (1/13–1/14)

☐ Member of MAA or AMS	$125	$140	
☐ Nonmember	$175	$190	
☐ Student, Unemployed, Emeritus	$ 50	$ 60	

$ _____

MAA Minicourses (see listing in text)
I would like to attend: ☐ One Minicourse ☐ Two Minicourses
Please enroll me in MAA Minicourse(s) #_____ and/or #_____
In order of preference, my alternatives are: #_____ and/or #_____
(no onsite registration for Minicourses 1 & 2)
Prices: $90 for Minicourses #1–6 and $60 for Minicourses #7–16

$ _____

Employment Center
Applicant résumé forms and employer job listing forms will be on the AMS website and in *Notices* in September and October.

Employer—First Table ☐ Regular ☐ Self-scheduled	$220	$300
Employer— Each Additional Table ☐ Regular ☐ Self-scheduled	$ 65	$100
☐ Employer—Posting Only	$ 50	N/A
☐ Applicant (all services)	$ 40	$ 75
☐ Applicant (Winter List & Message Ctr only)	$ 20	$ 20

$ _____

Events with Tickets

MER Banquet (1/16)	$42	#____Regular	#____Veg
NAM Banquet (1/17)	$45	#____Regular	#____Veg
AMS Banquet (1/18)	$45	#____Regular	#____Veg

$ _____

Other Events (no charge)
☐ Graduate Student Reception (1/15)

Total for Registrations and Events $ _____

Payment

Registration & Event Total (total from column on left) $ _____

Hotel Deposit (only if paying by check) $ _____

Total Amount To Be Paid **$** _____

(Note: A $5 processing fee will be charged for each returned check or invalid credit card. Debit cards are not accepted.)

Method of Payment

☐ Check. Make checks payable to the AMS. Checks drawn on foreign banks must be in equivalent foreign currency at current exchange rates.

☐ Credit Card. VISA, MasterCard, AMEX, Discover (no others accepted)

Card number: _____

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☐ Purchase order #_____ (please enclose copy)

Registration for the Joint Meetings is not required for the Short Courses, but it is required for the Minicourses and the Employment Center.

Other Information

Mathematical Reviews field of interest # _____

How did you hear about this meeting? Check one:
☐ Colleague(s) ☐ *Notices* ☐ *Focus* ☐ Internet

☐ I am a mathematics department chair.

☐ **Please do not include my name on any promotional mailing list.**

☐ Please ✓ this box if you have a disability requiring special services.

Mail to:

Mathematics Meetings Service Bureau (MMSB)
P. O. Box 6887
Providence, RI 02940-6887
Fax: 401-455-4004
Questions/changes call: 401-455-4143 or 1-800-321-4267 x4143; mmsb@ams.org

Deadlines

For résumés/job descriptions printed in the *Winter Lists*, return this form by:	**Oct. 25, 2002**
To be eligible for the room lottery:	**Nov. 1, 2002**
For housing reservations, badges/programs mailed:	**Nov. 15, 2002**
For housing changes/cancellations through MMSB:	**Dec. 13, 2002**
For advance registration for the Joint Meetings, Employment Center, Short Courses, MAA Minicourses, & Tickets:	**Dec. 19, 2002**
For 50% refund on banquets, cancel by:	**Dec. 30, 2002***
For 50% refund on advance registration, Minicourses & Short Courses, cancel by:	**Jan. 10, 2003***

***no refunds after this date**

Baltimore Joint Meetings Hotel Reservations

To ensure accurate assignments, please rank hotels in order of preference by writing 1, 2, 3, etc., in the column on the left and by circling the requested room type and rate. If the rate or the hotel requested is no longer available, you will be assigned a room at a ranked or unranked hotel at a comparable rate. Participants are urged to call the hotels directly for details on suite configurations, sizes, and availability; however, suite reservations can be made only through the MMSB to receive the convention rates listed. Reservations at the following hotels must be made through the MMSB to receive the convention rates listed. Reservations made directly with the hotels may be changed to a higher rate. All rates are subject to a 12.5% sales tax. **Guarantee requirements: First night deposit by check (add to payment on reverse of form) or a credit card guarantee.**

