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From the AMS Secretary

Special Section—2006 American Mathematical Society Election

Opinions expressed in signed Notices articles are those of the authors and do not necessarily reflect opinions of the editors or policies of the American Mathematical Society.
Please Vote

Soon you will be receiving (or have received) your ballot for the current AMS elections. The Web-based instructions or your paper ballot will contain much information concerning the candidates for elected positions and also an additional issue, namely the implementation of an AMS Fellows Program. Each year all AMS members have the chance to vote. Only a relatively small percentage choose to do so—this means your vote really counts! Some years ago the AMS did not have contested elections so the concept of a “vote” was vacuous. In my opinion it is desirable that the members have a choice and can affect the governance of the Society by registering their opinions through this choice.

The issue of an AMS Fellows Program has received much earnest discussion in the past years in various AMS committees. There are many serious and legitimate arguments for and against inaugurating such a program. Some of these arguments are set out in the well-reasoned essays by Ronald Stern and David Eisenbud in the August issue of the Notices. I was the chair of the committee appointed by the current AMS president, James Arthur, to formulate a specific mechanism by which an AMS Fellows Program could be initiated and function. Our goal was to construct a program that was similar to programs already functioning in other scientific societies but modified a little to reflect the democratic spirit of the AMS. We also aimed to produce a practical mechanism by which the program could be initiated and a framework for a steady state that would be fair but not too burdensome on the community. It was envisioned that in its steady state approximately 1,500 members of the AMS would be recognized by the title “AMS Fellow”. This specific proposal is now presented to you for your approval or disapproval.

If at least 2/3 of the people who vote are in favor of the proposal, the AMS will start the process of creating an AMS Society of Fellows. Only time and experience will confirm the arguments for or against joining many other scientific societies in the U.S. and honoring a group of our members by electing them “Fellow of the American Mathematical Society”. The proposal allows for a fair amount of oversight and guidance by the AMS Council and president, hence over time any Fellowship would evolve to meet the perceived interests and goals of the Society. However now is possibly the only time each member has the chance to express his/her opinion on this matter. After much discussion in committees it is my opinion that the matter should now go to the members for their vote—and I cannot guess what the vote will be. I argued hard in the AMS Council that ultimately the members should be allowed to vote. I hope very much that you will read some of the background material about the Fellows Program Proposal and determine the outcome through your vote.

—Susan Friedlander
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Editor’s Note:
The Notices is supported by dues paid by the members of the American Mathematical Society, who have provided access for all mathematicians throughout the world, the headline on our webpage announces. Our typical features, communications, and commentary, are generally intended for member and nonmember mathematicians alike, with member-specific information appearing in our Inside the AMS department and our From the AMS Secretary section. Susan Friedlander’s Opinion column above is an exception. The Notices has no editorial position on the issue of AMS Fellows, of course, other than sharing Friedlander’s hope that members consider it and exercise their right to vote. To help that choice be an informed one, the August Notices carried essays and information on the Fellows proposal assembled by Friedlander and AMS President James Arthur in place of a feature article. As we return this month to our regular format, I’d like to remind all our readers that not only do AMS members support the Notices as a service to the worldwide mathematical community, but that Notices wants to serve the membership as well.

—Andy Magid
Letters to the Editor

Printing Duesberg’s Statement on AIDS Bad Decision

It seems to us a bad decision of the Notices to print (in the framework of the Serge Lang memorial article, May 2006 issue, p. 553) a full-page statement by Peter Duesberg, who instead of talking about Serge Lang uses the opportunity to repeat his absurd, scandalous, and dangerous theory that “AIDS is not caused by HIV, but is a lifestyle epidemic.” After all, this is not a mathematical theory, but just an example of the strange debates and fights Serge Lang engaged in. On the other hand, it is a prime example of an extremely dangerous “scientific” theory—which in the hands of politicians kills many people, for example in Africa.

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(Received May 26, 2006)

Idealism in Mathematics and Business

Concerning “Business Week Looks at Mathematics” (June/July 2006 Notices):

I have an unusual perspective, living and working in the world of a commercial weekly magazine but also being deeply connected to the mathematics community. The point made in the Notices piece is fundamentally correct, but also to some extent beside the point. The thrust of Steve Baker’s story in Business Week was that the demand for mathematics in business is way up and has spread far beyond quantitative investment analysis and bioinformatics. I wish there were a way to describe meaningfully what these mathematicians actually do in these jobs in ways that are consistent with the magazine constraints of space and of not wanting to make our readers have to think very hard. I suggested some examples to Steve, but it is really, really difficult to try to explain things like data mining through lattice reduction.

Mathematicians who choose to go into commerce make a Faustian bargain. They can make a lot of money, but that pursuit of truth and beauty is going to suffer in the process. (Of course, the same has been true for years for mathematicians who work for the NSA, without the lot of money part.)

On the whole, though, I think the increase in employment opportunities for mathematicians in industry is a wonderful thing for the profession. Any overall improvement in the employment picture will help attract good minds to mathematics and will help increase the funding for research of all sorts. And you may only have to rent your soul, not sell it. Recently I spent time at an American Regions Bank competition for high school students, held at Penn State. ARML has gotten a great deal of assistance from the Wall Street quant firm of D.E. Shaw & Co. and its current and former employees. I doubt that there’s a lot of room for idealism at Shaw or other firms of its ilk, but at least some of the mathematicians who work or have worked there managed to keep some of theirs and are helping the next generation find truth and beauty in mathematics.

—Steve Wildstrom
Technology & You columnist
Business Week
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(Received June 15, 2006)

Names, Second Names, Family Names, Surnames

After I completed my online registration for the International Congress of Mathematicians, 2006, Madrid, a friend of mine told me that he was having difficulty in registering because of a technical problem. The form requires First Name and Surname as mandatory, and my friend has only one name! If he uses this as the first name, the field for surname remains empty, and vice versa. Every time he tries to fill in the form he gets the message: “Some data is missing, please go back and check the information.” Now, it is not uncommon to have a name consisting of only one part, in many parts of the world including Pakistan and India. To give just two examples, Riazuddin and Fayyazuddin are two very good theoretical physicists of Pakistan, and these are their whole and complete names. (Perhaps a little explanation is due here that these names appear to have only one part as written in English, but in Arabic they have two parts.) ICM is not the only place where one faces this problem; it happens in numerous registration forms and on many other occasions, where people from the East encounter the West.

A related issue is that of second names, family names, and surnames. While in the West they all appear as the last name, there is no such practice in many other regions. In Pakistan and India, for example, the family name may appear as the first name or the middle name or the last name, or it may not appear at all, and even when it is a part of the name it does not signify what it does in the West. In China the family name is usually written first and the given name(s) second. In these three countries, the last names sometimes come from the name of the town or city in which one lived or to which the family belonged. (In the ancient Roman Empire there was also a practice of deriving the family names from place names or from different crafts.)

A person from this part of the world faced this problem while he was going through health insurance procedures for his wife and children in a western country. The company refused to consider them as a family because their last names did not match. The officials, in fact, put a last name at the end of all of them to settle the issue! In situations like these the people in the West do not accept this as cultural diversity. They usually think that these people are a little ignorant, ill-mannered, and backward (perhaps not “terrorists”), and that they don’t know how to name their children. Unfortunately, this urge for complete conformity and compliance on cultural issues is being propagated by some countries at the highest level and by their media. Relevant for the issue is the statement in Caesar and Cleopatra by George Bernard Shaw: Forgive him, for he believes that the customs of his tribe are the laws of nature.

Mathematicians should have a trivial solution to this issue: call the names as the first, middle, and last names, and require only one of them to be mandatory.

—Khalid Saifullah
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(Received June 7, 2006)
Math in Moscow
Scholarships

The AMS invites undergraduate mathematics and computer science majors in the U.S. to apply for a special scholarship to attend a Math in Moscow semester at the Independent University of Moscow. Funding is provided by the National Science Foundation and is administered by the AMS.

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The application deadline for spring semesters is September 30, and for fall semesters is April 15.

For more information, see www.ams.org/employment/mimoscov.html.

Contact: Membership and Programs Department, American Mathematical Society, 201 Charles Street, Providence, RI 02904-2294, USA; telephone: 800-321-4267, ext. 4170; email: student-serv@ams.org.
Notes on the Deuring-Heilbronn Phenomenon

Jeffrey Stopple

Introduction

Analytic number theory studies $L$-functions, generalizations of the Riemann zeta function $\zeta(s)$. It can be difficult to see why this is number theory. In fact, the Class Number Formula (6) of Dirichlet gives the number $h(-d)$ of classes of binary quadratic forms of discriminant $-d$ as the value of such an $L$-function at $s = 1$. The location of the zeros is important: since the functions are continuous, the value is influenced by any zero of the function near $s = 1$. Such a zero would of course contradict the Generalized Riemann Hypothesis (GRH).

The Deuring-Heilbronn phenomenon says that such a counterexample to the GRH for one $L$-function would influence the horizontal and vertical distribution of the zeros of other $L$-functions. They would be forced to lie on the critical line $s = 1/2 + it$, at least up to some height. This is the "Local GRH". More surprisingly, the imaginary parts $t$ would be restricted to a set which is very nearly periodic. This is a very beautiful result indeed. Standard analogies interpret the imaginary parts $t$ as frequencies; the Deuring-Heilbronn phenomenon means these frequencies are in harmony.

We give an overview of the proof, first in the case $h(-d) = 1$ before treating $h(-d) > 1$. Even though the class number 1 problem is now solved, the essential features of the general problem are visible there. We also look at some examples which indicate that even in the absence of a contradiction to GRH, "near contradictions" still cause a tendency towards such a phenomenon.

The author would like to thank David Farmer for suggesting the calculations in the last section.

Notations

The complex variable $s$ is written $\sigma + it$. We write

$$f(x) \ll h(x) \quad \text{resp.} \quad f(x) = g(x) + O(h(x))$$

if there is some constant $C$ so that

$$|f(x)| \leq C h(x) \quad \text{resp.} \quad f(x) - g(x) \ll h(x)$$

usually for $x$ approaching some limiting value, which may not be explicitly stated. We write

$$f(x) \sim h(x) \quad \text{if} \quad f(x)/h(x) \to 1.$$

Binary Quadratic Forms

Algebraic number theory has its roots in the beautiful theorem of Fermat that an odd prime $p$ is the sum of two squares,

$$p = x^2 + y^2 \iff p \equiv 1 \pmod{4}.$$  

Euler, Lagrange, and Gauss developed many generalizations of this; for example, $p \neq 7$ can be written as

$$p = x^2 + xy + 2y^2 \iff p \equiv 1, 2, 4 \pmod{7}.$$  

The necessity of the congruence is the easy half, as it is in Fermat's theorem ($4p = (2x + y)^2 + 7y^2$, now reduce modulo 7). In general one studies positive definite binary quadratic forms, functions

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\[ Q(x, y) = ax^2 + bxy + cy^2, \]

with \(-d = b^2 - 4ac < 0\)

the discriminant. (We build the minus sign into the notation to simplify later when we want square root or logarithm of the absolute value.)

Two forms \(Q\) and \(Q'\) are said to be *equivalent* if there is an integer matrix \(M\) with determinant \(1\) such that

\[ Q'(x, y) = Q((x, y)M). \]

Such forms obviously have the same range as functions, i.e., represent the same integers. A calculation shows that equivalent forms have the same discriminant, and it is not difficult to show the number \(h(-d)\) is finite. In fact, a very deep result of Gauss is that they form a finite abelian group \(C(-d)\).

Below we will need the Kronecker symbol \(\chi_{-d}\) attached to a discriminant \(-d\). In the simplest case that \(d\) is an odd prime, \(\chi_{-d}\) reduces to the Legendre symbol

\[ \chi_{-d}(n) = \begin{cases} 0, & \text{if } d \mid n \\ 1, & \text{if } n \equiv a \text{ square} \\ -1, & \text{otherwise.} \end{cases} \]

Of course, this definition works just fine for positive discriminants as well. For odd composite discriminants we can define a Jacobi symbol via multiplicativity. This no longer detects squares, for example,

\[ \chi_{-15}(2) = \chi_{-3}(2)\chi_{5}(2) = -1 \cdot -1 = 1, \]

but 2 is not a square modulo 15. It does however, detect whether a prime is represented by some form of discriminant \(-d\), just as in the example with discriminant \(-7\) above. For primes \(p\) with \(\chi_{-15}(p) = 1\) then

\[ p = x^2 + xy + 4y^2 \quad \implies \quad p = 1, 4 \text{ mod } 15 \]

\[ p = 2x^2 + xy + 2y^2 \quad \implies \quad p = 2, 8 \text{ mod } 15. \]

Primes with \(\chi_{-15}(p) = -1\) are not represented by any form of discriminant \(-15\). The natural (slightly complicated) extension of this function to even discriminants as well is called the Kronecker symbol.

A weaker relation than equivalence is also useful: two forms are in the same *genus* if they represent the same congruence classes in the multiplicative group modulo \(d\). For example,

\[ x^2 + 14y^2 \quad \text{and} \quad 2x^2 + 7y^2 \]

both have discriminant \(-56\); they must be in different classes since the first represents 1 while the second does not. However, they are in the same genus since

\[ 2 \cdot 5^2 + 7 \cdot 1^2 = 57 = 1 \text{ mod } 56. \]

In this case \(h(-56) = 4\); the other two classes of forms are

\[ 3x^2 \pm 2xy + 5y^2. \]

Both these forms represent 3, while neither of the first two forms can represent an integer congruent to 3 mod 56 (reduce modulo 7). So there are two genera each consisting of two classes. For more details on the algebraic theory of binary quadratic forms, see [2].

To bring analysis to the study of binary quadratic forms, we introduce the classical Riemann zeta function and the Dirichlet \(L\)-function

\[ \zeta(s) = \sum_{n=1}^{\infty} \frac{1}{n^s} = \prod_p (1 - p^{-s})^{-1} \]

\[ L(s, \chi_{-d}) = \sum_{n=1}^{\infty} \frac{\chi_{-d}(n)}{n^s} = \prod_p (1 - \chi_{-d}(p)p^{-s})^{-1}. \]

We will also want the Epstein zeta function

\[ \zeta_Q(s) = \frac{1}{2} \sum_{(x,y)} Q(x, y)^{-s} \]

where the ' in the sum means omit the term \((0,0)\). (The factor of \(1/2\) in the definition accounts for the automorphism \((x, y) \to (-x, -y)\). This is in fact the only automorphism, if we assume \(d > 4\), which we do from now on. Forms with positive discriminant have infinitely many automorphisms.) For another way of writing this, we group together all the terms in which the form takes on the same value, and count them with the representation numbers \(r_Q(n)\):

\[ r_Q(n) = \frac{1}{2} \cdot \# \{ (x, y) \mid Q(x, y) = n \}. \]

This gives

\[ \zeta_Q(s) = \sum_{n=1}^{\infty} r_Q(n)n^{-s}. \]

**Asymptotic Behavior**

We begin by generalizing the proof that

\[ \zeta(s) = \frac{1}{s-1} + O(1). \]

The idea is that the sum \(\sum_{n \leq B} r_Q(n)\) of the representation numbers is one half the number of lattice points inside the ellipse \(Q(x, y) = B\), which, as \(B \to \infty\), is approximately the area. The change of variables that converts the ellipse to a circle has Jacobian \(2/\sqrt{d}\), independent of \(Q\), which gives

\[ \sum_{n \leq B} r_Q(n) \sim \frac{\pi B}{\sqrt{d}}. \]
In fact one can show the error is $O(B^{1/2})$. From this and a calculus identity for $n^{-s}$, we can compute a residue:

$$\zeta_Q(s) = \sum_{n=1}^{\infty} r_Q(n) s \int_{n=\infty}^{\infty} x^{-s-1} \, dx$$

$$= s \int_{1}^{\infty} \left( \sum_{n=1}^{\infty} r_Q(n) \right) x^{-s-1} \, dx$$

$$= s \int_{1}^{\infty} \left( \frac{\pi}{\sqrt{d}} x + O(\sqrt{x}) \right) x^{-s-1} \, dx.$$  

The integral of the error term is finite for $\sigma > 1/2$, which gives

$$\zeta_Q(s) = \frac{\pi}{\sqrt{d}} s^{1/2} + O(1).$$

The key fact is that the residue is the same for all forms $Q$ of discriminant $-d$.

This same circle of ideas will actually give us a little more information: there is a constant $C$ so that, for $\sigma > 1$, we have

$$|\zeta_Q(s) - a^{-s} \zeta(2s)| \leq \left( \frac{d}{4} \right)^{1/2-\sigma} \frac{C}{\sigma - 1}.$$  

Here's a sketch of a proof. The expression $a^{-s} \zeta(2s)$ is exactly the contribution to $\zeta_Q(s)$ of the terms $Q(m,n)^{-s}$ with $n = 0$. So we want to bound the remaining terms

$$\sum_{m \in \mathbb{Z}} \sum_{n=1}^{\infty} Q(m,n)^{-s}.$$

We use the fact that the sum is absolutely convergent for $\sigma > 1$, and the usual trick of comparing a sum to an integral. (There are some things to check carefully here which is why this is only a sketch.) We may as well assume the middle coefficient $b = 0$; if not a real rotation by $\phi = \arctan((b/(a-c))/2$ makes it so, without changing the value of the integral or the discriminant. So we want to estimate

$$\int (ax^2 + cy^2)^{-s} \, dxdy,$$

where the annular region of integration $r > 1, \phi \leq \theta \leq \phi + \pi r$ contains our (rotated) lattice points. A change of variables

$$x = \sqrt{cr} \cos(\theta) \quad y = \sqrt{ar} \sin(\theta)$$

with Jacobian $\sqrt{ac} r = \sqrt{d}/4r$ converts this to

$$\left( \frac{d}{4} \right)^{1/2-\sigma} \pi \int_{1}^{\infty} r^{-1-2\sigma} \, dr = \left( \frac{d}{4} \right)^{1/2-\sigma} \frac{\pi}{\sigma - 1}.$$  

The point of (2) is that for $s$ in the region $\sigma > 1$, we get

$$\zeta_Q(s) - a^{-s} \zeta(2s) \asymp \sqrt{d}/a \to \infty.$$  

We will see below that we can extend (3) to the larger region $\sigma > 0, s \neq 1$. This is in some sense the reason why the Deuring-Heilbronn phenomenon occurs.

**Class Number Formula**

The representation numbers $r_Q(n)$ of the individual forms are mysterious, but there is a nice expression for $r_{-d}(n)$, the total number of ways $n$ is represented by any form of discriminant $-d$:

$$\sum_{[Q]} r_Q(n) = \sum_{m,n} \chi_{-d}(m).$$

The proof uses the Chinese Remainder Theorem. The right side above is the Dirichlet convolution of the multiplicative functions $\chi_{-d}$ and 1, the constant function. Together with (4), this implies

$$\sum_{[Q]} \zeta_Q(s) = \sum_{n=1}^{\infty} \left( \sum_{m,n} \chi_{-d}(m) \right) n^{-s}$$

$$= \zeta(s) L(s, \chi_{-d}).$$

The previous calculation (1) of the residues at $s = 1$ for the Epstein zeta function gives us, when we sum over classes $[Q]$, Dirichlet's Analytic Class Number Formula

$$L(1, \chi_{-d}) = \frac{\pi h(-d)}{\sqrt{d}}.$$  

From this it is not too hard to prove upper bounds on the class number:

$$h(-d) \ll \log(d) \sqrt{d}.$$  

(See [12] for an exposition). Figure 1 shows a scatter plot of discriminants and class numbers for $d < 10000$. You can see the square root upper bound in the upper envelope of the points, roughly a parabola.

Lower bounds are much much harder. Gauss conjectured in Art. 303 of *Disquisitiones Arithmeticae*
...the series of [discriminants] corresponding to the same given classification (i.e., the given number of both genera and classes) always seems to terminate with a finite number. There seems to be no doubt that the preceding series does in fact terminate, and by analogy it is permissible to extend the same conclusion to any other classifications. However rigorous proofs of these observations seem to be very difficult.

Getting good answers to these questions are still the main open problems in the theory.

**Fourier Expansion**

So far we have viewed the forms \( Q(x, y) = ax^2 + bxy + cy^2 \) as discrete objects. A slightly different point of view lets us view them as sitting in a continuous family parametrized by a variable \( z \) in the complex upper half plane \( \mathcal{H} \). We dehomogenize the form to find roots (Heegner points) then

\[
-b + \sqrt{-d} \quad \text{and} \quad a^2 \sum_{(m,n)} |m-nz|^{-2s}.
\]

As a function of \( z \) in the complex upper half plane, this is invariant under \( z \rightarrow z + 1 \), since

\[
Q(m, n) \sim Q \left( \begin{bmatrix} 1 & 0 \\ -1 & 1 \end{bmatrix} \right),
\]

and thus the Epstein zeta function has a Fourier expansion in \( x = \Re(z) \).

**Aphorism. [Hecke]** A periodic function should always be expanded into its Fourier series.

In fact, we will end up with a Fourier cosine series since our Epstein zeta function is an even function of the \( x = b/2a \) parameter: the forms

\[
Q(m, n) = am^2 + bmn + cn^2
\]

and

\[
Q^{-1}(m, n) = am^2 - bmn + cn^2
\]

represent the same integers, so their Epstein zeta functions are identical. The Fourier coefficients will each be a function of the Dirichlet series variable \( s \), as well as \( \Im(z) = \sqrt{-d}/2a \). To see what the Fourier expansion looks like, we will need the K-Bessel function \( K_v(y) \), which is the solution to the second order ODE (derivatives with respect to \( y \))

\[
u'' + \frac{1}{y} u' - \left( 1 + \frac{y^2}{y^2} \right) u = 0
\]

which tends to 0 as \( y \rightarrow \infty \). In fact

\[
K_v(y) = \left( \frac{\pi}{2y} \right)^{1/2} \exp(-y) \left( 1 + O(y^{-1}) \right).
\]

Also significant for us is that it has the integral representation (Mellin transform)

\[
K_v(y) = \frac{1}{2} \int_0^\infty \exp(-y/2(t + 1/2)) t^v \frac{dt}{t},
\]

A good reference for this is \([5]\). The change of variables \( t \rightarrow t^{-1} \) in the integral \((8)\) gives

\[
K_v(y) = K_{-v}(y).
\]

**Theorem. [Chowla-Selberg]**

\[
\Lambda_Q(s) \overset{\text{def}}{=} \left( \frac{\sqrt{-d}}{2\pi} \right)^{s-1/2} \Gamma(s) \zeta_d(s) - T(s) + T(1-s) + U(s),
\]

where

\[
T(s) = \left( \frac{\sqrt{-d}}{2\pi} \right)^{s-1/2} a^{-2s} \Gamma(s) \zeta(2s)
\]

and

\[
U(s) = \frac{4\sqrt{\pi}}{\sqrt{-d}} \sum_{n=1}^\infty n^{s-1/2} \sigma_{-2s}(n) \times \left( \frac{\pi n \sqrt{-d}}{a} \right) \cos(n \pi b/a).
\]

The divisor function \( \sigma_v(n) \) is defined by \( \sum_{m|n} m^v \). Notice that each term \( n^{s-1/2} \sigma_{-2s}(n) \) is invariant under \( s \rightarrow 1-s \), as is the K-Bessel function by \((9)\), and this gives as a Corollary the analytic continuation and functional equation

\[
\Lambda_Q(s) = \Lambda_Q(1-s).
\]

**Proof (extremely sketchy):** The appearance of the term \( T(s) \) is not surprising; just as before it is exactly the contribution of pairs \((m, n)\) that have \( n = 0 \). The remaining terms contribute a sum over \( m \) in \( \mathbb{Z} \) and \( n \) in \( \mathbb{N} \). Each summand can be written as a Mellin transform, and the sum pulled through the integral. Poisson Summation gives the integral \((8)\) for the K-Bessel function.

We wrote the Fourier expansion this way, isolating the constant term \( T(s) + T(1-s) \), because this term will be dominant. The details are messy because the implicit constant in \((7)\) depends on \( s \), but it is shown in \([1]\) that for \( 0 \leq \sigma \leq 1 \)

\[
|U(s)| \leq \frac{2}{d^{1/4}} \frac{\Gamma(\sigma)}{\Gamma(1)} \exp(-\pi \sqrt{-d}/a).
\]

On the critical line \( \sigma = 1/2 \) one can get from \((8)\) an estimate independent of \( t \):
\[ \left| U(1/2 + it) \right| \leq \frac{6}{d^{1/4}} \exp(-\pi \sqrt{d}/a). \]

An important consequence of this is that we extend the asymptotic behavior (3)

\[ (10) \quad \zeta_Q(s) \rightarrow a^{-s} \zeta(2s) \quad \text{as} \quad \sqrt{d}/a \to \infty \]

to \( s \) in the region \( \sigma > 0 \), and \( s \neq 1 \). This has to fail at \( s = 1 \), of course; \( \zeta_Q(s) \) has a pole there and \( \zeta(2s) \) does not. It is slightly surprising where this pole appears in our Fourier expansion: it is in the \( T(1 - s) \) term; the function \( \Gamma(s) \) has a simple pole at \( s = 0 \).

**The Siegel Zero and Consequences**

Hecke's aphorism pays off now by showing us a deep connection between the arithmetic and the analysis in the following three theorems.

**Theorem.** [Chowla-Selberg] For \( d / a^2 > 200 \),

(i) The Epstein zeta function has a real zero in \((1/2, 1)\).

(ii) If \( h(-d) = 1 \), then the Generalized Riemann Hypothesis (GRH) is false.

Proof: We start by computing \( A_Q(s) \) at \( s = 1/2 \).

Although the term \( \zeta(2s) \) has a pole at \( s = 1/2 \), a calculation will show that \( T(s) + T(1 - s) \) has a removable singularity at \( s = 1/2 \):

\[
\begin{align*}
\zeta(2s) &= \frac{1}{s - 1/2} + y + O(s - 1/2) \\
\Gamma(s) &= \sqrt{\pi} + \sqrt{\pi}(-y - \log(4))(s - 1/2) + O(s - 1/2)^2 \\
a^{-s} \left( \frac{2\pi}{\sqrt{d}} \right)^{1/2} &= \frac{1}{\sqrt{d}} + \frac{\log(\sqrt{d}/(2\pi a)))}{\sqrt{a}} (s - 1/2) + O(s - 1/2)^2.
\end{align*}
\]

Here \( y \) is Euler's constant, and these calculations are classical enough that Mathematica can do them for us. So \( T(s) \) is

\[
T(s) + T(1 - s) = \frac{\sqrt{\pi} / a}{s - 1/2} + \frac{\sqrt{\pi} / a / 2}{s - 1/2} \left( y + \log(\sqrt{d}/(8\pi a)) \right) + O(s - 1/2) \text{.}
\]

Adding the expansion of \( T(1 - s) \) kills off all powers of \( s - 1/2 \) with odd exponent, including the pole, and we find

\[
T(s) + T(1 - s) \bigg|_{s=1/2} = \frac{\sqrt{\pi} / a \left( y + \log(\sqrt{d}/(8\pi a)) \right)}{s - 1/2} + O(s - 1/2) \text{.}
\]

Since \( U(1/2) \) is exponentially small, \( A_Q(1/2) > 0 \) for \( d/a^2 \gg 1 \) (in fact bigger than 200). But recall

\[
\zeta_Q(s) = \frac{\pi}{\sqrt{d}} \cdot \frac{1}{s - 1/2} + O(1)
\]

is negative for \( s = 1 \) - 1. By the Intermediate Value Theorem, \( \zeta_Q(s) \) has a real zero in \((1/2, 1)\). This proves (i).

Now suppose \( h(-d) = 1 \), so by genus theory \( d \) is a prime congruent to 3 mod 4, and

\[
Q(x, y) = x^2 + xy + \frac{1 + d}{4} y^2, \quad a = 1.
\]

We make use of (5), which now says \( \zeta_Q(s) = \zeta(s)L(s, \chi_d) \). The fact that the Riemann zeta function has no real zeros in \((0, 1)\) follows from Euler's identity

\[
(1 - 2^{1-s})\zeta(s) = \sum_{n=1}^{\infty} (-1)^{n+1} n^{-s}.
\]

The series converges for real \( s > 0 \) by the Alternating Series Test; now group the terms in pairs to see that the sum is positive. So \( L(s, \chi_d) \) has a real zero in \((1/2, 1)\), a Siegel zero.

The Argument Principle tells us the number of zeros minus the number of poles, inside the circle of say radius 1/4 around, \( s = 1 \), is given by

\[
\frac{1}{2\pi i} \int_{|s|=1/4} \frac{\zeta_Q(s)}{\zeta_Q(s)} ds.
\]

By (10), for sufficiently large \( d \) this is

\[
= \frac{1}{2\pi i} \int_{|s|=1/4} \frac{\zeta_Q(2s)}{\zeta_Q(2s)} ds = 0
\]

because \( \zeta(2s) \) has neither zeros nor poles near \( s = 1 \). Of course one has to justify passing the limit through the integral. The convergence is not uniform, but it is uniform on a compact set containing the path of integration. Since the Epstein zeta function has one simple pole, there is only one Siegel zero close to \( s = 1 \).

In fact, you can say even more about the location of this zero:

**Exercise.** Use Mathematica to compute the Laurent expansion

\[
T(s) + T(1 - s) = \frac{\zeta(s)}{s - 1/2} + O(s - 1/2)
\]

around \( s = 1 \). Neglecting the higher order terms and the \( U(s) \) contribution, show the zero is at \( 1 - \beta \) for

\[
\beta = \frac{6a}{\pi \sqrt{d}} \quad \text{as} \quad \sqrt{d}/a \to \infty.
\]

Still under the hypothesis \( h(-d) = 1 \) and \( d \gg 1 \),

**Theorem.** [Deuring] Except for the Siegel zero, all other zeros of \( \zeta_Q(s) \) in \( 0 < \sigma < 1, 0 < t < \sqrt{d} \) have real part \( \sigma = 1/2 \). This is the "Local GRH".

Outline of Proof: Write

\[
T(s) + T(1 - s) = T(s) \left( 1 + \frac{T(1 - s)}{T(s)} \right)
\]

The term \( |T(s)| \) is never zero for \( \sigma \geq 1/2 \); \( \Gamma(s) \) has no zeros, and the fact that \( \zeta(s) \) is nonzero for
\[ \sigma \geq 1 \] is equivalent to the Prime Number Theorem.

1. Deuring shows \(|T(1-s)/T(s)| < 1\) as long as \(\sigma > 1/2\) and \(|s| > 1/4\). This depends on known estimates for \(\Gamma(s)\) and \(\zeta(2s)\) but basically works because for \(d\) large relative to \(t\), the \((\sqrt{d}/2\pi)^{1/2}\) term dominates, as long as we stay away from the pole of \((1-s)\) at \(s=1\). Thus
\[ T(s) + T(1-s) = 0 \implies \sigma = 1/2. \]

2. Next, he shows these zeros are simple as follows:
Write \(f(s)\) for \(T(1-s)/T(s)\), so the zeros occur at \(\rho = 1/2 + it\) such that \(f(\rho) = -1\). Then
\[ \left. \frac{d}{ds} T(s)(1+f(s)) \right|_{s=\rho} = T(\rho)f'(\rho). \]

For
\[ f'(\rho) = -\frac{f'(\rho)}{f(\rho)} = \left. \frac{d}{ds} T(s) \right|_{s=\rho} - \left. \frac{d}{ds} T(1-s) \right|_{s=\rho}, \]

he can get a lower bound \(f'(\rho) \gg \log(d)\) from known estimates for the logarithmic derivative of the Riemann zeta function, as long as \(t\) is small enough relative to \(d\). Similarly, known estimates give \(T(\rho) \gg 1/\log(d)\).

3. He then shows that
\[ |T(s) + T(1-s)| > |U(s)|, \]
and so by Rouche’s Theorem \(\Lambda_0(s)\) has the same number of zeros in the box \(0 < \sigma < 1\), \(0 < t < \sqrt{d}\) as does \(T(s) + T(1-s)\). Here he needs \(t < \sqrt{d}\), since by Stirling’s formula, \(T(s)\) also has exponential decay as \(t\) increases.

4. Around each zero \(\rho\) of \(T(s) + T(1-s)\), Deuring puts a circle of radius \(\exp(-\pi/\sqrt{d})\) and uses the Cauchy Integral Formula to get upper bounds on the Taylor series coefficients
\[ T(s) + T(1-s) = c_1(s-\rho) + \sum_{n=2}^{\infty} c_n(s-\rho)^n \]
of the form \(c_n \ll K^n\). By (2) above he already has \(c_1 \gg 1\). The triangle inequality and summing a geometric series gives \(T(s) + T(1-s) \gg \exp(-\pi/\sqrt{d})\) on the circle. He can then apply Rouche’s Theorem again to see \(\Lambda_0(s)\) has one zero in that circle. Since any zeros off the line would come in symmetric pairs (by the functional equation \(s \rightarrow 1-s\)), that zero is on the line.

Deuring’s theorem is quite strong. Since the zeros of \(\zeta(s)\) are a subset of the zeros of \(\zeta(2s)\) whenever \(h(-d) = 1\) by (5), as a Corollary we get that either there are only finitely many \(d\) with \(h(-d) = 1\), or the Riemann hypothesis for \(\zeta(s)\) is true! Of course it is now known that the latter is false, but Deuring’s theorem was an essential first step in solving the problem.\(^1\)

---

**Figure 2. A page from Stark’s thesis.**

**Folklore Theorem.** [Deuring, Heilbronn] In the presence of a Siegel zero, the low-lying zeros \(s = 1/2 + it\) of \(L(s, \chi_d)\) are very regularly spaced:
\[ t \sim \frac{\pi}{\log(\sqrt{d}/2\pi)} \cdot n \text{, for integer } n. \]

**Idea of proof:** We make use of the fact that for \(s = 1/2 + it\), \(1 - s = \overline{s}\). The zeros of \(L(s, \chi_d)\) are zeros of \(\Lambda_0(s)\), which we have seen are very near the zeros of \(\sum_{n=1}^{\infty} c_n(s-\rho)^n\)
\[ T(s) + T(1-s) = \sum_{n=1}^{\infty} c_n(s-\rho)^n \]
of the form \(c_n \ll K^n\). By (2) above he already has \(c_1 \gg 1\). The triangle inequality and summing a geometric series gives \(T(s) + T(1-s) \gg \exp(-\pi/\sqrt{d})\) on the circle. He can then apply Rouche’s Theorem again to see \(\Lambda_0(s)\) has one zero in that circle. Since any zeros off the line would come in symmetric pairs (by the functional equation \(s \rightarrow 1-s\)), that zero is on the line.

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\(^1\)An editorial comment: this result made me have a lot more respect for Rouche’s Theorem, which previously I thought existed only to provide problems for analysis qualifying exams.
so \( \arg(\zeta(2s)) = -\pi/2 \) for \( s = 1/2 + it \sim 1/2 \). Finally
\[
\arg \left( \frac{\sqrt{d}/2\pi}{} \right) = t \log \left( \frac{\sqrt{d}/2\pi}{\pi} \right),
\]
and
\[
\cos \left( t \log \left( \frac{\sqrt{d}/2\pi}{\pi/2} \right) \right) = \sin \left( t \log \left( \frac{\sqrt{d}/2\pi}{\pi/2} \right) \right).
\]
So
\[
t \log \left( \frac{\sqrt{d}/2\pi}{\pi} \right) \sim n\pi.
\]
(Actually, it is not enough above that \( |T(s)| \) is nonzero. To make this argument precise, we need to estimate a lower bound.) To the extent that one can bound the tail of the Fourier expansion, every \( n \) above corresponds to a zero by Rouché's Theorem.

The other factor \( \zeta(s) \) of \( \zeta_Q(s) \) has no low-lying zeros, but the same analysis shows that the zeros \( \rho = 1/2 + iy \) of \( \zeta(s) \) with \( y \ll \sqrt{d} \) make \( T(\rho) \) nearly pure imaginary.

**Experimental Observations**

Even in the absence of a Siegel zero, can one see this effect for a class number extremely small relative to its discriminant? Stark, in his 1964 Ph.D. thesis, was the first to investigate this numerically; see Figure 2 for a cryptic comment.

For a graphical interpretation, one can use Mathematica to plot
on the critical line $s = 1/2 + it$ for various values of $d$ that have $h(-d) = 1$. How close to the imaginary axis is $T(\rho)$ for $\rho$ that are known zeros of $\zeta(s)$? Figures 3-6 show several examples for various $d$, with the same five lowest zeros $\rho$ of $\zeta(s)$ indicated in red on each. Since Stirling's Formula for $\Gamma(s)$ makes $|T(s)|$ decay exponentially as $t$ increases, one does not see the function "wrap around" the origin, so I have renormalized the absolute value by taking the logarithm, without changing the argument. Increasing $t$ corresponds to spiraling in counterclockwise.

$L$-function Magic
Since the class number problem $h(-d) = 1$ is already solved, we want to think about lower bounds in general. In this case the Dedekind zeta function

$$\sum_{[\mathcal{Q}]} \zeta_{\mathcal{Q}}(s) = \zeta(s)L(s, \chi_d)$$

is a sum over all classes of Epstein zetas. Whenever $d/a^2 > 200$, the corresponding $\zeta_{\mathcal{Q}}(s)$ has a zero in $(1/2, 1)$ by Chowla-Selberg. This does not contradict any GRH, since the individual Epstein zetas do...
not have Euler products over primes, only the sum does. The reduced representatives of the forms can have $a$ as big as $\sqrt{d}/3$, which means the exponential bound on the tail $U(s)$ in the Fourier expansion can be as big as $\exp(-\pi\sqrt{3}) \approx 0.0044$ for each of the $h(-d)$ terms. We still get the benefit of the $d^{1/4}$ term in the denominator, though, so if $h(-d)$ is very small relative to $\sqrt{d}$ (i.e., much smaller than $d^{1/4}$), then the sum of the tails is still small.

Under this hypothesis $L(s, \chi_{-d})$ has a Siegel zero, and the Deuring-Heilbronn Phenomenon reappears as before: we get the Local GRH, and the low-lying zeros are uniformly spaced just as in (11). But more is true. Given a homomorphism on the class group

$$\psi : C(-d) \to \mathbb{C}^*$$

we can form an $L$-function

$$L(s, \psi) = \sum_{[\mathfrak{a}] \in C(-d)} \psi([\mathfrak{a}]) \zeta_q(s, \mathfrak{a}).$$

More generally, for an auxiliary discriminant $f$ we can “twist” the Epstein zeta function

$$\zeta_q(s, \chi_f) = \sum_{n=1}^\infty \chi_f(n) r_q(n) n^{-s}$$

and form

$$L(s, \psi \cdot \chi_f) = \sum_{[\mathfrak{a}] \in C(-d)} \psi([\mathfrak{a}]) \zeta_q(s, \mathfrak{a}).$$

For any odd fundamental discriminant $k_1$, we can make the Dirichlet $L$-function $L(s, \chi_{k_1})$ appear as a factor of such an expression, by careful choice of $\psi$ and $f$: Factor $-d = D_1 \cdot D_2$ as a product of fundamental discriminants, in such a way that $D_1 = \gcd(k_1, d)$. By a theorem of Kronecker, this factorization corresponds to a genus character $\psi$ with $k_1 = -5507$, $k_2 = 100481$, $f = 1$.

![Figure 11. $d = 553348867 = 5507 \cdot 89 \cdot 1129$](image1)

![Figure 12. $d = 14111 = 83 \cdot 17$](image2)

(12) $L(s, \psi) = L(s, \chi_{D_1}) L(s, \chi_{D_2})$, generalizing (5). In fact the genera of quadratic forms mentioned above are exactly the cosets of the class group $C(-d)$ modulo the subgroup $C(-d)^2$ of squares of classes. The genus group is therefore a product of copies of $\mathbb{Z}/2$, and Gauss showed the number of terms is $g - 1$, where $g$ is the number of prime factors of $d$. The corresponding genus characters are exactly those taking only the values $\pm 1$.

By a comparison of the corresponding Dirichlet series in (12)

$$\sum_{n=0}^\infty \psi(q(n)) n^{-s} = \sum_{n=0}^\infty \left( \sum_{c|n} \chi_D(c) \chi_{D_2}(n/c) \right) n^{-s},$$

and the uniqueness of Dirichlet series coefficients, we deduce that for all $n$,

(13) $\sum_{[\mathfrak{a}] \in C(-d)} \psi([\mathfrak{a}]) \zeta_q(n, \mathfrak{a}) = \sum_{c|n} \chi_D(c) \chi_{D_2}(n/c).$

This is a generalization of (4).

**Theorem.** Let $f = k_1/D_1$, $k_2 = fD_2$. Then

(14) $L(s, \chi_{k_1}) L(s, \chi_{k_2}) = L(s, \psi \cdot \chi_f)$.

**Proof:** The idea goes back to Heilbronn:

$$L(s, \psi \cdot \chi_f) = \sum_{[\mathfrak{a}] \in C(-d)} \psi([\mathfrak{a}]) \zeta_q(s, \mathfrak{a})$$

$$= \sum_{[\mathfrak{a}] \in C(-d)} \psi([\mathfrak{a}]) \sum_{n=0}^\infty \chi_f(n) r_q(n) n^{-s}$$

$$= \sum_{n=0}^\infty \chi_f(n) \left( \sum_{[\mathfrak{a}] \in C(-d)} \psi([\mathfrak{a}]) \right) n^{-s}.$$

By (13) we get
k1 = -47, k2 = 209, f = 1

Figure 13. $d = 9823 = 11 \cdot 19 \cdot 47$

\[ L(s, \psi \cdot \chi_1) = \sum_{n>0} \chi_1(n) \left( \sum_{c|n} \chi_D(c) \chi_D(n/c) \right) n^{-s} \]
\[ = \sum_{m>0} \left[ \sum_{c|m} \chi_1(c) \chi_1(n/c) \chi_D(n/c) \right] m^{-s} \]
\[ = \sum_{n>0} \left( \sum_{c|n} \chi_1(c) \chi_2(n/c) \right) n^{-s} \]
\[ = L(s, \chi_1) L(s, \chi_2). \]

From the right side of (14), we have a Fourier expansion

\[ \left( \frac{\sqrt{d}}{2\pi} \right)^{s-1/2} \Gamma(s) L(s, \chi_1) L(s, \chi_2) = T(s) + T(1-s) + U(s) \]

similar to the previous one, with now

\[ T(s) = \left( \frac{\sqrt{d}}{2\pi} \right)^{s-1/2} \Gamma(s) \zeta(2s) \Psi(s) A(s), \]

and

\[ P_l(s) = \prod_{p|M} (1 - p^{-2s}), \quad A(s) = \sum_{[Q]} \psi(Q) \chi(Q) a^{-s}. \]

In fact in the examples below, we take $f = 1$. In this case we have a linear combination of the Chowla-Selberg Fourier expansions; the coefficients are merely the character values $\psi(Q)$.

If the class number $h(-d)$ is too small, or $L(s, \chi_{-d})$ has a Siegel zero, the Deuring-Heilbronn phenomenon (11) appears for $L(s, \chi_k)$ as well, as long as $f$ is not too big.

**Experimental Observations II**

As in the case of $h(-d) = 1$, we can plot $T(s)$ on the line $s = 1/2 + it$ and see where the zeros of $L(s, \chi_k)$ and $L(s, \chi_{-d})$ end up. For "extreme" values of $-d$, will they tend towards the imaginary axis? Figures 7-11 show some examples with small class number. The lowest five zeros of $L(s, \chi_{k_1})$ are shown in red, while the lowest five zeros of $L(s, \chi_{k_2})$ are shown in blue. (In some cases not all five are visible if they lie nearly on top of each other.)

1. The discriminant $-85507 = -2311 \cdot 37$ has class group isomorphic to $\mathbb{Z}/22$, so $h(-d)/\sqrt{d} \approx 0.75$. There is one nontrivial genus character.

2. The discriminant $-991027$ has class group isomorphic to $\mathbb{Z}/63$; there is only the trivial genus character. This is the famous example of Shanks; $h(-d)/\sqrt{d} \approx 0.63$ which minimizes this ratio for all $d < 10^8$. (Because the zeros of $\zeta(s) = L(s, \chi_k)$ are so high up, we show instead 10 zeros of $L(s, \chi_{-d}) = L(s, \chi_k)$ in Figure 8.)

3. The discriminant $-55334867 = -5507 \cdot 89 \cdot 1129$ has class group isomorphic to $\mathbb{Z}/732 \times \mathbb{Z}/2$, so $h(-d)/\sqrt{d} = 0.626$. There are three nontrivial genus characters.

Observe that in each of the examples, the parameter $f$, which in some sense measures the correlation between $-d$ and the auxiliary discriminant $k_1$, is as small as possible: $f = 1$ or in other words $k_1/d$. Even so, the correlation between the zeros is by no means trivial. There is no obvious relation between the class groups $C(k_1)$ and $C(-d)$; one is not a direct factor of the other.

Of course, these examples are hand picked to show off this tendency towards the Deuring-Heilbronn phenomenon; in general one sees nothing like this. In the next section below we discuss contemporary conjectures about the distribution of zeros.