☐ Deposit enclosed ☐ Hold with my credit card Card Number _____ Exp. Date _____ Signature _____

Date and Time of Arrival _____ **Date and Time of Departure** _____

Name of Other Room Occupant _____ **Arrival Date** _____ **Departure Date** _____ **Child (give age(s)** _____

Order of choice	Hotel	Single	Double 1 bed	Double 2 beds	Triple 2 beds	Triple 2 beds w/cot	Quad 2 beds	Quad 2 beds w/cot	Suites Starting rates
	Hyatt Regency Baltimore on the Inner Harbor (hqtrs)	$124	$124	$124	$164	$164	$174	$174	$450
	Student	$114	$114	$114	$154	$154	$164	$164	N/A
	Renaissance Harborplace Hotel	$124	$124	$124	$147	$147	$147	$147	$328
	Student	$113	$113	$113	$136	$136	$136	$136	N/A
	Baltimore Marriott Inner Harbor	$124	$134	$134	$154	$154	$174	$174	$189
	Student	$99	$105	$105	$125	$125	$145	$145	N/A
	Brookshire Suites (all suites-rates include breakfast)	$129	$129	$129	$144	$169	$159	$184	$129
	Sheraton Inner Harbor	$122	$122	$122	$142	$162	$162	$182	$450
	Student	$110	$110	$110	$130	$150	$150	$170	N/A
	Baltimore Marriott Waterfront	$135	$135	$135	$155	$155	$175	$175	$410
	Holiday Inn Inner Harbor	$115	$123	$123	$123	$138	$123	$138	N/A
	Student	$89	$89	$89	$89	$104	$89	$104	N/A
	Wyndham Baltimore Inner Harbor	$114	$124	$124	$144	$156	$164	$176	$214
	Student	$91	$101	$101	$121	$133	$141	$153	N/A
	Radisson Plaza Lord Baltimore	$113	$113	$113	$133	$153	$153	$173	$175
	Student	$90	$90	$90	$110	$130	$130	$150	N/A
	Days Inn Inner Harbor	$109	$119	$119	$119	$129	$119	$129	N/A
	Student	$87	$95	$95	$95	$105	$95	$105	N/A

Special Housing Requests:

☐ I have disabilities as defined by the ADA that require a sleeping room that is accessible to the physically challenged. My needs are: _____

☐ Other requests: _____

☐ I am a member of a hotel frequent-travel club and would like to receive appropriate credit. The hotel chain and card number are: _____

If you are not making a reservation, please check off one of the following:

☐ I plan to make a reservation at a later date.

☐ I will be making my own reservations at a hotel not listed. Name of hotel: _____

☐ I live in the area or will be staying privately with family or friends.

☐ I plan to share a room with _____, who is making the reservations.

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.

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The Meetings and Conferences section of the *Notices* gives information on all AMS meetings and conferences approved by press time for this issue. Please refer to the page numbers cited in the table of contents on this page for more detailed information on each event. Invited Speakers and Special Sessions are listed as soon as they are approved by the cognizant program committee; the codes listed are needed for electronic abstract submission. For some meetings the list may be incomplete. **Information in this issue may be dated. Up-to-date meeting and conference information** at www.ams.org/meetings/.

Meetings:

Important Information regarding AMS Meetings

Potential organizers, speakers, and hosts should refer to page 175 in the January 2002 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 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 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.

Conferences: (See http://www.ams.org/meetings/ for the most up-to-date information on these conferences.)

February 13-18, 2003: AAAS Annual Meeting, Denver, Colorado.

June 8 - July 24, 2003: Joint Summer Research Conferences in the Mathematical Sciences, Snowbird, Utah.