It is also interesting to look at some examples of discriminants $-d$ that are famous for $L(s, \chi_{-d})$ having a very low-lying zero. Figures 13-17 show
some examples. The low-lying zero does not appear in the figures, rather it is "causing" the Deuring-Heilbronn phenomenon.

1. The $L$-function $L(s, \chi_{-1411})$ has a zero at $s = 1/2 + i \cdot 0.077967 \ldots$. The discriminant $-1411 = -83 \cdot 17$ has one nontrivial genus character.

2. The $L$-function $L(s, \chi_{-9823})$ has a zero at $s = 1/2 + i \cdot 0.058725 \ldots$. The discriminant $-9823 = -11 \cdot -19 \cdot -47$ has three nontrivial genus characters.

3. The $L$-function $L(s, \chi_{-30895})$ has a zero at $s = 1/2 + i \cdot 0.018494 \ldots$. The discriminant $-30895 = -167 \cdot 5 \cdot 37$ also has three nontrivial genus characters.

4. The $L$-function $L(s, \chi_{115147})$ has a zero at $s = 1/2 + i \cdot 0.003158 \ldots$. The discriminant $-115147 = -1019 \cdot 113$ has one nontrivial genus character.

5. $L(s, \chi_{175990483})$ has a zero at $s = 1/2 + i \cdot 0.000475 \ldots$. The discriminant $-d = -175990483 = 19 \cdot 1427 \cdot 6491$ has three nontrivial genus characters.

In both sets of examples, $T(\rho)$ is very nearly pure imaginary for zeros $\rho$ of $L(s, \chi_k)$ or $L(s, \chi_{\overline{k}})$, and so $T(\rho) + T(1 - \rho)$ is also very near $0$. Necessarily this means that the tail of the Fourier expansion $U(\rho)$ is also very near $0$, much smaller than our estimate $O((h(-d)d^{-1/4})$.

It would be nice to have examples where the zeros $\rho$ not only forced $T(s)$ to be nearly purely imaginary, but also were restricted to near integer multiples of $\pi/\log\sqrt{-d}/2\pi$ as in (11). This would require $\arg(T(s)\zeta(2s))$ to be very near its limiting value $-\pi/2$, and thus $k_1$ very large in order that $L(s, \chi_k)$ have several zeros so low. But this may allow $f > 1$ as well.

---

**Can You Hear the Class Number?**

In 1966 Mark Kac posed the question, "Can you hear the shape of a drum?" In fact what one hears are solutions to the wave equation, i.e., eigenvalues of the Laplace operator. The mathematical meaning of Kac's question is, what does this spectrum determine about the geometry? In the very useful analogy between spectral geometry and number theory, eigenvalues of the Laplacian correspond to zeros of $L$-functions, while geometric properties correspond to properties of primes. It is very interesting that the Deuring-Heilbronn phenomenon (11), if it occurs, corresponds in this analogy to frequencies in harmony.

Above I mentioned Stark's Ph.D. thesis, in which he used precise values of zeros of the Riemann zeta function to show that a certain range of discriminants did not have $h(-d) = 1$. He later extended this to the problem of $h(-d) = 2$. Montgomery and Weinberger used low-lying zeros of auxiliary $L(s, \chi_k)$ to attack $h(-d) = 2$ and $3$ in [6]. This work led Montgomery to investigate the question, "If GRH is true and there are no Siegel zeros and no Deuring-Heilbronn phenomenon, what is the vertical distribution of the zeros on the critical line?" Remarkably, he discovered [7] that the "pair correlation" of the zeros is the same as that for the eigenvalues of random unitary matrices, the Gaussian Unitary Ensemble (GUE). Montgomery's proof works only for a restricted range of test functions, not in general, but the GUE hypothesis is also supported by the statistics of 10 billion zeros of the zeta function computed by Odlyzko [8]. This suggests the zeros of $L$-functions may indeed have a spectral interpretation, as conjectured by Hilbert and Pólya.
Figure 17. $d = 175990483 = 19 \cdot 1427 \cdot 6491$

References


About the Cover

$Z(t)$ on the critical line

Two articles in this issue are concerned with $\zeta$-functions, the review of Dan Rockmore's book and the article by Jeffrey Stopple. This month's cover displays the behavior of $\zeta(s)$ on the critical line $\Re(s) = 1/2$. The function

$$\xi(s) = \Gamma(s/2)\pi^{-s/2} \zeta(s)$$

satisfies the functional equation $\xi(s) = \xi(1-s)$ and therefore takes real values on the critical line. If $\theta(t)$ is the argument of $\Gamma(1/4 + it/2)\pi^{-it/2}$ then $Z(t) = e^{i\theta(t)}\zeta(1/2 + it)$ also takes real values, and this is what is graphed along the helix. Lengths of the natural unit $2\pi$ are marked. The colors display the angle $\theta(t)$.

The behavior of $Z(t)$ encodes, in principle, the mysterious distribution of prime numbers, and it is hard to look at its graph without trying to read a message from it. But then humans are always trying to read meaning into random patterns.

—Bill Casselman,
Graphics Editor
(notices-covers@ams.org)
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An Invisible Minority: Asian Americans in Mathematics

Sharad Goel

There is an obvious dearth in the number of African Americans, Latinos, and Native Americans in the mathematical sciences. It seems incongruous, however, to describe Asian Americans as an invisible minority in mathematics. Asians—foreign and American—earned about half of the doctorates in statistics awarded by American universities in the last five years. For doctorates in mathematics, this proportion drops to about a quarter, substantially less but hardly characteristic of an "invisible minority". Among U.S. citizens and permanent residents, Asian Americans received less than 8% of mathematics Ph.D.'s during that same time period. Although this figure may seem surprisingly low, it is nearly double the proportion of Asian Americans in the U.S. population. Moreover, Asian Americans on average earn more and attend college and graduate school at higher rates than white Americans. By many measures Asian Americans are the most successful ethnic group in the United States, and relative to their proportion in the population, Asian Americans are overrepresented in mathematics.

Now take a closer look at the numbers. In 2004 only thirty Asian Americans received doctorates in mathematics.1 With over 170 graduate mathematics programs, Asian Americans are aptly described as invisible in most schools. Among the top fifty research universities, ten mathematics departments had at most one Asian faculty member.2 These numbers seem increasingly inadequate when one considers the tremendous diversity within the Asian American community itself. The socioeconomic disparity between Asian American ethnic groups, for example, is staggering: 64% of Asian Indians have college degrees, more than twice the attainment level of whites; of the combined Cambodian, Hmong, and Laotian population, only 9% have college degrees, comparable to the rates for African Americans, Latinos, and Native Americans.3 Notwithstanding certain economic successes, Asian Americans continue to encounter racial discrimination: The Department of Housing and Urban Development found that "Asian and Pacific Islander homebuyers experience consistent adverse treatment ... This level of discrimination is comparable to the level experienced by African American homebuyers, and significantly higher than the level of discrimination against Hispanics."4 Furthermore, views of Asian Americans as "perpetual foreigners" persist: A 2001 national survey reported that 23% of Americans would be

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2 Donna Nelson, "Faculty Diversity in Mathematics Departments at the 'Top Fifty' Research Universities", AWIS Magazine, Volume 31, Number 3, Summer 2002, pages 42-46.
3 United States Census 2000, Summary File 4 (SF 4), Sample Data.
uncomfortable voting for an Asian American to be
president of the United States. A

A diverse student body and workforce consistently are seen to further the goals of universities. The National Academies jointly released a statement on affirmative action endorsing the position that "racial diversity is a compelling educational interest that is fundamentally compatible with the social and economic mission of institutions of higher learning."6

Diversity promotes the robust exchange of ideas, enhances cross-racial understanding, breaks down stereotypes, and prepares individuals for increasingly diverse workplaces. Many mathematics departments lack the meaningful numbers of Asian American graduate students and faculty necessary to achieve these benefits of racial and ethnic diversity. I propose three strategies to address this concern: 1) include the issue of Asian Americans in dialogues on diversity; 2) maintain and report detailed information on the representation of Asian Americans in mathematics, specifically differentiating between principal Asian ethnic groups; and 3) during the admittance and hiring process, consider the role of Asian Americans in attaining a diverse educational environment.

These recommendations should not, and need not, work against ongoing efforts to increase the numbers of African Americans, Hispanics, Native Americans, and women in mathematics. In comparison to these groups, Asian Americans as a whole have done well. It is false to argue that diversity can be extended along only one line at a time. To the contrary, policies that include Asian Americans promulgate a vision of diversity that benefits the entire mathematics community.

The Numbers. Table 1 records the number of Asian Americans who received doctorates in mathematics in the last five years. My experience has been that there is a consistent tendency within the mathematical community to overestimate these numbers. One explanation for this phenomenon is the conflation of Asian American (U.S. citizen or permanent resident of Asian descent) with Asian (any person of Asian descent, including students who immigrated to the United States for graduate school). The data support the perception that Asians, as opposed to Asian Americans, are represented in large numbers in mathematics. Table 2 lists the data for mathematics Ph.D. recipients without regard to resident status. In 2004, for example, 182 Ph.D. recipients were Asian, but only 30 of these students—less than one-sixth—were Asian American. Nearly a quarter of mathematics Ph.D. recipients in the last five years were Asian. However, over the same time period, only about 4% were Asian American. The proportion of Asian American graduates among American graduates rises to about 8% since approximately half of the graduates were American. Even if one argues that 8% is nearly double the proportion of Asian Americans in the U.S. population, the figure hardly supports the perception that Asian Americans are ubiquitous in graduate mathematics programs.

Quite to the contrary, only 147 Asian Americans received mathematics Ph.D.'s during the five-year period between 2000 and 2004—fewer than the number of departments.

Table 1: Number of American recipients of mathematics Ph.D.'s by group.7

<table>
<thead>
<tr>
<th>Year</th>
<th>Institutions Reporting</th>
<th>Asian Americans</th>
<th>Americans</th>
</tr>
</thead>
<tbody>
<tr>
<td>2004</td>
<td>173 of 177</td>
<td>30</td>
<td>366</td>
</tr>
<tr>
<td>2003</td>
<td>172 of 177</td>
<td>19</td>
<td>341</td>
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<tr>
<td>2002</td>
<td>174 of 178</td>
<td>21</td>
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</tr>
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<td>2001</td>
<td>174 of 178</td>
<td>33</td>
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</tr>
<tr>
<td>2000</td>
<td>171 of 178</td>
<td>44</td>
<td>432</td>
</tr>
<tr>
<td>Total, 2000-2004</td>
<td>147</td>
<td>1891</td>
<td></td>
</tr>
</tbody>
</table>

Table 2: Number of recipients of mathematics Ph.D.'s by group.8

<table>
<thead>
<tr>
<th>Year</th>
<th>Institutions Reporting</th>
<th>Asians</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>2004</td>
<td>173 of 177</td>
<td>182</td>
<td>712</td>
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<td>2003</td>
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<td>174 of 178</td>
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<tr>
<td>2000</td>
<td>171 of 178</td>
<td>189</td>
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</tr>
<tr>
<td>Total, 2000-2004</td>
<td>847</td>
<td>3508</td>
<td></td>
</tr>
</tbody>
</table>

When trying to build and maintain diverse institutions, it is imperative to recognize Asian Americans as a distinct subgroup of the Asian population. As opposed to recent Asian immigrants, Asian Americans share with other American minorities the experience of growing up in the United States as a visibly distinct group from the majority, white population. Like African Americans, Latinos, and...

5 Committee of 100, American Attitudes toward Chinese Americans & Asian Americans, May 2001.
6 Bruce Alberts (president, National Academy of Sciences), William A. Wulf (president, National Academy of Engineering) and Harvey Fineberg (president, Institute of Medicine), Statement on Affirmative Action, April 2003.
7 Statistics compiled and released upon request to Colleen Rose, AMS Survey Analyst.
8 Ibid.
Native Americans, Asian Americans are thus particularly alert to issues of diversity and race. Moreover, Asian Americans and recent immigrants are culturally unlike, and often have dissimilar educational training and professional aspirations. Although both groups certainly enhance the diversity of a department, they do so in different ways. In particular, Asian Americans and recent immigrants will undoubtedly differ in their perspectives on race in America.

Tables 1 and 2 include data only from departments of mathematics (AMS Groups I-III), and in particular exclude data from departments of statistics, biostatistics, and biometrics (AMS Group IV). This division seems reasonable since, in my experience, statistics and mathematics departments tend to have limited interaction. Furthermore, the representation of Asians in these two fields is significantly different so as to warrant separate analysis. Indeed, between 2000 and 2004, Asians earned about 45% of Group IV Ph.D.'s, and Asian Americans earned about 15% of the degrees that went to Americans. The Group IV figures for both Asians and Asian Americans are about twice as large as the corresponding numbers for mathematics departments (Groups I-III). The differences among Groups I, II, and III are not as pronounced.

In all three groups, Asians constituted about a quarter of the graduates over the last five years. Of American graduates, Asian Americans represented 8.7%, 7.6%, and 5.7% of Ph.D. recipients from Groups I, II, and III, respectively; there was significant year-to-year variability within each group. Only one Asian American received a doctorate from a Group III institution in 2004.

The representation of Asians among mathematical faculty is slim. Only 11% of mathematics professors in the top fifty research departments are Asian, including both Asian Americans who were raised in the United States and those who immigrated as adults. Seven of these top fifty departments have only one Asian faculty member and three departments have none. Again, one can argue that 11% is nearly triple the proportion of Asians in the U.S. population, but it is difficult to believe that one Asian faculty member constitutes the meaningful number of Asian Americans necessary to build and maintain a racially and ethnically diverse institution.

Asian Americans are even less visible in the highest ranks of academia. Asian Americans fill approximately 2.4% of higher education senior administrative positions and hold only fifty-seven, or less than 1.5%, of nearly 4,000 college and university presidencies.

Perceptions and Misconceptions of Asian Americans. Despite a degree of economic success, Asian Americans continue to face significant racial discrimination. Asian Americans are, for example, widely perceived as “perpetual foreigners”. A 2001 national survey found that 23% of Americans would be uncomfortable voting for an Asian American to be president of the United States; this compares to 15% and 14% for African American and female candidates, respectively. The same survey found that 24% of Americans would disapprove if a family member married an Asian American, comparable to the percentage who would disapprove of a Hispanic spouse (21%) and lower than the percentage who would disapprove of an African American spouse (34%). Furthermore, the survey concluded that 17% of Americans would be upset if a “substantial number” of Asian Americans moved into their neighborhood, similar to the percentage that would be upset by an influx of African Americans (19%) or Hispanics (21%).

Asian Americans are characterized as the “model-minority”, with traits including industriousness, perseverance, intelligence, and docility. The Cornell Daily Sun, the university’s student paper, recently printed a comic that satirized Asians as “over-achieving, curve-busting” robots. The author subsequently apologized, admitting that

Many graduate mathematics programs lack the meaningful numbers of Asian American doctoral students and faculty necessary to achieve the benefits of racial and ethnic diversity.

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9 Ibid.
12 Committee of 100, American Attitudes toward Chinese Americans & Asian Americans, May 2001.
the cartoon was insensitive, adding, "I had previously assumed that making a lighthearted reference to the popular conception of strong Asian work ethic would be harmless, if not complimentary." Although these traits may seem innocuous or even flattering, they contribute to a warped and damaging perception of Asian Americans. In particular, these attitudes minimize the achievements of individual Asian Americans who validate the stereotypes, and pressure Asian students who fail to meet the expectations. Furthermore, the idea of Asian Americans as the model-minority is a not so subtle jab at African Americans, Hispanics, and Native Americans, who by contrast are viewed as "problem" groups. The editorial staff of the Sun stood by their decision to publish the cartoon despite a student rally protesting the comic. It is hard to imagine they would have backed a caricature of African Americans as "basketball machines" or Jews as "accomplished bankers."

The model-minority stereotype reinforces the misconception of Asian Americans as a homogeneous, problem-free group and masks the considerable cultural and socioeconomic diversity within the Asian American community. Fourteen Asian ethnic groups have a large presence in the United States: Chinese, Filipino, Asian Indian, Korean, Vietnamese, Japanese, Cambodian, Pakistani, Laotian, Hmong, Thai, Taiwanese, Indonesian, and Bangladeshi. These ethnic groups have markedly different demographic profiles as measured, for example, by median income, college degree attainment, and homeownership. By and large, Asian Indians as a group have done well economically. On the other hand, Cambodians, Hmong, Laotians, and, to a lesser extent, Vietnamese, on average have not seen those successes. Furthermore, it appears, at least anecdotally, that few Asian ethnic groups are represented in American mathematics departments.

The Department of Housing and Urban Development (HUD) found that "Asians and Pacific Islanders face significant levels of discrimination when they search for housing in large metropolitan areas nationwide." Their results are based on paired tests, in which two individuals—one minority and the other white—pose as otherwise identical homeseekers and visit real estate or rental agents to inquire about the availability of advertised housing. The report concluded that "Asian and Pacific Islander homebuyers experience consistent adverse treatment 20.4 percent of the time, with systematic discrimination occurring in housing availability, inspections, financing assistance, and agent encouragement. This level of discrimination is comparable to the level experienced by African American homebuyers, and significantly higher than the level of discrimination against Hispanics."

At the extreme, perceptions of Asian Americans lead to violence. Perhaps the most notorious case is that of Vincent Chin, who in 1982 was beaten to death in Detroit by two white autoworkers angry about the loss of auto manufacturing jobs to Japan. Ironically, Chin was not Japanese but rather Chinese. In 2004, the FBI recorded 217 incidents of hate crime motivated by anti-Asian bias. This figure is comparable (relative to population size) to the 475 incidents of hate crime due to anti-Hispanic bias and the eighty-three incidents due to anti-Native American bias reported that year. The number of hate crime incidents due to anti-African American bias is considerably larger: 2,731 in that single year. Hate crimes that are motivated principally by anti-Muslim or anti-Sikh bias often involve Asian American victims, but are not included in the figures above. The recent surge of violence toward Muslims and Sikhs prompted the U.S. Department of Justice to form an initiative to combat post-9/11 discrimination.

Counterarguments. There are two types of arguments for excluding Asian Americans in diversity policies: general disapproval of affirmative action programs for any minority group; and resistance to affirmative action in the particular case of Asian Americans, with endorsement of those efforts when applied to African Americans, Hispanics, and Native Americans. Regarding the first sort, I write only this: African Americans, Hispanics, and Native Americans together constitute about a quarter of the U.S. population but received less than 8% of mathematics Ph.D.'s that went to Americans in 2004. Nearly every mathematics program in the country endorses affirmative action policies as an effective tool for addressing this critical education gap. The pertinent question is not whether universities should employ affirmative action policies, but rather how schools can enhance those efforts.

Regarding the second argument, I see two objections for extending affirmative action to Asian Americans: a concern that Asian Americans will drain resources away from other minority groups, and a conviction that the affirmative action doctrine simply does not apply to this relatively more successful minority group. The first concern can

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*United States Census 2000, Summary File 1 (SF 1), 100-Percent Data. These are the fourteen Asian ethnic groups whose total population in the U.S. exceeds 50,000, listed in order of population size.*

*Department of Housing and Urban Development, Discrimination in Metropolitan Housing Markets: Phase 2—Asians and Pacific Islanders, March 2003.*


*Statistics compiled and released upon request to Colleen Rose, AMS Survey Analyst.*
be alleviated by policies that explicitly aim to increase the total number of minorities in an institution, instead of including Asian Americans by excluding other minority groups. Given that minority students (including Asian Americans) constitute only about 15% of American mathematics Ph.D. recipients, it is reasonable to elevate the level of Asian American graduate students without adversely affecting the representation of African American, Hispanic, and Native American students.

Diversity policies that include Asian Americans are, I believe, consonant with the tenets of affirmative action. With regard to any minority group, there are at least two compelling rationales for diversity programs. First, race-conscious policies are useful tools to counteract the effects of past and current discrimination. Despite a plethora of evidence that documents the pervasiveness of racial bias, it is impossible to gauge the effects of discrimination on any given individual. Consequently, affirmative action provides a push in the right direction, a check on the cumulative effects of discrimination. By this rationale, affirmative action does not directly address the causes of bias, but rather focuses on mitigating the symptoms. Second, affirmative action facilitates the creation and maintenance of diverse institutions, a desirable end in and of itself. To wit, diverse institutions promote the robust exchange of ideas, enhance cross-racial understanding, break down stereotypes, and prepare individuals for heterogeneous workplaces. In front of the U.S. Supreme Court, the University of Michigan Law School "asserted only one justification for their use of race in the admissions process: obtaining the educational benefits that flow from a diverse student body." It is this second rationale that is particularly cogent in the case of Asian Americans: Many graduate mathematics programs lack the meaningful numbers of Asian American doctoral students and faculty necessary to achieve the benefits of racial and ethnic diversity. Diversity is essential, for example, to facilitate discussions of race in America, an issue that is central to every institution of higher learning during a time when students must be prepared to interact in an increasingly pluralistic society. Of particular importance in these discussions are the perspectives of groups that historically have faced discrimination—including Asian Americans.

Summary. Affirmative action programs are driven by an understanding that diverse institutions are necessary to address the needs and concerns of a heterogeneous society and acknowledge as essential the inclusion of groups that historically have faced discrimination. In contrast to recent Asian immigrants, Asian Americans share with other American minorities the experience of growing up in the United States as a visibly distinct group from the majority, white population. Bias against Asian Americans is evidenced by derogatory stereotypes, discriminatory housing practices, and incidents of hate crime. Many doctoral mathematics programs lack the meaningful numbers of Asian American graduate students and faculty necessary to achieve the benefits of racial and ethnic diversity. This situation is exacerbated by the tremendous diversity within the Asian American community itself, with substantial differences in socioeconomic well-being among Asian ethnic groups.

I suggest three courses of action: 1) include the issue of Asian Americans in dialogues on diversity; 2) maintain and report detailed information on the representation of Asian Americans in mathematics, specifically differentiating between principal Asian ethnic groups; and 3) during the admittance and hiring process, consider the role of Asian Americans in attaining a diverse educational environment. These strategies should not, and need not, work against ongoing efforts to increase the numbers of African Americans, Hispanics, Native Americans, and women in mathematics. Policies that include Asian Americans further a vision of diversity that benefits the entire mathematics community.

Acknowledgments. I thank AMS Survey Analyst Colleen Rose for compiling several of the statistics that are presented in this article. I am grateful to Johnny Guzman and Joe Tien for many informative discussions.

Now, thanks I guess to Andrew Wiles, the competition has just about disappeared. There is no Fermat conjecture to cloud the issue. The Riemann hypothesis reigns supreme as the mathematical goal which is to be used to grab the public's attention. How else to explain the sudden proliferation; this is at least the third popular book on the subject to appear since 2003, the others being:


The reviewer has now read all three of these, in order, each case having no dream at all that he would ever find occasion to read another popular book on this topic.

Each of these books is aimed at two audiences and, as such, faces somewhat of a dilemma. To quote Rockmore, "To distill years, even centuries, of scientific investigation for a broad and curious audience, while not raising the hackles of the experts in the field is something of an intellectual tightrope walk."

To a certain extent this is not as serious a problem for [SAB] who is not a mathematician. He exhibits less need to try to make the mathematics understandable. Although spending some of his time on this, he concentrates more heavily on telling amusing stories about various of the players in this drama, a part which I found rather enjoyable. Unfortunately, in the latter part of the book, well, to quote from Heath-Brown's Mathematical Review\(^2\) of [SAB], "The human story is dominated by an account of Louis de Branges and his work on the Riemann hypothesis, to which the author devotes four chapters and an appendix. The reviewer found this rather depressing reading..." So did I.

The book by Rockmore is closer in spirit to the book [SAU] and, in the reviewer's mostly positive opinion, is of roughly equal merit. Either book is enjoyable, but perhaps most people would find reading both of them to be a little too much. Like

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I thank Allyn Jackson for drawing my attention to a fourth such book, Prime Obsession: Bernhard Riemann and the Greatest Unsolved Problem, by John Derbyshire.

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Apart from this one exception, all quotation marks refer to excerpts taken directly from the book under review.
that book, it is written by a mathematician (although neither is an analytic number theorist; I wonder if any such would dare attempt this job). Hence, there is a genuine effort to make the mathematics understandable. Such an effort necessarily involves using, here, there, and everywhere, approximations to the truth and, given the audience, these approximations need to be much cruder than those we use in our survey articles or our colloquium lectures when we are addressing the well-known general mathematical audience. How well does Rockmore succeed in making his descriptions convey, to a nonmathematical audience, the idea of just what mathematics is about? I think he does a pretty good job of this although I am not at all certain that this is a question that can or should be answered by a mathematician.

Where would a book on the Riemann hypothesis begin? Would you believe the answer is Greenwich Village? Quickly, though, we dart back to Greece for, after all, at least for us eurocentrics, "This is number theory and the Pythagoreans are history's first number theorists." We begin with the primes as "the integral atoms", move on to the fundamental theorem of arithmetic, the sieve of Eratosthenes, and Euclid's proof of the infinitude of primes.

Soon, after some passages on how to count things asymptotically, we jump all the way forward to the "primal cartographers" Legendre and Gauss and their conjectures which would eventually become known as the prime number theorem. Here and at various places, other mathematical topics get briefly mentioned: non-Euclidean geometry, differential geometry, fast Fourier transform. Gauss is Gauss, after all.

The next chapter is entitled "Shoulders to stand on". Of course the quotation is due to Newton but, in this case, the shoulders are due to Euler. Back we go. Euler, when he was not being a "bridge builder" in Königsberg or any number of other things, was giving "a harmonious proof for Euclid". Specifically, he introduced, for many different purposes, the use of generating functions and, in particular, the one which was going to become the Riemann zeta-function. He developed a number of its most important properties, and he used it to study the primes and to give a proof that the sum of the reciprocals of the primes is divergent, a stronger version of Euclid's result.

Before we get to Riemann we need a couple of other shoulders, those of Dirichlet. Dirichlet took Euler's zeta-function and considered it as a function of a real variable, whereas Euler had been interested in it mainly at the integers. As a result, Dirichlet could consider limits. He also introduced $L$-functions which generalized the zeta-function and which allowed him, starting from Euler's ideas, to fashion a proof that every arithmetic progression

of integers (apart from certain trivial counterexamples) contains infinitely many primes. Analytic number theory was born.

Next we come to the main event: "Riemann was waiting." After a brief description of his early years and his work on Riemannian geometry we come back to the primes. This chapter requires some harder work for the general audience. "The range of tools and techniques that Riemann would bring to bear on this problem make it seem as if he had been preparing all his life for this moment ... These advances in the study of complex numbers, complex analysis and Fourier analysis are crucial to the Riemann hypothesis ..." After several pages of preparation the audience is led (of course there are no precise statements) to the zeta-function as a function of a complex variable, the explicit formula which gives the prime-counting function in terms of the zeros of the zeta-function, paving the way for the future proof of the prime number theorem, and also making it clear why the location of the "zeta zeros" is so crucial. Finally, we meet the Riemann hypothesis itself which is the most desirable, and also the simplest, explanation for the location of these zeros.

After some time on the ideas of Stieltjes for proving the Riemann hypothesis by showing that the Möbius function behaves like a random walk, we reach Hadamard and de la Vallée Poussin and the proof of the prime number theorem. We then turn the century. As it must, the century begins with Hilbert's problems. But then we come to the eighth problem, and back to the Riemann hypothesis.

The first seventy years of the century saw the work of H. Bohr and E. Landau, of Hardy and Littlewood, of Cramér, of Siegel and Riemann's Nachlass, of Weil and "a Riemann hypothesis that is true" and of Selberg, who would later be described as "the eminence grise of the Riemann hypothesis". This summary happens in about twenty-five pages. Are my hackles showing? Not really. There are many deep and beautiful theorems from this period but perhaps not so much possibility to explain more than a few of the most striking statements to this audience.

The past thirty-five years get substantially more press. And why not? There is lots of sexy stuff happening. We start with the chance (Chowla-engineered) meeting of Dyson and Montgomery and the pair-correlation of the zeros, which ignited the revival of the Hilbert-Pólya dream of a spectral interpretation of the zeros and the consequent resolution of the Riemann hypothesis. With Odlyzko's impressive computational evidence and further theoretical evidence provided by the higher correlations (Rudnick and Sarnak) and the function field analogues (Katz and Sarnak), it appears more and more as though the zeros are behaving like the eigenvalues of random matrices from certain
families studied by the physicists! Does this help us to prove the Riemann hypothesis any more than Stieltjes was helped by the fact that the Möbius function appears to behave like the toss of a random coin? Well, at least this connection is not so straightforward. We have “quantum chaos”, we have “life at the semi-classical limit”, we have “billiards in the Poincaré disk”.

The reviewer is not the only one to be somewhat skeptical. “Sarnak is among the first to say that in spite of all the exciting and beautiful mathematics and physics coming out of recent investigations into quantum chaos it is ’naive’ to think that this work will culminate in the discovery of a physical system whose energies produce the zeta zeros, and thus a proof of the Riemann hypothesis.”

Still we go on, to noncommutative geometry, the central limit theorem, the Painlevé differential equations, and the shuffling of decks of cards! Why are we doing this?

“In this web of connections we truly see the stature of the Riemann hypothesis. A great problem of mathematics becomes an intellectual nexus, providing a bridge across subjects and connecting seemingly disparate ideas... And finally, with its relevance to almost all of mathematics laid bare, almost every mathematician can have a chance to dream of contributing to, and (dare we say!) even settling, this most important open problem in mathematics that is the Riemann hypothesis.”

Inside this quote is one wisp: “a chance to dream”. Now, that is something to which I can relate!

And, on the seventh day God rested. But, by afternoon she had become a little bored and decided to play a game. She set out to create the story of the primes. However, even being God, she did something that you or I would do. She used the tools with which she was familiar, the same tools she had been using all week long to create the universe.
The long answer is: no one is sure. But the short answer is straightforward: a quasicrystal is a crystal with forbidden symmetry. Forbidden, that is, by "The Crystallographic Restriction", a theorem that confines the rotational symmetries of translation lattices in two- and three-dimensional Euclidean space to orders 2, 3, 4, and 6. This bedrock of theoretical solid-state science—the impossibility of five-fold symmetry in crystals—can be traced, in the mineralogical literature, back to 1801—crumbled in 1984 when Dany Shechtman, a materials scientist working at what is now the National Institute of Standards and Technology, synthesized aluminum-manganese crystals with icosahedral symmetry. The term "quasicrystal", hastily coined to label such theretofore unthinkable objects, suggests the confusions that Shechtman's discovery sowed. What's "quasi" about them? Are they sort-of-but-not-quite crystals? Solid with some sort of quasiperiodic structures? For that matter, what is a crystal?

Since the discovery of x-ray diffraction in 1912, a crystal's identifying signature has been sharp bright spots in its diffraction pattern; that's how Shechtman knew his were special. If it looks like a duck and quacks like a duck, it's a duck: charged in 1992 with formulating a suitably inclusive definition, the International Union for Crystallography's newly-formed Commission on Aperiodic Crystals decree a crystal to be "any solid having an essentially discrete diffraction diagram." In the special case that "three dimensional lattice periodicity can be considered to be absent," the crystal is aperiodic (http://www.iucr.org/iucr-top/iucr/cac.html).

I was a member of the commission when this definition was hammered out, and I argued strongly in favor of it. It wasn't a cop-out; it was designed to stimulate research. Which atomic structures or, more abstractly, point sets, have essentially discrete diffraction diagrams? The set of vertices of a Penrose tiling does—that was known before Shechtman's discovery. But what other objects do, and how can we tell? The question was wide open at that time, and I thought it unwise to replace one inadequate definition (the lattice) with another. That the commission still retains this definition today suggests the difficulty of the question we deliberately but implicitly posed. By now a great many kinds of aperiodic crystals have been grown in laboratories around the world; most of them are metals, alloys of two or three kinds of atoms—binary or ternary metallic phases. None of their structures has been "solved". (For a survey of current research on real aperiodic crystals see, for example, the website of the international conference ICQ9, http://www.icq9.ameslab.gov/index.html/)

And what have we learned about point set crystals? Let \( \Lambda \) be a discrete, countably infinite point set in \( \mathbb{R}^n \) and \( \mu_\Lambda \) the tempered distribution \( \sum_{x \in \Lambda} \delta_x \), \( \mu_\Lambda \) is a Dirac comb, N.G. de Bruijn's apt name for any weighted sum of Dirac deltas \( \sum_{w \in \Lambda} C(w) \delta_w \), where \( \Lambda \) is discrete. Whether \( \Lambda \) "diffraacts" depends on the relative, not absolute, positions of its points, so we are less interested in \( \Lambda \) itself than in the interpoint differences \( x - y \in \Lambda - \Lambda \) and in the convolution (autocorrelation) measure \( \gamma_\Lambda \), a Dirac comb \( \sum_{w \in \Lambda} C(w) \delta_w \) with nonnegative weights. The diffraction measure of \( \Lambda \) is the Fourier transform \( \gamma_\Lambda \). In general, \( \gamma_\Lambda \) is a sum of a Dirac comb \( \gamma_{\text{discrete}} \) and continuous components. The diffraction diagram of \( \Lambda \) is a plot of \( \gamma_\Lambda \); it is "essentially discrete" if \( \gamma_{\text{discrete}} \) is nontrivial, that is, if it has relatively dense support. (A set is relatively dense in \( \mathbb{R}^n \) if its intersection with every ball of some fixed, sufficiently large, radius is nonempty.) If \( \gamma_\Lambda = \gamma_{\text{discrete}} \), then \( \Lambda \) is a pure point crystal. A lattice \( L \) is the simplest pure point crystal; \( L - L = L \) and, by the Poisson summation formula, \( \gamma_L = \gamma_{\text{discrete}} = \sum_{x \in \Lambda} \delta_x \), where \( L^* \) is the lattice dual to \( L \), \( \{ y \in \mathbb{R}^n, \exp 2\pi i y \cdot x = 1, \forall x \in L \} \).

So far, so good, but we want to characterize crystals by local (geometrical) criteria, and this definition neither supplies nor implies them. In fact, some crystals are counterintuitive. We expect a point set crystal \( \Lambda \) to be, if not a lattice, then relatively dense. For
example, the set of "visible points" (points with relatively prime coordinates) in the plane, which has "holes" of arbitrarily large radii, should not be a crystal. But it is, and pure point no less (note that $\Lambda - \Lambda$ is the integer lattice). On the other hand, some point sets that "ought" to be crystals are not. Consider the famous pinwheel tiling ([1], [3]) with congruent right triangles. Like the Penrose tilings and many other aperiodic tilings (see the online "encyclopedia", http://saturn.math.uni-bielefeld.de), the pinwheel tiling is a substitution tiling, generated by a straightforward two-step process, decomposition and inflation. But, unlike tile edges in a Penrose tiling, the triangles' edges are aligned in a countable infinity of directions, so $\Lambda - \Lambda$ is not discrete.

Some large classes of aperiodic crystals do conform to our intuitive notions of pointy sets derived from lattices inherit a crystalline structure in modified form. If, like the set of visible points, $\Lambda$ is a subset of a lattice $L$, then so is $\Lambda - \Lambda$ and $\frac{1}{2}\Lambda$ is a weighted sum of deltas at points of $L^*$. We can construct a wide class of crystals $\Lambda$, the Penrose tiling vertices among them, from higher-dimensional lattices by the powerful and versatile cut-and-project method. Every cut-and-project set $\Lambda$ is discrete, relatively dense, and a pure point crystal. Cut-and-project sets are a special case of a large and general family of point sets called Meyer sets, which admit a hierarchy of order types. $\Lambda$ is a Delone set if it is uniformly discrete and relatively dense in $\mathbb{R}^n$. A Delone set is of finite type if it has a finite number (finite atlas) of local patterns of every radius, up to translation. (Equivalently, $\Lambda$ is of finite type if the difference set $\Lambda - \Lambda$ of interpoint vectors is closed and discrete.) A Meyer set $\Lambda$ is a set of finite type where $\Lambda - \Lambda$ is Delone. Meyer sets are always crystals, not necessarily pure point. They can be characterized in many ways; here is another: Meyer sets are almost-lattices. That is, $\Lambda$ is a Meyer set if and only if, for every $\epsilon > 0$, its $\epsilon$-dual $\Lambda^\epsilon := \{ y \in \mathbb{R}^n, \exp 2\pi i \langle y, x \rangle < \epsilon, \forall x \in L \}$ is relatively dense.

But shouldn't repetitivity ("quasiperiodicity") be the local criterion we are looking for? I expect, when all is said and done, it will be, but its role is not yet clear. A Delone set $\Lambda$ of finite type is repetitive if, for every $T > 0$, all local patterns of radius $T$ are relatively dense [2]. The rate of growth, with increasing $T$, of the size of $\Lambda$'s atlas of local patterns is a useful measure of its complexity. For example, if the growth function is bounded, then $\Lambda$ is a lattice. One expects the diffraction condition to be characterized by some big-O condition on $T$. However, repetitivity lies somewhat outside the hierarchy sketched above: all repetitive Delone sets are of finite type, but not all repetitive sets are Meyer, and not all Meyer sets are repetitive. If a repetitive set is Meyer, then it's a crystal since all Meyer sets are. But if it's a crystal, is it Meyer?

Meanwhile the burgeoning mathematical field of long-range aperiodic order and the experimental study of real aperiodic crystals are symbiotic and mutually stimulating. Their cross-fertilization has been more metaphorical than practical, but no less valuable for that. Penrose tilings, the $Drosophila$ of aperiodic order, don't tell us what the structures of real aperiodic crystals are, but they do tell us what aperiodic order can look like. (Still, we are missing something. For suitable choices of lattice, dimension, and other parameters, we get cut-and-project sets with (diffraction) rotational symmetry of any finite order. Yet the symmetries of real aperiodic crystals found so far are only pentagonal, decagonal, dodecagonal, and icosahedral. Evidently, the real crystallographic restriction is yet to be discovered.)

Reciprocally, structure studies of real crystals suggest that coverings by clusters may be more useful models than packings and tilings. The Penrose tilings' nonlocal growth (despite local matching rules) raises—but does not answer—questions about how crystals really grow. And recent experiments suggest that real crystal growth may be partly nonlocal too [4].

Stay tuned.

References

To make an animated implicit plot
1. Type an equation in four variables.
2. With the insertion point in the expression, from the Plot 3D Animated submenu choose Im.

$z^2 + ty + z - 1 = 0$

Animated Tube Plot

To make an animated tube plot
1. Type an expression in one or two variables.
2. With the insertion point in the expression, from the Plot 3D Animated submenu choose Im.

$\sin (\theta) \sin (\phi)$

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—American Mathematical Monthly

Yandell writes well and has done a good job of researching these stories, supplementing the standard written sources with interviews and photographs. The resulting profiles are interesting, readable, and insightful. Along the way, the reader gets some of the actual mathematics, but the most important message is really about the people: how brilliant they were, how passionate about mathematics, and sometimes how strange and eccentric, as well.
—SCIENCE

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A K Peters
What Is the BMSA and What Does It Do?

Scott Weidman

Government policies should rest on a solid foundation of analysis, and increasingly that analysis consists of mathematical models. But mathematical scientists, with their in-depth understanding of how to construct and analyze mathematical models, and of the limitations of mathematical models, have often not been involved in the discussions leading to those policy decisions. The Board on Mathematical Sciences and Their Applications (BMSA) exists to increase the involvement of mathematical scientists and their perspectives in policy decisions that depend on, or affect the practice of, mathematical research.

The BMSA is a standing committee of the National Research Council (NRC), a nongovernmental, nonprofit entity that conducts studies on behalf of the National Academy of Sciences (NAS) and the National Academy of Engineering (NAE). The NAS, NAE, and NRC, along with a sister organization, the Institute of Medicine, are collectively known as The National Academies. National Academies studies, some 200 per year, address issues such as the proper use of computational models in setting environmental regulations, the validity of biometric security technologies, priorities for supercomputing investments, and many other topics with mathematical relevance. The common theme in such studies is that of distilling lessons from the scientific, engineering, and medical communities to guide federal policies and decisions. The National Academies are considered the premier source of objective technical advice in the United States, both because of the quality of people recruited for these studies and because of the processes in place to ensure that those studies are conducted independent of bias or conflicts. Increasing the involvement of mathematical scientists in studies such as these is a great opportunity to improve policymaking while increasing the visibility of mathematical scientists, and those are the goals that motivate the BMSA.

In order to maintain its understanding of the needs of federal agencies, BMSA has in the past year engaged in discussions with the heads of the National Science Foundation, the National Institute of General Medical Sciences, and the Air Force Office of Scientific Research, with leaders in the Federal Reserve System, and with many other highly placed officials. Members have also had discussions with leading figures in computer science, biology, medical informatics, economics, defense, intelligence, and so on. This access allows the board to raise issues of importance to the mathematical sciences, contribute perspectives of our community to high-level policy discussions, and generally raise the community’s profile so it is less likely to be overlooked during policymaking. In many cases, these discussions are one of the few occasions where the high-level decision-makers have a chance to interact with mathematical scientists, and they welcome that involvement. The board’s interactions in this way spread the word that mathematical scientists are engaged, interested, and contributing professionals.

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What Is the BMSA?

The BMSA consists of nineteen members who serve pro bono; a list appears at the end of this article. While they are appointed by the president of the NAS, academy membership is not a prerequisite. The board takes a very broad interpretation of the mathematical sciences and includes members from core and applied mathematics, operations research, statistics, computer science, computational science, economics, systems engineering, financial engineering, genomics, risk analysis, and decision analysis. All of the board members consider themselves mathematical scientists, and they feel strongly that there is a core mathematical foundation that unites, grounds, and strengthens their fields. The BMSA has a long-term vision of uniting these many fields under a general umbrella of “mathematics” while encouraging a similar broadening within many academic mathematics departments.

The board is not an advocacy or lobbying organization. Rather, it aims to understand many uses of the mathematical sciences—explicit or, more often, hidden—throughout the federal government, and it undertakes studies or workshops to provide two-way communication between the mathematical research community and those important application areas. Through these workshops and studies, planned by expert committees that include mathematical scientists as well as leaders of other fields and that often address non-mathematical needs (examples are below), the BMSA accomplishes at least three good goals:

1. The best mathematical thinking is brought to the subject of the study or workshop, which improves public policy;
2. The value of mathematical thinking is demonstrated, both to the non-mathematicians on the committee and to the readers of the study’s final report; and
3. The BMSA (through a report or follow-on presentations) can steer mathematical researchers to open research questions that will contribute both to future advances in other fields and to the mathematical sciences, thereby strengthening that important interface.

This approach, of working with communities that need mathematics to address challenges that may be only partly mathematical, is the best way of demonstrating the value of the mathematical sciences. A long-term effect will be an improvement in the way the mathematical sciences are perceived—as essential and willing partners in problem-solving, partners whose toolkit is special and valuable—which could broaden federal support for the mathematical sciences. At the same time, this approach builds bridges that counter the isolation that hampers some mathematics at present. This is a gradual process, accomplished by long-term, consistent involvement of mathematical scientists in issues that transcend our own profession. There is no quick fix, no chance to whisper magical words to a high-ranking person who will then orchestrate a greater, widespread appreciation of (and funding for) mathematicians.

To most sectors of the nation and most agencies of the federal government, “mathematics” is nearly synonymous with “analysis” (meaning quantitative modeling, not the subfield of mathematics). There are very few people with the title of mathematician in government or industry, but many people who would readily agree they are performing mathematical tasks. In many cases, these people have difficulty staying connected to the academic mathematical sciences community because the level of work, and the types of questions addressed, are so disparate. This is the community of mathematical practitioners: those people who apply mathematical methods but generally do not carry out research. These professionals are connected to many exciting challenges that are essentially mathematical, challenges that give them an incentive to apply research advances if relevant ones can be found. In the absence of bridges to the academic mathematical profession, many of these practitioners are more likely to align themselves with other professional communities, which simply deepens the gulf between theory and practice in the mathematical sciences. That gulf is bad not only because it lessens the transmission of mathematical advances into practice and the identification of challenges to the research community, but also because it contributes to the reputation of the mathematical sciences as being of less practical value than some other fields.

The BMSA aims to overcome that gulf in several ways. First, its activities related to federal analysis and decision-making identify directly how state-of-the-art mathematics is applicable to, and necessary for, the real needs of nonresearch agencies. Second, in the course of providing such advice, the board brings together leading mathematical scientists and mathematical practitioners, broadening the knowledge base of the mathematical scientists and demonstrating to the practitioners the value of such interactions. Presumably, some or many of the practitioners will maintain those connections as new challenges arise, leading to sustainable connections among communities that depend on the mathematical science research enterprise. Third, the BMSA’s access to high-level decision-makers in agencies and Congress gives it the opportunity to drive home the value of such interactions and the consequent need for a healthy mathematical sciences research base. Remember that these interactions are primarily with leading figures who are not in research agencies, so the BMSA is able to build up diverse support for the capabilities and
value of the mathematical sciences within sectors that might otherwise be unaware of our community. This will gradually improve the political support for mathematical sciences funding.

So the BMSA includes in its mission anything that improves the quality of analysis underlying public policy and federal decision-making. Improving the quality of analysis requires the board to address all of the following needs:

1. Rapid and effective sharing of ideas, skills, and methods among and within sectors. The BMSA's 2004 workshop on Enterprise Risk Management is an example that addresses this need, because it assisted in the transition of risk management capabilities from the banking sector to the public sector while alerting academia to unresolved research challenges. That subject is likely to be explored further in coming years, as more and more federal agencies adopt quantitative methods to evaluate their internal risks. Any BMSA study that applies the insights of leading scientists and engineers to advise an agency about their analytic capabilities and guide their programs would also fall within this general mission of the board.

2. Ensuring that people with the right skill sets are produced by the academic pipeline, so that the nation has the right foundation for high-quality analysis.

3. Ensuring that adequate tools—including research results, software, and analytical methods—are available and used properly. Studies that offer guidance to the research enterprise would address this need, as would reviews of how well selected federal agencies carry out their analyses.

4. Improving the health of the academic foundation of quantitative sciences—which the board agrees is centered within mathematics departments—and improving the connectivity between this base and the widespread community that performs analyses and research. This part of the mission is essential if we are to pursue items 2-3, and it helps in performing item 1. BMSA studies that help connect research disciplines, such as our recent study on computational biology, fall within this part of the mission, and almost any study the BMSA does for a federal or state agency also includes some lessons to transmit back to the academic community so as to improve the connections and make mathematical sciences research responsive to emerging needs.

5. Ensuring healthy communication between the analysis and policy communities, so that the former understands the goals and constraints of the latter, and the latter understands the value and potential of the former. This part of the mission would be addressed through the way we conduct studies—i.e., simply by getting technical people, researchers, and policy people working together on tasks—with the result that these communities have better communication and, in particular, that the mathematical sciences community becomes a more valued contributor.

What Does the BMSA Do?
The board's current program addresses four general areas at the interface of mathematical sciences research and public policy:

1. Advice for the responsible and effective use of computational models. The rapid increases in computing capabilities in recent years have increased the need for care in interpreting output from complex models and simulations.

2. Creation of knowledge from large amounts of data. Over the past twenty years, many areas of science and engineering have evolved from being data-poor to being awash in data, and there is a growing need for better methods of data analysis.

3. Advancing the mathematical and statistical underpinnings of risk analysis.

4. Leadership for the mathematical sciences. The mathematical sciences community benefits from guidance about emerging research directions and the development of policy for the discipline.

The last of these areas is probably the easiest for Notices readers to recognize. An example of the board's work in this area is its recent reports Mathematics and 21st Century Biology and Basic Research in Information Science and Technology for Air Force Needs. The first of these, released in June 2005, captures the results of a one-year study by an expert, cross-disciplinary committee to identify ways to best position mathematical sciences research to be of most value to biology. The committee was chaired by a leading biologist, Maynard Olson of the University of Washington, to ensure that the study and its report would have maximal credibility and not be biased toward the goals of mathematical researchers. Although the study was sponsored by the Department of Energy in order to better align its mathematical sciences research program with the DoE's research in biology and environmental science—which are fairly constrained—the committee decided that a broader scope would be critical for really strengthening the mathematics-biology interface. Therefore, it decided to examine the roles of mathematical sciences research on research in genomics, molecules, cells, organs, populations, and communities. This was a good choice, because the committee also found a great deal of overlap in the mathematical challenges for addressing biology problems from across these scales. The committee—which included six members of the National Academy of Sciences and other prominent leaders in biology, ecology, bioinformatics, applied mathematics, and statistics, most of whom work on the interface of the two fields—also made recommendations about how funding...
agencies can best encourage fruitful research on this interface.

Most recently, Basic Research in Information Science and Technology for Air Force Needs (2006) was the first document to lay out a clear research agenda to build the foundations of information science of importance to the Air Force. That report was generated by a committee with strong credibility in both computer science and mathematical sciences communities,¹ and so its recommendation for a major increase in research funded by the AFOSR (Air Force Office of Scientific Research) with a mathematical orientation was well received. As a result of this study, AFOSR’s Directorate of Mathematics and Space Sciences is slated to receive an increase of US$6 million per year.

More generally, the BMSA serves to provide highly credible advice regarding the best infrastructure for the mathematical sciences enterprise and the best use of the community’s insights for improving the work of the federal government and underpinning national policy. Regarding the infrastructure for the mathematical sciences, the board’s reports on research opportunities (next paragraph) contribute specific advice, distilled from the leaders of the cognizant fields or interfaces. Occasionally, the board develops reports with a more overt policy orientation. Examples include Harnessing Moore’s Law: Mathematical Science Priorities in Support of Computational Science and Engineering (planned for 2007) and U.S. Research Institutes in the Mathematical Sciences (1999).

One way in which the BMSA improves interfaces between the mathematical sciences and other fields of research is by documenting fertile sources of exciting research opportunities at the interface with other fields of science and engineering. The board has a long history of doing this through reports such as Mathematics and 21st Century Biology (2005), Mathematics and Physics of Emerging Biomedical Imaging (1996), Calculating the Secrets of Life (1995), Mathematical Sciences and Theoretical/Computational Chemistry (1995), Mathematical Research in Materials Science (1993),² and others. To create such reports, the BMSA typically assembles a cross-disciplinary committee of experts that—through interactions with other experts, funders, and other involved parties over the course of a year or more—identifies some of the most exciting and promising opportunities. These committees often make recommendations to the funding agencies and the affected communities about how to improve the effectiveness of the subject interface.

In addition to reports, the BMSA organizes workshops to bring together communities performing research that is synergistic, both to strengthen those communities and to inform federal funding agencies about some of the most promising directions to support. Examples of these, some of which were organized by the BMSA’s Committee on Applied and Theoretical Statistics (CATS), include:

- Workshop on Statistics on Networks, September 26–27, 2005
- Workshop on Visualization of Uncertain Information, March 3–4, 2005
- Statistical Methods for the Analysis of Massive Streams of Data, December 13–14, 2002
- Mathematical Sciences’ Role in Homeland Security, April 26–27, 2002
- The Interface of Three Areas of Biomedical Science with the Mathematical Sciences, April 26–28, 2001
- The Interface of Three Areas of Computer Science with the Mathematical Sciences, April 28–29, 2000
- Large-Scale Structures in Acoustics and Electromagnetics, September 26–27, 1994
- Motion, Control, and Geometry, April 12, 1994

Because of the BMSA’s position within the National Academies, it has had great success in attracting leading scientists from other fields to its workshops. That allows these meetings to be truly cross-disciplinary and to have influence in multiple fields. Workshops such as the 2002 one dealing with homeland security profited from the board’s ability to attract leading managers from a variety of federal agencies, including the National Security Agency, the Centers for Disease Control, the National Imagery and Mapping Agency, and the predecessor of the Department of Homeland Security. Some of those workshops are documented via proceedings (e.g., Motion, Control, and Geometry), web-based video (e.g., Mathematical Sciences’ Role in Homeland Security, the video of which is hosted at the website of the Mathematical Sciences Research Institute, http://www.msri.org), and articles in professional journals (e.g., a December 2003 special issue of Journal of Computational and Graphical Statistics, drawn from the workshop on statistical methods for the analysis of massive streams of data).

¹The committee included five members of the National Academy of Engineering, one member of the National Academy of Sciences, and one of the Institute of Medicine, including well-known mathematical scientists Elwyn Berlekamp, Roger Brockett, and Prabhakar Raghavan.
²All reports cited in this article are available through the National Academies Press, http://www.nap.edu, and most may be perused online at that site.
The BMSA is taking steps to increase its contact with the broader academic mathematics community, for example with an article about recent work that appeared in the September 2005 issue of the Notices. The board has also taken steps to present cross-disciplinary opportunities at professional conferences, such as special sessions at the 2003 and 2004 Joint Mathematics Meetings on mathematics and computer science and on mathematics and biology, respectively, and a special session at the 2004 Joint Statistical Meetings on statistics and forensic sciences. A special session is being planned for the 2006 Joint Statistical Meetings dealing with statistics on networks.

Some Future Directions
The BMSA has seen increasing interest among a wide variety of federal agencies to receive top-quality mathematical advice. The board recently held a workshop jointly with the Federal Reserve Bank of New York to stimulate fresh approaches to modeling systemic risk in the financial sector. It is hoped that this workshop will be just a first step in a long-term effort to strengthen ties between mathematical scientists and the central banking community. The board’s Committee on Applied and Theoretical Statistics will soon be involved in a major study aimed at strengthening the foundations of forensic science; statisticians are needed to deal with the many uncertainties. BMSA has nearly finished a major study on defense modeling, simulation, and analysis, which is a very broad enterprise providing input to many critical decisions affecting defense and budgets. That enterprise is only weakly coupled with the broader mathematical sciences community, and the board hopes that its report will be a first step toward reconnecting the two communities, which were very close in the 1940s and 1950s.

This is just a snapshot of the BMSA and its activities. As it explores new connections for the mathematical sciences community, we will provide updates periodically through articles like this one and at professional meetings. These are tremendously exciting times for mathematical scientists.

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In 2001 the AMS began sponsoring MathJobs.Org, a job application database for mathematics departments. Originally developed by systems programmer Yunliang Yu for the mathematics department at Duke University, MathJobs is a sophisticated, well-functioning system that can manage all aspects of a department’s job search in an entirely paperless environment. Although the number of departments using MathJobs is small—about sixty for the 2005-2006 academic year—the number has been growing every year and the response has been positive. The AMS is sponsoring MathJobs in the belief that the system offers great benefits to the mathematical community in providing an efficient, centralized, and secure way to manage the job search process.

Although MathJobs was designed for academic searches, it can be used by any employer seeking to hire mathematicians. An employer can sign up to use MathJobs for US$350 a year. For that fee, the employer can list up to seven positions on MathJobs. Job seekers, who use the service for free, create personalized password-protected accounts through which they can upload files to create their own personalized portfolios. They can then browse through employment listings and create tailored applications by selecting the appropriate documents from their portfolio. Those asked to write letters of reference for positions advertised in MathJobs receive via email a password for the system so that they can upload their letters directly. Applicants cannot access the letters, but they can check to make sure they have been submitted.

In mathematics departments using MathJobs, one person in the department is designated as the administrator, and that person assigns passwords to other users as needed. The users can then access electronically all of the documentation about the job candidates. MathJobs creates a page for each applicant that contains his or her application materials as well as information about which documents have and have not been received. On each applicant’s page there is a space where faculty can enter comments that can be viewed by colleagues. MathJobs can produce lists of candidates sorted according to various criteria, generate reports (such as equal employment opportunity reports), and send email automatically to candidates to inform them of progress in the job search. One of the biggest advantages of MathJobs is that it frees faculty from dealing with a stack of paper applications. Not only is the information accessible from home, office, or the road, it is also accessible by multiple people at the same time.

The fee the AMS charges departments for use of MathJobs goes towards covering maintenance costs the Society pays to Duke University; all of the hardware and systems support is centered at Duke. The fee also helps to cover the cost of MathJobs user support, which is provided by AMS staff, headed by Diane Boumenot, manager of the AMS Membership and Programs Department. Last year Boumenot’s team spent about 500 hours on MathJobs user support. “At first, it was only technically savvy departments that were using MathJobs,” Boumenot commented. “They thought it was cool. But now we are getting departments that are less technically savvy too, so we are getting more questions from users.” Initially, departments were often using MathJobs simply as a warehouse for the application data, which they would print out and assemble into the traditional paper folders. Fewer departments seem to be doing that now. “We find that departments are now using all the facilities that MathJobs has to offer,” she remarked.

Random inquiries to a half dozen departments that have been using MathJobs turned up positive responses and no complaints. “I am very pleased
with MathJobs," said Ken Brown, chair of the mathematics department at Cornell University. "I find the search features especially useful, and I like being able to use MathJobs during a faculty meeting, if someone raises a name without advance warning." Cornell has been requiring applicants to use MathJobs, and Brown said he is not aware of any complaints from them. Cornell does not require writers of recommendation letters to use MathJobs, and the department still receives a lot of letters on paper that it must scan and upload into MathJobs. Indeed, according to Boumenot, many departments have found it difficult to get letter writers to submit their letters directly into MathJobs. Although the MathJobs interface is quite easy to use, with a simple cut-and-paste operation for submitting letters, some writers do not want to spend the time to log in and figure out how to use the system. Still, Boumenot noted that gradually more letter writers are submitting their letters directly into MathJobs or are naming a proxy, such as a departmental secretary, to do it for them.

"MathJobs saved us a huge amount of time compared to the system we employed the previous year in which we uploaded all the materials we received to our own secure website," said Simon Tavener, chair of the mathematics department at Colorado State University. "We also found the MathJobs support to be responsive and helpful." A strict interpretation of state law by the university's Office of Equal Opportunity and Diversity raised the possibility that the department might have to stop using MathJobs. The difficulty centered on access to recommendation letters. But a small adaptation implemented by the MathJobs staff got around this difficulty, and Tavener expects his department can continue using MathJobs.

Another user of MathJobs is the Mathematical Sciences Research Institute (MSRI) in Berkeley. In 2003 MSRI began using a new online application form it had created. Glitches in the system meant that it was put to full use only in 2004. Although the system works well for applications by participants in MSRI workshops, there were various problems in using it for applications for the approximately ten memberships and postdoctoral positions MSRI offers each year. So MSRI switched to MathJobs to fill memberships and postdoctoral positions, starting in 2005. MSRI's selection committees consist of mathematicians at various institutions, and wherever they are they can view applicant information on MathJobs. MSRI deputy director Hugo Rossi said MathJobs has worked very well. In the past the MSRI technical staff had occasional struggles when applicants submitted PDF files that were unreadable. That problem is gone: MathJobs has an automated system that produces a new PDF to replace the faulty one. With ten positions to fill, MSRI has to pay double the yearly MathJobs fee. But, said Rossi, "Compared to cost in staff time without Mathjobs, it is extremely inexpensive."

The mathematics department at Vassar College is small, with just seven tenure-track lines. But their applicant pool is large: in 2005 they advertised one tenure-track and two visiting positions and received around 750 applications. For a small department without a lot of human resources to manage that workload, MathJobs "was definitely a big plus for us," said department chair Benjamin Lotto. Among the biggest advantages of MathJobs was the ability to produce Affirmative Action/Equal Employment Opportunity Commission reports with the press of a button. "This saved our administrative assistant hours of work," he said. The department functions as a "committee of the whole" in making hiring decisions, so it was an advantage to have all of the job application information centralized and accessible to everyone, whether they were in the department or logging in from home or from a conference. Lotto downloaded the entire applicant database to his laptop before going to the Joint Meetings in San Antonio in January 2006 so that if he met any applicants he would have their documents at his fingertips.

Lotto called MathJobs "an impressive work" that has the flavor of middle-aged software—not quite mature, but certainly not a "beta version" either. Sometimes, after being away from MathJobs for a couple of weeks, he would find that new features had been added that were not there before. "That was neat—but also a little confusing, because then we had to ask ourselves, 'Do we now want to use these new features?'" On the other hand, most of the time his department found that when they wanted a certain feature, the feature was already in MathJobs.

Rossi called MathJobs "a great service to the mathematical community," but he worries that as the volume goes up and the diversity of job types increases, the workload, in terms of time spent by AMS staffers and the group at Duke, could become insupportable. However, if MathJobs really takes off and a lot of departments use it, the user-support needs might decline as the system becomes more familiar to more people. Clearly the need is there for some kind of automated database system for filling positions in mathematics. If every department developed its own system, applicants might face a nightmare when they apply to, say, forty institutions and must figure out forty different systems. Preventing such a situation is part of the reason the AMS began sponsoring MathJobs in the first place. Time will tell whether the service really catches on.

—Allyn Jackson
Conjectures No More?
Consensus Forming on the Proof of the Poincaré and Geometrization Conjectures

Allyn Jackson

Have the Poincaré Conjecture and the Thurston Geometrization Conjecture been proved?
This question has been on the minds of mathematicians for more than three years, ever since Grigory Perelman posted his now-famous papers on the Web. In midsummer 2006, as the International Congress of Mathematicians in Madrid approaches and speculation about the Fields Medals is buzzing, some experts who had been making cautious statements for the past three years sound increasingly confident that the conjectures are finally yielding. In particular, many believe the Poincaré Conjecture is now a bona fide theorem. The picture is slightly less clear for the Geometrization Conjecture, but there is much optimism that this result will soon be established as well.

Of the Dollars and the Glory
For mathematicians, the million dollars that the Clay Mathematics Institute (CMI) has offered for the solution of the Poincaré Conjecture is mere icing on the cake. The real prize is the glory of settling a question that has tantalized mathematicians for more than a century. The statement dates back to 1904, when Henri Poincaré conjectured that it is the property of being simply connected that topologically distinguishes the three-sphere from other compact three-manifolds. Since that time there have been many incorrect attempts to prove the Poincaré Conjecture, some of them by such well-known mathematicians as Edwin Moise, Christos Papakyriakopolous, Valentin Poenaru, and Colin Rourke. A recent incorrect proof, by Martin Dunwoody of Southampton University, came in 2002, about six months before Perelman posted his first paper on the subject. Almost as soon as news stories started to appear about Dunwoody's proof (an April 2002 article in the New York Times carried the headline "UK Math Wiz May Have Solved Problem"), the proof fell apart.

In fact, there have been so many wrong proofs of the Poincaré Conjecture that John Stallings of the University of California, Berkeley, has posted on his webpage a paper he wrote in 1966 called "How not to prove the Poincaré Conjecture", which describes his own failed attack, as a warning to others who might hit upon the same idea. One characteristic that most of the failed attempts share is a reliance on topological arguments. But, noted John Morgan of Columbia University, "It seems like this problem does not succumb to that type of argument." Rather, he said, one needs tools from outside topology, from geometry and analysis, to tackle this topological question.

In contrast to the multiple failed attempts on Poincaré, it appears that, before Perelman's work appeared, no one had seriously claimed to be able to prove the full Thurston Geometrization Conjecture. In fact, this is a much deeper and more far-reaching statement than the Poincaré Conjecture and includes Poincaré as a special case. First proposed in the 1970s by William Thurston, who is now at Cornell University, the Geometrization Conjecture provides a way to classify all three-manifolds. Thurston's great insight was to see how geometry could be used to understand the topology of...
three-manifolds. The Geometrization Conjecture states that any three-manifold can be split into pieces in an essentially unique way and that each of these pieces carries a geometric structure given by one of eight model geometries. The conjecture was not wide open before the work of Perelman; it had been established in many cases. Thurston himself proved the conjecture for manifolds that are sufficiently large. Several mathematicians contributed to establishing the full conjecture for six of the eight geometries. The two remaining geometries are the spherical and hyperbolic ones, where the metrics have constant positive and constant negative curvature, respectively. The Poincaré Conjecture comes under the case of metrics of constant positive curvature. (An excellent historical account is [Milnor].)

Against this background, mathematicians were naturally skeptical when Perelman posted his articles on the arXiv, the first in November 2002, the second in March 2003, and the third in July 2003 [Perelman1–3]. Nevertheless, his efforts were from the outset taken quite seriously. One reason is that Perelman is a well-regarded mathematician who had already made distinguished contributions to geometric analysis. He was an invited speaker at the 1994 ICM in Zurich, where he gave a lecture in the geometry section about spaces with curvature bounded below. In 1996 he was awarded one of the ten prizes given to outstanding young mathematicians every four years by the European Mathematical Society (Perelman refused to accept that prize).

Another reason Perelman’s work was taken seriously is that it fits into a well-known program to use the Ricci flow to prove the Geometrization Conjecture. The originator of this program is Richard Hamilton, now at Columbia University, who will be a plenary speaker at the 2006 ICM in Madrid. The abstract for Hamilton’s talk says that the Ricci flow program was developed by him and Shing-Tung Yau of Harvard University. The idea, first described in a 1982 paper by Hamilton [Hamilton], is to use the Ricci flow, a partial differential equation that is a nonlinear version of the heat equation, to homogenize the geometry of three-manifolds to show that they fit into Thurston’s classification. It was generally believed that, philosophically, Hamilton’s approach ought to work. This belief strengthened as Hamilton and others worked out much of the analysis that was needed. The toughest obstacle was handling the singularities that could develop in the Ricci flow. It was this obstacle that Perelman, by introducing deep new ideas in geometric analysis, was able to overcome to such spectacular effect. (An excellent expository account about the Ricci flow is [Anderson].)

Poring over Perelman

In the spring of 2003, after his first two papers had appeared on the Web, Perelman gave lectures at several universities in the U.S., including Columbia University, the Massachusetts Institute of Technology, and Princeton University, as well as a series of lectures at Stony Brook University. Soon thereafter he returned to his home base in St. Petersburg, and he has given only a very few lectures on the subject since then. He answered mathematical questions by email, but some mathematicians report that after a while he stopped even that form of communication. It is not clear what Perelman has made of the acclaim that has surrounded his achievements. Many articles about his work have come out in the popular press, though it appears that he never consented to be interviewed by reporters.

As mathematicians began to read the papers carefully, they found them tough going. "Perelman’s articles are remarkably carefully written if one takes into account how much new ground he breaks in a relatively few number of pages," explained John Lott of the University of Michigan. "However, they are not written in such a way that one can just sit down and quickly decide whether his arguments are complete." Morgan remarked that Perelman omits certain technicalities that turned out to be standard, but rather tricky, to work out in detail. And, Morgan said, sometimes arguments are justified by a statement that they are analogous to arguments presented earlier, but it is not always clear exactly how the earlier arguments can be adapted. On top of these difficulties, there are some outright mistakes in the paper, though none has proven serious. It appears that Perelman never submitted his articles to any journal. Had he done so, they probably would not have been accepted without substantial revisions.

Soon after Perelman’s papers appeared on the Web, mathematicians undertook efforts to understand and verify them. In June 2003 Lott, together with Bruce Kleiner, who is now at Yale University, started a webpage in which they presented notes about Perelman’s work as they went carefully through his papers. In late 2003 the American Institute of Mathematics in Palo Alto and the Mathematical Sciences Research Institute in Berkeley jointly sponsored a workshop on Perelman’s first article; another workshop, about Perelman’s second article, was held in the summer of 2004 at Princeton University. The Clay Institute, which has an obvious interest in knowing whether Perelman’s work is correct, provided funding for the Princeton workshop and also sponsored a month-long summer school held at MSRI in the summer of 2005. In addition Clay provided some support to Kleiner and Lott, who continued to add to and post their notes on the Web, as well as Morgan and
Gang Tian of Princeton University, who are collaborating on a book about Perelman's work on the Poincaré Conjecture.

In June 2005 Gérard Besson of the University of Grenoble presented a Bourbaki lecture on the work of Perelman; the lecture will appear in the *Astérisque* series in September 2006. In the fall of 2005 Xi-Ping Zhu of Zhongshan University gave a six-month series of lectures at Harvard University, describing the content of a paper that he has written with Huai-Dong Cao of Lehigh University and that appeared in the June 2006 issue of the *Asian Journal of Mathematics*. There have been other workshops and summer schools on the subject, not to mention the many lectures given in mathematics departments and at conferences. Study groups were formed to go through Perelman's papers in several countries, including China, France, Germany, and the United States.

While it seems that Perelman's papers were never refereed in the traditional sense, they have been subjected to extraordinary scrutiny in the three and a half years since their posting on the Web. The simple passage of time without anyone finding a serious problem in his work has, at least for many nonexperts, led to a conviction that it must be correct. For example, Koji Fujiwara of Tohoku University is not an expert in this area, but he believes Perelman's work must be right, for two reasons. "If there were something philosophically wrong, so that the approach could not work, after three years someone would have found the philosophical problem," he reasoned. And second, Fujiwara said, Perelman is a well-known expert on Ricci curvature, and his previous papers have been reliable and have not been found to contain mistakes. Of course, this kind of confidence is the privilege of the nonexpert. Experts have to work much harder.

Filling in the Details

"They should give [Perelman] a Fields Medal for the Poincaré Conjecture," declared John Morgan in an interview in May 2006. "I believe the argument is correct, as do, I think, all who have looked at it seriously....This is clearly the most exciting thing that has happened in mathematics in the last four years," since the previous batch of Fields Medals were awarded. Morgan said that the book he is writing with Tian, which is to appear in early 2007, will provide a full exposition of the proof of the Poincaré Conjecture à la Perelman.¹ Morgan said that he has no doubts that Perelman can also prove the Geometrization Conjecture, but Morgan has not personally gone through that proof in detail, as he has done with Poincaré.

Indeed, many mathematicians express more confidence in the proof of Poincaré than in the proof of Geometrization. Perelman himself provided a shortcut to proving Poincaré, and there is a more extensive body of material that is needed for the proof of the full Geometrization Conjecture. Some believe that the best way to ensure that Poincaré has really been proved is to verify the proof of Geometrization. So what is the status of the proof of the Geometrization Conjecture?

In May 2006 Kleiner and Lott posted on the arXiv an article titled "Notes on Perelman's papers". They say that their article, along with a 2005 paper by T. Shioya and T. Yamaguchi, provides details for Perelman's arguments for the Geometrization Conjecture. Lott cautioned that Perelman's work has to be further examined by the mathematical community before there can be any universally accepted verdict. The Kleiner-Lott paper is based on the set of notes they began posting on the Web in the summer of 2003. In the three years over which they developed the notes and made them public, Kleiner and Lott received corrections and comments from many mathematicians. They plan to submit their paper to a journal.

In late April 2006 the *Asian Journal of Mathematics* announced on its website the upcoming publication of the paper by Cao and Zhu, "A complete proof of the Poincaré and Geometrization Conjectures—Application of the Hamilton-Perelman theory of the Ricci flow". The announcement included the paper's abstract, which states in full: "In this paper, we give a complete proof of the Poincaré and the geometrization conjectures. This work depends on the accumulative works of many geometric analysts in the past thirty years. This proof should be considered as the crowning achievement of the Hamilton-Perelman theory of Ricci flow." The 330-page paper appeared in print in the June 2006 issue of the *Asian Journal*. The issue has not been made available electronically on the journal's website and is available only as a printed paper publication. The Cao-Zhu article did not circulate as a preprint, but the work presented was described in Zhu's lectures at Harvard during the 2005-2006 academic year.

Some have noted the short amount of time between the submission date for the Cao-Zhu paper, December 12, 2005, and the date when it was accepted for publication, April 16, 2006, and wondered whether such an important paper of over 300 pages could have been refereed in a serious way. In a May 2006 interview, Yau, who is one of the editors-in-chief of the *Asian Journal*, said that the manuscript had been around for a year, but "we have been very careful not to distribute it, to make sure everything is right before it is in print." Asked

whether the paper had been refereed in the usual way, Yau said that it had and remarked that the Asian Journal has very high standards.

Although not enough time has yet passed for the Cao-Zhu paper to have been subjected to much scrutiny by the mathematical community, the paper became widely known because of coverage about it in the Chinese press during June 2006. “Chinese Mathematicians Solve Global Puzzle” read the headline of an article that appeared on the Xinhua news service on June 3, 2006. The article’s first sentence stated: “Two Chinese mathematicians have put the final pieces together in the solution to a puzzle that has perplexed scientists around the globe for more than a century.” Cao characterized the barrage of media attention to his work with Zhu as “overwhelming”. Some of the news articles were translated into English and posted on the Web. In those articles, the achievements of Cao and Zhu, both of whom are Chinese, are emphasized, while the achievements of Perelman are mentioned in a less prominent way. In one story from the Xinhua news agency, which appeared on June 21, 2006, the name of Perelman does not even appear. The coverage began after Yau held a news conference in Beijing on June 3, 2006, in which he announced the work of Cao and Zhu. Yau said that he was misquoted in some of the media accounts and does not endorse what is said there. On June 20, 2006, he presented a public lecture on the subject at the Morningside Center of Mathematics at the Chinese Academy of Sciences in Beijing, the slides of which are available on the center’s website at http://www.mcm.ac.cn/Active/yau_new.pdf.

**Doling Out the Prizes**

With so many players, who will get credit for the proof of these monumental results? This is not a simple question. Often in mathematics credit for a result goes to the person who came up with the decisive ideas that really made the proof work, even if that person never wrote up a complete proof. As a historical example, Robion Kirby of the University of California, Berkeley, pointed to Thurston’s orbifold theorem. Thurston described this result in a 1982 article in the Bulletin of the AMS [Thurston], using an argument that Kirby characterized as “definitely sketchy”. The orbifold theorem covers the Geometrization Conjecture when there is a discrete group acting on the three-manifold with fixed points, and this covers a lot of cases, although not the Poincaré Conjecture. After more than a dozen years had passed without a complete proof, Kirby added the orbifold theorem to his well-known problem list in topology and declared it to be an open question. Two different groups of mathematicians independently produced complete proofs of the theorem (one group was Daryl Cooper, Craig Hodgson, and Steven Kerckhoff, and the other was Michel Boileau, Bernhard Leeb, and Joan Porti). “This was a lot of work, some pieces of Thurston’s sketch were improved, and the community honors their work,” Kirby said. “But it is acknowledged that this is Thurston’s theorem.”

The mathematical world is waiting to find out whether Perelman will receive a Fields Medal for his work. The traditional rule followed by the Fields Medal committee is that a recipient must not be over forty in the year in which the medal is given. Perelman turned forty in June 2006. Some believe that, even disregarding the Poincaré and Geometrization Conjectures, Perelman may have done enough to deserve a Fields Medal. “What Perelman’s work says about singularity development in Ricci flow is an enormous advance that in itself would make him a serious candidate for a Fields Medal,” Morgan said.

The Poincaré Conjecture is one of the CMI’s seven Millennium Prize Problems, which were announced in 2000. Until Perelman’s work, there were no serious solutions proposed to any of the problems, so no prizes have yet been given. The prize rules state that a proposed solution must be published in “a refereed journal of worldwide repute” and that this published solution must be out for two years before the CMI will consider awarding a prize. The rules are worded in such a way that the person considered for the prize need not be the author of the published solution, noted James Carlson, president of the Clay Mathematics Institute. “The fact that Perelman pursued an unorthodox route and posted his papers on the arXiv and did not submit them to a journal is not itself an obstacle” to him receiving the prize, Carlson said. At the appropriate time, he said, the Clay Institute will consider all the available materials and make a judgment about whether the proof of Poincaré is correct. Only after that will it consider giving the prize. One question the Clay Institute faces is whether to give the prize solely to Perelman or to include others as joint recipients—perhaps Hamilton? Carlson said it would be premature for him to speculate on such possibilities.

But no doubt the mathematical world will continue to speculate and to discuss the extraordinary saga of Perelman’s work. One thing is clear: Perelman has made an enormous contribution to the field. Many of the things he did—not submitting his work to a journal, not lecturing much, completely shunning the limelight—are not easy to understand. “Perelman is a very talented and unusual individual, and this is the route that he has chosen,” Carlson remarked. “I think the most important thing is that he wrote those three papers and he posted them on the arXiv, and that has given mathematicians a great gift and lots of new ideas and things to think about.”
References
Mathematics People

Candès Receives NSF Waterman Award

Emmanuel Candès of the California Institute of Technology has been selected to receive the National Science Board's prestigious Alan T. Waterman Award. The board cited Candès' development of new mathematical tools that allow efficient digital representation of wave signals, together with his discovery of new methods to translate analog data into a cleaner, tighter digital form—work that promises to improve the digital processing of signals in a vast array of modern technologies.

The annual Waterman Award recognizes an outstanding young researcher in any field of science or engineering supported by the National Science Foundation. Candidates may not be more than thirty-five years old, or seven years beyond receiving a doctorate. In addition to a medal, the awardee receives a grant of US$500,000 over a three-year period for scientific research or advanced study at the institution of the recipient's choice.


The Work of Emmanuel Candès

The Notices asked David Donoho of Stanford University to comment on the work of Candès. Donoho's response follows.

Emmanuel Candès applies harmonic analysis to scientific and technical signal processing, a field of central importance in our modern signals-drenched world, underpinning fields as diverse as cosmology, genomics, medical imaging, biometrics, oil exploration, and digital communications.

While some signal processing simply involves moving information around, many important applications deploy nontrivial transformations to solve difficult tasks with surprising elegance. A poster child for a previous generation was the Fast Fourier Transform (FFT), which now accelerates everything from secure encryption to speech recognition, image compression, medical imaging, and digital blurring. The FFT revolution combined an insight about technology and a mathematical contribution—the insight being that convolutions and correlations were of fundamental importance, and the contribution being that such operations could be radically sped up by exploiting dyadic divide-and-conquer in the Fourier domain.

All mathematicians recognize Fourier analysis as one of the great achievements of human intellect. Far fewer know that harmonic analysis is a broad subject with a powerful toolkit offering "atoms" and "molecules" with prescribed properties, for the purpose of better representing objects or operators. Examples include wavelet analysis and Gabor analysis, in which the atoms are, respectively, time-scale atoms and time-frequency atoms. Such tools offer new ways to break down, transform, and re-express objects and operations. In fact they are not merely new, but for certain model classes of signals they each are optimal—just the right way to transform and represent certain kinds of signals. Moreover, formal statements of optimality in mathematical models correspond to actual advantages in practical implementations. Thus, wavelet transforms offer a better framework for compressing images than the Fourier approach, which was the basis of JPEG, and form the basis for the new compression standard JPEG-2000; and wavelets are responsible for the success of various fast computer graphics rendering algorithms—wavelet radiosity.

Emmanuel Candès' work over the last ten years has developed new systems of analysis that go beyond wavelets and has applied them to important scientific and technical signal processing problems. I mention four examples. (In many cases, Candès worked with collaborators, but space restrictions force us to omit details.)

Ridgelets. These provide a multiscale system for representing multivariate functions, consisting of objects which, unlike wavelets, are highly directional—infinitely long in one direction and multiscale in the other direction. They are useful for representing functions with singularities along lines and for representing operators, like the Radon transform, which integrate along lines. Candès established the basic results about this system in his thesis and applied them to image denoising and limited-angle tomography, a fundamental operation throughout medical imaging and applied physics.
Curvelets. This system again consists of objects that are highly directional, with width scaling parabolically in the length of the support. Prefigured by work of Charles Fefferman, Andreas Seeger, Elias Stein, Christopher Sogge, and especially Hart Smith, Candès' work created a computationally useful system, a tight frame, and a concrete concept to create an adaptive basis of chirplets, to show that curvelets do a theoretically optimal job of compressing objects with edges—much better than wavelets or Fourier methods. Candès also worked to show that curvelets in principle offer an unheard-of efficiency in solving the wave equation with rough initial wavefields.

Chirplets. Chirplets are a multiscale system with time-varying frequency content, having elements at all different base frequencies, durations, and chirp rates. Candès worked to create an adaptive basis of chirplets, to show that they do a theoretically optimal job of representing chirping signals with smoothly-changing frequency. They are much better than Gabor systems.

Noisefields. The idea is to project the signal onto random elements. Although no “real” signal is efficiently representable by random elements, paradoxically by making measurements using only a small subset of a random basis one gets enough information to approximately reconstruct a real signal. While the measurements are linear, the reconstruction must be nonlinear, involving convex optimization. Potential applications include rapid medical imaging and much faster analog-digital converters.

In each case, Candès considered a fundamental signal type, developed a fundamental aspect of the architecture for information for that signal type, and used that architecture to give an optimal solution to a model problem of considerable applied interest. His work shows how applied mathematics can serve as a central component of the information sciences (instead of its traditional role supporting the physical sciences).

Biographical Sketch
A professor of applied and computational mathematics at Caltech, Candès studied in his native France before receiving a doctorate in mathematics and computer science at Stanford University in 1998. He has received numerous awards for his work, including the Vasil Popov Prize in approximation theory, the Department of Energy Young Investigator Award, the James H. Wilkinson Prize in numerical analysis and scientific computing, and the Best Paper Award of the European Association for Signal, Speech, and Image Processing. He was selected as an Alfred P. Sloan Research Fellow in 2001.

Emmanuel Candès wrote a WHAT IS...? column, “WHAT IS... a Curvelet?”, which appeared in the December 2003 issue of the Notices.

Young Scholars’ Competition Prizes Awarded at Gödel Centenary
Three mathematicians were awarded prizes in the Young Scholars’ Competition held at the Gödel Centenary. Justin Moore of Boise State University was awarded the first prize of 20,000 euros (approximately US$25,000) for his paper, “The Continuum and Aleph-2”; Mark Van Atten of the Institute for the History and Philosophy of Science and Technology, Paris, received the second prize of 5,000 euros (approximately US$6,000) for his paper “Gödel and German Idealism”; and Ben-Sasson of the Israel Institute of Technology was awarded the third prize of 5,000 euros for his paper “Searching for the Conditional Answer to Gödel’s Question”.

“Horizons of Truth: Logics, Foundations of Mathematics, and the Quest for Understanding the Nature of Knowledge”, the Gödel Centenary Symposium, was held April 27-29, 2006, in Vienna, Austria, to honor the 100th birthday of Kurt Gödel.

—Elaine Kehoe

Sherratt Awarded Adams Prize
Jonathan Sherratt of the Heriot-Watt School of Mathematical and Computer Sciences has been awarded the 2006 Adams Prize by the University of Cambridge. The selected topic for the prize was mathematical biology.

The Adams Prize is awarded each year by the Faculty of Mathematics and St. John’s College to a young researcher based in the United Kingdom who is doing first-class international research in the mathematical sciences. The prize is named after the mathematician John Couch Adams and was endowed by members of St. John’s College. It is currently worth £13,000 (approximately US$24,000), of which one-third is awarded to the prizewinner on announcement of the prize; one-third is provided to the prizewinner’s institution (for research expenses of the prizewinner); and one-third is awarded to the prizewinner on acceptance for publication in an internationally recognized journal on a substantial (normally at least twenty-five printed pages) original survey article of which the prizewinner is an author.

—From a University of Cambridge announcement

Putnam Prizes Awarded
The winners of the sixty-sixth William Lowell Putnam Mathematical Competition have been announced. The Putnam Competition is administered by the Mathematical Association of America and consists of an examination containing mathematical problems that are designed to test
both originality and technical competence. Prizes are awarded to both individuals and teams.

The six highest ranking individuals, listed in alphabetical order, were OLEG I. GOLDBERG, Massachusetts Institute of Technology; MATTHEW M. INCE, Massachusetts Institute of Technology; DANIEL M. KANE, Massachusetts Institute of Technology; RICKY L. LIU, Harvard University; TIANKAI LIU, Harvard University; and AARON C. PIXTON, Princeton University.

Institutions with at least three registered participants obtain a team ranking in the competition based on the rankings of three designated individual participants. The five top-ranked teams (with team members listed in alphabetical order) were: Harvard University (Tiankai Liu, Alison B. Miller, Tong Zhang); Princeton University (Ana Cariani, Andrei Negut, Aaron C. Pixton); Duke University (Nikifor C. Bliznashki, Jason Ferguson, Lingren Zhang); Massachusetts Institute of Technology (Timothy G. Abbott, Vladimir Barzov, Daniel M. Kane); and University of Waterloo (Olena Bormashenko, Ralph Furmaniak, Xiannan Li).

The top five individuals in the competition received cash awards of US$2,500; the next ten received US$1,000. The first-place team was awarded US$25,000, with each team member receiving US$1,000. The team awards for second place were US$20,000 and US$800; for third place, US$15,000 and US$600; for fourth place, US$10,000 and US$400; and for fifth place, US$5,000 and US$200.

The Elizabeth Lowell Putnam Prize is awarded periodically to a woman whose participation in the Putnam Competition is deemed particularly meritorious. In the recent competition, this prize went to ALISON B. MILLER of Harvard University. The prize carries a cash award of US$1,000.

—Elaine Kehoe

European Mathematical Society Article Competition

The European Mathematical Society (EMS), through its committee for Raising Public Awareness of Mathematics (RPA), has announced the winners of its article competition. Articles appearing in newspapers or other general-interest magazines in the authors' home countries were eligible.

NUNO CRATO of Universidade Técnica de Lisboa, Portugal, was awarded first prize for his three-part article "Unbreakable Cybersecrets", published in the Portuguese weekly newspaper Expresso in 2001. His articles are available in Portuguese and English at the website http://pascal.iseg.utl.pt/~ncrato/EMS/. F. THOMAS BRUSS of Université Libre de Bruxelles, Belgium, was awarded second prize for his article "Playing a Trick on Uncertainty", published in the magazine Spektrum der Wissenschaft in 2000, and for a similar article published in the daily German newspaper Die Welt in 2001. His article is available in German and English at the website http://www.ub.ac.be/facs/sciences/math/perso/bruuss.html. SAVA GROZJEN, IVAN DERZHANSKI, and EVGENIA SENDOVA of the Union of Bulgarian Mathematicians were awarded third prize for their article "For Those Who Think Mathematics Dreary", published in the Bulgarian daily newspaper Dnevnik in 2001. Their article is available in Bulgarian and English at the website http://www.math.bg/ml/1ad/dmathe.html.

—From International Mathematical Union email newsletter

AMS Menger Awards at the 2006 ISEF

The 2006 Intel International Science and Engineering Fair (ISEF) was held May 7–13, 2006, in Indianapolis, Indiana. This was the fifty-seventh year of the ISEF competition. More than fifteen hundred ninth to twelfth graders from forty-seven countries qualified to compete for US$4 million in scholarships and prizes by winning top honors in local, regional, and state fairs in the United States or national science fairs abroad. The AMS participated by presenting special awards at the ISEF. Prizes awarded by the AMS included cash, certificates, books, and tote bags.

For the AMS this was the nineteenth year of participation in the ISEF and the seventeenth year of presentation of the Karl Menger Awards. AMS awards were presented to one first-place, two second-place, four third-place projects, and honorable mention to three others.

The AMS Menger Committee served as the AMS Special Award Panel of judges. The members of the AMS Menger Committee are Gisele Ruiz Goldstein (chair) (University of Memphis), Dmitry Fuchs (University of California, Davis), and Tatiana Shubin (San Jose State University). The committee reviewed sixty mathematics projects and selected ten winners.

The winners are:

First-Place Award (US$1,000): “The Solution of the Dirichlet Problem with Rational Boundary Data”, MICHAEL ANTHONY VISCARDI, 17, Josan Academy, San Diego, California.


Mega Math Challenge 2006

The Moody’s Foundation and the Society for Industrial and Applied Mathematics (SIAM) have announced the awarding of US$60,000 in scholarships to teams of high school students in the Mega Math Challenge, a competition in applied mathematics that focuses on real-world problems. The problem for the competition was "Solving the Social Security Stalemate" and it required students to "develop a mathematical analysis of the issues and present one or more approaches that would guarantee the integrity of the system for at least 75 years."

Staples High School in Westport, Connecticut, was awarded the Summa Cum Laude team prize of US$20,000. The team members were MILES LURIN, ELIZABETH MARSHMAN, VIKAS MURALI, and ANDREW TSCHIRHART. Immaculata High School in Somerville, New Jersey, was awarded the Magna Cum Laude team prize of US$15,000. The team members were CHRISTOPHER FAJARDO, MARY GERMING, ROBERT LEE OWEN, WILLIAM PUGH, and MATTHEW TOM WOLVERTON. Hetticks High School in New Hyde Park, New York, received the Cum Laude team prize of US$10,000. The team members were AMULYA BHAGAT, AMOI JAIN YAAGNIGA KOSURI, and SAM YOON. Other team prizes went to Great Neck North High School, Great Neck, New York; Manalapan High School, Manalapan, New Jersey; and High Technology High School, Lincroft, New Jersey. The top six solutions are available at the website http://m3challenge.siam.org.

—From a Moody’s Foundation/SIAM announcement

Royal Society of London Elections

Five mathematical scientists are among those elected as new fellows and foreign members of the Royal Society of London for 2006. They are: PETER J. DONNELLY, University of Oxford, for contributions to population genetics and other areas of probability and statistics; RAYMOND W. OGDEN, University of Glasgow, for contributions to the nonlinear theory of elasticity and its applications; NICHOLAS I. SHEPHERD-BARRON, University of Cambridge, for contributions to algebraic geometry and classification of higher dimensional varieties; JERROLD E. MARSDEN, California Institute of Technology, for contributions to a wide range of fields, including Hamiltonian systems; and ALAN G. WILSON, Director General of Higher Education in the United Kingdom, for research on cities and regions through mathematical and computer models.

—From a Royal Society announcement

Correction

A review of Alex Kasman’s book Reality Conditions appeared in the August 2006 issue of the Notices. The summary information about the book that appeared at the beginning of the review gave the number of pages in the book as 512; in fact, the book has 264 pages.

—Allyn Jackson
Mathematics Opportunities

American Mathematical Society

Centennial Fellowships

Invitation for Applications for Awards for 2007–2008
Deadline December 1, 2006

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

Eligibility: The primary selection criterion for the Centennial Fellowship is the excellence of the candidate's research. Preference will be given to candidates who have not had extensive fellowship support in the past. Recipients may not hold the Centennial Fellowship concurrently with another research fellowship, such as a Sloan or National Science Foundation Postdoctoral Fellowship. Under normal circumstances, the fellowship cannot be deferred. A recipient of the fellowship shall have held his or her doctoral degree for at least three years and not more than twelve years at the inception of the award (that is, the doctoral degree must have been received between September 1, 1995, and September 1, 2004). Applications will be accepted from those currently holding a tenured, tenure-track, postdoctoral, or comparable (at the discretion of the selection committee) position at an institution in North America.