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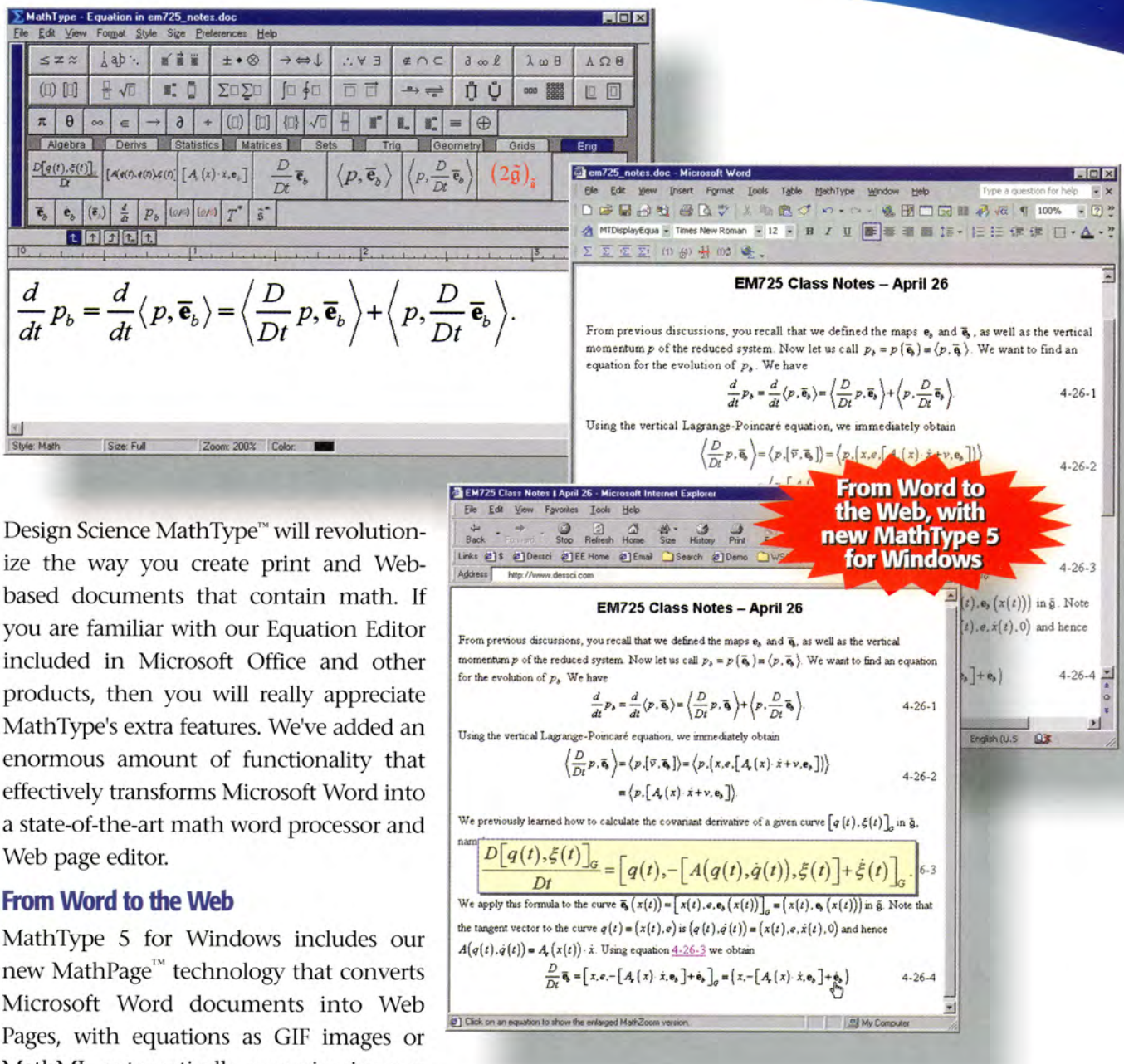

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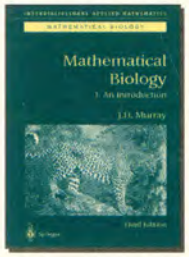

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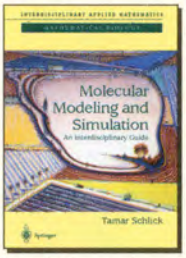

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