Grant amount: The stipend for fellowships awarded for 2007–2008 is expected to be US$66,000, with an additional expense allowance of about US$3,500. Acceptance of the fellowship cannot be postponed. The number of fellowships to be awarded is small and depends on the amount of money contributed to the program. The Society supplements contributions as needed. One fellowship will be awarded for the 2007–2008 academic year. A list of previous fellowship winners can be found at: http://www.ams.org/prizes-awards.

Deadline: The deadline for receipt of applications is December 1, 2006. Awards will be announced in February 2007 or earlier, if possible.

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

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

—AMS announcement

NSA Grant and Sabbatical Programs

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

The NSA makes grants to universities and nonprofit institutions to support self-directed research in the following areas of mathematics (including possible computational aspects): algebra, number theory, discrete mathematics, probability, and statistics. Research grants are designed principally to provide summer salaries for professors and limited support for their graduate students. The deadline for submission of all grant proposals is October 15, 2006. Grants begin in the fall of the following year. The postal address is: Michelle D. Wagner, Director, NSA Mathematical Sciences Program, National Security Agency, ATTN: R1, Suite 6557, Ft. George G. Meade, Maryland 20755-6557; telephone 301-688-0400.
The sabbatical opportunities offered by the NSA provide support for academic mathematical scientists to visit the NSA for periods ranging from nine to twenty-four months. The sabbaticals primarily involve cryptanalysis, though sabbatical work may also involve algebra, probability, statistics, number theory, and discrete mathematics. Visitors' sabbatical stipends will be supplemented with funds to equal their regular monthly salaries. A choice is offered between an allowance for moving expenses or a housing supplement. Applicants and their immediate family members must be U.S. citizens. Because a complete background investigation is required, applications should be submitted well in advance of the requested starting date. The address for applications is National Security Agency, ATTN: R51A National Security Agency, Fort George G. Meade, Maryland 20755-6000.

Further information may be obtained from the NSA's website: http://www.nsa.gov/msp/index.cfm.

From an NSF announcement

**NSF Distinguished International Postdoctoral Research Fellowships**

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

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

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

The deadline for full proposals is October 11, 2006. For technical and scientific information, contact Lynne Walling, Program Director, Division of Mathematical Sciences, Room 1025, National Science Foundation, 4201 Wilson Boulevard, Arlington, VA 22230; telephone 703-292-8104; email: lwalling@nsf.gov. The program announcement is available at http://www.nsf.gov/pubs/2001/nsf01154/nsf01154.txt.

From an NSF announcement

**NSF International Research Fellow Awards**

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

The deadline for applying is September 12, 2006. For further information contact the program officer, Susan Parriss, 703-292-8711, sparriss@nsf.gov; or visit the website http://www.nsf.gov/pubs/2005/nsf05599/nsf05599.txt.

From an NSF announcement

**NSF Graduate Fellowships**

The National Science Foundation (NSF) awards Graduate Research Fellowships to graduating seniors and first-year graduate students. These are three-year fellowships awarded to U.S. students for full-time graduate study at the institutions of their choice. The fellowships include a stipend, tuition coverage, and possible international travel allowances. Awards are made based on the candidates' intellectual merit and potential for research achievement. The deadline for applications had not been set at the time of this writing but will likely occur during the first week of November 2006. More information and applications for the upcoming competition will be available at http://www.nsf.gov/grfpd.

Elaine Kehoe

**AMS Scholarships for “Math in Moscow”**

The Independent University of Moscow has created a program called "Math in Moscow", which offers foreign students (undergraduate or graduate students specializing in mathematics and/or computer science) the chance to spend a semester in Moscow studying mathematics. The AMS provides a small number of scholarships to students to attend the program.

Math in Moscow provides students with a fifteen-week program similar to the Research Experiences for Undergraduates programs that are held each summer across the
United States. Math in Moscow draws on the Russian tradition of teaching mathematics, which emphasizes creative approaches to problem solving. The focus is on developing in-depth understanding of carefully selected material rather than broad surveys of large quantities of material.

Discovering mathematics under the guidance of an experienced teacher is the central principle of Math in Moscow. Most of the program's teachers are internationally recognized research mathematicians, and all of them have considerable teaching experience in English, typically in the United States or Canada. All instruction is in English.

With funding from the National Science Foundation, the AMS awards five US$5,000 scholarships each semester to U.S. students to attend the Math in Moscow program. To be eligible for the scholarships, students must submit applications to both the Math in Moscow program and the AMS. An applicant should be an undergraduate mathematics or computer science major enrolled at a U.S. institution. September 30, 2006, is the deadline for the spring 2007 semester; April 15, 2007, is the deadline for scholarship applications for the fall 2007 semester.

Information and application forms for Math in Moscow are available on the Web at http://www.mccme.ru/mathinmoscow, or by writing to: Math in Moscow, P.O. Box 524, Wynnewood, PA 19096; fax +7095-291-65-01; email: minim@mccme.ru. Information and application forms for the AMS scholarships are available on the Web at http://www.ams.org/outreach/mathinmoscow.html, or by writing to: Math in Moscow Program, Membership and Programs Department, American Mathematical Society, 201 Charles Street, Providence RI 02904-2294; email: student-serv@ams.org.

—AMS announcement

AWM Travel Grants for Women

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

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

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

The final deadline for the Travel Grants program for 2006 is October 1, 2006; the deadlines for 2007 are February 1, 2007; May 1, 2007; and October 1, 2007. For the Mentoring Travel Grants program the deadline is February 1, 2007. For further information and details on applying, see the AWM website, http://www.awm-math.org/travelgrants.html; or telephone 703-934-0163 or email: awm@awm-math.edu. The postal address is: Association for Women in Mathematics, 11240 Waples Mill Road, Suite 200, Fairfax, VA 22030.

—From an AWM announcement

News from Oberwolfach

The Mathematisches Forschungsinstitut Oberwolfach (MFO), in Oberwolfach-Walke, Germany, is pleased to announce that the U.S. National Science Foundation (NSF) has again awarded a grant to the MFO for support of the project "U.S. Junior Oberwolfach Fellows". This is a five-year prolongation of previous NSF awards to the MFO.

This grant enables the MFO to support the participation of outstanding young scientists from U.S. universities/institutes in every Oberwolfach workshop (e.g., postdocs, tenure-track holders) or Oberwolfach seminar (e.g., graduate students). This award is effective April 1, 2006, and expires March 31, 2011. Travel expenses (U.S. airlines only) for these U.S. Junior Oberwolfach Fellows can be covered up to 400 Euros (about US$500). The internal costs for accommodation and meals at Oberwolfach will be covered by the NSF as well.

The participants must hold a job or position at a U.S. university or institute (every nationality can apply) and must come from the U.S. to Oberwolfach. The Ph.D./Dr. degree must have been received not more than ten years ago.

Interested persons meeting these conditions may apply by sending an email with the following information: full name and address of university or institution; age, gender, and nationality; year of Master/Diploma degree and year of Ph.D./Dr. degree; current position; and short description of their research activity. This information should be sent to the director of the MFO.

As the institute wishes to increase the number of female participants, applications from female researchers are very welcome.

The final decision about participation will be made by the director after advice by the organizers. The MFO emphasizes that the number of eligible participants is limited.

Further information may be found on the MFO website, http://www.mfo.de/.

—MFO announcement

News from AIM

The American Institute of Mathematics (AIM) Research Conference Center seeks proposals for week-long focused workshops in all areas of the mathematical sciences.

Detailed information about AIM programs, upcoming workshops, and application forms for proposing workshops can be found at http://www.aimath.org.

—AIM announcement
The AMS has made awards to five mathematics students to attend the Math in Moscow program in the fall of 2006. The following are the undergraduate students and their institutions: DANIEL BLAZEVSKI, University of Michigan; WESLEY ESSIG, University of Washington, Seattle; DANIEL LE, Stanford University; and JARED GRANT SERIO, University of Arkansas, Fayetteville. In addition, a scholarship was awarded to ANNA MEDVEDOVSKY, who graduated from Harvard University in 2001. Each student has been awarded a US$5,000 scholarship.

Math in Moscow is a program of the Independent University of Moscow that offers foreign students (undergraduate or graduate students specializing in mathematics and/or computer science) the opportunity to spend a semester in Moscow studying mathematics. All instruction is given in English. The fifteen-week program is similar to the Research Experiences for Undergraduates programs that are held each summer across the United States.

Since 2001, each semester the AMS has awarded several scholarships of approximately US$5,000 each for U.S. students to attend the Math in Moscow program. The scholarships are made possible through a grant from the National Science Foundation. Information about how to apply may be found in the “Mathematics Opportunities” section of this issue of the Notices. For more information about Math in Moscow, consult http://www.mccme.ru/mathmom and the article “Bringing Eastern European mathematical traditions to North American students”, Notices, November 2003, pages 1250-4.

—Elaine Kehoe

AMS Participates in CNSF Exhibition

Eva K. Lee of the School of Industrial and Systems Engineering at the Georgia Institute of Technology represented the AMS at the 12th annual Exhibition of the Coalition for National Science Funding (CNSF) held June 7, 2006, on Capitol Hill in Washington, DC. Lee highlighted her work on disease prediction and treatment design by showing how mathematical programming, optimization, and scientific computing can be used to process data on tumors in real-time, allowing design of optimal treatment over the entire treatment horizon. This can assist doctors in inflicting maximum damage to tumors, with minimum damage to healthy tissue.

Lee also presented biologically-enhanced treatment design as another area of investigation. This treatment design uses advanced imaging to identify high-density cancerous cells. Her team is using mathematical models to translate these regions onto the treatment images. Lee’s work in this area is featured in “Mathematical Moments” on the AMS website; see http://www.ams.org/ams/mathmoments.html and click on “Targeting Tumors”.

Lee’s presentation at this exhibition was attended by members of Congress, congressional staff, administration representatives, and members of the scientific community. The 2006 exhibition included thirty-four exhibit booths and drew over 330 attendees.

CNSF is an alliance of over one hundred scientific and professional societies and universities that are united by a concern for the future vitality of the national science, mathematics, and engineering enterprise. This coalition, chaired by Samuel M. Rankin III, associate executive director of the AMS and the director of its Washington office, works to increase the federal investment in the National Science Foundation (NSF).

The annual CNSF exhibition showcases the crucial role the NSF plays in meeting the nation’s research and education needs. It highlights research made possible by the NSF through exhibits displaying a wide range of scientific research and education projects. The exhibition provides an opportunity for university researchers and educators to describe their work to leaders on Capitol Hill.

—Anita Benjamin, AMS Washington office

Deaths of AMS Members

TIBERIU CONSTANTINESCU, professor, University of Texas at Dallas, died on July 29, 2005. Born on June 13, 1955, he was a member of the Society for 17 years.

IRVING KAPLAN, director emeritus, Mathematical Sciences Research Institute, and former AMS president (1985-86), died on June 25, 2006. Born on March 22, 1917, he was a member of the Society for 65 years.

FRANK KOSIER, retired, from the University of Iowa, died on June 3, 2006. Born on July 2, 1934, he was a member of the Society for 48 years.

A. FENTON PILLOW, professor emeritus, from Indooroopilly, Australia, died on April 1, 2006. Born on March 27, 1921, he was a member of the Society for 46 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 the editor and notices@ams.org in the case of the managing editor. Fax numbers are 405-325-7484 for the editor and 401-331-3842 for the editor and notices@ams.org in the case of the managing editor. Postal addresses may be found in the masthead.

Upcoming Deadlines

September 12, 2006: AWM Travel Grants. See http://www.awm-math.org/travelgrants.html; telephone 703-934-0163; email: awm@math.umd.edu; or contact Association for Women in Mathematics, 11240 Waples Mill Road, Suite 200, Fairfax, VA 22030.


October 1, 2006: Nominations for André Aisenstadt Mathematics Prize. Contact Director, CRM, Université de Montréal, C.P. 6128, Succursale Centre-ville, Montréal, QC H3C 3J7 Canada; fax: 514-343-2254; email: direktur@crm.umontreal.ca.


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

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November 1, 2006: Nominations for Vasili Popov Prize. Contact彭cho Petrushev, Chair, Popov Prize Selection Committee, Department of Mathematics, University of South Carolina, Columbia, SC 29208; email: popov@math.sc.edu.

December 1, 2006: Applications for AMS Centennial Research Fellowship Program. See "Mathematics Opportunities" in this issue.


Conference Board of the Mathematical Sciences
1529 Eighteenth Street, NW
Washington, DC 20036
202-293-1170
http://www.cbmsweb.org/

Ronald C. Rosier
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202-293-1170
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Member Societies
American Mathematical Association of Two-Year Colleges (AMATYC)
American Mathematical Society (AMS)
American Statistical Association

(AAA)
Association for Symbolic Logic (ASL)
Association for Women in Mathematics (AWM)
Association of Mathematics Teacher Educators (AMTE)
Association of State Supervisors of Mathematics (ASSM)
Benjamin Baneker Association (BBA)
Institute for Operations Research and the Management Sciences (INFORMS)
Institute of Mathematical Statistics (IM)
Mathematical Association of America (MAA)
National Association of Mathematicians (NAM)
National Council of Supervisors of Mathematics (NCSM)
National Council of Teachers of Mathematics (NCTM)
Society for Industrial and Applied Mathematics (SIAM)
Society of Actuaries (SOA)

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

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


Reference and Book List


Stipends for Study and Travel

Graduate Support

American Association for the Advancement of Science
Mass Media Summer Fellowship
(AMS supports at least one Fellow per year under this program)

Description: Fellows work for newspapers, magazines, and radio and television stations. Travel expenses and stipends are paid by the AAAS. Fellows have the opportunity to: observe and participate in the process by which events and ideas become news, improve their communication skills by learning to describe complex technical subjects in a manner understandable by the public, and increase their understanding of editorial decision making and the manner in which information is effectively disseminated. Each fellow will: attend an orientation and evaluation session in Washington, DC; begin the 10-week internship in mid-June; and submit an interim and final report to AAAS to help evaluate the program.

Eligibility: Provides support for 20-25 outstanding graduate students in mathematics, the natural and social sciences, and engineering as reporters, researchers, and production assistants in the mass media. (Exceptional undergraduate or postdoctoral students also considered.)

Grant amount: $450/week stipend for ten weeks.


The American Society of Naval Engineers
Scholarships

Description: Candidate will be applying for either the last year of a full-time or co-op undergraduate program or one year of graduate study leading to a designated engineering degree or physical science degree in an accredited college or university. A scholarship will not be awarded to a doctoral candidate or to a person already having an advanced degree.

Eligibility: Candidate must be a United States citizen; must have demonstrated or expressed a genuine interest in a career in Naval Engineering, e.g., activity in a professional engineering society and extracurricular engineering activities. Graduate student candidate must be a member of ASNE or SNAME. Candidate's academic record, work history, professional promise, and recommendations of college faculty, employers, and other character references. Financial need may also be considered.

Grant amount: $5,000-$12,000.
Deadline: Must be postmarked by January 10 (applications are available August 1).

Application information: For more information contact: AAUW Educational Foundation, 2201 Dodge Street, Iowa City, IA 52243-4030; tel: 319-337-1716; or visit our website at http://www.aauw.org/.

The American Association of University Women (AAUW) Educational Foundation
Selected Professions Fellowships

Description: These fellowships are awarded to women of outstanding academic ability who are citizens or permanent residents of the U.S. for full-time graduate study in designated fields where women's participation has traditionally been low. Eligible fields currently include mathematics and statistics.

Eligibility: Fellowships are for the final year of the master's degree. Fellowship year is July 1-June 30. Degree must be earned at the end of the fellowship year.

Grant amount: $5,000-$12,000.
Deadline: Must be postmarked by January 10 (applications are available August 1).

Application information: For more information contact: AAUW Educational Foundation, 2201 Dodge Street, Iowa City, IA 52243-4030; tel: 319-337-1716; or visit our website at http://www.aauw.org/.

The Burroughs Wellcome Fund
Career Awards at the Scientific Interface

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

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

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

Deadline: May 1, 2007.

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

Florida Education Fund

The McKnight Doctoral Fellowship Program

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

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

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

Deadline: The deadline for applications for Fall 2007 is January 15, 2007.

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

Ford Foundation Dissertation Fellowships for Minorities

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

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

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

Ford Foundation Predoctoral Fellowships for Minorities

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

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

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

National Academies
Christine Mirzayan Science and Technology Policy Graduate Fellowship Program

Description: The Christine Mirzayan Science and Technology Policy Graduate Fellowship Program of the National Academies is designed to engage graduate and postdoctoral science, engineering, medical, veterinary, business, and law students in science and technology policy and to familiarize them with the interactions between science, technology, and government. As a result, students develop essential skills different from those attained in academia and make the transition from being a graduate student to a professional.

Eligibility: Applications are invited from graduate students through postdoctoral candidates in any physical, biological, or social science field or any field of engineering, medicine/health, or veterinary medicine, as well as business and law education, and other graduate and professional programs.

Grant amount: There are three 10-week sessions per year beginning in January, June, and September. The grant amount is $4,800 to $5,300 depending on location.

Deadline: Deadline for receipt of materials is November 1 for the January program, March 1 for the June program, and June 1 for the September program.

Application information: For program details and a link to the online application, please visit the website at http://national-academies.org/policyfellows. For further information, email: policyfellow@nas.edu (preferred) or phone 202-334-2455. Resumes are not accepted.

National Science Foundation
Graduate Research Fellowships

Description: The NSF's Graduate Research Fellowship Program recognizes and supports outstanding graduate students in the relevant science, technology, engineering, and mathematics disciplines who are pursuing research-based master's and doctoral degrees. NSF provides three years of financial support which includes a $30,000 annual stipend, and a $10,500 annual cost-of-education allowance.

Eligibility: Applicants must be U.S. citizens, nationals, or permanent residents, and at or near the beginning of graduate studies in an NSF-supported field: Chemistry, Computer and Information Science and Engineering, Engineering, Geosciences, Life Sciences, Mathematical Sciences, Physics and Astronomy, Psychology, and Social Sciences.

Deadline: Applications and deadline information will be available online at http://www.fastlane.nsf.gov/grfp/. Deadlines vary by field and applications must be submitted to NSF by the appropriate deadline.

Application information: Please visit http://www.nsf.gov/grfp for additional information.

The University of Texas at Austin

Description: Graduate students in mathematics, both new and continuing, are eligible for a variety of fellowships, including the Edward Louis and Alice Laidman Dodd Fellowship, David Bruton Jr. Graduate Fellowships in Mathematics, Regents Endowed Graduate Fellowships in Mathematics, Arthur Lefevre Scholarships in Mathematics, John L. and Anne Crawford Endowed Presidential Scholarship, H. S. Wall Memorial Scholarship in Mathematics, Charles Rubert Scholarship, and University Fellowships. All participants are automatically considered for each of these fellowships and need not apply separately for them. The Graduate Advisor, in consultation with a faculty committee, decides who will be awarded (or, in the case of University Fellowships, who will be nominated for) these fellowships.

Grant amount: The level of stipends varies from $1,000 (which entitles one to pay tuition at the in-state rate) to $34,000.

Application information: Information on our mathematics program can be found at http://www.ma.utexas.edu, or contact Graduate Advisor, Mathematics Department, The University of Texas at Austin, TX 78712-1082. For admission to our graduate program, you should use the online application at http://www.ma.utexas.edu/student/giac. Applicants admitted to the graduate program must authorize a security sensitive background check.

Zonta International Foundation

Amelia Earhart Fellowship Awards

Description: The Zonta International Amelia Earhart Fellowships were established in 1938 in honor of Amelia Earhart, famed pilot and Zonta club member. The fellowships are granted annually to women pursuing graduate Ph.D./doctoral degrees in aerospace-related sciences and aerospace-related engineering.

Eligibility: To qualify for the fellowship, a woman must have by the time of her application: a bachelor's degree in a qualifying area of science or engineering closely related to advanced studies in aerospace-related science or aerospace-related engineering; a superior academic record and evidence of potential at a recognized institute of higher learning, as demonstrated by transcripts, recommendations, and acceptance or verification by an institute of higher learning with accredited courses in aerospace-related studies; evidence of a well-defined
Postdoctoral Support

Air Force Office of Scientific Research
Research Contracts and Grants

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

Application information: Research proposals should be forwarded to the Mathematics and Space Sciences Directorate, Air Force Office of Scientific Research (AFOSR/NM), 875 North Randolph Street, Suite 325, Room 3112, Arlington, VA 22203; http://www.afosr.af.mil.

American Mathematical Society
Centennial Fellowships

Postdoctoral Fellowships

Description: The AMS Centennial Research Fellowship Program makes awards annually to outstanding mathematicians to help further their careers in research. The number of fellowships to be awarded is small and depends on the amount of money contributed to the program. The Society supplements contributions as needed. At most, two fellowships will be awarded for the 2007-08 academic year. A list of previous fellowship winners can be found at http://www.ams.org/prizes-awards.

Eligibility: The eligibility rules are as follows. The primary selection criterion for the Centennial Fellowship is the excellence of the candidate’s research. Preference will be given to candidates who have not had extensive fellowship support in the past. Recipients may not hold the Centennial Fellowship concurrently with another research fellowship such as a Sloan or NSF Postdoctoral Fellowship. Under normal circumstances the fellowship cannot be deferred. A recipient of the fellowship shall have held his or her doctoral degree for at least three years and not more than twelve years at the inception of the award (that is, received between September 1, 1995, and September 1, 2004). Applications will be accepted from those currently holding a tenured, tenure-track, postdoctoral, or comparable (at the discretion of the selection committee) position at an institution in North America. Applications should include a cogent plan indicating how the fellowship will be used. The plan should include travel to at least one other institution and should demonstrate that the fellowship will be used for more than reduction of teaching at the candidate’s home institution. The selection committee will consider the plan in addition to the quality of the candidate’s research and will try to award the fellowship to those for whom the award would make a real difference in the development of their research careers. Work in all areas of mathematics, including interdisciplinary work, is eligible.

Grant amount: The stipend for fellowships awarded for 2007-08 is expected to be $66,000, with an additional expense allowance of about $3,500. Acceptance of the fellowship cannot be postponed.

Deadline: The deadline for receipt of applications is December 1, 2006. Awards will be announced in February 2007 or earlier if possible.

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

American Philosophical Society
Franklin Research Grants

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

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

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

Deadline: October 1, December 1.

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

Description: Applications are invited for postdoctoral fellowship positions at the Fields Institute in Toronto for the 2007-08 academic year. The thematic program on Operator Algebras will take place at the Institute from August-December 2007, while the thematic program on New Trends in Harmonic Analysis will run from January-June 2008. The fellowships provide for a period of engagement in research and participation in the activities of the Institute. They may be offered in conjunction with partner universities, through which a further period of support may be possible. One recipient will be awarded the Institute’s prestigious Jerrold E. Marsden Postdoctoral Fellowship. Applicants seeking postdoctoral fellowships funded by other agencies (such as NSERC or international fellowships) are encouraged to request the Fields Institute as their proposed location of tenure, and should apply to the Institute for a letter of invitation. Funding is being sought from NSF to support junior U.S. participants in these programs.

Eligibility: Qualified candidates who will have recently completed a Ph.D. in a related area of the mathematical sciences are encouraged to apply.

Deadline: December 7, 2006, although late applications may be considered.

Application information: Please consult http://www.fields.utoronto.ca/proposals/postdoc.html. The Fields Institute is strongly committed to diversity within its community and especially welcomes applications from visible minority group members, women, Aboriginal persons, persons with disabilities, members of sexual minority groups, and others who may contribute to the further diversification of ideas.

Ford Foundation Postdoctoral Fellowships for Minorities

Description: Approximately 30 postdoctoral fellowships will be awarded in a national competition sponsored by the Ford Foundation and administered by the National Research Council.

Eligibility: U.S. citizens or nationals who are Native American Indian, Mexican American/Chicana/Chicano, Alaska Native (Eskimo or Aleut), Native Pacific Islander (Polynesian or Micronesian), Black/African American, or Puerto Rican and who are currently in or planning a career in teaching and research at the college or university level.

Application information: For further information and applications, contact: Fellowship Office, GR 346A, National Research Council of the National Academies, 550 Fifth Street, NW, Washington, DC 20001; tel: 202-334-2872; fax: 202-334-3419; email: infofell@nas.edu; website: http://national-academies.org/fellowships.

John Simon Guggenheim Memorial Foundation Fellowships

Description: Fellowships are on an advanced professional level. Approximately 221 awards are made.

Eligibility: U.S. or Canadian citizenship or permanent residence is required. Fellowships are also offered to citizens or permanent residents of Latin America and the Caribbean.

Deadline: Application deadline: October 1 for the U.S. and Canada competition, December 1 for the Latin American and Caribbean competition.

Application information: For more information write to John Simon Guggenheim Memorial Foundation, 90 Park Avenue, New York, NY 10016; tel: 212-687-4470; fax: 212-697-3248; email: fellowships@gf.org; World Wide Web: http://www.gf.org/.

Institute for Advanced Study Memberships

Description: The School of Mathematics will grant a limited number of memberships, some with financial support, for research in mathematics at the Institute during the academic year 2007-08.

Eligibility: Candidates must give evidence of ability in research comparable at least with that expected for the Ph.D. degree.

Deadline: December 1, 2006.

Application information: Application blanks may be obtained from The School of Mathematics, Institute for Advanced Study, Princeton, NJ 08540, and should be returned (whether or not funds are expected from some other source) by December 1. Forms may also be downloaded but not submitted via Web connection at https://applications.ias.edu. An Equal Opportunity/Affirmative Action Employer.

Institute for Mathematics and its Applications (IMA)

General Memberships

Description: The Institute for Mathematics and its Applications at the University of Minnesota announces the availability of general memberships in connection with its 2007-08 thematic program on Mathematics of Molecular and Cellular Biology. General memberships provide an opportunity for mathematicians and scientists employed elsewhere to spend a period of one month to one year in residence at the IMA, and to participate in the 2007-08 thematic program. The residency should fall in the period September 2007 through June 2008 (in special cases extending into the summer months). Logistic support such as office space, computer facilities, and secretarial support will be provided, and local expenses may be provided.

Eligibility: Preference will be given to supplementary support for persons with sabbatical leaves, fellowships, or other stipends. The research interests of General
Members must relate to the thematic program and a doctoral degree is normally expected.

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

**Deadline:** Applications may be submitted at any time until the end of the thematic program, and will be considered as long as funds remain available.

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

### Institute for Mathematics and its Applications (IMA)

**Industrial Postdoctoral Fellowships**

**Description:** The Institute of Mathematics and its Applications at the University of Minnesota announces the availability of industrial postdoctoral fellowships. IMA industrial postdoctoral positions are designed to prepare mathematicians for research careers in industry or involving industrial interaction. IMA industrial postdoctoral fellowships run two years starting August 31, 2007. They are funded jointly by the IMA and an industrial sponsor, and holders devote 50% effort to their own research and the IMA program and 50% effort working with industrial scientists.

**Eligibility:** Documentation of completion of all requirements for a doctoral degree in mathematics or a related area is required by the start of the appointment and within the last three years.

**Grant amount:** Industrial postdoctoral fellows receive a salary of $50,000 annually, and a travel allowance.

**Deadline:** January 5, 2007.

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

### Institute for Mathematics and its Applications (IMA)

**New Directions Visiting Professorships**

**Description:** The Institute of Mathematics and its Applications at the University of Minnesota provides an extraordinary opportunity for established mathematicians—typically mid-career faculty at U.S. universities—to branch into new directions and increase the impact of their research by spending the 2007-08 academic year immersed in the thematic program at the IMA. Visiting professors will enjoy an excellent research environment and stimulating scientific program connecting Molecular and Cellular Biology and related areas of mathematics with a broad range of fields of application.

**Grant amount:** The New Directions program will supply 50% of academic year salary up to $50,000 maximum.

**Deadline:** November 1, 2006.

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

### Institute for Mathematics and its Applications (IMA)

**Postdoctoral Fellowships**

**Description:** The Institute of Mathematics and its Applications at the University of Minnesota announces the availability of postdoctoral fellowships in connection with its 2007-08 thematic program on Mathematics of Molecular and Cellular Biology. Postdoctoral fellowships provide an excellent opportunity for mathematical scientists near the beginning of their career who have a background in and/or an interest in learning about applied and computational aspects of Molecular and Cellular Biology. IMA postdoctoral fellowships run one to two years, at the option of the holder, starting August 31, 2007. In the second year of the appointment there are a variety of options to enhance career development, including participation in the 2008-09 academic year program on Mathematics and Chemistry, teaching, and working on an industrial project.

**Eligibility:** Documentation of completion of all requirements for a doctoral degree in mathematics or a related area is required by the start of the appointment and within the last three years.

**Grant amount:** Postdoctoral fellows receive a salary of $50,000 annually, and a travel allowance.

**Deadline:** January 5, 2007.

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

### Los Alamos National Laboratory

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

**Description:** Research opportunities are granted in many areas of chemistry, mathematics, computer science, materials science, biological sciences, environmental science, geoscience, and many engineering fields. Appointments are for three years.
Eligibility: Candidates must be recipients of a doctoral degree within the past five years and must show clear and definite promise of becoming outstanding leaders in scientific research.

Grant amount: Starting salary: $97,000.

Deadline: Submission deadline for sponsored candidates: mid-October each year.

Application information: Los Alamos National Laboratory is an Equal Opportunity Employer. See details and apply online at: http://www.hr.lanl.gov/postdoc/.

Los Alamos National Laboratory
Postdoctoral Appointments and Fellowships

Description: Research opportunities are granted in many areas of chemistry, mathematics, computer science, materials science, biological sciences, environmental science, geoscience, and many engineering fields. Appointments are available for two years, subject to renewal for a third year. A postdoctoral committee meets to review candidates for postdoctoral fellowships in February, May, August, and November.

Eligibility: Candidates must be recipients of a doctoral degree within the past five years.

Grant amount: Starting salary: $64,500-$75,500.

Application information: Los Alamos National Laboratory is an Equal Opportunity Employer. For more information: email: postdoc-info@lanl.gov; tel: 505-667-0872; fax: 505-665-5419; see details and apply online at: http://www.hr.lanl.gov/postdoc/.

Mathematical Sciences Research Institute (MSRI)

General Memberships

Description: The Institute will invite about 60 General Members for stays of 1 month or more during 2006-07, when three programs will be featured. Two will be half year: Computational Applications of Algebraic Topology (August 14 to December 18, 2006), and Dynamical Systems (January 8 to May 21, 2007). One will be the full academic year: Geometric Evolution Equations (August 14, 2006, to May 21, 2007). Some invitations will be made in other areas, so applications from candidates in all fields are welcome.

Eligibility: For mathematicians postdoctoral and above.

Grant amount: While there is no stipend for General Members, MSRI may offer partial support toward living and travel expenses. It is expected that General Members will visit MSRI with partial or full support from other sources.

Deadline: Files must be complete by December 16, 2006.


Mathematical Sciences Research Institute (MSRI)

Postdoctoral Fellowships

Description: The Mathematical Sciences Research Institute announces the availability of postdoctoral fellowships for a semester or academic year in conjunction with the MSRI research programs: Fall 2006: Geometric Group Theory, Teichmuller Theory and Kleinian Groups; Spring 2007: Combinatorial Representation Theory, Representations of Finite Groups. Candidates with other interests may also apply for the Complementary Program.

Eligibility: For new and recent Ph.D.’s (Ph.D. earned in 2002 or later). Applicants should apply through the usual process for MSRI Postdoctoral Fellowships, indicating their interest in this internship/fellowship and adding relevant documentation. Applications indicating interest in this program will be reviewed by Microsoft Research as well as by MSRI.


Application information: Please complete online application form at: http://www.mathjobs.org.

The Michigan Society of Fellows

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

Description: The Michigan Society of Fellows was founded in 1970 through grants from the Ford Foundation and Horace H. Rackham Graduate School for the purpose of promoting academic and creative excellence in the arts, sciences, and professions. The objective of the program is to support individuals selected for
outstanding achievement, professional promise, and interdisciplinary interests. We invite applications from qualified candidates for three-year postdoctoral fellowships at the University of Michigan. Fellows are appointed as assistant professors/postdoctoral scholars with departmental affiliations. They spend the equivalent of one academic year teaching; the balance of time is devoted to their own scholarly research and creative work. Applications will be screened by faculty in relevant University of Michigan departments. Final selections will be made by the senior fellows of the society. New fellows will be selected for three-year terms beginning September 2006.

Eligibility: Candidates must have received the Ph.D. degree between June 1, 2004, and September 1, 2007.

Grant amount: The annual stipend will be $49,635.

Deadline: Completed applications due October 6, 2006.

Application information: Please see the application on our website or send requests for application materials to: Michigan Society of Fellows, 3572 Rackham Building, University of Michigan, 915 E. Washington St., Ann Arbor, MI 48109-1070; tel: 734-763-1259; email: society.of.fellows@umich.edu; Web: http://www.rackham.umich.edu/Faculty/society.html

Michigan State University

MSU Postdoctoral Instructorships

Description: Several two-year positions will be available beginning fall 2006 for new or recent Ph.D.’s who show strong promise in research and teaching. The teaching load is four semester courses per year, and participation in the research activities of the department is expected.

Grant amount: A starting salary of $43,000 per year. Additional income from summer teaching is usually available if desired.

Deadline: Completed applications (including letters of recommendation) received by November 15, 2006, are assured of consideration.

Application information: Applicants should send a vita and a brief statement of research interests and arrange for at least four letters of recommendation, one of which must specifically address their ability to teach, to be sent to the department. Interested applicants should go to the website at http://www.math.msu.edu/hiring to complete an online application and to find a description of other required application materials. Application materials can be addressed to: to: Hiring Committee, Department of Mathematics, Michigan State University, East Lansing, MI 48824-1027. Women and minorities are strongly encouraged to apply. MSU is an Affirmative Action/Equal Opportunity Institution.

National Center for Atmospheric Research

Advanced Study Program

Description: Postdoctoral fellowships are offered for highly qualified atmospheric scientists and scientists from related disciplines who wish to continue basic research in the atmospheric sciences. Appointments are for a one-year period with a possible extension for an additional year.

Eligibility: For recent recipients of the Ph.D. Applicant must have received Ph.D. after October 1, 2002.

Grant amount: Stipends are $48,500 and are adjusted annually in June.

Deadline: The application deadline is January 6, 2006.

Application information: http://www.asp.ucar.edu; email: asp-apply@ucar.edu; phone: 303-497-1328; or Advanced Study Program, NCAR, ASP, P.O. Box 3000, Boulder, CO 80307-3000.

National Science Foundation

Mathematical Sciences Postdoctoral Research Fellowships (with Research Instructorship Option)

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

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

Deadline: Deadline for applications is October 18, 2006; applicants will be notified of decisions on or about February 8, 2007.

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

The NSA Mathematical Sciences Program

Grants for Research in Mathematics

Description: The National Security Agency (NSA) has a grants program, the Mathematical Sciences Program (MSP), that awards grants to colleges and universities in support of self-directed research in the following areas of the mathematical sciences: Algebra, Number Theory, Discrete Mathematics, Probability, and Statistics. The MSP also accepts proposals for modest-sized grants for conferences, workshops, and special academic endeavors. Research grants are intended primarily to provide
National Security Agency
Sabbatical Program

Description: The National Security Agency (NSA) offers the nation's leading mathematicians and computer scientists an opportunity to tour on a sabbatical for a minimum of 9 months to a maximum of 24 months.

Eligibility: U.S. citizenship is required for the sabbatical applicant and his or her immediate family members. Applications should be submitted at least 8 months in advance of the desired starting date. A complete background investigation is required.

Grant amount: NSA pays half the cost of the sabbatical employee's salary and benefits during the academic year and 100% of salary and benefits during summer months. The employee may choose either an allowance for moving expenses or a monthly housing supplement.

Application information: Inquiries should be made to Dr. Michelle D. Wagner, Director, Mathematical Sciences Program, mdwagner4@nsa.gov, or Ms. Rosalie (Jackie) Smith, rjsmit2@nsa.gov, 301-688-0400. Written correspondence and hardcopy proposal submissions should be mailed to Dr. Michelle D. Wagner, Mathematical Sciences Program, Department of Defense, National Security Agency–Suite 6557, Ft. Meade, MD 20755-6557. The address for overnight service is Dr. Michelle D. Wagner, Department of Defense, National Security Agency, ATTN: R1/Suite 6557/301-688-0400, 9800 Savage Road/SAB 3, Ft. George G. Meade, MD 20755-6557.

Radcliffe Institute Fellowship Program

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

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

Grant amount: Stipends are funded up to $60,000 for one year, with additional funds for project expenses.

Deadline: Applications must be postmarked by December 4, 2006.

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

Rice University
Griffith Conrad Evans Instructorships

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

Deadline: Applications received by December 15, 2006, will receive thorough consideration.

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

Sloan Foundation
Research Fellowships

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

Eligibility: Candidates must be members of the regular (i.e., tenure-track) faculty, in the early stage of their academic career, at a recognized college or university in the United States or Canada.

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

Application information: For information write to the Sloan Research Fellowships, Alfred P. Sloan Foundation, Suite 2550, 630 Fifth Ave., New York, NY 10111; email: stella@sloan.org; Web: http://www.sloan.org/.
University of Michigan, Ann Arbor
Assistant Professorships, and T. H. Hildebrandt Research Assistant Professorships

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

Eligibility: Preference is given to candidates who receive the Ph.D. degree in 2005 or later and who submit a completed application by December 15, 2006.

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

Application information: An application form for these positions, along with a list of current tenured mathematics faculty, is available for download in Microsoft Word or PDF format. Please provide evidence of teaching excellence. This form may also be obtained by email from math-postdoc-search@umich.edu; or by mail to: Hiring Committee, Department of Mathematics, University of Michigan, 2074 East Hall, 530 Church St., Ann Arbor, MI 48109-1043. The University of Michigan is an Equal Opportunity, Affirmative Action Employer. Women and minorities are encouraged to apply. The University is responsive to the needs of dual career couples.


Yale University
Josiah Willard Gibbs Instructorships/Assistant Professorships

Description: Offered to men and women with the doctorate who show definite promise in research in pure mathematics. Applications from women and members of minority groups are welcome. Appointments are for two/three years. The teaching load is kept light to allow ample time for research. This will consist of three one-semester courses. Part of the teaching duties over the term of the appointment may consist of a one-semester course at the graduate level in the general area of the instructor's research.

Grant amount: The 2007-08 salary will be at least $61,000.


Application information: Applications are available at http://www.math.yale.edu/. Inquiries and application supporting documents should be sent to the Gibbs Committee, Department of Mathematics, Yale University, P.O. Box 208283, New Haven, CT 06520-8283; via email: gibbs.committee@math.yale.edu. Yale University is an Affirmative Action/Equal Opportunity Employer.

Travel and Study Abroad
Alexander von Humboldt Foundation
Research Fellowships

Description: The Humboldt Foundation grants up to 600 Humboldt Research Fellowships annually to highly qualified scholars under the age of 40 holding doctorates, enabling them to undertake long-term periods of research (6-24 months) in Germany. Applications are decided upon by a selection committee which is composed of eminent German scholars from all disciplines. Candidates' academic attainments are the only criterion for selection; there are no limitations in respect to specific countries or subjects.

Eligibility: Application requirements include high academic qualifications, academic publications, a specific research plan, and for humanities scholars a good command of the German language. As part of the Humboldt Research Fellowship Program, U.S. citizens and residents from all disciplines may also apply for these variations: Summer Research Fellowship for U.S. Scientists and Scholars (3 months per year in 3 consecutive years), http://www.humboldt-foundation.de/en/programme/stip_aus/tshp2.htm; 2-year Post-Doctoral Fellowship for U.S. Scientists and Scholars (24 consecutive months), http://www.humboldt-foundation.de/en/programme/stip_aus/tshpl.htm.

Grant amount: Monthly stipends range from 2,100 to 3,000 euros. Family allowances, travel expenses, and language courses are covered by the fellowship.

Deadline: Applications may be submitted at any time; however, the actual selection committees meet in March, July, and November. Applications should be submitted 5 months before the meeting at which the candidate wishes to be considered.

Application information: Interested scholars may contact the Alexander von Humboldt Foundation, Jean-Paul-Str. 12, D-53173 Bonn, Germany; tel: +49-228-833-0; fax: +49-228-833-212; email: select@avh.de; homepage: http://www.humboldt-foundation.de/; or, American Friends of the Alexander von Humboldt Foundation, 1012-14th Street, NW, Suite 1015, Washington, DC 20005; tel: 202-783-1907; fax: 202-783-1908; email: avh@verizon.net.

Fulbright Teacher Exchange Program

Description: Sponsored by the United States Department of State, this program offers international exchange opportunities for two-year college faculty members and elementary and secondary school teachers and administrators. Currently the program conducts exchanges with over 30 countries in Eastern and Western Europe, Latin America, and Africa. (The list of countries is subject to change.) Most exchanges are for the full academic year; however, some are for a semester or six weeks. In most cases both the U.S. and international teacher remain on the payroll of their respective home institutions. The Fulbright Teacher Exchange Program also offers six-to eight-week summer seminars in Italy and Greece which
Eligibility: Eligibility requirements are U.S. citizenship, fluency in English, a bachelor’s degree or higher, three years’ full-time teaching/administrative experience, a current full-time teaching/administrative position, approval of school administration, and no participation in a Fulbright Program longer than eight weeks in the last two years. In addition to the general eligibility requirements, each applicant must meet the specific subject, level, and language fluency requirements for the countries to which he/she applies; these requirements are detailed in the application booklet.

Deadline: The application deadline is October 15 for the following year’s program.

Application information: The application booklet should be requested from the Fulbright Teacher Exchange Program, 600 Maryland Ave., SW, Room 320, Washington, DC 20024-2520; tel: 800-726-0479.

Marshall Scholarships

Description: Marshall Scholarships finance young Americans of high ability to study for a degree in the United Kingdom. The scholarships are tenable at any British university and cover two years of study in any discipline, at either undergraduate or graduate level, leading to the award of a British university degree.

Eligibility: Open only to United States citizens who (by the time they take up their scholarship) hold a first degree from an accredited four-year college or university in the United States with a minimum GPA of 3.7. To qualify for awards tenable from September 2007, candidates must have graduated from their undergraduate college or university by April 2004 (although this restriction may be waived in the case of those wishing to read business studies or an allied subject). N.B. Persons already studying for or holding a British degree or degree-equivalent qualification are not eligible to apply for a Marshall Scholarship.

Deadline: October 5, 2006 (although some universities might have earlier internal application deadlines), to commence the following September.

Application information: The application process is all online, interested parties should visit: http://www.marshallscholarship.org. For further information please contact your local British Consulate General: Atlanta, 404-954-7708; Boston, 617-245-4513; Chicago, 312-970-3811; Houston, 713-659-3275, ext. 2118; Los Angeles, 310-996-3028; New York, 212-745-0252; San Francisco, 415-617-1340; Washington, DC, 202-588-7844.

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

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

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

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

Deadline: Application deadline is October 20.

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

Winston Churchill Foundation of the United States

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

Grant amount: Tuition and living allowance worth approximately $40,000, depending upon course of study.

Application information: Application forms are available from representatives on campuses of colleges and universities participating in the program. For further information write to the Winston Churchill Foundation, 600 Madison Avenue-16th Floor, New York, NY 10022-1615. Tel: 212-752-3200 or see foundation homepage: http://www.winstonchurchillfoundation.org.

Study in the U.S. for Foreign Nationals

American Association of University Women (AAUW) Educational Foundation

International Fellowships

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

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

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

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

Application information: For more information contact: AAUW Educational Foundation, P.O. Box 4030, Iowa City, IA 52243-4030; tel: 319-337-1716; fax 319-337-1204.
2006 American Mathematical Society Election

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2006 AMS Elections
Special Section

List of Candidates–2006 Election

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<th>Member at Large of the Council</th>
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<tr>
<td>Robert L. Bryant</td>
<td>(five to be elected)</td>
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<td>Sylvia M. Wiegand</td>
<td>(five to be elected)</td>
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<td>Rodrigo Bañuelos</td>
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<td>Robert L. Devaney</td>
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<td>Marjorie Senechal</td>
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<td>Katherine St. John</td>
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<td>Francis Edward Su</td>
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<td>Board of Trustees</td>
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<td>(one to be elected)</td>
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<td>Henry B. Laufer</td>
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<td>Carol Saunders Wood</td>
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Nominating Committee
(three to be elected)

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<th>Thomas C. Hales</th>
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<td>Roger Howe</td>
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<td>David Manderscheid</td>
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<td>John E. McCarthy</td>
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<td>Hema Srinivasan</td>
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<td>William Yslas Vélez</td>
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Editorial Boards Committee
two to be elected

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<tr>
<th>Eric Bedford</th>
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<td>Niky Kamran</td>
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<td>Peter Kuchment</td>
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<td>Irena Swanson</td>
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Ballots
AMS members will receive by September 20 either a traditional paper ballot or email with instructions for voting online. If you do not receive this information by that date, please contact the AMS (preferably before October 1) to request a ballot. Send email to ballot@ams.org or call the AMS at 800-321-4267 (within the U.S. or Canada) or 401-455-4000 (worldwide) and ask to speak with Member Services. The deadline for receipt of ballots is November 3, 2006.

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

Replacement Ballots
For those who wish to vote by paper ballot, the following replacement procedure has been devised: A member who has not received a ballot by September 20, 2006, or who has received a ballot but has accidentally spoiled it, may write to ballot@ams.org or Secretary of the AMS, 201 Charles Street, Providence, RI 02904-2294, USA, asking for a second ballot. The request should include the individual's member code and the address to which the replacement ballot should be sent. Immediately upon receipt of the request in the Providence office, a second ballot, which will be indistinguishable from the original, will be sent by first class or airmail. Although a second ballot will be supplied on request and will be sent by first class or airmail, the deadline for receipt of ballots cannot be extended to accommodate these special cases.

Biographies of Candidates
The next several pages contain biographical information about all candidates. All candidates were given the opportunity to provide a statement of not more than 200 words to appear at the end of their biographical information.

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

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

The candidates for vice president, members at large, and
Proposal for an AMS Fellows Program

The April 2006 Council directed that the following question be put to the membership on the 2006 election ballot:

The possibility of initiating an AMS Fellows Program has been discussed for many years. The following specific proposal has been placed on the ballot for the vote of the membership. If 2/3 of the voting members approve, the AMS will begin to initiate this program.

Members will be asked to approve or disapprove this question.

Proposal for a Fellows Program of the AMS

The Goals of the Fellows Program are:

• To create an enlarged class of mathematicians recognized by their peers as distinguished for their contributions to the profession.
• To honor not only the extraordinary but also the excellent.
• To lift the morale of the profession by providing an honor more accessible than those currently available.
• To make mathematicians more competitive for awards, promotions, and honors when they are being compared with colleagues from other disciplines.
• To support the advancement of more mathematicians in leadership positions in their own institutions and in the broader society.

I. Program (steady-state)

A. The Fellows Program of the American Mathematical Society recognizes members who have made outstanding contributions to the creation, exposition, advancement, communication, and utilization of mathematics.

B. The responsibilities of the Fellows are:
• To take part in the election of new Fellows,
• To present a “public face” of excellence in mathematics, and
• To advise the president and/or the Council on public matters when requested.

C. All AMS members are eligible to be elected Fellows.

D. The target number of Fellows will be determined by the AMS Council as a percentage of the number of eligible members. The target percentage will be revisited by the Council at least once every ten years and may be increased or decreased in light of the history of the nomination and election process. The intended size of each year’s class of new Fellows should be set with this target size in mind.

E. Following an election process (see below), individuals are invited to become Fellows. They may decline and they may also resign as Fellows at any time.

F. Each year all Fellows are invited to a reception at the AMS annual meeting, and the new Fellows are introduced at this reception, followed by a press release. New Fellows receive a certificate and their names are listed on the AMS website. The names of new Fellows are also included in the Notices.

G. If they are not already Fellows, the AMS president and secretary are made Fellows when they take office.

II. Election Process

A. New Fellows are elected each year after a nomination process. Eligible voters consist of current Fellows who are also members of the Society. Both the election and the nomination process are carried out under the direction of the secretary with help from the AMS staff.

B. The Election Committee will consist of nine members of the AMS who are also Fellows, each serving a three-year term, and with three new members appointed each year. The AMS president, in consultation with the Executive Committee of the Council, nominates the new members of the Election Committee in November of each year. At the same time, the president nominates a continuing member of the Election Committee to serve as chair. The president’s choices are approved by Council at its January meeting.

\[1\text{This proposal's recommendation to Council is 5\% of eligible members. At present there are about 30,000 eligible members so the number of Fellows would be about 1,500.}\]
C. The Election Committee accepts nominations for Fellows between February 1 and March 31 each year. Nominations are made by members of the AMS. A member can nominate no more than 4 nominees a year.

D. To be eligible for nomination to Fellowship, an individual must be an AMS member for the year in which he or she is nominated as well as for the prior year.

E. A nominator must supply a package with the following information on the nominee:
   1. A curriculum vitae of no more than five pages.
   2. A citation of fifty words or less explaining the person's accomplishments.
   3. A statement of cause of 500 words or less explaining why the individual meets the criteria of Fellowship.
   4. The signatures of the nominator and three additional AMS members who support the nomination, with at least two of these individuals current Fellows.

F. A person can be nominated no more than 3 times in a 5-year period.

G. Each year the January Council provides a guideline for the number of nominations to appear on the ballot. The Election Committee assembles the ballot from the nominations bearing in mind this guideline, diversity of every kind, and the quality and quantity of the external nominations. The Election Committee has the discretion to make nominations itself to fulfill the general goals of the Fellowship.

H. The ballot is available electronically (only) and voting is conducted throughout the month of September each year. The curriculum vitae and citation for each candidate will be available to all eligible voters. Election is by plurality voting. The choices you make in these elections directly affect the direction the Society takes. If the past election serves as a reliable measure, about 14 percent of you will vote in the coming election, which is comparable with voter participation in other professional organizations which allow an online voting option. This is not mentioned as encouragement for you to throw the ballot in the trash; instead, the other officers and Council members join me in urging you to take a few minutes to review the election material, fill out your ballot, and submit it. The Society belongs to its members. You can influence the policy and direction it takes by voting.

Also, let me urge you to consider other ways of participating in Society activities. The Nominating Committee, the Editorial Boards Committee, and the Committee on Committees are always interested in learning of members who are willing to serve the Society in various capacities. Names are always welcome, particularly when accompanied by a few words detailing the person’s background and interests. Self-nominations are probably the most useful. Recommendations can be transmitted through an online form (www.ams.org/committee-nominate) or sent directly to the secretary (secretary@ams.org) or Office of the Secretary, American Mathematical Society, 312D Ayres Hall, University of Tennessee, Knoxville, TN 37996-1330.

PLEASE VOTE.
Biographies of Candidates 2006

Biographical information about the candidates has been verified by the candidates, although in a few instances prior travel arrangements of the candidate at the time of assembly of the information made communication difficult or impossible.

Candidates have had the opportunity to make a statement of not more than 200 words on any subject matter without restriction and to list up to five of their research papers.

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

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

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

Vice President
Robert L. Bryant

Juanita M. Kreps Professor of Mathematics, Duke University.

Born: August 30, 1953, Harnett County, North Carolina, USA.


Additional Information: Member of the MAA; Alfred P. Sloan Fellow 1982-1984; NSF Presidential Young Investigator 1984-1989; MAA Southeastern Region Distinguished Teaching Award, 1993; Elected Fellow of the American Academy of Arts and Sciences, 2002.


Statement: I believe in supporting the central role of the AMS in promoting research in Mathematics and this should always be its main concern. This does not mean that the
AMS should only focus on what immediately benefits professional research mathematicians. Not only must we be concerned with educating the general public about the fundamental nature of mathematics and its practical importance in our increasingly technological lives, but we must also be involved in shaping the level and contents of mathematics education, not only at the college and university level, but earlier as well. I believe that we can and should also be involved in shaping the level and contents of mathematics but at the same time take advantage of new interdisciplinary opportunities, which will enliven our own research programs and simultaneously increase employment opportunities for our students.

The next several years will present major challenges to any business-as-usual approach to the AMS. Changing demographics, funding structures, and employment opportunities will affect the professional lives of all mathematicians. I look forward to a chance to study these problems and contribute what I can to finding creative solutions.

Sylvia Wiegand

Professor of Mathematics, University of Nebraska.

Born: March 8, 1945, Cape Town, South Africa.


Selected Addresses: AMS Invited Address, Fargo, SD, October, 1991; Commutative Algebra Conference, Venice, Italy, June, 2002; Commutative Algebra Conference, Graz, Austria, September, 2003; Special session, AMS-DMS Joint Meeting, Mainz, Germany, June, 2005; Special session, Joint Mathematics Meetings, San Antonio, TX, January, 2006.


Statement: The dedication of the officers, staff and members of the American Mathematical Society in the many areas related to our profession has truly made our world better. We should continue this tradition. In particular we still need to increase the participation of underrepresented groups in mathematics, to bring more talented young people into mathematics, to improve federal and local support for mathematics, and to increase public awareness of mathematics. We should work with math educators toward our mutual goals of preparing future mathematicians and scientists and generally getting people to reason critically. At the same time let’s continue to create, communicate and celebrate mathematics!

Trustee

Henry B. Laufer

Chief Scientist, Renaissance Technologies.

Born: August 13, 1945, Brooklyn, New York, USA.


Statement: I was a typical academic Professor, at SUNY at Stony Brook, until 1991. Then I joined Renaissance Technologies, where I help to manage a hedge fund. As a business experience should also prove valuable with regard to building on my experience within the mathematics community, as distinct from the welfare of mathematics. My general feeling here is that the Society should devote more effort to the welfare of mathematicians, as distinct from the welfare of mathematics. My business experience should also prove valuable with regard to the internal affairs of the Society.

Carol Saunders Wood

Professor of Mathematics, Wesleyan University.

Born: February 9, 1945, Pennington Gap, Virginia, USA.

Ph.D.: Yale University, 1971.


Statement: The role of AMS Trustee has been demanding at times, but never uninteresting. It is a privilege to serve, especially during an era in which the Society has enjoyed strong and imaginative leadership. I have tried to build on my experience within the mathematics community, alongside the experience and wisdom of others, to seek out what works best for mathematics and for mathematicians throughout our careers. If elected, I would continue to look for ways to promote the recognition of mathematics, including its rich interplay with other disciplines, and to celebrate and communicate its success stories. One sign of excellent health, and a lifelong goal for me, would be for the demographic profile of mathematicians to become indistinguishable from that of our society. This goal informs my priorities as Trustee, as does a desire for our community to be open and welcoming to its newest members.

Member at Large of the Council

Rodrigo Bañuelos

Professor of Mathematics, Purdue University.

Born: June 5, 1954, La Masita, Zacatecas, Mexico.


Statement: Our profession will continue to face, as it has for many years, many challenges. These include 1) research funding opportunities for pure and applied mathematics, 2) employment opportunities for new and recent Ph.D.’s and 3) the dissemination and publication of high quality mathematics at affordable prices, to mention but a few. The AMS must continue to work on these problems. At the same time we must keep in mind that the health and vitality of any organization and any profession depend on the young people. I am concerned that despite the efforts of the last decade, including the VIGRE program, the many REU sites around the country, and the opportunities created by the mathematics research institutes, we are still not attracting enough young people to careers in the mathematical sciences. This problem is particularly serious within the minority student population where these efforts have had a limited impact. If elected, I will work within the AMS to raise greater awareness on these issues.

Robert L. Devaney


Additional Information: Co-organizer: AMS Short Course on Chaos and Fractals, Centennial Meeting, Providence, RI, 1988; Director, Dynamical Systems and Technology Project, Boston University, 1990-; Organizer, AMS Short Course on Complex Dynamics, Cincinnati, 1994; MAA Haimo Award, 1995; NSF Distinguished Teaching Scholar Award, 2002; NSF-EHR Advisory Board, 2002-2005; Massachusetts Professor of the Year, Carnegie Foundation, 2004; Co-organizer, AMS-IMS-SIAM Summer Research Conference on Complex Dynamics, Snowbird, 2004; Trevor Evans Award, MAA, 2005.


Statement: The AMS has assumed a leadership role in communicating the beauty and the importance of mathematics and mathematical research to the wider community. I wholeheartedly support the AMS in these outreach activities. I also support the development of strong ties between all segments of the mathematics community, including researchers, teachers at all levels, and mathematicians in government and industry.

Detlef Gromoll

Professor of Mathematics, SUNY Stony Brook.

Born: May 13, 1938, Berlin, Germany.


Frank S. Quinn

Professor, Virginia Polytech Institute & State University, Blacksburg, Virginia.

Born: June 3, 1946, Havana, Cuba.


AMS Committees: Hour speakers for Southeastern section; Committee on Publication Policy; Committee on the Profession, 1999–2002; Committee on Committees, 1999–2003; Committee on Education, 2006–2008.

Selected Addresses: CBMS lectures, University of Notre Dame, 1984; ICM, 45 minute speaker, 1986; Park City Math Institute short course, 1991.

Additional Information: Virginia Outstanding Faculty Award, 1987; Fellow of American Association for the Advancement of Science, 2000.


Statement: The AMS Council already has many concerns both internal (meetings, publications, etc.) and external (funding, attracting new talent). Nonetheless I feel the AMS—starting with the Council—should consider further issues in the near future. These include:

1. Web and computer-based courses and testing. These are cost-effective and this alone will drive use. However, they are often mechanical, weaken communication skills, and short-change better students. The AMS might pro-

Gregory F. Lawler

Professor of Mathematics, University of Chicago.

Born: July 14, 1955, Alexandria, Virginia, USA.


Statement: Having advised more than twenty Ph.D. students, I consider it a most rewarding challenge to pass on exciting new mathematics to the next generation. There are many tough issues with graduate education: We must work harder to attract more top domestic students to the field and redouble our efforts to achieve diversity. We need a better support structure for graduate students, nationally and locally. NSF is moving in only slowly, and AMS can play a bigger role beyond the current initiatives. There are a number of challenges facing American mathematicians in the twenty-first century. One of the most important is to promote research mathematics to the wider community. As we go through a period of many retirements at universities, it is critical that positions are filled by research mathematicians (who are also excellent teachers). Since it is clearly less expensive for many departments to replace researcher/educators with full-time teachers, this will require continual emphasis and demonstration of the importance of a strong mathematics research community.
provide reviews or a clearing-house for these efforts to promote good work and to keep problems clearly in view.

(2) K-12 education. The U.S. decline effects college and university programs and threatens the long-term health of the mathematical community. Individual mathematicians have made substantial contributions, but the problem is huge and the academic community, as a whole, cannot divert resources from already under-funded primary missions. AMS activity should focus on areas with great leverage. One is high-stakes K-12 standardized tests: current tests are desperately in need of professional help. Another might be developing a "sense of the community" of what high-school graduates should know to be successful in college work.

Election to the Council should be an opportunity to serve the community, not a mandate to pursue an individual agenda. If elected, I would hope to get input from the community on these and other issues.

David J. Saltman

Mildred Caldwell and Baine Perkins Kerr Centennial Professor in Mathematics, University of Texas at Austin, Austin, Texas.

Born: March 23, 1951, New York City, New York, USA.

Ph.D.: Yale University, 1976.


Selected Addresses: "Noether's problem, Galois theory, and the Brauer Group" (one hour address), Joint Mathematics Meetings, January, 1987; "Unravelled Cohomology" (4 lectures), Tata Institute for Fundamental Research, Bombay, India, January-February, 1997; CBMS Lecture Series "Lectures on Division Algebras", Colorado State University, June, 1998; "Division algebras", Invited speaker, Richard Brauer Centennial Conference, Stuttgart, Germany, March, 2001; "Mathematics in History", two day-long seminars as part of the "Teachers as Scholars" program of the UT Humanities Institute, April, 2002.

Additional Information: Member, AWM; National Science Foundation Graduate Fellowship, 1972-1975; National Science Foundation Postdoctoral Fellowship, 1980-1981; Sloan Foundation Fellowship, 1980-1984; University of Texas-Austin, College of Natural Science Teaching Award, 2002; Principle PI of UT VIGRE grant, 2001-2006.


Statement: The AMS is and should be the main support organization for research mathematicians. In this role it publishes journals and books, sponsors lectures and meetings, and generally supports mathematics research. The AMS also has a vital role in ensuring the health of the mathematical community by encouraging diversity in our ranks, and helping to support emerging and young mathematicians. The AMS also has a public role to play, because the outlook and precision of mathematics is vitally needed by students of all interests and by society in general. As a member of the Council, I hope to be able to contribute as the AMS pursues and balances these goals.

Martin G. Scharlemann

Professor of Mathematics, University of California at Santa Barbara.

Born: December 6, 1948, Carlisle Barracks, Pennsylvania, USA.


Statement: The AMS is the only institution that fully understands and supports the process of mathematical re-
search. With this unique role comes special responsibilities: to articulate clearly the power and the beauty of mathematics to the general public; to argue convincingly for the resources that are needed to sustain mathematical research; to help undergird the larger infrastructure (education, publication venues, etc.) on which mathematical research ultimately relies. Most importantly, the AMS must continue to affirm the value of research to mathematicians involved in that process, for whom every other voice may be arguing that their talents are best used elsewhere. There is little point in the AMS duplicating, at member expense, advice that an often harried and professionally vulnerable mathematician can get from her dean for free. The AMS does remarkable work: MathSciNet continues to amaze. AMS non-specialized journals can be instantly accessed from any (subscribing) institution in the world. But can it do more to resist predatory academic publishers? For example, does the AMS actively encourage mathematicians to establish other, more focused, open-access journals, or are such efforts viewed as unwelcome competition? The AMS should remain wary of its own institutional conflicts of interest, and its leadership should resist them.

Marjorie Senechal

Louise Wolff Kahn Professor in Mathematics and History of Science and Technology, Smith College.

Born: July 18, 1939, St. Louis, Missouri, USA.


Statement: The AMS is the mathematical community’s strongest advocate for mathematics research and research mathematicians, and I’m honored to be nominated to serve on its Council. I will, if elected, work to strengthen that voice. First, in the corridors of power. We must, as always, do all we can to increase support—grants, conferences, centers, and special programs—for research. We must preserve or increase the ratio of civilian to other funding, by pressing for higher funding levels for the NSF and other non-military and non-security-related grant-making agencies. Second, we must enhance and improve our public outreach: the future of our profession depends on it. It takes a society—small ‘s’—to inspire, encourage, train and provide jobs for new generations of mathematicians; our Society must find creative ways to spread awareness of what mathematics is, what mathematicians do, and why both matter. Third, we must continue to broaden our own constituency. Changes in the AMS’s demographic landscape—gender, age, institutional, disciplinary (including cross, multi, and inter)—are increasingly visible, but we can do more to encourage and support these trends. And fourth, we must broaden and strengthen international contacts between mathematicians, now more than ever.
Katherine St. John

Associate Professor of Mathematics & Computer Science, Lehman College and the Graduate Center, City University of New York.

**Ph.D.:** University of California, Los Angeles, 1995.

**AMS Committees:** Joint Committee on Employment Opportunities in the Mathematical Sciences, 2001-2006.


**Statement:** The AMS is the organization in the U.S. which advocates for research activities in the mathematical sciences. It is necessary that we include all those with the talent and interest to succeed, especially members of underrepresented groups. Reaching out to these students in their undergraduate years by providing research opportunities is vital to their inclusion. The AMS has significant efforts in involving undergraduates in research. These activities are important to opening the eyes of students to the beauty and power of mathematics. Providing additional support to graduate students, postdoctoral fellows, and young faculty is essential to keeping young people in the profession. These include increased mentoring, inclusion at research meetings, addressing dual career issues and the streamlining of the job searching process. As a member of the Joint Committee on Employment Opportunities and a mentor to research students, I have seen first hand, how encouragement and removal of administrative hurdles can make a huge difference in the success of individual students.

Francis Edward Su

Associate Professor of Mathematics, Harvey Mudd College.

**Born:** October 7, 1969.

**Ph.D.:** Harvard University, 1995.

**AMS Committees:** Short Course Subcommittee, 2006--

**Selected Addresses:** Invited Speaker, Georgia Topology Conference, Athens, GA, May, 2002; Topological and Geometric Combinatorics, Oberwolfach, Germany, April, 2003; Park City Mathematics Institute, Park City, UT, July, 2004; MAA Invited Address, Joint Mathematics Meetings, San Antonio, TX, January, 2006; James R. C. Leitzel Lecture, MathFest, Knoxville, TN, August, 2006.


**Statement:** I believe the AMS exists to promote the research efforts of all its members who, in addition to those at R1 universities, also include research-active faculty at liberal arts colleges, regional universities, and community colleges. The mathematical community has made some progress in making funding, journals, MathSciNet, etc.,
available to faculty at all types of institutions, but we can do still more. Recent Ph.D.s need our support as well, and the AMS can play a pivotal role in supporting the development of our junior colleagues. We should also recognize that if we desire public support for mathematics research and programs, then we need to shape public perceptions of our work. Our collective efforts to teach our students well can have an enormous impact on whether the next generation of national leaders and decision-makers are friendly or adverse towards mathematics. To this end, we must promote the successful teaching of mathematics at all levels, through external public policy initiatives as well as internal efforts to increase awareness among research-active faculty about teaching-related issues in K-12 and college education. I am also a strong believer in promoting mathematics among the general public and raising math awareness in media and entertainment, and I would seek ways to further the role of the AMS in this critical effort. Finally, I hope we can continue to increase participation in AMS meetings by picking plenary speakers who have not only done outstanding research, but can communicate it well to a broad audience. If elected, I would be honored to serve to advance these efforts.

Nominating Committee

Thomas C. Hales

Andrew Mellon Professor of Mathematics, University of Pittsburgh.
Born: June 4, 1958, San Antonio, Texas, USA.
Additional Information: MAA Chauvenet Prize for outstanding exposition, 2003; Moore Prize for Applications of Interval Analysis, 2004; Past academic affiliations include Harvard, University of Chicago, University of Michigan, MSRI, and IAS.

Statement: The vitality of the AMS depends on the enthusiastic contributions of many mathematicians. The Nominating Committee finds mathematicians to serve on the various committees of the AMS. If elected, I will work with the other members to produce a broad slate of mathematicians who will continue to provide a tradition of excellence in AMS publications, meetings, policies, and prizes.

Roger Howe

William Kenan Jr. Professor of Mathematics, Yale University.
Born: May 23, 1945, Chicago, Illinois, USA.
Statement: To meet the manifold challenges facing the mathematical community, the Society needs to draw on the energies and talents of its members, to serve in many different capacities. The Nominating Committee plays a key role in matching people with tasks. It must cast its nets wide to identify people of all types and in all stages of their careers who can advance the interests of mathematics. I plan if elected to supplement my own knowledge by extensive consultation in order to find people who can keep the Society moving forward.
David Manderscheid

Professor and Chair, Department of Mathematics, University of Iowa.

Born: March 7, 1955, Redwood City, California, USA.

Ph.D.: Yale University, 1981.


Additional Information: NSF Mathematical Sciences Postdoctoral Fellowship, 1985-1988; Member, MSRI, 1988; Member, Institute for Advanced Study, 1988-1989; Member, MSRI, 1995; Organizer, AMS Special Session, Theta Correspondences and Automorphic Forms, Iowa City, 1996; Visiting Professor, Université Paris (Denis Diderot), 2001; Co-organizer, AMS-NSF Conference on Mentoring in Mathematics, 2004; Presidential Award for Excellence in Science Mathematics and Engineering Mentoring to the Department of Mathematics at the University of Iowa from NSF and the White House, 2005; Recognition of the Department of Mathematics at the University of Iowa from the AMS Committee on the Profession, 2006; Co-organizer, Leadership Workshop, Finding and Keeping Diverse Graduate Students in the Mathematical Sciences, American Institute of Mathematics, 2006.


Statement: The mission of the AMS has broadened beyond the promotion of mathematical research and scholarship. It now includes strengthening mathematics education and fostering public appreciation of the role of mathematics in our world. With this broadening, the Nominating Committee plays a critical role in determining the direction and tenor of the Society. I would bring to the Committee a commitment to excellence in mathematics research and scholarship, as they are the core of our profession. I would also bring a commitment to the broader mission of the Society. I would work with the committee to identify candidates who can further the mission of the AMS in all its aspects.

I would make sure that we identify candidates from a broad spectrum of diverse backgrounds. A key criterion for me in this process would be that candidates be forward thinking while appreciating the many current strengths of the Society.

John E. McCarthy

Professor of Mathematics, Washington University, St. Louis.


Statement: The American Mathematical Society has been extremely successful in supporting mathematics, primarily by organizing meetings, and by providing a high quality, reasonably priced, ethical publishing service. Running the Society, as I learned when I was a Council member, requires huge amounts of effort, much of it put in voluntarily by members and officers on the various committees of the Society. If elected, I shall seek to help the Nominating Committee find energetic and enthusiastic individuals from all over the Society to continue the good work that has been done since 1888.
Hema Srinivasan  
Professor, University of Missouri.  
**Born:** May 11, 1959.  
**Ph.D.:** Brandeis University, 1986.  
**AMS Committees:** Committee on Meetings and Conferences, 2000–2003; Summer Research Conferences Committee, 2000–2004.  
**Additional Information:** Organized AMS special sessions in Columbia, MO, 1996, Washington DC, 2000, Montreal, 1997 and 2002, and Bangalore, India, 2003; Member of AWM.  
**Statement:** AMS continues to play an important role in promoting mathematical research, the profession and the interests of mathematicians. This is not limited to journals, conferences and meetings but also has significant components in education by nurturing future mathematicians and scientists, enhancing public perception of mathematics and influencing public policy affecting the profession. In order to do all of these, it draws upon the considerable talent and dedication of its diverse membership. We have among us many energetic, enthusiastic and imaginative mathematicians whose ideas and expertise will help the mission of AMS. As a member of the Nominating Committee, I will do my best in identifying and engaging members in service to the society.

William Yslas Vélez  
Professor and University Distinguished Professor, University of Arizona.  
**Born:** January 15, 1947, Tucson, Arizona.  
**Ph.D.:** University of Arizona, 1975.  
**Additional Information:** Program Officer, Algebra and Number Theory Program, National Science Foundation, 1992–1993; President’s Award for Excellence in Science, Mathematics and Engineering Mentoring Program, Washington, DC, September, 1997; Founding member and past-president, Society for the Advancement of Chicanos and Native Americans in Science; James Leitzel Lecturer, MAA Summer Math Fest, August, 2005.  
**Statement:** The function of this committee is to nominate members from the AMS to serve the needs of the society and of the mathematical community. AMS should play a vital role in promoting, not only the importance of mathematical research, but also the importance of maintaining a vibrant mathematical education at the undergraduate and graduate level. The Nominating Committee should have a broad knowledge of the mathematical activities of its members if it is to effectively provide candidates to fill the diverse needs of the society.
Editorial Boards Committee

Professor of Mathematics, Indiana University at Bloomington.

**Born:** December 23, 1947, Salt Lake City, Utah.

**Ph.D.:** University of Michigan, 1974.


**Selected Addresses:** Invited Address, All-Union Conference on Complex Analysis, Tashkent, former USSR, June, 1989; International Congress of Mathematicians, 1990.


**Statement:** The publication of books and journals is an important activity of the AMS, and the success of the journals and book series depends largely on the editorial boards that run them. There is a broad diversity of mathematicians to choose from, and it is the job of the EBC to find people who will best carry out the missions of the various book series and journals.

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Niky Kamran

James McGill Professor of Mathematics, McGill University.

**Born:** May 22, 1959, Brussels, Belgium.

**Ph.D.:** University of Waterloo, 1984.

**Selected Addresses:** Distinguished Lectures in Nonlinear Mathematics, Los Alamos National Laboratory and University of New Mexico, 1992; CBMS-NSF lecture series, Howard University, Washington, 2000; Invited Address, AMS Sectional Meeting, Northeastern Section, Montreal, 2002.


**Statement:** The Editorial Boards of the AMS are playing a key role in ensuring that the standards of excellence which have built the outstanding reputation of the AMS publications are maintained. As a member of the Editorial Boards Committee, I will do my best to identify and recommend individuals whose research expertise, breadth and organizational skills will make them assets to their respective Editorial Boards. I also hope to use my experience as outgoing Editor-in-Chief of the Canadian Journal of Mathematics to work with my colleagues on the Editorial Boards Committee so that we can assist the various AMS Editorial Boards in their efforts to function even more efficiently.
Peter Kuchment

Professor, Mathematics Department, Texas A&M University.

Born: April 9, 1949, Chernovtsy, USSR.


Additional Information: Doctor of Science, Mathematics Institute of Ukrainian Acad. Sci., Kiev, Ukraine, 1983; Member, Editorial Board, Bulletin of the AMS, since 2005; editor of four AMS volumes; organizer of four Joint Summer Research Conferences.


Statement: The AMS has done a wonderful job publishing first rate journals and research monographs, as well as educational, historical, and popular mathematics materials. If elected, I will do my best to help in appointing the most able editorial members, who could advance further the quality of AMS publications and make them even more attractive to the authors and readers.

Irena Swanson

Professor, Reed College, Portland, Oregon.

Born: January 26, 1965, Maribor, Slovenia.

Ph.D.: Purdue University, 1992.

AMS Committees: Western Section Program Committee, 2002 and 2003 (chair, 2003).


Statement: One of the primary roles of the AMS is the dissemination of mathematical progress through publications. It is important that the publications be of high quality and be readily available. As far as the quality is concerned, much depends on the editorial board: the members need to be excellent mathematicians, fair and well-organized persons, and be representative of the diverse mathematical research community.
CALL FOR Suggestions

Your suggestions are wanted by:

The Nominating Committee, for the following contested seats in the 2007 AMS elections:
vice president, trustee,
and five members at large of the Council

Deadline for suggestions: November 5, 2006

The President, for the following contested seats in the 2007 AMS elections:
three members of the Nominating Committee
two members of the Editorial Boards Committee

Deadline for suggestions: January 28, 2007

The Editorial Boards Committee, for appointments to various editorial boards of AMS publications

Deadline for suggestions: Can be submitted any time

Send your suggestions for any of the above to:

Robert J. Daverman, Secretary
American Mathematical Society
312D Ayres Hall
University of Tennessee
Knoxville, TN 37996-1330 USA
e-mail: secretary@ams.org
Nominations by Petition

Vice President or Member at Large

One position of vice president and member of the Council ex officio for a term of three years is to be filled in the election of 2007. The Council intends to nominate at least two candidates, among whom may be candidates nominated by petition as described in the rules and procedures.

Five positions of member at large of the Council for a term of three years are to be filled in the same election. The Council intends to nominate at least ten candidates, among whom may be candidates nominated by petition in the manner described in the rules and procedures.

Petitions are presented to the Council, which, according to Section 2 of Article VII of the bylaws, makes the nominations. The Council of 23 January 1979 stated the intent of the Council of nominating all persons on whose behalf there were valid petitions.

Prior to presentation to the Council, petitions in support of a candidate for the position of vice president or of member at large of the Council must have at least fifty valid signatures and must conform to several rules and operational considerations, which are described below.

Editorial Boards Committee

Two places on the Editorial Boards Committee will be filled by election. There will be four continuing members of the Editorial Boards Committee.

The President will name at least four candidates for these two places, among whom may be candidates nominated by petition in the manner described in the rules and procedures.

The candidate's assent and petitions bearing at least 100 valid signatures are required for a name to be placed on the ballot. In addition, several other rules and operational considerations, described below, should be followed.

Nominating Committee

Three places on the Nominating Committee will be filled by election. There will be six continuing members of the Nominating Committee.

The President will name at least six candidates for these three places, among whom may be candidates nominated by petition in the manner described in the rules and procedures.

The candidate's assent and petitions bearing at least 100 valid signatures are required for a name to be placed on the ballot. In addition, several other rules and operational considerations, described below, should be followed.

Rules and Procedures

Use separate copies of the form for each candidate for vice president, member at large, or member of the Nominating and Editorial Boards Committees.

1. To be considered, petitions must be addressed to Robert J. Daverman, Secretary, American Mathematical Society, 312 D Ayres Hall, University of Tennessee, Knoxville, TN 37996-1330 USA, and must arrive by 25 February 2007.

2. The name of the candidate must be given as it appears in the Combined Membership List (www.ams.org/cm1). If the name does not appear in the list, as in the case of a new member or by error, it must be as it appears in the mailing lists, for example on the mailing label of the Notices. If the name does not identify the candidate uniquely, append the member code, which may be obtained from the candidate's mailing label or by the candidate contacting the AMS headquarters in Providence (amsmem@ams.org).

3. The petition for a single candidate may consist of several sheets each bearing the statement of the petition, including the name of the position, and signatures. The name of the candidate must be exactly the same on all sheets.

4. On the next page is a sample form for petitions. Petitioners may make and use photocopies or reasonable facsimiles.

5. A signature is valid when it is clearly that of the member whose name and address is given in the left-hand column.

6. The signature may be in the style chosen by the signer. However, the printed name and address will be checked against the Combined Membership List and the mailing lists. No attempt will be made to match variants of names with the form of name in the CML. A name neither in the CML nor on the mailing lists is not that of a member. (Example: The name Robert J. Daverman is that of a member. The name R. Daverman appears not to be.)

7. When a petition meeting these various requirements appears, the secretary will ask the candidate to indicate willingness to be included on the ballot. Petitioners can facilitate the procedure by accompanying the petitions with a signed statement from the candidate giving consent.
Nomination Petition for 2007 Election

The undersigned members of the American Mathematical Society propose the name of

as a candidate for the position of (check one):

☐ Vice President
☐ Member at Large of the Council
☐ Member of the Nominating Committee
☐ Member of the Editorial Boards Committee

of the American Mathematical Society for a term beginning 1 February, 2008

Return petitions by 25 February 2007 to:
Secretary, AMS, 312 D Ayres Hall, University of Tennessee, Knoxville, TN 37996-1330 USA

Name and address (printed or typed)

Signature

Signature

Signature

Signature

Signature

Signature

Signature

Signature
Mathematics Calendar

The most comprehensive and up-to-date Mathematics Calendar information is available on e-MATH at http://www.ams.org/mathcal/.

August 2006

Description: The IMS Committee on New Researchers is organizing a meeting of recent Ph.D. recipients in Statistics and Probability. The purpose of the conference is to promote interaction among new researchers primarily by introducing them to each other’s research in an informal setting. As part of the conference, participants will present talks and posters on their research and discuss interests and professional experiences over meals and social activities organized through the meeting as well as by the participants themselves. The relationships established in this informal collegiate setting among junior researchers are ones that may last a career (lifetime?) The meeting is to be held prior to the 2006 Joint Statistical Meetings in Seattle, WA.
Information: http://www.stat.ohio-state.edu/~pfc/NRC/.

1–September 30 Dynamical Chaos and Non-equilibrium Statistical Mechanics: From Rigorous Results to Applications in Nano-systems, Institute for Mathematical Sciences, National University of Singapore, Singapore. (Jun/Jul. 2006, p. 709)
Organizing Committee: Leonid Bunimovich (Georgia Institute of Technology), Giulio Casati (University Insurbia, Italy, and National University of Singapore), Lock Yue Chew (National University of Singapore), Baowen Li (National University of Singapore), George Zaslavsky (New York University).
Collaborative Research: During this period, local and overseas researchers will interact and collaborate in research on various topics of the field.
Workshop: The purpose is to bring together researchers worldwide to discuss the most recent developments in anomalous energy (heat) transport in low dimensional systems, synchronization of chaotic systems and applications to communication of information. It also serves as a forum to promote regional as well as international scientific exchange and collaboration.
Information and registration: http://www.ims.nus.edu.sg/Programs/chaos/; email: imssec@nus.edu.sg. For any inquiries on scientific aspects of the program, please email Baowen Li at phy11be@nus.edu.sg.

2–4 31st Sapporo Symposium on Partial Differential Equations, Department of Mathematics, Hokkaido University, Sapporo, Japan. (Jan. 2006, p. 70)
Description: The Sapporo Symposium on Partial Differential Equations has been held annually to present the latest developments on PDE with a broad spectrum of interests not limited to the methods of a particular school.
Organizers: T. Ozawa, Y. Giga, S. Jimbo, Y. Tonegawa, K. Tsutaya; email: crl@math.sci.hokudai.ac.jp.

2–4 DIMACS Workshop on Computational Tumor Modeling, DIMACS Center, CoRE Bldg, Rutgers University, Piscataway, New Jersey. (Jun/Jul. 2006, p. 709)
Organizers: David Axelrod, Rutgers University, Axelrod@nrel-exchange.rutgers.edu; Thomas S. Deisboeck, Harvard Medical School, deisboeck@helix.mgh.harvard.edu.
Local Arrangements: Workshop Coordinator, DIMACS Center, workshop@dimacs.rutgers.edu, 732-445-5928.
Information: http://dimacs.rutgers.edu/Workshops/

This section contains announcements of meetings and conferences of interest to some segment of the mathematical public, including ad hoc, local, or regional meetings, and meetings and symposia devoted to specialized topics, as well as announcements of regularly scheduled meetings of national or international mathematical organizations. A complete list of meetings of the Society can be found on the last page of each issue.

An announcement will be published in the Notices if it contains a call for papers and specifies the place, date, subject (when applicable), and the speakers; a second announcement will be published only if there are changes or necessary additional information. Once an announcement has appeared, the event will be briefly noted in every third issue until it has been held and a reference will be given in parentheses to the month, year, and page of the issue in which the complete information appeared. Asterisks (*) mark those announcements containing new or revised information.

In general, announcements of meetings and conferences held in North America carry only the date, title of meeting, place of meeting, names of speakers (or sometimes a general statement on the program), deadlines for abstracts or contributed papers, and source of further information. Meetings held outside the North American area may carry more detailed information. In any case, if there is any application deadline with respect to participation in the meeting, this fact should be noted. All communications on meetings and conferences in the mathematical sciences should be sent to the Editor of the Notices in care of the American Mathematical Society in Providence or electronically to notices@ams.org or mathcal@ams.org.

In order to allow participants to arrange their travel plans, organizers of meetings are urged to submit information for these listings early enough to allow them to appear in more than one issue of the Notices prior to the meeting in question. To achieve this, listings should be received in Providence eight months prior to the scheduled date of the meeting.

The complete listing of the Mathematics Calendar will be published only in the September issue of the Notices. The March, June/July, and December issues will include, along with new announcements, references to any previously announced meetings and conferences occurring within the twelve-month period following the month of those issues. New information about meetings and conferences that will occur later than the twelve-month period will be announced once in full and will not be repeated until the date of the conference or meeting falls within the twelve-month period.

The Mathematics Calendar, as well as Meetings and Conferences of the AMS, is now available electronically through the AMS website on the World Wide Web. To access the AMS website, use the URL: http://www.ams.org/.
TumorModeling/

Short Description: This workshop will present a variety of relevant computational tumor models and algorithms, covering several scales of interest by starting from the genetic instability and the functional genomics level up to tumor cell invasion and the angiogenesis level. Work on tumor cell signaling and information processing, multicellular pattern formation and scaling laws will be discussed as well. Finally, the workshop will also focus on several key challenges related to cancer modeling, such as biomedical data acquisition, access and quality, as well as the pros and cons of combining different (e.g., discrete and continuous) modeling approaches.


Description: It is a thematic conference on Algebra, Geometry, Analysis held under the auspices of the Pakistan Mathematical Society. The entire conference is organized under one roof at a four-star hotel in the modern, peaceful and beautiful federal capital of Pakistan located at the footstep of the scenic Margalla Hills. There will be free housing and lodging for foreign participants. Several recreational trips will be organized in and around Islamabad introducing the unique local and multi-ethnic culture.

Information and registration: Please fill in the on-line registration form http://www.dmelo.org.pk and find more information therein. The conference is convened by Qaiser Mushtaq in collaboration with Mathematics Division, Institute of Basic Research (Florida, USA), Higher Education Commission, Pakistan Telecommunication Ltd, and Quaid-i-Azam University, Islamabad.

5-11 Workshop on Symplectic Field Theory, Universitaet Leipzig, Germany. (Jun./Jul. 2006, p. 709)

Information: Workshop on Symplectic Field Theory Lecture Series by Y. Eliashberg with contributions by F. Bourgeois et al.


Preparatory Precourse: August 5-6; main workshop August 7-11.


7-11 Effective Randomness, AIM Research Conference Center, Palo Alto, California. (May 2006, p. 609)

Description: This workshop, sponsored by AIM and the NSF, will bring together researchers who have studied effective randomness at different times, with different motivations, and drawing from different academic backgrounds, with an aim toward increasing communication and collaboration, and developing broad shared research goals and a coherent research community.

Topics: For the workshop will include effective notions of randomness such as Martin–Löf randomness; measures of relative randomness; effective dimension; Kolmogorov complexity and other concepts from algorithmic information theory; and interactions with computability theory and complexity theory.

Organizers: Joseph Miller and Denis Hirschfeldt.


7-11 Partial Differential Equations on Noncompact and Singular Manifolds, University of Potsdam, Potsdam, Germany. (Feb. 2006, p. 287)

Topics Include: Qualitative Theory of PDEs (Regularity, Asymptotics), Geometric Analysis on Singular Spaces, K-theoretic Methods, Operator Algebra Aspects, Boundary Value Problems, Noncommutative Geometry, Quantization.

Organizing Committee: B. Fedosov (Moscow), G. Grubb (Copenhagen), T. Kainer (Potsdam), V. Nistor (Penn State), L. Rodino (Torino), B-W. Schulze (Potsdam), N. Tose (Tokyo), M. W. Wong (Toronto).

Information: PDEs on Noncompact and Singular Manifolds c/o T. Kainer and B-W Schulze, Institut für Mathematik, Universität Potsdam, Postfach 60 15 53, D-14415 Potsdam, Germany; email: pdemath.uni-potsdam.de; http://pdemath.uni-potsdam.de.


Organizers: Michael Falk (Northern Arizona University), Eva-Maria Feichtner (University of Stuttgart), Hiroaki Terao (Tokyo Metropolitan University).

Information: http://www.msi.mpg.de/calendar/workshops/WorkshopInfo/389/show_workshop/.

9-12 The Third International Conference on Neural, Parallel & Scientific Computations, Morehouse College, Atlanta, Georgia. (Mar. 2006, p. 379)


Information: Contact M. Sambandham, ICNPS'03, Department of Mathematics, Morehouse College, Atlanta, Georgia 30314; email: icnps9@yahoo.com; http://www.dynamicpublisher.com/ICNPS03.


Speakers: The FLoC'06 program includes a keynote session to commemorate the Geodel Centenary, with John Dawson and Dana Scott as speakers, a keynote talk by David Harel, plenary talks by Randy Bryant and David Dill, and invited talks by F. Bacchus, A. Blass, B. Buchberger, A. Darwiche, M. Das, J. Esparza, J. Giesl, A. Gordon, T. Hoare, O. Kupferman, M. Lam, D. Miller, K. Sakallah, J. Soty, and C. Wolty.

Funding: FLoC has received an NSF grant to provide funds for travel grants of up to $750 for student attendees of FLoC'06. We expect to award about 50 grants. See application information on the website.

Registration: Online registration for FLoC is now open at: http://www.easychair.org/FLoC-06/.


Description: The LICS Symposium is an annual international forum on theoretical and practical topics in computer science that relate to logic in a broad sense. LICS 2006 will be held as part of the Fourth Federated Logic Conference (FLoC'06).
Invited Speakers: A. Blass, A. Gordon, and O. Kupferman. There will also be a joint LICS/RTA/SAT plenary lecture given by R. Bryant.

Information: http://www.lfc.informatics.ed.ac.uk/lics. For further information about FiLoC’06, see http://www.informatik.hu-berlin.de/filc/.

13-19 Workshop on Triangulated Categories, University of Leeds, United Kingdom. (Mar. 2006, p. 380)

Aim: To bring together researchers from many parts of mathematics who all use triangulated categories and related structures. Hopefully, the event will promote interactions across traditional borders. Moreover, it should give postgraduate students and postdocs the opportunity to learn about exciting modern developments.

Organizers: Thorsten Holm, Peter Jorgensen, Raphael Rouquier.

Preliminary list of speakers (to be confirmed): Paul Balmer (Zurich), John Greenlees (Sheffield), Srikant Iyengar (Lincoln), Bernhard Keller (Paris), Henning Krause (Paderborn), Ralf Meyer (Muenster), Amnon Neeman (Canberra), Dmitri Orlov (Moscow), Jeremy Rickard (Bristol), Stefan Schwede (Bonn).

Information: http://www.maths.leeds.ac.uk/pure/algebra/TriCat06.html.

14-16 Network Design: Optimization and Algorithmic Game Theory, Centre de Recherches Mathematiques, Montreal, Canada. (May 2006, p. 609)

Description: As the network infrastructure keeps changing and new applications are emerging, the mathematical models themselves must be adapted constantly. The workshop will explore recent developments in the field and especially the relationship between combinatorial optimization and the models used in distributed network design.

Organizers: Shie Mannor (McGill) and Adrian Vetta (McGill).

Participants: Kamal Jain (Microsoft Research Center), Ramesh Johari (Stanford University), George Karakostas (McMaster University), Anna Karlin (University of Washington), Jochen Koennen (University of Waterloo), Kate Larson (University of Waterloo), Yishay Mansour (Tel Aviv University), Peter Marsch (University of Toronto), Sven Meyn (University of Illinois), Tim Roughgarden (Stanford University), Andreas Schulz (ETH Zentrum), Nahum Shimkin (Technion), Eva Tardos (Cornell University).

Information: http://www.crm.umontreal.ca/Network06/.

15-18 International Conference on Spectral Theory and Global Analysis, Carl von Ossietzky University, Oldenburg, Germany. (Feb. 2006, p. 287)

Topics will include: Spectral asymptotics, Scattering theory, Index Theory and Hodge Theory; Spectral Invariants, Analysis on singular and non-compact spaces.

Organizing Committee: D. Grieser (Oldenburg), T. Kainer (Potsdam), A. Vasy (Stanford).

Information: http://www.mathematik.uni-oldenburg.de/personen/grieser/stra/I.


Description: This conference will bring together experts in the fields of mathematics, computer science, statistics, operations research, physics, engineering, and finance to discuss the latest developments in Monte Carlo and quasi-Monte Carlo methods and their applications. The program will consist of invited plenary talks, several special thematic sessions, and contributed talks.

Invited Speakers: R. Cools (Belgium), A. Genz (USA), M. Jordan (USA), F. Kuo (Australia), T. Muller-Gronbach (Germany), H. Niederreiter (Singapore), G. Pages (France), K. Sabelfeld (Germany).

Contact: Professor Alexander Keller, Abt. Medieninformatik, University of Ulm, D-89069 Ulm, Germany; email: mcqmc@uni-ulm.de.

Information: Regularly updated information can be obtained from the Web page http://mcqmc.uni-ulm.de.

14-18 The Teachers Circle, Mathematical Sciences Research Institute, Berkeley, California. (Aug. 2006, p. 820)

Organizers: Tom Davis, Mary Fay-Zenker, Tatiana Shulkin, Sam Vandervelde, Paul Zeitz, Joshua Zucker.

Information: http://www.msri.org/calendar/workshops/WorkshopInfo/397/show_workshop/.

14-21 Geometry and Analysis on Complex Algebraic Varieties: Joint RFBR-JSPS Symposium, Independent University of Moscow, Moscow Krasnoyarsk State University, Krasnoyarsk, Russian Federation.

Summary: The Joint Symposium, organizing in the framework of a RFBR-JSPS bilateral cooperation project, covers a broad range of topics within Geometry and Analysis on complex algebraic varieties including the following directions: logarithmic and multi-logarithmic differential forms, logarithmic connections, groupoids, structures and their applications in mathematical physics, theory of residues and characteristic classes for singular varieties, the theory of index of vector fields on complex hypersurfaces and complete intersections, topology of singular divisors and their complements, geometry and combinatorics of hyperplane arrangements, modern methods of the theory of multidimensional residues and their applications, etc.


Information: http://www.sccmo.ru/symposium/.

15-18 Communicating Mathematics in the Digital Era, University of Aveiro, Aveiro, Portugal. (Jun./Jul. 2006, p. 709)

Main Topics: The main topics of CMDE2006 include, but are not restricted to: Data Mining, Clustering and Recovery; Digital Libraries and Archiving Networks; E-Mathematics Resources; Electronic Publishing; Free and Open Source Initiatives; Information Representation and Visualization; International Copyrights and Author's Rights; Math network and Electronic Communication; Mathematics E-Learning; Metadata Models and Standards; Multimedia Tools; Retrodigitisation; Web Searching.

Information: Can be found in the Webpage of the conference at http://www.cmde2006.org.

16-19 First announcement: Satellite Conference on Algebraic Geometry, Segovia, Spain. (Jan. 2006, p. 70)

Description: Satellite Conferences are relevant scientific activities organized around ICM Madrid 2006. This conference will deal with recent trends in Algebraic Geometry.

Plenary lectures: There will be two plenary lectures in the mornings.


Information: http://www.escet.urjc.es/satellite/.

16-19 Satellite conference on Algebraic Geometry, Segovia Campus of the Universidad de Valladolid, Segovia, Spain. (Apr. 2006, p. 497)

Description: Satellite Conferences are relevant scientific activities organized around ICM Madrid 2006. This conference will deal with recent trends in Algebraic Geometry.

Main Speakers: J. I. Burgos, G. M. Greuel, P. Griffiths, J. Lipman, Z. Mebkhout, T. Pantev, M. Reid, A. Sommese

Sessions: Interactions with physics, Classical geometry and Singularities.


Information: http://www.escet.urjc.es/satellite/.

16-19 Trends and Challenges in the Calculus of Variations and its Applications, Toledo, Spain. (Jan. 2006, p. 70)


Organizers: E. Aranda, J. C. Bellido (Co-ordinator), P. Pedregal (University of Castilla-La Mancha).

Call for Applications: Young researchers have the possibility to apply for giving a short talk. The Scientific Committee will make a selection among the received applications. The deadline for applying for a talk is March 15th, 2006.

Registration: Pre-registration is already open on-line. Registration will start by the beginning of February.

Information: http://www.matematicas.ucm.es/toledo2006; email: JoseCarlos.Bellido@ucm.es.


Topics: Symplectic topology, Contact topology Gauge theories, Topology of low dimension manifolds, Mirror symmetry.

Scientific Committee: Simon Donaldson, Imperial College, London, UK; Yakov Eliashberg, Stanford University, USA; José M. Fernández de la Bastida, CSIC, Madrid, Spain; Kenji Fukaya, Kyoto University, Japan; Robert F. Gompf, University of Texas at Austin, USA; Helmut Hofer, Courant Institute, New York University, USA; Dusa McDuff, Stony Brook University, USA; Gang Tian, Princeton University, USA.

Invited Speakers: Denis Auroux, MIT, Cambridge, USA; Paul Biran, Tel-Aviv University, Israel; Ko Honda, University of Southern California, USA; Robert Gompf, University of Texas at Austin, USA; Dusa McDuff, Stony Brook University, USA; Grigory Mikhalkin, University of Toronto, Canada; William P. Minicozzi, The Johns Hopkins University, Maryland, USA; Tom Mrowka, MIT, Cambridge, USA; Peter S. Ozsváth, Columbia University, New York, USA; D.H. Phong, Columbia University, New York, USA; Bernd Siebert, Albert-Ludwigs-Universität, Freiburg, Germany.

Deadlines: For grant applications is June 1, 2006. The deadline for registration, including receipt of the workshop fee, is July 1, 2006. Abstracts submission: May 1, 2006 Applying for financial support: June 1, 2006 (including receipt of fee payment): July 1, 2006.

Information: For further information and queries, please contact the conference secretariat: email: gesta@vlima.upc.edu; http://www.ma1.upc.edu/gesta.


Organizers: The Romanian Society of Applied and Industrial Mathematics (ROMA), Mathematical Society of the Republic of Moldova, Moldova State University, Tiraspol State University, Institute of Mathematics and Computer Science of the Academy of Sciences of Moldova and the Center for Education and Research in Mathematics and Computer Science at Moldova State University (CRDF/MDRA).


Information: http://www.ust.md/math/CATN/; email: mathconf@mail.md.


Workshop Topics: This workshop, sponsored by AIM and the NSF, will be devoted to the study of phase transitions in several traditionally separate subjects. We propose to bring together experts in different fields to present the various intuitions, motivations, canonical examples and conceptual techniques of their areas, the hope being to come to agreement on a few key definitions, and perhaps thereby to bring fresh ideas to bear on open problems.


Information: http://aimath.org/ARCC/workshops/phasetransition.html.


Description: The ICM, held every four years, is sponsored by the International Mathematical Union. The Fields Medals and the Savinina Prize will be awarded at the Congress, in addition to a new prize, the Carl Friedrich Gauss Prize. A full scientific program of plenary and parallel sessions is planned, and there will be many satellite conferences.

Organizers: Manuel de Leon (president of the organizing committee), ad Carlos Andrade (vice president general).


Workshop Goals: The aim of the workshop is to expose the participants to the newest methods available for the description and analysis of large-scale, complex structures using methods of combinatorics and graph theory, in combination with nonlinear adaptive systems theory, and statistical physics.

Information: http://www.cnd.math.msu.edu/nfsworkshop06/.


Main Speakers: P. Deift (Courant Institute, New York University), B. Simon (California Institute of Technology), F. A. Grunbaum (University of California, Berkeley), S. Khrushchev (Atilim University, Ankara, Turkey), M. E. H. Ismail (University of Central Florida), A. J. Kuijlaars (Katholieke Universiteit Leuven, Belgium).

Deadlines: Submission of abstracts is May 31, 2006; Registration is June 15, 2006.

Contact: Francisco Marcellan, Departamento de Matematicas, Universidad Carlos III de Madrid, Avenida de la Universidad 30, 28911 Leganes, Spain; email: pacomarc@ing.uc3m.es.

Information: Visit the website http://www.uc3m.es/uc3m/dpto/MAT/ETH/OrthApprox/ICM06/uc3m_ICM06.html.


Organizer: Susan Holmes.

Mathematics Calendar

31-September 2 Geometry and Topology of Low Dimensional Manifolds, Burgos de Osma, Spain. (Apr. 2006, p. 497)
Description: A satellite conference to ICM 2006, Madrid, Spain.
Plenary Speakers: Michel Boileau (Univ. Paul Sabatier, Toulouse); Cameron Gordon (Univ. of Texas, Austin); William Harvey (King's College, Univ. of London); Gareth A. Jones (Univ. of Southampton); Louis H. Kauffman (Univ. of Illinois, Chicago); Alexander Mednykh (Sobolev Inst. of Math., Novosibirsk); Hugh Morton (Univ. of Liverpool); Sergej Natanzon (Independent Univ. of Moscow); Jozef Przytycki (The George Washington Univ., Washington DC); Jürgen Wolfart (Univ. of Frankfurt).
Information: http://www.mai.liu.se/lowdim.

31-September 5 Advanced Course on Combinatorial and Computational Geometry: Trends and topics for the future, Centre de Recerca Matemàtica, Barcelona, Spain. (May 2006, p. 610)
Speakers: János Pach (City College and Courant Institute, New York and Rényi Institute, Budapest, Hungary), Micha Sharir (Tel Aviv University, Israel).
Grants: The CRM offers a limited number of grants for registration and/or accommodation addressed to young researchers. The deadline for application is April 14, 2006.
Further Information: Visit http://www.crm.es/ACComGeometry; email: AComGeometry@crm.es.

September 2006

1-4 Conference on Mathematical Neuroscience, Sant Julià de Lòria (Andorra), Madrid, Spain. (May 2006, p. 610)
Plenary Speakers: Bard Ermentrout (University of Pittsburgh), Nancy Kopell (Boston University), John Rinzel (New York University).
Information: See http://www.crm.es/CMathNeuroscience;email: CMathNeuroscience@crm.es.

1-4 Topics in Mathematical Analysis and Graph Theory, University of Belgrade, Faculty of Electrical Engineering, Department of Applied Mathematics, Serbia and Montenegro. (Dec. 2005, p. 1383)
Description: This conference is a satellite to International Congress of Mathematicians, August 22-30, 2006.
Topics: Classical mathematical analysis, including inequalities and convexity, Graph theory and combinatorics, Special functions, Differential equations, Functional analysis, Numerical analysis, Complex analysis, Probability and Statistics, Mathematical aspects of computer science, Differential geometry and related topics, Number theory, Applications of mathematics in Electrical Engineering and Telecommunications.
Invited speakers: R. P. Agarwal (USA), L. M. Berkovich (Russia), Dragos Cvetkovic (Serbia), Curtis Cooper (USA), Soon-Young Chung (Korea), Sever Dragomir (Australia), A.M. Fink (USA), Aleksandar Ivić (Serbia), Hira Koul (USA), Gradimir Milovanovic (Serbia), Ingram Olkin (USA), B.G. Pachpatte (India), Themistocles Rassias (Greece), Peter Rowlinson (UK), Hari M. Srivastava (USA), Zsolt Tuza (Hungary).
Scientific Committee: L. M. Berkovich (Russia), Dragos Cvetkovic (Serbia), Sever Dragomir (Australia), A.M. Fink (USA), Aleksandar Ivić (Serbia), Hira Koul (USA), Gradimir Milovanovic (Serbia), Ingram Olkin (USA), Peter Rowlinson (UK), Hari M. Srivastava (USA), Zsolt Tuza (Hungary).
Local organizing committee: Milan Merkle (coordinator), Nenad Cakic, Dragos Cvetkovic, Cemal Dolicanin, Ivan Lackovic, Zoran Radosavljevic, Dejan Tonic, Dobrilo Tonic, Slobodan Simic, Gradimir Milovanovic, Stevan Pilipovic, Milan Taskovic.
Information: http://magt.etf.bg.ac.yu; email: pefmath@etf.bg.ac.yu.

Theme: Interdisciplinary Mathematical and Statistical Techniques.
Speakers: C. R. Rao (Penn State), Barry Arnold (University of California, USA), Carlos Braumann (Evora, Portugal), Tadeusz Calisky (Poznan, Poland), Angela Dean (Ohio State, USA), Malay Ghosh (Florida, USA), Ivette Gomez (Lisbon, Portugal), Benjamin Kedem (Maryland, USA), and John Stufken (Georgia, USA).
Information: Contact: Sat Gupta (angupta@unccg.edu), Carlos Coelho (cmac@fct. unl.pt) or Satya Mishra (mishra@aguar11.southalabama.edu; http://scra2006.southalabama.edu/.


3-8 CR Geometry and PDE's, Grand Hotel Bellavista, Levico Terme, Trento, Italy. (Aug. 2006, p. 821)
Topic: CR Geometry and Partial Differential Equations present a field of interaction with a wide range of mathematical areas such as Real and Complex SYmplectic Geometry, Differential Geometry, Complex Dynamics, Jet Theory, Microlocal Analysis. The aim of the conference is to bring together both active senior researchers and young mathematicians with interest in CR Geometry and Partial Differential Equations and to foster exchange of ideas and interaction between these fields.
Scientific Organizers: Dmitri Zaitsiev (Dublin) and Giuseppe Zampieri (Padova).
Confirmed Participants: M. Agranovsky (Ramat Gan), L. Baracco (Padova), F. Bracci (Roma II), A. Caip (Wien), P.D. Cordero (Sao Paulo), M. Derridj (Rouen), P. Dolbeault (Paris), M. Eastwood (Adelaide), P.F. Ebenfelt (La Jolla), N. Eisen (Poitiers), C. Epstein (Philadelphia), G. Fels (Tuebingen), F. Forstneric (Ljubljana), S. Fu (Camer), L. Garatti (Roma II), G. Globevnik (Ljubljana), S. Gong (Madison), A. Hichri (Tokyo), X. Huang (Piscataway), A. Iseay (Canberra), W. Kaup (Tuebingen), B. Lamel (Rio), C. Laurent-Thiebaut (Grenoble), H.M. Maire (Geneve), N. Mir (Rouen), M. Nacinovich (Roma II), M. Peloso (Torino), A. Perroti (Trento), F. Ricci (SNS Pisa), G. Schmalz (Armida), Y.-T. Siu (Harvard), L. Stolovitch (Toulouse), G. Tomassini (SNS Pisa), V. Vajaitu (Bucharest), S.-T. Yau (Chicago), L. Zalcman (Ramat Gan).
Deadline for registration: July 31, 2006.
Information: Augusto Micheletti, Secretary of CIRM, Istituto Trentino di Cultura, Via Sommarive 14, 38050 Povo (Trento), Italy; Tel. +39-0461-816128; Fax +39-0461-810629; email: michelet@science.unitn.it; http://www.science.unitn.it/cirm/AnnCR2006.html.

4-6 Optimal Discrete Structures and Algorithms (ODSA 2006), University of Rostock, Rostock, Germany. (Apr. 2006, p. 497)
Information: http://www.math.uni-rostock.de/odsa/

4-8 Barcelona Analysis Conference, University of Barcelona, Barcelona, Spain. (Jan. 2006, p. 70)
Description: BAC06 has been recognized as a Satellite Conference of the International Congress of Mathematicians, Madrid 2006. The meeting will take place at the historical building of the University of Barcelona.
Main areas of interest: Harmonic Analysis, Geometric Measure Theory, Real and Functional Analysis, Complex Analysis, Signal Analysis, Aspects of the above related to PDE's.

Description: This meeting is in honour of Professor Nigel Hitchin (University of Oxford) on the occasion of his 60th birthday. This is a satellite conference of the ICM 2006 to take place in Madrid in August 2006. The meeting is devoted to the many research topics covered by Nigel Hitchin.

Organizing Committee: L. Alvarez-Consul (CSIC, Madrid), O. García-Prada (CSIC, Madrid, Chairman), F. Kirwan (University of Oxford), H. Pedersen (University of Southern Denmark, Odense), Y.-S. Poon (University of California at Riverside), S. Salamon (Politecnico di Torino).

Deadline to Register: June 15, 2006.

Information: For a list of speakers and on-line registration, please visit the website http://www.mat.csic.es/webpages/conf/hitchin2006/.

4–8 International Conference on Arithmetic Algebraic Geometry, El Escorial, Madrid, Spain. (Jun./Jul. 2006, p. 710)

Topics: This Satellite Conference of ICM2006 is organized by the European Research Network “Arithmetic Algebraic Geometry”, and the main topics will be those covered by the network: Arithmetic of varieties over local fields, Arithmetic of varieties over global fields, Automorphic forms and the Langlands Program.

Coordinator of the Organizing Committee: Adolfo Quiros (U. Autonoma de Madrid, email: aag2006@uam.es).


Information: http://gigda.ugr.es/isaga06/; email: isaga06@ugr.es.


Topics: Resolution of singularities, local study of singularities, singular foliations, differential algebra, asymptotic analysis, and differential and geometrical study of dynamical systems.

Scientific Committee: Felipe Cano (Univ. Valladolid), Frank Loray (Univ. Rennes I), Juan Jose Morales (Univ. Politecnica Catalunya), Paulo Sad (IMPA), Mark Spivakovsky (Univ. Paul Sabatier).

Organizers: Jorge Mozo Fernández, José Cano and Fernando Sanz (Univ. Valladolid).


Information: http://www.uva.es/tordesillas2006; email: sdef2006@ieip.uva.es.

4–8 Stochastic Analysis in Mathematical Physics, CI Uni. Lisbon, Lisbon, Portugal. (Mar. 2006, p.380)

Description: To illustrate the versatility of modern stochastic analysis in various fields and applied mathematics, with a special emphasis on Mathematical Physics. Among the themes covered in this meeting are: Hydrodynamics and turbulence, Conformal invariance, Random environment, Applications of large deviations, Quantum field theory.


Purpose: Of the conference is to create a platform for international exchange of ideas and the newest results in the fields of applied analysis and differential equations.


Speakers: Please see website below.

Information: http://www.math.uaic.ro/~icaade; email: icaade@uaic.ro.


Organizers: Professor P. P. Boalch (ENS Paris), Professor P. A. Clarkson (Kent), Professor L. Mason (Oxford), Professor Y. Ohyama (Osaka).

Information: http://www.newton.cam.ac.uk/programmes/PDM/.

5–6 Digitization of Mathematical Journals and Related Topics, Research Institute for Mathematical Sciences, Kyoto University, Kyoto, Japan. (Aug. 2006, p. 821)

Organizer: TOSE, Nobuyuki (Faculty of Economics, Keio Univ.).


5–8 Workshop on Computational Applications of Algebraic Topology, Mathematical Sciences Research Institute, Berkeley, California. (Aug. 2006, p. 821)


6–8 Development of operator algebra, Research Institute for Mathematical Sciences, Kyoto University, Kyoto, Japan. (Aug. 2006, p. 821)

Organizer: KAJIWARA, Tsuyoshi (Graduate School of Environmental Science, Okayama Univ.).


Information: http://applied.math.uoa.gr/m3st.html.

7–10 Categorification in Algebra and Topology, Uppsala University, Uppsala, Sweden. (Jun./Jul. 2006, p. 710)
Mathematics Calendar

Invited Speakers: Dror Bar-Natan; Anna Beliakova; Jonathan Brundan; Ian Grojnowski; Bernard Leclerc; Jacob Rasmussen; Raphaël Rouquier; Lev Rozansky (to be confirmed); Vladimir Turaev; Wolfgang Soergel; Catharina Stroppel.
Organizers: Volodymyr Mazorchuk and Oleg Viro.
Information: http://www.math.uu.se/cat2006/.
Inquiries: cat2006@math.uu.se.
Registration Deadline: July 31, 2006.

Organizers: Christine Guenther and Panagiota Daskalopoulos.
Information: http://www.msri.org/calendar/workshops/WorkshopInfo/579/show_workshop/.

8-10 The Fourth International Conference on Origami in Science, Mathematics, and Education (4OSME), California Institute of Technology, Pasadena, California. (Jun/Jul. 2006, p. 711)
Purpose: To gather those interested and showcase new results in mathematical methods, scientific applications, and educational uses of paper folding.
Organizers: Robert J. Lang, Thomas C. Hull, Ryda D. Rose.
Speakers: Erik Demaine, MIT.

Conference: Dedicated to Robert Wisbauer at the occasion of his 65th birthday. It will bring together leading specialists in the theory of rings and modules, corings and comodules as well as in the theory of Quantum groups and its derivates.
Main Speakers: Helena Albuquerque (Coimbra), Tomasz Brzezinski (Swansea), José Gómez Torrecillas (Granada), Pedro Gull Asensio (Murcia), Claudia Menini (Ferrara), Alexandre V. Mikhailov (Moscow), Mike Prest (Manchester), Ivan Shestakov (São Paulo), Patrick Smith (Glasgow).
Information: The deadline for submitting an abstract is the 31st of May 2006. The conference fee for non-students is 75 Euros and 50 Euros for students. Unfortunately we cannot offer any financial support. For more details, including the Conference Program please refer to http://www.fc.up.pt/mp/clomp/ModulesAndComodules/ or send an email to ModulesAndComodules@fc.up.pt.

8-12 1st Dolomites Workshop on Constructive Approximation and Applications: Dedicated to Walter Gautschi for his 50 years of professional activity, Alba di Canazei, Trento, Italy. (Apr. 2006, p. 497)
Topics: Approximation by Multivariate Polynomials (Interpolation, Orthogonal Polynomials...), Approximation by Radial Basis Functions and other Meshfree Methods, Cubature Methods, Computational Tools, Applications to Scientific Computing, Applications to Numerical Modelling in Engineering and Finance.
Speakers: Bojanov B. (Sofia, BG), Bos L. (Calgary, CA), Bozzini M. (Milan, I), Brezinski C. (Lille, F), Buhmann M. (Giessen, D), Fassbauer G. (Chicago, IL, USA), Iseki A. (Hamburg, D), Levesley J. (Leicester, UK), Montefusco L. (Bologna, I), Sauër T. (Giessen, D), Schaback R. (Goettingen, D), Sloan I. (Sydney, AU), Wendland H. (Dresden, D), Xu Y. (Eugene, OR)
Registration: Since the meeting is limited to at most 80 participants, people interested in participating in this workshop are invited to pre-register.
Information: http://www.sci.univr.it/~ducaad06.

Topics: General theory of univalent and multivalent functions; Extremal problems for conformal and quasiconformal mappings; Bloch functions, normal functions, normal families; Covering theorems in conformal mapping theory; Finey holomorphic functions and topological function theory; Quasiconformal methods and Teichmüller theory; Fuchsian and Kleinian groups as dynamical systems; Potentials and capacity, harmonic measure, extremal length; pluripotential theory; Bergman spaces; Potential theory on Riemannian manifolds; Biharmonic and polyharmonic equations and functions; Discrete potential theory; Equations of mathematical physics and other areas of application; Holomorphic mappings and correspondences; Nonlinear potential theory; Related topics.
Organizing Committee: Tahir Aliyev Azergolu (Gebze Institute of Technology, chair), Promarz Tamrazov (Institute of Mathematics of the NAS of Ukraine), Alinur Buyukaksoy (Gebze Institute of Technology, Mithat idemen (Yeditepe University, Turkey), Aydin Aytuna (Sabanci University, Turkey), Fulkilov (Gebze Institute of Technology).
Information: http://www.gyte.edu.tr/iccapt/.

Description: Nonlinear waves and coherent structures is a broad area of applied mathematics. Its theoretical aspects are relevant to subjects diverse as general relativity, high-energy particle physics, fluid and solid mechanics, plasmas, nonlinear electrical circuits, Bose-Einstein condensation, nonlinear optics, random media, atmosphere and ocean dynamics, chemical reactions, and biology. One of the most successful and topical applications is the propagation of information in optical fibers, but remarkable agreement between theory and experiments can be claimed in many of the fields mentioned above.
Goals: The goals of this meeting are to provide an opportunity for the cross-fertilization among the different fields of applications and to increase the understanding and communication between the mathematicians who build the theory and the scientists who use it. The conference is designed to facilitate presentations of advances in nonlinear waves and coherent structures, ranging from basic mathematical research to various applications.
Organizers: The organizing committee will make every effort to attract a large pool of members from different backgrounds and at different stages in their careers.
Information: Additional information is available at http://www.siam.org/meetings/nw06/index.php.

11-15 Arithmetic Algebraic Geometry, Research Institute for Mathematical Sciences, Kyoto University, Kyoto, Japan. (Aug. 2006, p. 821)
Organizer: KAT0, Kazuya (Dept. of Math. Kyoto Univ).

Topics: Study mappings in CR geometry. Participants will focus on a quite specific part of this general subject, namely the relationship between the complexity of a CR mapping and the complexity of the CR structures on the domain and target manifolds.
Goals: To determine the fundamental notions of CR complexity and to prove sharp results about these notions; to organize CR complexity theory into a broad framework that will be useful in CR geometry and also apply to other parts of mathematics; to bring active senior researchers and young mathematicians together to work in a focused manner that will forge interactions and guide future research.
Organizers: Peter Ebenfelt and John P. D’Angelo.
Sponsors: AIM and the NSF.

11-15 Groups of Diffeomorphisms 2006, University of Tokyo, Tokyo, Japan. (Jan. 2006, p. 70)
Topics: Groups of diffeomorphisms, Moduli and classifying spaces, Mapping class groups, Characteristic classes, K-theory.
Speakers: Joan Birman, Kiyoshi Igusa, Nariya Kawazumi, Dieter Kotschick, Shigeyuki Morita, Robert Penner, Takashi Tsuboi, Karen Vogtmann.

Organizers: Bennett Chow, Peter Li and Gang Tian.
Information: http://www.msri.org/calendar/workshops/WorkshopInfo/380/show_workshop/.

11-15 Stochastic Analysis and Applications, Research Institute for Mathematical Sciences, Kyoto University, Kyoto, Japan. (Aug. 2006, p. 821)
Organizers: SHIGEKAWA, Ichiro (Dept. of Mathematics, Kyoto Univ.).

11-16 XV Fall Workshop on Geometry and Physics, Puerto de la Cruz (Tenerife, Canary Islands), Spain. (May 2006, p. 610)
Main topics: Continuum Mechanics, Dynamical systems, Geometry Control Theory, Integrable systems, Lie algebroids (groupoids) and its applications, Poisson Geometry, Classical and Quantum Field theories, Riemannian and Lorentz Geometry and Relativity, Symplectic and Contact Geometry and Topology, String Theory, Supergravity and Supersymmetry.
Deadline: July 1, 2006.

12-17 International Conference on Differential Equations, Dedicated to the 100th Anniversary of Ya. B. Lopatynsky, Ivan Franko National University of Lviv, Lviv, Ukraine. (Mar. 2006, p. 380)
Invited Speakers: V. Barbu (Romania), H. Beresticki (France), M. Chipot (Switzerland), J. L. Diaz (Spain), H. Engl (Austria), A. Friedman (USA), A. M. Filimonov (Russia), Y. Giga (Japan), A. L. Gladkov (Belgium), M. I. Gorbachuk (Ukraine), S. D. Ivasyshen (Ukraine), N. V. Ibrarau (Moldova), R. Kersner (Hungary), E. Ya. Khruslov (Ukraine), V. A. Kondratiev (Russia), A. I. Kozhanov (Russia), A. Lorenzi (Italy), F. Murat (France) A. D. Myshkis (Russia), A. Prilepskii (Russia), V. Pukhnachov (Russia), A. Shishkov (Ukraine), L. Veron (France), H. Zoladek (Poland).
Information: email: ICLI100@franko.lviv.ua; http://www.franko.lviv.ua/faculty/mechmat/Departments/Conf/index.htm.

13-15 Combinatorics and its application to Information Sciences, Research Institute for Mathematical Sciences, Kyoto University, Kyoto, Japan. (Aug. 2006, p. 821)
Organizers: FUJI-HARA, Ryoh (System Information and Engineering, Univ. of Tsukuba).

Subjects: The main subjects are Banach spaces and function spaces with related topics. Twelve invited lectures and an appropriate number of short communications of 20-30 minutes will be planned. We are also planning to organize a special lecture of 30 minutes devoted to the memory of the Japanese mathematician Professor Tosio Aoki at the beginning of the conference by Professor Lech Maligranda.
Organizing and Scientific Committee: Mikio Katge (Kyushu Institute of Technology, Chair), Lech Maligranda (Lulea University of Technology-Sweden), Toshiaki Okazaki (Kyushu Institute of Technology), Kichi-Suke Saito (Niigata University), Wataru Takahashi (Toyko Institute of Technology), Yasuji Takahashi (Okayama Prefectural University).
Invited Speakers: Francesco Altomare (Italy), Juan Cerda (Barcelona, Spain), Kazimierz Geobel (Lublin, Poland), Anna Kaminska (Memphis, USA), Lech Maligranda (Lulea, Sweden), Toshiliko Nishishiraha (Okayama, Japan), Lars Erik Persson (Luleåand Upsala, Sweden), Gerd Sinnamon (London, Canada, Yasuji Takahashi (Okayama, Japan), Wataru Takahashi (Tokyo, Japan), Yuwen Wang (Harbin, P. R. China), Witold Wnuk (Poznan, Poland).

Description: This is one of the IMA Participating Institution Conferences. It is devoted to stochastic asymptotic analysis.
Local Organizers: Pao-Liu Chow, Boris Mordukhovich, George Yin.
Conference Secretary: Barbara Malicke (email: barb@math.wayne.edu).
Information: http://www.math.wayne.edu/~conf/.

Aim: To bring together leading scientists of the International Numerical & Applied Mathematics community and to attract original research papers of very high quality.
Topics: The topics to be covered include (but are not limited to): All the research areas of Numerical Analysis and Computational Mathematics and all the research areas of Applied Mathematics: (see http://www. icnaam.org/topics.h t).}
Scientific Committee: G. Vanden Berghe, Belgium; S.C. Brenner, USA; J. R. Cash, UK; R. Cools, Belgium; A. Cuyt, Belgium; B. Fischer, Germany; R. W. Freund, USA; I. Gladwell, USA; B. Hendrickson, USA; W. F. Mitchell, USA; G. Psihoyios, UK; T. E. Simos, Greece; W. Sproessig, Germany; Ch. Tsitouras, Greece; G. Alistair Watson, UK.
Invited Speakers: Peter R. Graves-Morris, University of Bradford, UK; Gene H. Golub, Fletcher Jones Professor of Computer Science, Stanford University, USA; Bernhard Beckermann, Universite des Sciences et Technologies de Lille, France; Gerard L. G. Sleijpen, Utrecht University, The Netherlands; Mourad E. H. Ismail, University of Central Florida, USA; Ronald Hoppe, University of Augsburg, Germany, University of Houston, USA; Guido Vanden Berghe,
University of Gent, Belgium; Yang Chen, Imperial College London, UK and Center for Combinatorics, Nankai University, P. R. China; Vladislav V. Kvrchenko, Instituto Politecnico Nacional, Mexico. Information: Secretary ICNAAM; email: icnaam@op.gr, 10 Koinitis Street, Amfithea-Paleon Falirion, GR-175 64, Athens, Greece; fax: +30 210 94 20 901 or +30 210 237 397.


18-22 Hybrid Methods and Branching Rules in Combinatorial Optimization, Centre de Recherches Mathématiques, Montreal, Canada. (May 2006, p. 610) Description: Problems of combinatorial optimization (such as SAT, the problem of recognizing satisfiable boolean formulas in the conjunctive normal form) have been the subject of intensive study by two communities of researchers: Those in mathematical programming (often classified under “operations research”) and those in constraint satisfaction programming (often classified under “artificial intelligence”). Recent years have seen increasing interaction between these two initially separate communities. One of the aims of the workshop is to foster this confluence.

Second Theme: Branching rules are another theme of the workshop. These rules are an important component of branch-and-bound-based exact algorithms and their choice may have an overwhelming impact on the efficiency of such algorithms.

Organizer: Václav Chvátal (Concordia).

Information: email: paradis@crm.umontreal.ca.


Workshop topics: This workshop, sponsored by AIM and the NSF, will focus on the use of model theoretic ideas in analysis and metric geometry, bringing together model theorists and specialists from a few key application areas for a period of intense discussions. A diverse combination of backgrounds will allow the participants to explore from new angles certain examples, applications, and theoretical problems that define the frontier of research on the model theory of metric structures.

Application deadline: June 18, 2006.

For more information: http://aimath.org/ARCC/workshops/continuouslogic.html.


Information: http://www.msri.org/calendar/workshops/WorkshopInfo/381/show_workshop/.


Invited Speakers: S. Montgomery (Los Angeles), H.-J. Schneider (Munich), Y. Bessalov (Kiev), G. Böhm (Budapest), T. Brzeziński (Swansea at Wales), A. Marcus (Cluj-Napoca), C. Nastasescu (Bucharest), J. Gómez Torrecillas (Granada), A. Stolin (Göteborg), L. Kadison (Göteborg), A. Van Daele (Louvain), V. Turaev (to be confirmed).

Information: Preregistration is possible by sending an email to caenepeel@vub.ac.be; please mention if you plan to present a lecture of 30 minutes. The second announcement, with registration form and information on hotel accommodation will be sent around June 15. More information will appear on http://homepages.vub.ac.be/~caenepeel.

22-29 Conference on Geometry and Dynamics of Groups and Spaces In Memory of Alexander Reznikov, Max-Planck-Institut für Mathematik, Bonn, Germany. (May 2006, p. 610)

Organizers: Mikhail Kapranov (Yale University, USA), Sergiy Kolyada (Institute of Mathematics, Ukraine), Yuri Manin (MPIM, Germany), Pieter Moree (MPIM, Germany), Leonid Potyagailo (Université de Lille, France).

Contact: email: gdgs06@mip-bonn.mpg.de.

Topics: Alexander (Sasha) Reznikov (1960-2003) was a brilliant mathematician who died unfortunately very early. This conference in his remembrance focuses on topics Sasha made a contribution to. In particular: 1. Hyperbolic, Differential and Complex Geometry. 2. Geometric group theory. 3. Dimensional topology. 4. Dynamical systems.


Organizing Committee: B. Bhatt (chairman), bbhatt@uwi.tt, D. Owen, downe@carib-netlink.net, G. Shrivastava, shriveng@uwi.tt, C. Ward, cvard@uwi.tt, R. Dow, rdow@eng.uwi.tt, L. M. Pinto Pereira, lexelp@ymail.com.


Important Deadlines: Due date for abstracts: March 31, 2006; Acceptance Notification: April 30, 2006; Full paper: July 31, 2006; Registration fees: July 31, 2006.

Information: Instructions and how to participate and more at: http://uwa.edu.uw.edu/conferences/cmaai/, email: cmaai@uwa.edu.tt.

25-27 Information and mathematics of non-additivity and non-extensivity: from the viewpoint of functional analysis, Research Institute for Mathematical Sciences, Kyoto University, Kyoto, Japan. (Aug. 2006, p. 821)

Organizers: MURUFOUSHI, Toshikazu (Interdisciplinary Graduate School of Science and Engineering, Tokyo Institute of Technology).


25-29 50th Annual Meeting of the Australian Mathematical Society, Macquarie University, Sydney, New South Wales, Australia. (Jun/Jul. 2006, p. 711)

Plenary Speakers: Pascal Auscher (Université de Paris-Sud), Robert Bartsch (Monash University), Michael Batanin (Macquarie University), Steven Evans (University of California, Berkeley), Peter Forrester (University of Melbourne), Andrew Hassell (Australian National University), Frank De Hoog (Commonwealth Scientific and Industrial Organization), Adrian Lewis (Cornell University), Ngaiming Mok (University of Hong Kong), Christopher Spencer (University of Michigan), Terence Tao (University of California, Los Angeles), Katrina Tand (University of Bielefeld), Claire Voisin (Centre National de la Recherche Scientifique), Xu-Jia Wang (Australian National University).


Information: For further details of the academic program, registration and accommodation, visit http://www.maths.mq.edu.au/austms06/.

25-29 Joint research-trees on graphs, Research Institute for Mathematical Sciences, Kyoto University, Kyoto, Japan. (Aug. 2006, p. 610)
25-29 D’Alembert, les Lumières, l’Europe, Grand Hotel Bellavista, Lевico Terme, Trento, Italy.

Topic: D’Alembert’s scientific work, in the first place mathematics, and his activity of encyclopedist and polemist too has been a landmark for the European culture, starting from the middle of XVIII century, when he wrote his major writings. An international group of researchers is now preparing the collected edition of D’Alembert’s works. The aim of the conference is to bring together both promoters of D’Alembert’s edition And European researchers with interest in the Age of Enlightenment and to foster exchange of ideas about edition’s criteria and to draw up a balance-sheet of D’Alembert’s influence on European culture, first of all scientific.

Confirmed Participants: U. Baldini (Padova), M.T. Borgato (Ferrara), O. Brunenau (Nantes), J-D. Candaux (Genève), P. Casini (Roma 1), H. Chabot (Lyon), P. Crépel (Lyon), S. Demidov (Moscou), F. Ferlin (Saint-Étienne), G. Ferraro (Campionbasso), O. Ferret (Lyon), Y. Fonteneau (Lyon), M. Galuzzi (Milano), C. Gilain (Paris 6), A. Guillaume (Lyon), M. Jacob (Paris 7), G. Jouve (Lyon), F. Nagel (Basel), F. Passeron (Paris), L. Pelle (Ferrara), C. Phill (Athène), C. Preti, N. Riecu (Paris 8).

Deadline for application: July 31, 2006.

Information: Augusto Micheletti, Secretary of CIRM, Istituto Trentino di Cultura, Via Sommarive 14, I-38050 Povo (Trento), Italy; tel. +39-0461-881628; fax +39-0461-810629; email: michelet@science.unitn.it; http://www.science.unitn.it/cirm/AmanD’Alembert.html.


Organizers: Pete Casazza, Richard Kadison, and David Larson.

Topics: This workshop, sponsored by AIM and the NSF, will be devoted to the Kadison-Singer Problem and its relationship to various areas of research in mathematics and engineering. The hope is to resolve the problem, or more realistically, to share partial results and to map out paths that could lead to the solution.


Description: http://aimath.org/ARCC/workshops/kadison-singer.html.

*28-29 Second NIU Workshop on Longitudinal Data Analysis, Northern Illinois University, Dekalb, Illinois.

Description: The theme is “Recent Developments in Longitudinal Analysis with Emphasis on Missing Data”. Leader and teacher is Dr. Edward F. Vonesh (Baxter Healthcare Corporation). The number of participants is limited to 40.

Sponsor: Division of Statistics, Northern Illinois University.

Information: http://www.niu.edu/CLASEP. Or contact Mohsen Pourahmadi, email: pourmah@math.niu.edu or 815-753-6829.


Information: http://www.mtisd06.unirio.it/; email: squillere@uninano.it.

29-30 16th Annual Kansas City Regional Mathematics Technology EXPO, Rockhurst University, Kansas City, Missouri. (May 2006, p. 611)

Forum: For mathematics instructors at both the college and secondary levels to demonstrate how they use technology successfully in their teaching, to learn about new mathematics technology, and to discuss the philosophy and future of technology in the mathematics classroom.

Invited Speakers: M. Kathleen Heid (Pennsylvania State University, University Park, PA), Doug Ensley (Shippensburg University, Shippensburg, PA).


29-October 1 Mathematical Finance 60th Birthday Conference in Honor of Dilip B. Madan, University of Maryland at College Park, Maryland. (Jun./Jul. 2006, p. 712)

Information: http://www.mortbertwienere.umd.edu/Madan/email: madan-conference@math.umd.edu.

October 2006

*2-4 The Education Summit—The Future of American Competitiveness, Vail, Colorado.

Description: Education Summit 2006 is an invitation-only conference bringing together 200 of the best and brightest leaders in Business, Education and Government to formulate a new direction for the education system.

The agenda is designed to facilitate a realistic appraisal of the current education system; a review of what current and near-future assets, innovations, research, policies and methodologies are available for reform; and the construction of a forward-thinking plan based on the best available quantitative and qualitative information our nationally-recognized panelists and participants can provide.

Goals: While the goals of the Summit are ambitious, there will also be ample time for fun, networking, and enjoyment of the beauty of Vail, Colorado, at the peak of Fall color.

Information: email: vrc@tcfcir.org.

2-6 Complex Dynamics and its Related Topics, Research Institute for Mathematical Sciences, Kyoto University, Kyoto, Japan. (Aug. 2006, p. 822)

Organizers: SSHIKURA, Mitsuhiro (Dept. of Mathematics, Kyoto Univ.).


2-6 Quantum Cryptography and Computing Workshop, Fields Institute, Toronto, Canada. (May 2006, p. 611)

Information: http://www.fields.utoronto.ca/programs/scientific/06-07/crypto/quantum/.


Information: http://www.msri.org/calendar/workshops/WorkshopInfo/382/show_workshop/.


Topics: Numerical analysis and efficient algorithms, Volume coupling in suspensions and porous media, Surface coupled problems, Material modeling and multiscale problems.

Plenary Speakers: F. Bao (Eindhoven); M. Celia (Princeton); J. Delfs (Braunschweig); P. Deuffhard (Berlin); R. Klein (Berlin); T. Laursen (Durham); M. Ortiz (Pasadena); D. Quarteroni (Milano), M. Ortiz (Pasadena); A. Quarteroni (Lausanne/Milano).

Deadlines: Each participant is invited to give a contributed talk. Prospective speakers are asked to submit a one-page abstract by April 15, 2006. Deadline for conference early registration is May 31, 2006.

Information: For up-to-date information on the conference and online-registration, please visit the web-site: http://www.imp.uni-stuttgart.de.

7-10 PDE Approaches to Image Processing, Mathematical Institute, University of Cologne, Cologne, Germany. (May 2006, p. 611)

Workshop: sponsored by the ESF Programme “Global and Geometric Aspects of Nonlinear Partial Differential Equations”.
Description: Recent progress in mathematical image processing shows a surprising success when one applies numerical methods to ill-posed partial differential equations. There is hardly any theory for these equations, it lags far behind their use by engineers, and the purpose of the workshop is to learn more about the underlying mathematical questions. We shall address for instance issues like anisotropic diffusion and Perona-Malik type equations.
Organizers: Bernd Kawohl (Cologne), Felix Otto (Bonn)
Information: http://www.mi.uni-koeln.de/~jhorak/workshop/

11-13 Recent Developments in Theory of Linear Operators and its Applications, Research Institute for Mathematical Sciences, Kyoto University, Kyoto, Japan. (Aug. 2006, p. 822)
Organizers: NAKAZATO, Hiroshi (Faculty of Sci. & Tech., Hironosiki Univ.)

16-18 Pattern formation problems in dissipative systems, Research Institute for Mathematical Sciences, Kyoto University, Kyoto, Japan. (Aug. 2006, p. 822)
Organizers: KUWAMURA, Masatake (Faculty of Human Development, Kobe Univ.)

16-18 The interplay between set theory of the reals and iterated forcing, Research Institute for Mathematical Sciences, Kyoto University, Kyoto, Japan. (Aug. 2006, p. 822)
Organizers: BRENDLE, Jörg (Graduate School of Science and Technology, Kobe Univ.)

16-20 Subconvexity Bounds for L-functions, AIM Research Conference Center, Palo Alto, California. (May 2006, p. 611)
Organizers: William Duke, Philippe Michel, Andre Reznikov, and Akshay Venkatesh
Workshop topics: This workshop, sponsored by AIM and the NSF, will be devoted to subconvexity bounds for L-functions. In recent years, there has been substantial progress towards the subconvexity problem for GL(2) L-functions, beginning with the work of Duke, Friedlander, and Iwaniec; more recently, ideas from representation theory and dynamics have been brought to bear on the problem. Subconvexity bounds for L-functions in higher rank (and, more generally, bounds for periods) remain largely elusive. The aim of the workshop is to consolidate the existing approaches and initiate analysis of the higher rank subconvexity problem.
Application deadline: July 16, 2006.
vertices, extreme rays and facets and triangulating polyhedra). This workshop will bring together researchers with both theoretical and computational expertise with polyhedral computations.

Organizers: David Avis (McGill), David Bremner (New Brunswick) and Antoine Deza (McMaster).


Organizers: YAMAZAKI, Koori (Institute of Mathematics, Univ. of Tsukuba).


18-20 Mathematical Models of Phenomena and Evolution Equations, Research Institute for Mathematical Sciences, Kyoto University, Kyoto, Japan. (Aug. 2006, p. 822)

Organizers: YAMADA, Naoki (Fukuoka Univ.).


Aim: During the workshop we hope to resolve the 2n-conjecture and develop new approaches to the minimum rank problem that will lead to significant progress in the future. We hope to get a clearer picture of how energy depends on graph structure, and in particular, to understand the structure of graphs with maximal or minimal energy.

Topics: This workshop, sponsored by AIM and the NSF, will bring together people interested in combinatorial matrix theory and spectral graph theory for investigation of the following problems: The 2n-conjecture for spectrally arbitrary sign patterns. Determination of the minimum rank of symmetric matrices described by a graph. The energy of graphs.

Organizers: Leslie Hogben, Richard Brualdi, and Bryan Shader.


24-27 Combinatorics, Representation Theory and Related Topics, Research Institute for Mathematical Sciences, Kyoto University, Kyoto, Japan. (Aug. 2006, p. 822)

Organizers: SUZUKI, Takeshi (RIMS, Kyoto Univ.).


Organizers: Ricardo Cortez, Hugo Rossi, Ivelisse Rubio.

Information: http://www.msri.org/calendar/workshops/WorkshopInfo/394/abo\_workshop/.


Special Lecture: Rudolph A. Marcus, Nobel Prize in Chemistry 1992, Arthur Amos Noyes Professor of Chemistry, (California Institute of Technology).

Highlighted Lectures: A. D. Buckingham, University of Cambridge, UK; Bjorn O. Roos, University of Lund, Sweden; Werner Kutzelnigg, University of Bochum, Germany.

Invited Speakers: Tadeusz Bancewicz (Poland), Sylvio Canuto (Brazil), Minhaeng Cho (Korea), James R. Chelikowsky (USA), C. Cramer (USA), M. Heaven (USA), Hans Herrmann (Germany), A. Hinchliiffe (UK), K. Hiroa (Japan), K.A. Jackson (USA), P. Jorgensen (Denmark), Ilya Kaplan (Mexico), J. Leszczynski (USA), Paul G. Mezey (Canada), M. Nakano (Japan), P. Pyyskio (Finland), J. Sauer (Germany), H.F. Schaefer (USA), N. S. Scott (UK), M. Urban (Slovakia), K. Yamaguchi (Japan).

Highlighted Symposium: The multiconfigurational method for all the periodic table. A theoretical chemistry Symposium in honour of Bjorn Roos. Organizer: Laura Gagliardi, Department of Physical Chemistry, Sciences II University of Geneva.

Contact Information: Secretary ICCMSE 2006 Mrs Eleni Ralli-Sinou; email: iccmse@upg.fr and tainos1@mail.aliandne-t.gr.

10 Konitsis Street, Amathitea Paleon Faliron, GR-175 64, Athens, Greece; fax: +30210 94 20 091 or 30 2710 237397.

31-November 1 Mathematical Aspects and Applications of Wave Phenomena, Research Institute for Mathematical Sciences, Kyoto University, Kyoto, Japan. (Aug. 2006, p. 823)

Organizers: TANAKA, Mitsuhiro (Faculty of Engineering, Gifu Univ.).


31-November 3 Computational Challenges Arising in Algorithmic Number Theory and Cryptography, Fields, Toronto, Canada. (May 2006, p. 612)

Information: http://www.fields.utoronto.ca/programs/scientific/06-07/crypto/number_theory/.

November 2006

1-3 Workshop on Global Integrability of Field Theories and Applications (GIFT 2006), Cockcroft Institute, Daresbury, United Kingdom.

Organizers: J. Calmet (Karlsruhe), R. W. Tucker (Lancaster).

Invited Speakers: E. Hubert (Sofia Antipolis), V. V. Lychagin (Tromso), R. F. Streater (London).


Scope: The conference is concerned with the theory of computability and complexity over real-valued data. Computable Analysis combines concepts from Analysis/ Numerical Analysis and Computability/Computational Complexity and studies those functions over real-valued data, which can be realized by digital computers.

Submissions: Authors are invited to submit a PostScript or PDF version of a paper to cca-submission@ernst-uni-hagen.de by July 2, 2006.

Organizing Committee: Gainesville: Paul Brodhead, Douglas Cenzer, chair, Rick Smith.

Information: Klaus Weihrauch, email: Klaus.Weihrauch@fern-uni-hagen.de, Douglas Cenzer, email: cenzer@ufl.edu; http://cca-net.de/cca2006/.

4-10 Second International Conference on Finsler Geometry, Cairo, Egypt. (Jun/Jul. 2006, p. 712)
**Description:** The 2006 Conference will focus particular (though not exclusive) attention on geometries whose metric functions are symmetric polynomials.

In addition to the Scientific proceedings of the 2006 Conference, an extensive cultural program will be provided for participants. Amongst the excursions planned are guided visits to the Pyramid complexes of the Giza Plateau, Dashura, Medium and Saqqara, and the Museum of Egyptian Antiquities in Cairo, which houses incomparably the greatest collection of Egyptian Antiquities in the world. There will also be optional excursions to a number of ancient temples.

**Information:** email: vgladyashv@mil.ru or email: mpbse1879@yahoo.co.uk or http://hypercomplex.xpsweb.com.

6-10 **Development of Computational Algebraic Statistics**, Research Institute for Mathematical Sciences, Kyoto University, Kyoto, Japan. (Aug. 2006, p. 823)

**Description:** The activities will focus on commutative and non-commutative harmonic analysis, analysis on homogeneous spaces, representation theory, hypergroups, special functions and the interplay between these fields. It is planned as a forum for scientific and fruitful exchange of new ideas in these different areas. Young researchers are particularly invited to attend the event and even encouraged to present their research papers and to discuss their subjects with experts. We shall organize some half-day contributed talks especially for this purpose.

**Information:** Please contact: Mohamed Sifi: Faculté des Sciences de Tunis, Département de Mathématiques, 2092 El-Manar, Tunis, Tunisia. Mobile: (216) 97 672 349, Fax: (216) 71 885 350, email: mohamed.sifi@fst.rnu.tn. Ali Baklouti: Faculté des Sciences de Sfax, Département de Mathématiques, 3038 Sfax, Tunisia. Mobile: (216) 98 641 600, Fax: (216) 74 274 4347, email: ali.baklouti@fss.rnu.tn.


**Goals:** The major goals of the International Symposium are: (a) to share innovative, unique and creative solutions for enacting reform in the areas of elementary mathematics and science teacher preparation and development, school organization, policy, and classroom practices; (b) to develop and widely disseminate ideas presented at the symposium; (c) to initiate new and creative solutions to enduring problems; and (d) to initiate discussion of a grant proposal to enact and study the enactment in International House School settings of some of the innovative ideas presented in the Symposium.

**Deadlines:** Proposals are sought in the following areas: Teacher preparation and ongoing development, Policy initiatives, School organization, Classroom practices. Completed proposals are due no later than May 15, 2006.

**Information:** email: arogerson@inetia.pl.


**Organizers:** Marj Henningsen and Madeleine Long, in cooperation with our project.

**Information:** email: arogerson@inetia.pl.

20-22 **Padic Arithmetic Geometry**, Research Institute for Mathematical Sciences, Kyoto University, Kyoto, Japan. (Aug. 2006, p. 823)

**Description:** This workshop is aimed at developing new approaches and mathematical foundations for number theory, harmonic analysis and representation theory. Mathematics and engineering. The interplay connects to other subjects and applications.

**Organizers:** Ola Bratteli (University of Oslo), Palle Jorgensen (The University of Iowa), David Kribs (University of Guelph), Gestur Olafsson (Louisiana State University), Sergei Silvestrov (Lund University).

the mathematics community to enhance the recruitment and retention of graduate students in the mathematical sciences, with a particular emphasis on women and underrepresented minorities. The Workshop will bring together leaders in graduate education in the mathematical sciences, giving them the opportunity to develop tangible plans to take these efforts to the next level at their institutions. The Workshop will provide a varied mix of principles for designing successful programs and examples of programs that have demonstrated success in responding to the issues, including models of funding and other logistical considerations. An emphasis will be placed on programs that benefit all students.


12-16 The Eleventh Asian Technology Conference in Mathematics, Hong Kong Polytechnic University, Hong Kong, Hong Kong. (Jun/Jul. 2006, p. 712)
Information: "Advancing and Fostering Mathematical Sciences and Education through Technology." The aim of this conference is to provide a forum for educators, researchers, teachers and experts in exchanging information regarding enhancing technology to enrich mathematics learning, teaching and research at all levels. English is the official language of the conference. For more information, please visit http://atcminc.com.

Last Date for Submission of Full Papers: July 15, 2006.

Workshop topics: Equivalence problems for various geometric structures on manifolds, especially nonholonomic distributions, sub-Riemannian manifolds, Cauchy-Riemann (CR) structures with application to control systems, geometry of differential equations and variational problems.
Expected Participants: Andreas Cap (University of Vienna and Erwin Schrodinger Institute of Mathematical Physics), Boris Dubrovin (Belorussian State University, Minsk), Svetlana Ignatovich (Kharkov National University, Ukraine), Frederic Jean (ENSTA, Paris), Piotr Mormul (Warsaw University), Pawel Nurowski (Warsaw University), Jean-Baptiste Pomet (INRIA, Sophia Antipolis, France), Jan Slovak (Masaryk University in Brno, Czech Republic), Michal Zhitomirski (Technion -Israel Institute of Technology, Haifa, Israel).
Organizers: Andrei Agrachev (SISSA) and Igor Zelenko (SISSA).
Information: All who are interested in partaking in this activity are invited to contact Igor Zelenko, zelenko@si.ssa.it; http://www.sissa.it/~zelenko/CEIHomepage.html.

Aim: To provide a platform for academicians and professionals in computer science and information technology to meet, communicate, exchange ideas, and establish professional networks.
Sponsors: Technomathematics Research Foundation, India.
Information: http://www.sancarnet.in/kpr_tmarf/iccis05.html.

16-18 The 5th International Conference on Differential Equations and Dynamical Systems, University of Texas-Pan American, Edinburg, Texas. (Jun/Jul. 2006, p. 713)
Topics: All major research areas in differential equations and dynamical systems with focuses on analysis, modeling, computations and applications to sciences and engineering.

Special Sessions: Proposals are invited. Send to Xinzhi Liu, Dept. of Applied Mathematics, University of Waterloo, Waterloo, Ontario, Canada N2L 3G1, email: xzlui@uwaterloo.ca.

Call for Papers: Contributed papers are invited. Abstracts must be submitted to Zhaosheng Feng via email before Sept. 15, 2006: email: zsfeng@uta.edu.
Information: http://www. watatm.org/eds06.htm.

16-20 DION 2005: An International Conference on Diophantine Equations: in honour of Professor T. N. Shorey on his 60th Birthday, Tata Institute of Fundamental Research, Mumbai, India. (Jun/Jul. 2005, p. 675)
Information: Conference is open to mathematicians working in Number Theory and allied areas. Interested persons may find information at: email: math.tifr.res.in; http://www.math.tifr.res.in/~dion2005.

17-21 Integral Closure, Multiplier Ideals and Cores, AIMResearch Conference Center, Palo Alto, California. (May 2006, p. 612)
Organizers: Alberto Corso, Claudia Polini, and Bernd Ulrich.
Workshop Topics: This workshop, sponsored by AIM and the NSF, will be devoted to questions related to the notion of integral closure of ideals. Specific aspects of the workshop focus are: computation of the integral closure and its complexity; multiplicities and equisingularity theory; cores of ideals and Briancon-Skoda type theorems; multiplier ideals and test ideals; and multiplier ideals and jet schemes.
Application Deadline: September 1, 2006.

Description: The conference will highlight the latest development in non-commutative rings, group rings, diagram algebras, and their applications.
Co-Chairs of the Organizing Committee: S. Parvathi and S. K. Jain.
Local Host: Professor S. Parvathi, Director, Ramanujan Institute for Advanced Study in Mathematics, email: sparvathi@hotmail.com.
Information: For Registration and Abstract please go to http://www.math.ohiou.edu/~jain/conference.html.
Deadline: For submitting your abstract: November 15, 2006.

Objective: The aim of the School is to introduce mathematicians from developing countries to some fundamental techniques and recent developments in Commutative Algebra and to promote the collaboration between mathematicians of different developing and developed countries.
Scientific program: The school will be divided into two parts. The first week (26-30.12.05) is a school with 4 instructional courses on the following topics: Local cohomology (M. Brodmann), Toric rings and varieties (D. Cox), Finite free resolutions (J. Herzog), Blow-up algebras (B. Ulrich). The second week (January 3-6, 2006) is devoted to an international conference. Besides invited lectures on recent development in Commutative Algebra, there will be opportunities for mathematicians from developing countries to present their research works.
January 2007

5-8 Joint Mathematics Meetings, New Orleans, Louisiana. (Jun/Jul. 2006, p. 713)
Information: http://www.ams.org/amsmtgs/national.html

Organizers: Professor B. M. Brown (Cardiff), Professor W. D. Evans (Cardiff), Professor P. Glater (Czech Academy of Sciences), Professor J. P. Keating (Bristol), Professor P. Kuchment (Texas), Professor B. Plovow (Auckland).
Information: http://www.newton.cam.ac.uk/programmes/AGA/.

11-12 Connections for Women: Dynamical Systems, Mathematical Sciences Research Institute, Berkeley, California. (Aug. 2006, p. 823)
Information: http://www.msri.org/calendar/workshops/WorkshopInfo/384/show_workshop/

15-19 Computational Commutative Algebra and Computational Algebraic Geometry, Research Institute for Mathematical Sciences, Kyoto University, Kyoto, Japan. (Aug. 2006, p. 823)
Organizer: Hibi, Takayuki (Graduate School of Information Science and Technology, Osaka Univ.).

Information: http://www.msri.org/calendar/workshops/WorkshopInfo/385/show_workshop/

Organizers: Professor B. Engquist (Austin), Professor E. Hairer (Geneva) and Professor A. Iserles (Cambridge).
Information: http://www.newton.cam.ac.uk/programmes/HOP/.

22-26 Local Holomorphic Dynamics, Pisa, Italy. (Aug. 2006, p. 823)
Main Speakers: Dominique Cerveau (Univ. de Rennes), Jean-Ecalle (Univ. de Paris-Sud), Toddy Grammatik (Univ. di Cagliari), Mathias Jonsson (Royal Inst. of Tech. Stockholm), Frank Loray (Univ. de Rennes), Stefano Marmi (Scuola Normale Superiore Siena), Jean-Francois Mattei (Univ. P. Sabatier de Toulouse), Robert Moussu (Univ. de Bourgogne Dijon), Jorge V. Pereira (IMPA), Ricardo Perez-Marco (UCAL), Julio Rebelo (Univ. de Paris-Sud), Bruno Scardua (IMPA), Tetsuo Ueda (Kyoto Univ.), Jean-Cristophe Yoccoz (College de France). Nguyen Tien Zung (Univ. P. Sabatier de Toulouse).
Program: The aim of this workshop is to bring together researchers interested in local holomorphic dynamics, from both the continuous and discrete side of the subject, with the goals of presenting the more recent results, comparing the techniques used, and possibly to spark new collaborations and researches. Every morning there will be three plenary lectures given by some of the main researchers in the area. The afternoons will instead be devoted to talks given by junior researchers from all over the world.
Registration: To register, go to the address http://www.crm.sns.it/index_02.html and follow the links on the scientific activities—workshops—future—Local holomorphic dynamics—Registration. The deadline for registration is September 30, 2006.
Contacts: Dr. Ilaria Gaiotti, Dr. Antonella Gregorace, Centro di Ricerca Matematica “Ennio De Giorgi”, crm@crm.sns.it, Fax: +39/050/509178.

Scope: The modern theory of random sets is strongly based on results in geometric measure theory and has important applications in digital stereology. The aim of the winter school is to give an overview of this area that ranges from classical generalizations of differential geometry over stochastic geometry to recent applications in the analysis of digital images.
Address: The winter school is addressed to Ph.D.s, PostDocs and other researchers in mathematics and statistics who want to get introduced in the field. Scientists from the natural sciences with an interest in mathematics are also welcome.
Organizers: Eva B. Vedel Jensen and Markus Kiderlen, University of Aarhus.
Teaching Team: Markus Kiderlen, University of Aarhus, Ilya Molchanov, University of Bern, Jan Rataj, Charles University, Prague.
Information: http://www.thiele.au.dk/winterschool07/

March 2007

3-4 AMS Southeastern Section Meeting, Davidson College, Davidson, North Carolina. (Jun/Jul. 2006, p. 713)
Information: http://www.ams.org/amsmtgs/sectional.html

Organizers: Convener: A. D. R. Choudary, SMS, Lahore, Pakistan (choudary@cnu.edu); Conference Chairman: Fasqir Mm Bhatti, LUMS, Pakistan (fmbhatti@lums.edu.pk).
Keynote Speakers: C. G. Gibson (University of Liverpool, UK); T. Zamfirescu (University of Dortmund, Germany); D. Popescu (University of Bucharest, Romania); A. Laptev (Royal Institute of Technology KTH, Stockholm); D. A. Leites (Max-Planck-Institute for Mathematics, Germany); J. Scade (UNAM, Mexico); Edy Tri Baskoro (Institut Teknologi Bandung, Indonesia); D. K. Arrowsmith (University of London, UK).

4-8 Twelfth International Conference on Approximation Theory, Menger Hotel, San Antonio, Texas. (Jun/Jul. 2006, p. 713)
Invited Speakers: Charles Chui (Univ. Missouri, St. Louis), Frank Deutsch (Penn State Univ.), Ron DeVore (Univ. South Carolina), Ming-Jun Lai (Univ. Georgia), Peter Oswald (International Univ., Bremen), Gabriele Steidl (Univ. Mannheim), and Joe Ward (Texas A&M).
Organizers: Mike Neamtu and Larry L. Schumaker (Vanderbilt Univ.).
Information: http://www.math.vanderbilt.edu/~at07/at07.html; email: at07@math.vanderbilt.edu.

12-15 2007 MBI Workshop for Young Researchers in Mathematical Biology, The Ohio State University, Columbus, Ohio.
Description: The aims of this workshop are to broaden the scientific perspective of 40-50 young researchers in the mathematical sciences and to encourage interactions with other scientists that will be valuable for their future careers. The workshop will
include plenary talks by leading researchers in the mathematical biosciences. The workshop will also feature poster presentations by each participant, as well as working group discussions on issues relevant to mathematical biologists.

**Topic:** Mathematical biology.
**Organizer:** MBI Postdoctoral Fellows.
**Deadline:** October 1, 2006.
**Information:** http://mbi.osu.edu/postdocworkshop/wyrb.html.

**Organizers:** Bennett Chow, Gerhard Huisken, Chuu-Lian Terng, and Gang Tian.
**Information:** http://www.msri.org/calendar/worksheets/WorkshopInfo/386/show_workshop/.

16-17 AMS Central Section Meeting, Miami University, Oxford, Ohio. (Jun./Jul. 2006, p. 713)
**Information:** http://www.ams.org/amsmtgs/sectional.html

19-23 Representations of Surface Groups, AIM Research Conference Center, Palo Alto, California. (Jun./Jul. 2006, p. 713)
**Organizers:** Steven Bradlow, Oscar Garcia-Prada, William M. Goldman, and Anna Wienhard.
**Description:** This workshop, sponsored by AIM and the NSF, will bring together researchers studying representations of fundamental groups of Riemann surfaces into real semisimple Lie groups. Such representations form multi-component algebraic sets. Recent progress in understanding these components has come from quite different approaches. The main goal of the workshop is to clarify the relations between these different approaches to initiate further research in this area.
**Deadline:** January 5, 2007.
**Details:** http://aimath.org/ARCC/workshops/surfacegroups.html.

19-23 Stochastic Dynamical Systems and Control, Mathematical Sciences Research Institute, Berkeley, California. (Jun./Jul. 2006, p. 713)
**Organizers:** Jonathan Mattingly (Duke), Igor Mezic (UCSB-Chair), Andrew Stuart (Warwick).
**Information:** http://www.msri.org/calendar/worksheets/WorkshopInfo/387/show_workshop/.

**Supporter:** IEEE France.
**Submit papers:** Authors are invited to submit papers describing new advances in Sciences of Electronic, Technology of Information and Telecommunications. We welcome papers that may be theoretical, conceptual, descriptive in nature, or a survey of the state of the art. Papers selected for presentation will be published in a book and a CD with an ISBN. Your propositions are welcome (they can be made either in English or in French).
**Information:** The paper submission is on-line at: http://www.setit.rmu.tn/?pg=submission&id=453/.

**Organizers:** Jesper Andraesen, Myron Scholes, Domingo Tavella.
**Information:** http://www.msri.org/specials/compmath/index.html.

**Organizers:** Monica Vazirani, Michael Kapovich, and Arun Ram.
**Workshop topics and Goals:** This workshop, sponsored by AIM and the NSF, will bring together researchers with different perspectives in combinatorial representation theory: combinatorial, metric, and algebra-geometric. It has emerged from recently that Bruhat-Tits buildings play an essential, not yet well-understood role in combinatorial representation theory by providing a geometric realization to existing combinatorial models and linking them to the algebra-geometric tools of representation theory. Goals for the workshop include examining and comparing the different approaches to the saturation theorem, with an emphasis on the role of buildings.
**Application Deadline:** December 1, 2006.
**Information:** http://aimath.org/ARCC/workshops/buildings.html.

April 2007

14-15 AMS Eastern Section Meeting, Stevens Institute of Technology, Hoboken, New Jersey. (Jun./Jul. 2006, p. 713)
**Information:** http://www.ams.org/amsmtgs/sectional.html

21-22 AMS Western Section Meeting, University of Arizona, Tucson, Arizona. (Jun./Jul. 2006, p. 713)
**Information:** http://www.ams.org/amsmtgs/sectional.html

**Organizers:** Mladen Bestvina, Tadeusz Januszkiewicz, and Richard Scott.
**Workshop Topics:** This workshop, sponsored by AIM and the NSF, will be devoted to compiling a list of unsolved and partially solved problems in geometric group theory. The list will be organized into various subfields of geometric group theory and other fields that have substantial overlap with geometric group theory. The problems will be annotated with special cases, relationships among the problems, broader implications, and progress to date.
**Application Deadline:** January 12, 2007.
**Information:** http://aimath.org/ARCC/workshops/geometric.html.

**Organizers:** Joe Harris, Craig Huneke, Hugo Rossi, Frank-Olaf Schreyer, Bernd Sturmfels.
**Information:** http://www.msri.org/calendar/worksheets/WorkshopInfo/390/show_workshop/.

May 2007

7-11 Rational Curves on Algebraic Varieties, AIM Research Conference Center, Palo Alto, California. (May 2006, p. 612)
**Organizers:** Brendan Hassett and Sandor Kovacs.
**Workshop Topics and Goal:** This workshop, sponsored by AIM and the NSF, will be devoted to rationally-connected varieties. The workshop will focus on the following topics: deformation theory of curves and combs; constructions of free curves with desired properties; moduli spaces of stable maps; singularity theory and rational-chain connectedness. One main goal will be to present and discuss state-of-the-art techniques in each of these areas.
**Application Deadline:** January 21, 2007.
**Information:** http://aimath.org/ARCC/workshops/rationalcurves.html.

**Program:** The main theme of the program is the mathematical structure of the braid group, together with applications arising from this structure both within mathematics, and outside of mathematics such as (a) magnetohydrodynamics, (b) robotics and (c) stereochemistry. It is proposed to invite workers in these different areas with the intention of cross-fertilization. The interests of the
organizers lie mostly in topology. Therefore it is likely that most long-term visitors will be from that area.

**Deadline:** Completed forms should be received by the Institute at least one month before commencement of each activity. Registration is free of charge. Institute membership is not required for participation.

**Organizing Committee:** Co-chairs: Jon Berrick (National University of Singapore); Fred R. Cohen (University of Rochester).

**Information:** Email: le@ims.nus.edu.sg. For enquiries on scientific aspects of the program, please email A.J. Berrick at berrick@math.nus.edu.sg; http://www.ims.nus.edu.sg/Programs/brads/index.htm.

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18-20 The 2007 Midwest Geometry Conference (MGC 07), University of Iowa, Iowa City, Iowa. (Jun./Jul. 2006, p. 713)

MGC 07: To be held in the honor of Thomas P. Branson (1953-2006).

**Topics:** Functional deformations of conformal operators on 4-manifolds; PDE and geometric measure theory; Geometric and harmonic analysis.

**Plenary Speakers:** Ivan Avramidi, Alice Chang, Michael Eastwood, Charles Fefferman, Peter B. Gilkey, Rod Gover, Robin Graham, Kengo Hirachi, Gestur Olafsson, Bent Orsted, William Ugalde, Paul C. Yang.


**Information:** http://www.math.uiowa.edu/MGC2007/ (will be updated periodically).

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**Organizers:** Roberto Camassa (Univ. North Carolina, Chapel Hill), Qinjiao Duan (Illinois Institute of Technology, Chicago), Peter E. Kloeden (Univ. of Frankfurt, Germany), Jonathan Mattingly (Duke Univ.), Richard McLaughlin (Univ. North Carolina, Chapel Hill).

**Information:** http://www.msri.org/calendar/workshops/WorkshopInfo/398/show_workshop/.

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22-26 Extremal problems in complex and real analysis, Peoples Friendship University of Russia, Moscow. Russia. (Aug. 2006, p. 824)

**Topics:** The list of covered topics includes (but is not limited to): approximation theory, theory of spaces of analytic and harmonic functions, optimal recovery, geometric function theory in one and several variables, function related operator theory.

**Information:** Visit http://www albany edu /- pb6916/; email: koziuchenko@yahoo com, stessin@math albany edu.

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**Organizers:** S. Bacsu, L. Kozma and J. Szilai, Department of Geometry, Univ. of Debrecen, Hungary.

**Honorary chairman:** L. Tamássy, Univ. of Debrecen, Debrecen, Hungary.

**Information:** Visit http://www math klte hu/finsler2007/; email: kozma@math klte hu; http://www hoteljogar hu.

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June 2007

4-8 Arithmetic Harmonic Analysis on Character and Quiver Varieties, AIM Research Conference Center, Palo Alto, California. (Jun./Jul. 2006, p. 714)

**Organizers:** Tamas Hausel, Emmanuel Letellier, and Fernando Rodriguez-Villegas.

**Description:** This workshop, sponsored by AIM and the NSF, will be devoted to bringing together mathematicians working on the following circle of ideas: cohomology of character and quiver varieties, representation theory of finite groups and algebras of Lie type, applications of the Weil conjectures to cohomological calculations, geometric representation theory of various finite and infinite dimensional algebras, and the combinatorics of Macdonald polynomials. Specific questions to be addressed during the workshop are described on the announcement page.

**Deadline:** February 15, 2007.

**Details:** http://aimath org/KBCC/workshops/charvarieties.html.

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**Description:** This conference will give us the opportunity to (unofficially) celebrate Arnaud Beauville's 60th birthday.

**Scientific Committee:** Enrico Arbarello, Herbert Clemens, M. S. Narasimhan, Carlos Simpson.

**Organizing Committee:** Olivier Debarre, Yves Laszlo, Claire Voisin.

**Information:** http://www.math.polytechnique.fr/confaga.

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18-23 Combinatorics and Optimization 40th Anniversary Conference, University of Waterloo, Waterloo, Ontario, Canada.

**Description:** In celebration of the 40th anniversary of the department, and the 50th anniversary of the University.

**Focus:** On the six main research areas represented by the department: algebraic combinatorics; combinatorial optimization; continuous optimization; cryptography; graph theory; and quantum computing.

**Information:** For more details, including a list of invited speakers, see http://www.math.uwaterloo.ca/Cand0 Dept Conference/40thConference.shtml.

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24-30 Lyapunov Memorial Conference: International Conference on the occasion of the 150th Birthday of Aleksandr Lyapunov, Karazin Kharkiv National University and Verkin Institute for Low Temperature Physics, Kharkiv, Ukraine.

**Topics:** The conference will focus on the areas studied by A. M. Lyapunov: Stability and dynamic systems; Mathematical physics and mechanics; Probability theory.

**Organizers:** Karazin Kharkiv National University; Verkin Institute for Low Temperature Physics, Kharkiv; Institute of Mathematics, Kiev; Steklov Institute of Mathematics, Moscow.

**Co-chairmen of the Organizing Committee:** V. Marchenko (Ukraine), V. Kozlov (Russia), V. Bakurov (Ukraine).

**Deadlines:** Deadline for abstract submission: March 31, 2007.

**Information:** LMC07, Verkin Institute for Low Temperatures Physics, 47 Lenin Avenue, Kharkiv 61103, Ukraine tel: +38 057 330 85 86 fax: +38 057 340 33 70; email: lmc07@ilt.kharkov.ua; http://www.ilt.kharkov.ua/lmc07/.

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**Topics:** Geometrical methods in mathematical physics; Lie theory and differential equations; Integrable and nonintegrable systems, solitons, Painlevé analysis; Dynamical systems and quantum chaos; Exactly and quasi-exactly solvable models; Supergroups and nonlinear algebraic structures; Lie groups and algebras, representation theory and special functions; q-algebras, quantum groups and non-commutative geometry; Supersymmetry and supergravity, strings and branes; Cosmology and quantum gravity.

**Deadline for Registration:** May 24, 2007.

**Information:** http://www.imath.kiev.ua/~appmath/conf.html.

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28-July 4 6th Congress of Romanian Mathematicians, Faculty of Mathematics and Computer Science, University of Bucharest, Bucharest, Romania.

**Topics:** Algebra, Algebraic, Complex and Differential Geometry; Real and Complex Analysis, Potential Theory; Ordinary and Partial Differential Equations, Variational Methods, Optimal Control and Mathematical Physics; Functional Analysis, Operator Theory and Numerical Analysis; Probability, Mathematical Statistics, Computer
Organizers: Romanian Academy, Section of Mathematical Sciences; University of Bucharest, Faculty of Mathematics and Computer Science; Simion Stoilow Institute of Mathematics; West University of Timisoara; University of Pitești.
Information: http://www.imar.ro/~purice/announcements.html. 6th Congress of Romanian Mathematicians, c/o Simion Stoilow Institute of Mathematics, P.O. Box 1-764, RO-014700 Bucharest, Romania; fac: +40 21 319 65 05; email: congres@imar.ro.

July 2007
2-6 25th Journées Arithmetiques, University of Edinburgh, Scotland, UK. (May 2006, p. 612)
Information: email: c.amyth@bed.ac.uk.

2-6 Design Theory of Alex Rosa, a meeting in celebration of Alex Rosa's 70th Birthday, Bratislava, Slovakia.
Organizers: IAS, University of Washington, Tacoma; Mathematical Institute of the Slovak Academy of Sciences; Department of Applied Informatics and Information Technology; Slovak University of Technology.
Information: to be included in the mailing list of the conference; http://www.d.umn.edu/~dfroncekalex/index.htm.

9-13 European Dynamics Days 2007, Loughborough University, United Kingdom. (Jan. 2006, p. 70)
Organizers: Mark Groves, John Terry (Loughborough University), Mark Fromhold, Gregor Tanner (University of Nottingham).
Information: Email Mark Groves (M.D. Groves@lboro.ac.uk).

9-12 International Conference on Artificial Intelligence and Pattern Recognition, Orlando, Florida. (Aug. 2006, p. 824)
Description: AIPR is an important event in the areas of Artificial Intelligence (AI) as well as Pattern Recognition (PR) and focuses on all areas of AI, PR and related topics. The conference will be held at the same time and location where three other major events will be taking place.
Information: Visit http://www.promotersearch.org/; email: jeedward@gmail.com.

Description: EISWT is an important event in the areas of Enterprise Information Systems as well as Web Technologies. The conference will be held at the same time and location where three other major events will be taking place.
Information: Visit http://www.promotersearch.org/; email: jeedward@gmail.com.

Description: HPNCNS is an important event in the areas of computer networks, high performance computing, communication systems, signal processing and related areas. The conference will be held at the same time and location where three other major events will be taking place.
Information: Visit http://www.promotersearch.org/; email: jeedward@gmail.com.

Description: The conference will be held simultaneously at the same place where three other major events in computer science are taking place.
Information: Visit http://www.promotersearch.org/; email: jeedward@gmail.com.

16-22 The 8th International Conference on Fixed Point Theory and Its Applications, Department of Mathematics, Faculty of Science, Chiang Mai University, Chiang Mai, Thailand.
Purpose: This conference is to bring together leading experts and researchers to assess new developments in this very active and important field. The conference will continue the tradition of previous fixed point theory meetings which were held in Marseille (1989), Halifax (1991), Seville (1995), Kazimierz Dolny (1997), Haifa (2001), Valencia (2003), and Guanajuato (2005).
Organizer: Chiang Mai University.
Speakers: W. A. Kirk, R. Bruck, K. Goebel, B. Sims, T. Dominguez Benavides, W. Takahashi, S. Prus, J. García-Falset, etc.
Information: http://math.science.cmu.ac.th/1CFPTA2007/

August 2007
Conference Theme: The ACA series of conferences is devoted to promoting the applications and development of Computer Algebra and Symbolic Computation. Topics include Computer Algebra and Symbolic Computation in engineering, the sciences, medicine, pure and applied mathematics, education, communication and computer science.
General Chairs: Tony Shaska, Erich Kaltofen, Jaime Gutierrez, Alexander Hulpke.
Program Chair: Tony Shaska.
Organizing Committee: Stanly Steinberg, Michael Wester.
Information: Contact: shaska@oakland.edu; http://www.oakland.edu/~shaska/caa07.html.

September 2007
Organizers: Professor D. Huson (Tübingen), Professor V. Moulton (East Anglia) and Professor M. Steel (Canterbury, NZ).
Information: http://www.newton.cam.ac.uk/programmes/PLG/.

Preliminary Announcement and Call for Papers: The Mathematics Education into the 21st Century Project has just completed its eighth successful international conference in Malaysia, following conferences in Egypt, Jordan, Poland, Australia, Sicily, Czech Republic and Poland. Our project was founded in 1986 and its...
dedicated to the planning, writing and disseminating of innovative ideas and materials in Mathematics and Statistics Education.
Organizer: David K. Pugalee (chairman), of the University of North Carolina Charlotte.
Information: email: arogerson@inetia.pl.

Description: This workshop, sponsored by AIM and the NSF, will address numerical methods for wave propagation with a focus on high-order convergence for general scattering configurations. The workshop will have an emphasis on spectral methods concerning the following topics: High frequency approximations, Geometric singularities, and Generalized impedance boundary conditions.
Organizers: Oscar P. Bruno and Rainer Kress.
Deadline: June 1, 2007.

October 2007
Organizers: Mark Sapir and Tatiana Nagnibeda.
Description: This workshop, sponsored by AIM and the NSF, will be devoted to various incarnations of the notion of amenability for a finitely generated group. The main goal of the workshop is to gain better understanding of the meaning of being amenable or nonamenable for a discrete, finitely generated group. Our attention will be concentrated on a certain number of concrete open problems about (non)amenability of groups with origins in very different areas of mathematics, as described on the workshop announcement page.
Deadline: June 20, 2007.
Details: http://aimath.org/ARC/Workshops/nonamenable.html.

13-14 AMS Western Section Meeting. University of New Mexico, Albuquerque, New Mexico. (Jun/Jul. 2006, p. 714)
Information: http://www.ams.org/amsmtgs/sectional.html

November 2007
3-4 AMS Southeastern Section Meeting. Middle Tennessee State University, Murfreesboro, Tennessee. (Jun/Jul. 2006, p. 714)
Information: http://www.ams.org/amsmtgs/sectional.html

December 2007
Information: http://www.ams.org/amsmtgs/internmtgs.html

January 2008
Programme Theme: Most of twentieth-century statistical theory was restricted to problems in which the number p of 'unknowns', such as parameters, is much less than the number of experimental units. However, the practical environment has changed dramatically over the last twenty years or so, with the spectacular evolution of computing facilities and the emergence of applications in which the number of experimental units is comparatively small but the underlying dimension is massive, leading to the desire to fit complex models for which the effective p is very large. The existence of key applications strongly motivates the programme, but the fundamental aim is to promote core theoretical and methodological research. Both frequentist and Bayesian paradigms will be featured.
Organizers: D. Banks (Duke), P. Bickel (UC Berkeley), P. Hall (Australian National), I. M. Johnstone (Stanford), D. M. Titterington (Glasgow), S. van de Geer (Zurich).
Information: http://www.newton.cam.ac.uk/programmes/BST/
Isaac Newton Institute for Mathematical Sciences, 20 Clarkson Road, Cambridge, CB3 0EH, U.K. Tel.: +44-1223-335999, Fax: +44-1223-330508, email: info@newton.cam.ac.uk.

July 2008
Programme Theme: In his seminal paper "Absence of diffusion in certain random lattices" (1958) Philip W. Anderson discovered one of the most striking quantum interference phenomena: particle localization due to disorder. In the last 25 years the phenomenon of localization proved to be crucial for the understanding of the Quantum Hall Effect, mesoscopic fluctuations in small conductors as well as some aspects of quantum chaos. The goal of the programme is to bring together the world leaders in spectral theory of random Schrodinger operators and theoretical physicists successfully working on the problem of Anderson localization.
Information: http://www.newton.cam.ac.uk/programmes/MPT/
Isaac Newton Institute for Mathematical Sciences, 20 Clarkson Road, Cambridge, CB3 0EH, U.K. Tel.: +44-1223-335999, Fax: +44-1223-330508, email: info@newton.cam.ac.uk.

August 2008
Programme Theme: Turbulence is a notoriously difficult subject. The goal of this programme is to bring together leading experts from across the world to debate the fundamental questions. The discussion will be wide ranging, from the initiation of turbulence through to its asymptotic state at high Reynolds number, including the effects of rotation and stratiﬁcation, and the addition of different phases, such as bubbles, particles and polymers.
Organisers: P. Bartello (McGill), P. A. Davidson (Cambridge), D. Dritschel (St. Andrews), Y. Kaneda (Nagoya), R. Kerswell (Bristol).
Information: http://www.newton.cam.ac.uk/programmes/BFT/
Isaac Newton Institute for Mathematical Sciences, 20 Clarkson Road, Cambridge, CB3 0EH, U.K. Tel.: +44-1223-335999, Fax: +44-1223-330508, email: info@newton.cam.ac.uk.

September 2008
Description: 10th International Conference of The Mathematics Education into the 21st Century Project Our project was founded in 1986 and is dedicated to the planning, writing and disseminating of innovative ideas and materials in Mathematics and Statistics Education. Program: Papers are invited on all innovative aspects of mathematics education. There will be an additional social programme for accompanying persons. Our conferences are renowned for their friendly and productive working atmosphere. They are attended by innovative teachers and mathematics educators from all over the world, 25 countries were represented at our last conference for example.
Information: email: arogerson@inetia.pl.
New Publications Offered by the AMS

Algebra and Algebraic Geometry

The Beilinson Complex and Canonical Rings of Irregular Surfaces
Alberto Canonaco, Università di Pavia

Contents: Introduction; Graded schemes; Beilinson's theorem on \( \hat{\mathcal{P}}(w) \); The theorem on weighted canonical projections; Applications to surfaces with \( p_g = q = 2, K^2 = 4 \); Abelian categories and derived categories; Bibliography; Index.

Memoirs of the American Mathematical Society, Volume 183, Number 862

Lecture Notes on Motivic Cohomology
Carlo Mazza, Rutgers University, Piscataway, NJ, Vladimir Voevodsky, Institute for Advanced Study, Princeton, NJ, and Charles Weibel, Rutgers University, New Brunswick, NJ

The notion of a motive is an elusive one, like its namesake “the motif” of Cezanne’s impressionist method of painting. Its existence was first suggested by Grothendieck in 1964 as the underlying structure behind the myriad cohomology theories in Algebraic Geometry. We now know that there is a triangulated theory of motives, discovered by Vladimir Voevodsky, which suffices for the development of a satisfactory Motivic Cohomology theory.

However, the existence of motives themselves remains conjectural.

This book provides an account of the triangulated theory of motives. Its purpose is to introduce Motivic Cohomology, to develop its main properties, and finally to relate it to other known invariants of algebraic varieties and rings such as Milnor K-theory, étale cohomology, and Chow groups. The book is divided into lectures, grouped in six parts. The first part presents the definition of Motivic Cohomology, based upon the notion of presheaves with transfers. Some elementary comparison theorems are given in this part. The theory of (étale, Nisnevich, and Zariski) sheaves with transfers is developed in parts two, three, and six, respectively. The theoretical core of the book is the fourth part, presenting the triangulated category of motives. Finally, the comparison with higher Chow groups is developed in part five.

The lecture notes format is designed for the book to be read by an advanced graduate student or an expert in a related field. The lectures roughly correspond to one-hour lectures given by Voevodsky during the course he gave at the Institute for Advanced Study in Princeton on this subject in 1999-2000. In addition, many of the original proofs have been simplified and improved so that this book will also be a useful tool for research mathematicians.

Titles in this series are copublished with the Clay Mathematics Institute (Cambridge, MA).

Contents: Presheaves with transfers: The category of finite correspondences; Presheaves with transfers; Motivic cohomology; Weight one motivic cohomology; Relation to Milnor K-theory; Étale motivic theory; Étale sheaves with transfers; The relative Picard group and Suslin's rigidity theorem; Derived tensor products; A1-weak equivalence; Étale motivic cohomology and algebraic singular homology; Nisnevich sheaves with transfers: Standard triples; Nisnevich sheaves; Nisnevich sheaves with transfers; The triangulated category of motives; The category of motives; The complex \( \mathbb{Z}(n) \) and \( \mathbb{P}^n \); Equidimensional cycles; Higher Chow groups; Higher Chow groups; Higher Chow groups and equidimensional cycles; Motivic cohomology and higher Chow groups; Geometric motives; Zariski sheaves with transfers: Covering morphisms of triples; Zariski sheaves with transfers; Contractions; Homotopy invariance of cohomology; Bibliography; Glossary; Index.

Clay Mathematics Monographs, Volume 2
Analysis

Lectures and Exercises on Functional Analysis
A. Ya. Helemskii, Moscow State University, Russia

The book is based on courses taught by the author at Moscow State University. Compared to many other books on the subject, it is unique in that the exposition is based on extensive use of the language and elementary constructions of category theory. Among topics featured in the book are the theory of Banach and Hilbert tensor products, the theory of distributions and weak topologies, and Borel operator calculus.

The book contains many examples illustrating the general theory presented, as well as multiple exercises that help the reader to learn the subject. It can be used as a textbook on selected topics of functional analysis and operator theory.

Prerequisites include linear algebra, elements of real analysis, and elements of the theory of metric spaces.

Contents: Foundations: Categories and the like; Normed spaces and bounded operators ("Waiting for completeness"); Banach spaces and their advantages; From compact spaces to Fredholm operators; Polynormed spaces, weak topologies, and generalized functions; At the gates of spectral theory; Hilbert adjoint operators and the spectral theorem; Fourier transform; Bibliography; Index.

Translations of Mathematical Monographs, Volume 233
Mathematics Subject Classification: 46-01, 47-01, All AMS members US$103, List US$129, Order code MMONO/233

Weil-Petersson Metric on the Universal Teichmüller Space
Leon A. Takhtajan,
SUNY at Stony Brook, Stony Brook, NY, and Lee-Peng Teo

Contents: Introduction; Curvature Properties and Chern Forms; Kähler Potential and Period Mapping; Appendix A. The Hilbert Manifold Structure of \( \mathcal{T}_g(1) \); Appendix B. The Period Mapping \( \mathcal{P} \); Bibliography.

Memoirs of the American Mathematical Society, Volume 183, Number 861
Mathematics Subject Classification: 30F60; 30C55, 32G15, 46E20, 58B20, 58B25, Individual member US$36, List US$60, Institutional member US$48, Order code MEMO/183/861

Measure Theory and Integration
Michael E. Taylor,
University of North Carolina, Chapel Hill, NC

This self-contained treatment of measure and integration begins with a brief review of the Riemann integral and proceeds to a construction of Lebesgue measure on the real line. From there the reader is led to the general notion of measure, to the construction of the Lebesgue integral on a measurable space, and to the major limit theorems, such as the Monotone and Dominated Convergence Theorems. The treatment proceeds to \( L^p \) spaces, normed linear spaces that are shown to be complete (i.e., Banach spaces) due to the limit theorems. Particular attention is paid to \( L^2 \) spaces as Hilbert spaces, with a useful geometrical structure.

Having gotten quickly to the heart of the matter, the text proceeds to broaden its scope. There are further constructions of measures, including Lebesgue measure on \( \mathbb{R}^n \)-dimensional Euclidean space. There are also discussions of surface measure, and more generally of Riemannian manifolds and the measures they inherit, and an appendix on the integration of differential forms. Further geometric aspects are explored in a chapter on Hausdorff measure. The text also treats probabilistic concepts, in chapters on ergodic theory, probability spaces and random variables, Wiener measure and Brownian motion, and martingales.

This text will prepare graduate students for more advanced studies in functional analysis, harmonic analysis, stochastic analysis, and geometric measure theory.

Contents: The Riemann integral; Lebesgue measure on the line; Integration on measure spaces; \( L^p \) spaces; The Caratheodory construction of measures; Product measures; Lebesgue measure on \( \mathbb{R}^n \) and on manifolds; Signed measures and complex measures; \( L^p \) spaces, II; Sobolev spaces; Maximal functions and a.e. phenomena; Hausdorff's \( r \)-dimensional measures; Radon measures; Ergodic theory; Probability spaces and random variables; Wiener measure and Brownian motion; Conditional expectation and martingales; Metric spaces, topological spaces, and compactness; Derivatives, diffeomorphisms, and manifolds; The Whitney Extension Theorem; The Marcinkiewicz Interpolation Theorem; Sard's Theorem; A change of variable theorem for many-to-one maps; Integration of differential forms; Change of variables revisited; The Gauss-Green formula on Lipschitz domains; Bibliography; Symbol index; Subject index.

Graduate Studies in Mathematics, Volume 76
Mathematics Subject Classification: 28-01, All AMS members US$47, List US$59, Order code GSM/76

964
NOTICES OF THE AMS VOLUME 53, NUMBER 8
Applications

Recent developments in inverse problems, multi-scale analysis and effective medium theory reveal that these fields share several fundamental concepts. This book is the proceedings of the research conference, "Workshop in Seoul: Inverse Problems, Multi-Scale Analysis and Homogenization," held at Seoul National University, June 22-24, 2005. It highlights the benefits of sharing ideas among these areas, of merging the expertise of scientists working there, and of directing interest towards challenging issues such as imaging nanoscience and biological imaging. Contributions are written by prominent experts and are of interest to researchers and graduate students interested in partial differential equations and applications.


Contemporary Mathematics, Volume 408

Differential Equations

Recent Trends in Partial Differential Equations

Juan Luis Vázquez, Universidad Autónoma de Madrid, Spain; Xavier Cabrè, Universitat Politècnica de Catalunya, Barcelona, Spain, and José Antonio Carrillo, Universidad Autónoma de Barcelona, Bellaterra, Spain, Editors

This volume contains the research and expository articles for the courses and talks given at the UIMP-RSME Lluís A. Santaló Summer School, "Recent Trends in Partial Differential Equations". The goal of the Summer School was to present some of the many advances that are currently taking place in the interaction between nonlinear partial differential equations and their applications to other scientific disciplines. Oriented to young post-docs and advanced doctoral students, the courses dealt with topics of current interest.

Some of the tools presented are quite powerful and sophisticated. These new methods are presented in an expository manner or applied to a particular example to demonstrate the main ideas of the method and to serve as a handy introduction to further study. Young researchers in partial differential equations and colleagues from neighboring fields will find these notes a good addition to their libraries.

This is a joint publication of the Real Sociedad Matemática Española and the American Mathematical Society.

Contents: L. Ambrosio, Steepest descent flows and applications to spaces of probability measures; L. Desvillettes, Hypocoercivity: the example of linear transport; H. Koch and E. Zuazua, A hybrid system of PDE's arising in multi-structure interaction: Coupling of wave equations in n and n - 1 space dimensions; A. Alfal, Some rigorous results for vortex patterns in Bose-Einstein condensates; M. Escobedo and S. Mischler, Qualitative properties of some Boltzmann like equations which do not fulfill a detailed balance condition.

Contemporary Mathematics, Volume 409

Geometry and Topology

Floer Homology, Gauge Theory, and Low-Dimensional Topology


Mathematical gauge theory studies connections on principal bundles, or, more precisely, the solution spaces of certain partial differential equations for such connections. Historically, these equations have come from mathematical physics, and play an important role in the description of the electro-weak and strong nuclear forces. The use of gauge theory as a tool for studying topological properties of four-manifolds was pioneered by the fundamental work of Simon Donaldson in the early 1980s, and was revolutionized by the introduction of the Seiberg-Witten equations in the mid-1990s. Since the birth of the subject, it has retained its close connection with symplectic topology. The analog between these two fields of study was further underscored by Andreas Floer’s construction of an infinite-dimensional variant of Morse theory that applies in two a priori different contexts: either to define symplectic invariants for pairs of Lagrangian submanifolds of a symplectic manifold, or to define topological invariants for three-manifolds, which fit into a framework for calculating invariants for smooth four-manifolds. “Heegaard Floer homology”, the recently-discovered invariant for three- and four-manifolds, comes from an application of Lagrangian Floer homology to spaces associated to Heegaard diagrams. Although this theory is conjecturally isomorphic to Seiberg-Witten theory, it is more topological and combinatorial in flavor and thus easier to work with in certain contexts. The interaction between gauge theory, low-dimensional topology, and symplectic geometry has led to a number of striking new developments in these fields. The aim of this volume is to introduce graduate students and researchers in other fields to some of these exciting developments, with a special emphasis on the very fruitful interplay between disciplines.

This volume is based on lecture courses and advanced seminars given at the 2004 Clay Mathematics Institute Summer School at the Alfred Renyi Institute of Mathematics in Budapest, Hungary. Several of the authors have added a considerable amount of additional material to that presented at the school, and the resulting volume provides a state-of-the-art introduction to current research, covering material from Heegaard Floer homology, contact geometry, smooth four-manifold topology, and symplectic four-manifolds.

Titles in this series are copublished with the Clay Mathematics Institute (Cambridge, MA).

Contents: Heegaard Floer homology and knot theory: P. S. Ozsváth and Z. Szabó, An introduction to Heegaard Floer homology; P. S. Ozsváth and Z. Szabó, Lectures on Heegaard Floer homology; H. Goda, Circle valued Morse theory for knots and links; Floer homologies and contact structures: J. B. Etnyre, Lectures on open book decompositions and contact structures; A. I. Stipsicz, Contact surgery and Heegaard Floer theory; P. Lisca and A. I. Stipsicz, Ozsváth-Szabó invariants and contact surgery; T. Ekholm, Double points of exact Lagrangian immersions and Legendrian contact homology; Symplectic 4-manifolds and Seiberg-Witten invariants: R. Fintushel, Knot surgery revisited; R. J. Stern, Will we ever classify simply-connected smooth 4-manifolds?; J. Park, A note on symplectic 4-manifolds with $b_2^+ = 1$ and $K^2 = 0$; T.-J. Li, The Kodaira dimension of symplectic 4-manifolds; D. Auroux, Symplectic 4-manifolds, singular plane curves, and isotopy problems; I. Smith, Monodromy, vanishing cycles, knots and the adjoint quotient.

Clay Mathematics Proceedings, Volume 5

Fredholm Operators and Einstein Metrics on Conformally Compact Manifolds

John M. Lee, University of Washington, Seattle, WA

Contents: Introduction; Möbius coordinates; Function spaces; Elliptic operators; Analysis on hyperbolic space; Fredholm theorems; Laplace operators; Einstein metrics; Bibliography.

Memoirs of the American Mathematical Society, Volume 183, Number 864
The Universal 
Kobayashi-Hitchin 
Correspondence on 
Hermitian Manifolds

M. Lübke, Leiden University, 
The Netherlands, and A. 
Teleman, CMI, Marseille, 
France

Contents: Introduction; The finite 
dimensional Kobayashi-Hitchin correspondence; A "universal" complex geometric classification problem; Hermitian-Einstein pairs; Polystable pairs allow Hermitian-Einstein reductions; Examples and applications; Appendix; Bibliography.

Memoirs of the American Mathematical Society, Volume 183, 
Number 863
18G40, 55R20, 55R40, 55S10, 55T05, 55T15, 55T20, All AMS members US$44, List US$55, Order code MEMO/183/863

Steenrod Squares in Spectral Sequences

William M. Singer, Fordham University, Bronx, NY

This book develops a general theory of Steenrod operations in spectral sequences. It gives special attention to the change-of-rings spectral sequence for the cohomology of an extension of Hopf algebras and to the Eilenberg-Moore spectral sequence for the cohomology of classifying spaces and homotopy orbit spaces. In treating the change-of-rings spectral sequence, the book develops from scratch the necessary properties of extensions of Hopf algebras and constructs the spectral sequence in a form particularly suited to the introduction of Steenrod squares. The resulting theory can be used effectively for the computation of the cohomology rings of groups and Hopf algebras, and of the Steenrod algebra in particular, and so should play a useful role in stable homotopy theory.

Similarly the book offers a self-contained construction of the Eilenberg-Moore spectral sequence, in a form suitable for the introduction of Steenrod operations. The corresponding theory is an effective tool for the computation of the cohomology rings of the classifying spaces of the exceptional Lie groups, and it promises to be equally useful for the computation of the cohomology rings of homotopy orbit spaces and of the classifying spaces of loop groups.

Contents: Conventions; The spectral sequence of a bisimplicial coalgebra; Bialgebra actions on the cohomology of algebras; Extensions of Hopf algebras; Steenrod operations in the change-of-rings spectral sequence; The Eilenberg-Moore spectral sequence; Steenrod operations in the Eilenberg-Moore spectral sequence; Bibliography; Index.

Mathematical Surveys and Monographs, Volume 129

Number Theory in the Spirit of Ramanujan

Bruce C. Berndt, University of Illinois, Urbana-Champaign, IL

Ramanujan is recognized as one of the great number theorists of the twentieth century. Here now is the first book to provide an introduction to his work in number theory. Most of Ramanujan's work in number theory arose out of q-series and theta functions. This book provides an introduction to these two important subjects and to some of the topics in number theory that are inextricably intertwined with them, including the theory of partitions, sums of squares and triangular numbers, and the Ramanujan tau function. The majority of the results discussed here are originally due to Ramanujan or were rediscovered by him. Ramanujan did not leave us proofs of the thousands of theorems he recorded in his notebooks, and so it cannot be claimed that many of the proofs given in this book are those found by Ramanujan. However, they are all in the spirit of his mathematics.

The subjects examined in this book have a rich history dating back to Euler and Jacobi, and they continue to be focal points of contemporary mathematical research. Therefore, at the end of each of the seven chapters, Berndt discusses the results established in the chapter and places them in both historical and contemporary contexts. The book is suitable for advanced undergraduates and beginning graduate students interested in number theory.

Contents: Introduction; Congruences for p(n) and \tau(n); Sums of squares and sums of triangular numbers; Eisenstein series; The connection between hypergeometric functions and theta functions; Applications of the primary theorem of Chapter 5; The Rogers-Ramanujan continued fraction; Bibliography; Index.

Student Mathematical Library, Volume 34

New Publications Offered by the AMS

SEPTEMBER 2006
NOTICES OF THE AMS
967
Mathematical Ciphers
From Caesar to RSA
Anne L. Young, Loyola College in Maryland, Baltimore, MD

A cipher is a scheme for creating coded messages for the secure exchange of information. Throughout history, many different coding schemes have been devised. One of the oldest and simplest mathematical systems was used by Julius Caesar. This is where Mathematical Ciphers begins. Building on that simple system, Young moves on to more complicated schemes, ultimately ending with the RSA cipher, which is used to provide security for the Internet.

This book is structured differently from most mathematics texts. It does not begin with a mathematical topic, but rather with a cipher. The mathematics is developed as it is needed; the applications motivate the mathematics. As is typical in mathematics textbooks, most chapters end with exercises. Many of these problems are similar to solved examples and are designed to assist the reader in mastering the basic material. A few of the exercises are one-of-a-kind, intended to challenge the interested reader.

Implementing encryption schemes is considerably easier with the use of the computer. For all the ciphers introduced in this book, JavaScript programs are available from the Web.

In addition to developing various encryption schemes, this book also introduces the reader to number theory. Here, the study of integers and their properties is placed in the exciting and modern context of cryptography. Mathematical Ciphers can be used as a textbook for an introductory course in mathematics for all majors. The only prerequisite is high school mathematics.

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

Contents: Introduction; Caesar cipher; Terminology and results from number theory; Modular arithmetic; Describing the Caesar cipher mathematically; Cryptanalysis for the Caesar cipher; Multiplication cipher; Cryptanalysis for the multiplication cipher; Multiplication-shift cipher; Cryptanalysis for the multiplication-shift cipher; Non-mathematical substitution ciphers; Preparing to generalize; Finding inverses modulo n; General multiplication-shift cipher; Security of the general multiplication-shift cipher; Introduction to the exponential cipher; Deciphering the exponential cipher; Cryptanalysis for the exponential cipher; Mathematical basis for the exponential cipher; Public key ciphers; RSA cipher; Signatures; Security and implementation of the RSA cipher.

Probability

Essentials of Stochastic Processes
Kiyosi Itô, Kyoto University, Japan

This book is an English translation of Kiyosi Itô's monograph published in Japanese in 1957. It gives a unified and comprehensive account of additive processes (or Lévy processes), stationary processes, and Markov processes, which constitute the three most important classes of stochastic processes.

Written by one of the leading experts in the field, this volume presents to the reader lucid explanations of the fundamental concepts and basic results in each of these three major areas of the theory of stochastic processes.

With the requirements limited to an introductory graduate course on analysis (especially measure theory) and basic probability theory, this book is an excellent text for any graduate course on stochastic processes.

Kiyosi Itô is famous throughout the world for his work on stochastic integrals (including the Itô formula), but he has made substantial contributions to other areas of probability theory as well, such as additive processes, stationary processes, and Markov processes (especially diffusion processes), which are topics covered in this book. For his contributions and achievements, he has received, among others, the Wolf Prize, the Japan Academy Prize, and the Kyoto Prize.

Contents: Basic concepts; Additive processes; Stationary processes; Markov processes; Diffusion; Postscript.

Translations of Mathematical Monographs, Volume 231
Mathematics Subject Classification: 60-02, 60E07, 60J10, 60J25, 60J60, 60K51, 60J55, All AMS members US$55, List US$69, Order code MMONO/231
Déformation Quantification Théorie de Lie

In 1997, M. Kontsevich proved that every Poisson manifold admits a formal quantization, canonical up to equivalence. In doing so he solved a longstanding problem in mathematical physics. Through his proof and his interpretation of a later proof given by Tamarkin, he also opened up new research avenues in Lie theory, quantum group theory, deformation theory and the study of operads ... and uncovered fascinating links of these topics with number theory, knot theory and the theory of motives. Without doubt, his work on deformation quantization will continue to influence these fields for many years to come. In the three parts of this volume, we will 1) present the main results of Kontsevich's 1997 preprint and sketch his interpretation of Tamarkin's approach, 2) show the relevance of Kontsevich's theorem for Lie theory and 3) explain the idea from topological string theory which inspired Kontsevich's proof. An appendix is devoted to the geometry of configuration spaces.

This item will also be of interest to those working in algebra and algebraic geometry and mathematical physics.

A publication of the Société Mathématique de France, Marseilles (SMF), distributed by the AMS in the U.S., Canada, and Mexico. Orders from other countries should be sent to the SMF. Members of the SMF receive a 30% discount from list.

Contents: Introduction; Introduction (English translation); Part I. Deformation quantization after Kontsevich and Tamarkin (B. Keller); Presentation of the main results; Deformation theory; On Tamarkin's approach; Part II. Application à la théorie de Lie (C. Torossian); Introduction; La formule de Kontsevich pour \( \mathbb{R}^n \); Exemples de calculs de graphes; Application au cas des algèbres de Lie; Formalité dans le cas \( \mathbb{R}^n \); Part III. Deformation quantization from functional integrals; Symmetries and the BRST formalism; The Poisson sigma model; Deformation quantization of affine Poisson structures; Appendice (A. Bruguieres): Espaces de configurations; Bibliographie; Index.

Panoramas et Synthèses, Number 20

Noncommutative Geometry and Number Theory
Where Arithmetic meets Geometry and Physics

Caterina Consani, Johns Hopkins University, Baltimore, MD, and Matilde Marcolli, Max-Planck-Institut für Mathematik, Bonn, Germany, Editors

In recent years, number theory and arithmetic geometry have been enriched by new techniques from noncommutative geometry, operator algebras, dynamical systems, and \( K \)-Theory. This volume collects and presents up-to-date research topics in arithmetic and noncommutative geometry and ideas from physics that point to possible new connections between the fields of number theory, algebraic geometry and noncommutative geometry. The articles collected in this volume present new noncommutative geometry perspectives on classical topics of number theory and arithmetic such as modular forms, class field theory, the theory of reductive \( p \)-adic groups, Shimura varieties, the local \( L \)-factors of arithmetic varieties. They also show how arithmetic appears naturally in noncommutative geometry and in physics, in the residues of Feynman graphs, in the properties of noncommutative tori, and in the quantum Hall effect.

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

A publication of Vieweg Verlag. 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: A.-M. Aubert, P. Baum, and R. Plymen, The Hecke algebra of a reductive \( p \)-adic group: a view from noncommutative geometry; D. Blasius, Hilbert modular forms and the Ramanujan conjecture; F. P. Boca and A. Zaharescu, Farey fractions and two-dimensional tori; A. Connes and H. Moscovici, Transgression of the Godbillon-Vey class and Rademacher functions; C. Consani and M. Marcolli, Archimedean cohomology revisited; A. Feldshutyn and E. Troitsky, A twisted Burnside theorem for countable groups and Reidemeister numbers; M. Khalkhali and B. Rangipour, Introduction to Hopf cyclic cohomology; M. Kim, The non-abelian (or non-linear) method of Chabauty; D. Kreimer, The residues of quantum field theory—numbers we should know; M. Laca and M. van Frankenhuijsen, Phase transitions with spontaneous symmetry breaking on Hecke \( C^* \)-algebras from number fields; G. Landi, On harmonic maps in noncommutative geometry; M. Marcolli and V. Mathai, Towards the fractional quantum Hall effect; a
noncommutative geometry perspective; R. Meyer, Homological algebra for Schwartz algebras of reductive $p$-adic groups;
V. Nistor, A non-commutative geometry approach to the representation theory of reductive $p$-adic groups; Homology of Hecke algebras, a survey and some new results; F. Paugam, Three examples of non-commutative boundaries of Shimura varieties; A. Polishchuk, Holomorphic bundles on 2-dimensional noncommutative toric orbifolds; R. Ponge, A new short proof of the local index formula of Atiyah-Singer.

Vieweg Aspects of Mathematics, Volume 37

Cours Specialises—Collection SMF, Number 14

Dimension topologique et systèmes dynamiques
Michel Coornaert, University Louis Pasteur, Strasbourg, France

This book gives a detailed exposition of some elements of dimension theory for topological spaces and dynamical systems; Cech-Lebesgue dimension, dimension of normal spaces, zero-dimensional topological spaces, dimension of polyhedra, Menger-Nöbeling embedding theorem, Gromov mean topological dimension, Jaworski embedding theorem, Lindenstrauss-Weiss StS. It is intended for graduate students, beginning, and mature researchers interested in topology and dynamical systems. Some of the topics treated in the book directly lead to research areas that remain to be explored.

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

A publication of the Société Mathématique de France, Marseilles (SMF), distributed by the AMS in the U.S., Canada, and Mexico. Orders from other countries should be sent to the SMF. Members of the SMF receive a 30% discount from list.

Contents: Premiere partie Dimension topologique: Dimension d'un espace topologique; Espaces de dimension nulle; Dimension des polyèdres; Dimension et applications; Quelques contre-exemples; Deuxième partie Dimension topologique moyenne: Décalages et sous-décalages; Plongements dans les décalages; Bibliographie; Index.

Cours Specialises—Collection SMF, Number 14

Seiberg Witten and Gromov Invariants for Symplectic 4-Manifolds
Clifford Henry Taubes,
Harvard University, Cambridge, MA


The book forms the second volume from the International Press Lecture Series held at the University of California at Irvine. It is written at a graduate mathematics level and will be essential reading for mathematicians everywhere.

A publication of International Press. Distributed worldwide by the American Mathematical Society.

Contents: SW$\to$Gr: From the Seiberg-Witten equations to pseudo-holomorphic curves; Counting pseudo-holomorphic submanifolds in dimension 4; Gr$\to$SW: From pseudo-holomorphic curves to Seiberg-Witten solutions; Gr$=\text{SW}$: Counting curves and connections.

International Press
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Suggested uses for classified advertising are positions available, books or lecture notes for sale, books being sought, exchange or rental of houses, and typing services.

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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 classifieds@ams.org. AMS location for express delivery packages is 201 Charles Street, Providence, Rhode Island 02904. Advertisers will be billed upon publication.
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2006. Applicants must submit hard copies of a Curriculum Vitae, a research statement, a teaching statement, and four letters of recommendation (at least one letter must address teaching experience and ability). Letters of recommendation will be treated as confidential documents (please direct your letter writers to the UCSC Confidentiality Statement at http://www2.ucsc.edu/ahr/policies/confstm.html).

All applications should be sent to: Faculty Recruitment Committee, Mathematics Department, University of California, Santa Cruz, CA 95064. Please refer to position #718-07 in your reply. Inquiries (not applications) can be sent to mathrec@ucsc.edu. UCSC is an EEO/AA Employer. See http://www.math.ucsc.edu/about/jobs.html for complete job description.

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KANSAS
KANSAS STATE UNIVERSITY
Department of Mathematics

Subject to budgetary approval, applications are invited for a tenure-track position commencing August 12, 2007; rank and salary commensurate with qualifications. The Department seeks candidates whose research interests mesh well with current faculty. The Department has research groups in the areas of analysis, algebra, geometry/topology, and differential equations. Applicants must have strong research credentials as well as strong accomplishment or promise in teaching. Letter of application, current vita, description of research, and at least three letters of reference evaluating research should be sent to:

Louis Pigno
Department of Mathematics
Cardwell Hall 138
Kansas State University
Manhattan, KS 66506

The Department also requires that the candidate arrange for letters to be submitted evaluating teaching accomplishments and potential. Offers may begin by December 1, 2006, but applications for position will be reviewed until February 1, 2007, at which time position is closed. Kansas State University is an Equal Opportunity Employer. Paid for by Kansas State University.

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DISTRICT OF COLUMBIA
MATHEMATICAL ASSOCIATION OF AMERICA
Washington, DC
Associate Director for Student Activities

The Mathematical Association of America (MAA) seeks an Associate Director for Student Activities. The Association, with nearly 30,000 members, is dedicated to the advancement of mathematics, particularly at the collegiate level. The Associate Director will oversee a wide range of activities for both undergraduate and graduate students and develop new initiatives to advance the MAA in the area of student services and programs.

Candidates should have an advanced degree in one of the mathematical sciences and experience working with students both in and outside of the classroom through math clubs and/or mentoring undergraduate research. Experience using on-line instruction or development of Web content is a plus.

More information about this position and about the MAA may be found at http://www.maa.org. Applications will be accepted and reviewed as received, but it is expected that the position will begin July 1, 2007, though a January start date will be considered. Candidates should send a resume and letter of interest to:

Ms. Calluna Evving
Mathematical Association of America
1529 18th Street, NW
Washington, DC 20036
Fax: 202-387-5948;
Email: ce@maa.org

References will be requested after review of applications. Applications from individuals from underrepresented groups are encouraged. AA/EOE.

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MARYLAND
JOHNS HOPKINS UNIVERSITY
J. J. Sylvester Assistant Professor

Subject to availability of resources and administrative approval, the Department of Mathematics solicits applications for one non-tenure-track J. J. Sylvester Assistant Professor for the 2007-2008 academic year. The J. J. Sylvester Assistant Professorship is a three-year position offered to recent Ph.D.'s with outstanding research potential. Candidates in all areas of pure mathematics, including analysis, mathematical physics, geometric analysis, complex and algebraic geometry, number theory, and topology are encouraged to apply. The teaching load is three courses per academic year.

To submit your applications go to http://www.mathjobs.org/jobs/jhu/. Applicants are strongly advised to submit their other materials electronically at this site.

If you do not have computer access, you may mail your application to: Appointments Committee, Department of Mathematics, Johns Hopkins University, 404 Krieger Hall, Baltimore, MD 21218, and should include a vita, at least four letters of recommendation of which one concerns teaching, and a description of current and planned research. Write to math@math.jhu.edu for questions concerning these positions. Applications received by November 1, 2006, will be given priority. The Johns Hopkins University is an Affirmative Action/Equal Opportunity Employer. Minorities and women candidates are encouraged to apply.

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MICHIGAN
CENTRAL MICHIGAN UNIVERSITY
Mathematics Department Chair

The Department of Mathematics invites applications or nominations for the position of Department Chair, beginning in Fall 2007. Applicants must have a Ph.D. in Mathematics, Mathematics Education, Statistics, or a closely related field, and credentials qualifying for appointment at full professor in the department. Applicants are also expected to have demonstrated leadership skills, a strong, on-going research record, and demonstrated excellence in teaching and service. They should also display a commitment to faculty development, effective communication skills, openness to instructional innovation, and a strong interest in the continued development of our academic programs. Preference will be given to candidates who planned research. Write to math@math.jhu.edu for questions concerning these positions. Applications received by November 1, 2006, will be given priority. The Johns Hopkins University is an Affirmative Action/Equal Opportunity Employer. Minorities and women candidates are encouraged to apply.
have administrative experience and/or experiences with successful grant writing, curriculum development, expository writing, or leadership involvement with professional organizations. The department's research profile includes pure and applied mathematics, mathematics education, and statistics. The department offers undergraduate majors in mathematics, mathematics education, statistics and actuarial science; master's degrees in mathematics and mathematics education; and a Ph.D. in mathematics with a concentration in the teaching of college mathematics. Ph.D. students write dissertations in mathematics education, mathematics, or statistics. The university is proactive in exploring opportunities for the employment of spouses/partners both inside and outside the university. Further information is available at http://www.cst.cmich.edu/units/mth. Submit a letter of application, vita, a statement of teaching philosophy, and a leadership philosophy. Have at least three letters of recommendation sent directly to: Search Committee, Department of Mathematics, Central Michigan University, Mount Pleasant, MI 48859. Applications will be accepted and considered until the position is filled. Review of applications will begin September 30, 2006. Please contact the Department of Mathematics at highe1c@cmich.edu with any inquiries. CMU, an AA/EO institution, strongly and actively strives to increase diversity within its community (see http://www.cmich. edu/aao/).

University of Michigan
Department of Mathematics

Pending authorization, the Department invites applications for a Lecturer III in Mathematics, to begin September 2007. This is not a tenure-track position, but may be renewed annually for up to the first four years, and thereafter for intervals of three to five years. Criteria for renewal are excellence in classroom teaching and participation in administration of the Department's Introductory Program and Instructor Development. Interest in pedagogical research is encouraged but not essential for reappointment. The successful candidate is likely to have both a doctorate and substantial experience in teaching mathematics. Please submit a curriculum vitae, evidence of teaching excellence, and the names of at least three references. Application materials may be sent to: Personnel Committee, University of Michigan, Department of Mathematics, 2074 East Hall, Ann Arbor MI 48109-1043. Alternatively, applications may be submitted electronically through the AMS website MathJobs.Org. Applications are considered on a continuing basis, but candidates are urged to apply by November 1, 2006. Inquiries may be made by email to math-fac-search@umich.edu. More detailed information regarding the Department may be found on our webpage: http://www.math. umich.edu. Women and minority candidates are encouraged to apply. The University of Michigan is responsive to the needs of dual career couples and is an Equal Opportunity/Affirmative Action Employer.

http://www.math.1sa.umich.edu. Women and minority candidates are encouraged to apply. The University of Michigan is responsive to the needs of dual career couples and is an Equal Opportunity/Affirmative Action Employer.

UNIVERSITY OF MICHIGAN
Department of Mathematics

Pending authorization, the Department anticipates having one or more openings at the tenure-track or tenured level. Candidates should hold a Ph.D. in mathematics or a related field, and should show outstanding promise and/or accomplishments in both research and teaching. Applications are encouraged from any area of pure, applied, computational, or interdisciplinary mathematics. Salaries are competitive and are based on credentials. Junior candidates should furnish a plan of work and three letters of recommendation; senior candidates should submit a letter of application, curriculum vitae, and names of suggested reviewers. In all cases please provide a research statement and evidence of teaching excellence. Application materials may be sent to: Personnel Committee, University of Michigan, Department of Mathematics, 2074 East Hall, Ann Arbor MI 48109-1043. Alternatively, applications may be submitted electronically through the AMS website MathJobs.Org. Applications are considered on a continuing basis, but candidates are urged to apply by November 1, 2006. Inquiries may be made by email to math-fac-search@umich.edu. More detailed information regarding the Department may be found on our webpage: http://www.math. umich.edu. Women and minority candidates are encouraged to apply. The University of Michigan is responsive to the needs of dual career couples and is an Equal Opportunity/Affirmative Action Employer.

http://www.math.1sa.umich.edu. Women and minority candidates are encouraged to apply. The University of Michigan is responsive to the needs of dual career couples and is an Equal Opportunity/Affirmative Action Employer.

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TEXAS

TEXAS A&M UNIVERSITY
The Department of Mathematics

The Department of Mathematics is in the fourth year of an aggressive four-year hiring plan to increase its tenured and tenured-track faculty by 25%. As part of this effort, we anticipate several openings for tenured, tenure-eligible, and visiting faculty positions beginning Fall 2007. The field is open, but we particularly seek applications from individuals whose mathematical interests would augment and build upon existing strengths in both within the Department as well as other departments in the University. Salary, teaching loads, and start-up funds are competitive. For a tenured position the applicant should have an outstanding research reputation and would be expected to fill a leadership role in the department. An established research program, including success in attracting external funding and supervision of graduate students, and a demonstrated ability and interest in teaching are required. Inquiries are welcome. For an Assistant Professorship, we seek strong research potential and evidence of excellence in teaching. Research productively beyond the doctoral dissertation will normally be expected. We also have several visiting positions available. Our Visiting Assistant Professor positions are for a three-year period and carry a three-course-per-year teaching load. They are intended for those who have recently received their Ph.D. and preference will be given to mathematicians whose research interests are close to those of our regular faculty members. Senior Visiting Positions may be for a semester or one-year period. The complete dossier should be received by December 15, 2006. Early applications are encouraged since the department will start the review process in October. Applicants should send the completed “AMS Application Cover Sheet”, a vita, and arrange to have letters of recommendation sent to: Faculty Hiring, Department of Mathematics, Texas A&M University, College Station, Texas 77843-3568. Further information can be obtained from http://www.math.tamu.edu/hiring/.

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HONG KONG

THE HONG KONG UNIVERSITY OF SCIENCE AND TECHNOLOGY
Department of Mathematics

Applications for faculty positions are invited at all ranks and from all areas of mathematics, with preference for areas consistent with the department’s strategic planning.

Exceptionally strong research and teaching experience is required. Applicants must demonstrate excellence in teaching, with proven ability to teach effectively in English.

Starting rank and salary will depend on qualifications and experience. Fringe benefits include medical/dental benefits and annual leave; housing will also be provided where applicable. Initial appointment will be on a three-year contract. A gratuity will be payable upon successful completion of the contract.

Applicants should send curriculum vitae and provide the names of at least three referees to the Personnel Office, HKUST, Clear Water Bay, Kowloon, Hong Kong; Fax: (852) 2358 0700. Applications received by October 31, 2006, will be given full consideration for appointment in 2007. Applications received afterwards will be considered subject to availability of positions.

More information about the university is available on the university’s homepage http://www.ust.hk/.

(Please provide by applicants will be used for recruitment and other employment-related purposes.)

PUBLICATIONS AVAILABLE

NEW ADVANCED UNDERGRADUATE MATHEMATICS TEXT

The self-published advanced undergraduate mathematics textbook “Introductory Algebra, Topology, and Category Theory” may be ordered at http://www.hyperonsoft.com. It provides comprehensive introductions to many basic topics, and is ideal preparation for first-year graduate school. It is also ideal for further education for various other students, and as a supplementary text as early as sophomore year.
Overview of the Employment Center

The Employment Center (formerly the Employment Register) serves as a meeting place and information center for employers and Ph.D.-level job seekers attending the Joint Mathematics Meetings. Most applicants and employers began the search process in the fall and are looking for an opportunity to meet in person with those with whom they've already had communication. Some, however, use the Employment Center as a way to make some initial contacts, gather information, and distribute their own information. This is a less effective, but common, use of the program. The Employment Center allows everyone to choose a comfortable level of participation by seeking interviews for any of the open hours or by limiting schedules to certain days or hours.

The Employment Center is a four-day program which takes place on the Friday, Saturday, Sunday, and Monday (morning only) of the Joint Meetings. Most participants register in advance (by the October 27 deadline), and their brief résumé or job description is printed in a booklet that is mailed to participants in advance.

The Employment Center houses two services: the computer-scheduled interview tables (the Scheduled Employment Register) and the employer-scheduled interview tables (the Interview Center). Following two years of a job market favorable to employers, the Employment Center applicant/employer ratio seems to be improving, especially in the last year. At the 2006 Employment Center, 554 candidates and 139 employers participated, giving an overall applicant-to-employer ratio of 3.9:1 (compared with 549 applicants and 121 employers in 2005, a ratio of 4.5:1). Those with the most interviews are those requested most by employers, usually as a result of a careful application process during the months before the Employment Center takes place. The total number of interviews arranged is dependent on the number of participating employers. Fewer employers will mean fewer interviews overall.

At the January 2007 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 27, 2006) 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 27 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 Friday, January 5, which of the eight sessions (of five interviews each) they will participate in and submit their Availability/Interview Request Forms between 9:30 a.m. and 4:00 p.m. Friday. 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 Saturday and Sunday interviews on Saturday morning. The schedule allows 15-minute interviews, with 5 minutes between for note taking. One or more interviewers for the same position(s) may interview at the table separately, together, or in shifts (however, no more than two may sit at the table at one time). For follow-up interviews, the scheduled tables will also be available for use until 7:30 p.m. on Saturday and Sunday, and on Monday 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. Saturday or Sunday, or on Monday 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 Friday 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 Interview 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:

- Friday, January 5, 2007, 9:30 a.m.-6:00 p.m.
- Saturday, January 6, 2007, 8:00 a.m.-7:30 p.m.
- Sunday, January 7, 2007, 8:00 a.m.-7:30 p.m.
- Monday, January 8, 2007, 9:00 a.m.-noon

The fee for use of this area is the same as the normal employer fee, $235. 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 New Orleans, leave messages for Employment Center applicants in the Employment Message Center. Paper
forms will be provided to help speed the invitation process. Each employer will be provided with a box in the Message Center where applicants can leave items.

Employers should have at most two interviewers per table at any time due to space limitations. There will be no outlets or electricity available at the interviewing tables. Only banners that can be draped over the four-foot table can be accommodated.

**About the Winter List of Applicants**

This booklet contains hundreds of résumés of applicants registered by October 27 for the Employment Center. It will be mailed in December to all employers who register by October 27 and indicate on their Joint Meetings registration form that they would like their materials mailed. Employers should be aware that there will be hundreds of brief résumés to look through and should be sure to obtain the *Winter List of Applicants* as early as possible.

**Employers Not Planning to Participate in Interview**

Employers who do not plan to participate in the Employment Center at all may place a job description in the book of employers. This description must be submitted on the Employer Form, which is located on the Web at [www.ams.org/emp-reg](http://www.ams.org/emp-reg), with the appropriate box checked, indicating that no interviews will take place. A fee of $50 is charged for this service (paid through the Joint Meetings registration form). The form must be received in the Providence office (with payment or purchase order sent separately) by the October 27 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:

1. Indicate on the Joint Meetings registration form (available either electronically in early September 2006 at [www.ams.org/amsmtgs/2098_intro.html](http://www.ams.org/amsmtgs/2098_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.

2. Submit an Employer (job listing) Form electronically at [www.ams.org/emp-reg](http://www.ams.org/emp-reg), or use the print version in the back of this issue if you are unable to access the Internet. 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 27 deadline in order for your form to be included in the *Winter List of Employers*. However, registration will be accepted up to December 13 for the normal fees or on site in New Orleans at the on-site rates. Call 800-321-4267, ext. 4113, with any questions or deadline problems.

   Any representatives of the institution can sit at the table together or working in shifts (however, the limit is two at one time). If possible, their names should be listed on the Employer Form as a reference point for the applicants. Employment Center fees should be paid only for each table required, not for each person.

   In a few unusual cases, an institution will be conducting interviews in the Employment Center for two or more distinct positions and will not want to conduct these interviews at one table. In that case, two or more Employer Forms should be submitted, and separate tables and employer numbers will be provided. Applicants will then be able to request interviews for the appropriate job by employer number. First and second table fees should be paid.

   The fee for all employers to register in advance is $235 for the first table and $85 for each additional table. On-site registration fees (any registrations after 12/13/06) are $315 for the first table and $115 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 13 may register on site in New Orleans 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 Friday, January 5, to receive their materials. A typed copy of the Employer Form (found in the back of this issue) can be brought to the Employment Center for posting on site (or the form may be handwritten on site).

If registering for the employer-scheduled Interview Center only, registration on Saturday is possible.

In 2007 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 2007 Employment Center will find themselves talking with employers in two different settings:

1. A computer-scheduling program sets 15-minute interviews at the Employment Register numbered tables. This is the choice that has now become optional for applicants. Applicants do not have to hand in a computer-scheduling form at all.

2. There is also an Interview Center, where employers set their own schedules. These employers do not participate in the scheduling program, so applicants have no automatic access to interviews with them. They determine their own schedules and make their own appointments privately, either in advance or on site using the Employment Message Center. These interviews have always been “optional” for applicants, since they may turn down any written invitation they receive. Applicants are reminded to respond to all invitations promptly. Many applicants prefer the interviews they are invited for in this setting, since it is more relaxed and interviews tend to last longer.

Overall, many applicants report being disappointed that there are not more research-oriented jobs being interviewed for at the Employment Center. The best way to predict what type of employers will interview at the Employment Center is to peruse a list of institutions from the previous year, available at www.ams.org/emp-reg. Applicants should expect that many of the jobs are best suited to enthusiastic and well-qualified candidates who can contribute on many levels in an academic setting.

The Schedule

For applicants using all services there is a certain scheduling burden placed on them to juggle these simultaneous services. However, computer-scheduled sessions are in small blocks, for a total of eight sessions over the two days of interviews (Saturday and Sunday). 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 Friday, 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 Saturday morning.

Applicants are advised to place as many selections as possible on their scannable request sheets; however, be advised that this may result in interviews with less-preferred employers. Applicants should be aware that each year approximately 10 percent of applicants signing up for all services fail to submit a schedule request sheet. This is often due to having too many schedule conflicts.

Interviews

Applicants should understand that the Employment Center provides no guarantees of interviews or jobs. It is simply a convenient meeting place for candidates and employers who are attending the Joint Meetings. Those who have not yet begun their job search efforts may go unnoticed at the Employment Center (although applicants will likely receive between one and three interviews in the scheduled program). Attention generally goes to candidates who already have applied for open positions or to those who are well suited for teaching positions at bachelor's-granting colleges.

Data from recent Employment Centers show that women represent about half of the most sought-after applicants, although they make up less than half of the total Employment Center applicant pool. Those without permanent authorization to work in the United States will find themselves far less requested than U.S. citizens or permanent residents. Newer Ph.D.'s tend to be invited for more interviews than those who have been working longer. Most jobs listed require a doctorate. Approximately 27 percent of applicants responding to a recent survey report having between zero and two interviews in the Interview Center. The rest reported higher numbers. Most of the applicants reported that at least some of the Interview Center appointments had been arranged in advance of the meetings.

Preparations

Candidates just beginning a job search should realize that employers have no method to judge their credentials other than the brief résumé form, and they should make an effort to make it distinct and interesting.

Applicants who register in advance will receive the Winter List of Employers in mid-December. If time permits, they should apply for suitable open positions they notice in the Winter List of Employers after they receive it. Applicants are advised to bring a number of copies of their brief vita or résumé so that they may leave them with prospective employers. It is a good idea in the fall for applicants to alert any employer to whom applications are made that they plan to be present at the Joint Meetings. Also, they should bring enough materials with them to accompany requests for interviews they may want to leave in the Message Center boxes of the Interview Center employers.

Applicants are also encouraged to leave some extra copies of their résumés in their own message folders so that interested employers may find them there. Photocopying costs at a convention/hotel 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 27 deadline so the Applicant Form can be printed in the book. This greatly increases an applicant's chances of being invited to the Interview Center.

Applicants should keep in mind that interviews arranged by the Employment Center represent only an initial contact with the employers and that hiring decisions are not ordinarily made during or immediately following such interviews.
Results

In a recent survey, 58 percent of applicants responding reported being invited for at least one on-campus visit to an employer they had interviewed with during the Employment Center; 37 percent reported receiving at least one job offer in the months following the interview. Overall, 23 percent reported accepting a position with an employer they spoke with during the Employment Center. Another 32 percent reported (in May) having no new job offers. The rest accepted positions with employers they met through other means.

Applicants: Register Early
Applicants need to complete the following steps by the advance deadline of October 27, 2006.

1. Pay fees
   Register for the Joint Mathematics Meetings (see form in the back of the October issue of the Notices or the electronic information available in early September 2006 at www.ams.org/amsmtgs/2098_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 $44; "Message Center and Winter List ONLY" registration is $22.

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 if you are unable to access the Internet.

After Registration
Submission of the Applicant Form electronically will result in an email acknowledgement almost immediately. For registration and payments, the Meetings Service Bureau acknowledges all payments. When payments AND the Applicant Form have been received, another acknowledgement will go out by email, if possible, or by mail. Please allow a week or so for processing, but after that contact staff (AMS 800-321-4267, ext. 4113) if you do not receive acknowledgement from the Employment Center.

Around December 15 the Winter List of Employers will be mailed to all registered applicants unless they request otherwise.

Registering after the Deadline
After October 27 applicants can still register for the Employment Center at the same prices until the final deadline of December 13. 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 13 must register on site at the Joint Meetings registration desk and pay higher fees ($82 Employment Center fee; however, the "Message Center and Winter List ONLY" fee is always just $22).

It is worthwhile to submit the applicant form even if you miss the October 27 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 Friday, January 5, 2007, or they will not be included when the interview-scheduling program runs Friday 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 Friday is allowed for a higher fee but is severely discouraged. Most employers will not notice an Applicant Form that arrives on Friday. Therefore, these individuals will receive only a couple of computer-scheduled interviews. Registration on site is advisable only for those who know they will be interviewed in the Interview Center and would like a Message Center folder for employers to leave messages in. Registering on site for a mailbox only is possible, at the $22 rate, on Friday and Saturday. Pay the fees at the Joint Meetings registration area and then bring your receipt to the Employment Center desk to register yourself.
Instructions for Applicant and Employer Forms

Applicant forms submitted for the Employment Center by the October 27 deadline will be reproduced in a booklet titled Winter List of Applicants. Employer forms submitted by the October 27 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 27, 2006, 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
56 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
1. Forms should be accessed and submitted electronically if possible. The URL for accessing Employment Register information and forms is http://www.ams.org/emp-reg/.
2. Paper or electronic forms are due, along with payment and your Advance Registration/Housing Form, by October 27 (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.

<table>
<thead>
<tr>
<th>EMPLOYER CODE:</th>
<th>Institution ____________________________</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Department ____________________________</td>
</tr>
<tr>
<td></td>
<td>Mailing address ________________________</td>
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<td></td>
<td>E-mail address (one only) __________________</td>
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<td></td>
<td>URL (or other contact info) __________________</td>
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<tr>
<td>Name(s) of Interviewer(s) 1.</td>
<td>________________________________________</td>
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<tr>
<td>2.</td>
<td>________________________________________</td>
</tr>
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<td>3.</td>
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<td>4.</td>
<td>________________________________________</td>
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<tr>
<td>Specialties sought</td>
<td>________________________________________</td>
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<tr>
<td>Title(s) of position(s)</td>
<td>________________________________________</td>
</tr>
<tr>
<td>Number of positions</td>
<td>____________________________</td>
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<tr>
<td>Starting date</td>
<td>__/<strong><strong>/</strong></strong></td>
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<tr>
<td>Renewal</td>
<td>Month</td>
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<tr>
<td>Degree preferred</td>
<td>____________________________</td>
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<tr>
<td>Duties</td>
<td>________________________________________</td>
</tr>
<tr>
<td>Experience preferred</td>
<td>________________________________________</td>
</tr>
<tr>
<td>Significant other requirements, needs, or restrictions which will influence hiring decisions</td>
<td>________________________________________</td>
</tr>
<tr>
<td>This position will be subject to a security clearance which will require U.S. citizenship:</td>
<td>Yes</td>
</tr>
</tbody>
</table>

**THE EMPLOYER PLANS TO USE THE FOLLOWING SERVICES** (check all that apply):

- [ ] One or more computer-scheduled Interview Tables
- [ ] One or more self-scheduled Interview Tables
- [ ] Placing this form for information only (not using a table)
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SOCIETY FOR INDUSTRIAL AND APPLIED MATHEMATICS
1. Forms should be accessed and submitted electronically if possible. The URL for accessing Employment Register information and forms is http://www.ams.org/emp-reg/.
2. Paper or electronic forms are due, along with payment and your Advance Registration/Housing Form, by October 27 (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 RÉSUMÉ FORM
MATHEMATICAL SCIENCES EMPLOYMENT REGISTER
JANUARY 5–8, 2007
NEW ORLEANS, LOUISIANA

APPLICANT CODE:

Last name ___________ First name ________________

Mailing address (include zip code)

E-mail address (one only)

URL (or other contact info) _________________________

Specialties

(see 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 to to to

1. ___________________________ ___________________________ ____________

2. ___________________________ ___________________________ ____________

3. ___________________________ ___________________________ ____________

References (Name and Institution only)

Work authorization status: (check one) U.S. Citizen Non-U.S. Citizen, authorized to work permanently in U.S. Other

This applicant will be using: ALL Employment Center services Message Center and Winter List ONLY
Resources for Undergraduates in Mathematics

Visit the AMS Undergraduate Web page
www.ams.org/employment/undergrad.html

Find out about:

- Applying to graduate school
- REUs
- Special semester programs in mathematics
- Math problems
- Internships
- College math clubs
- Biographies of mathematicians
- Undergraduate math conferences
- Pi Day
- Undergraduate math journals
- Honor societies
- Mathematical contests
- Undergraduate math prizes
- Math Careers

Contact: Membership and Programs Department, American Mathematical Society, 201 Charles Street, Providence, RI 02904-2294, USA; telephone: 800-321-4267, ext. 4170; email: student-serv@ams.org.
Meetings & Conferences of the AMS

IMPORTANT INFORMATION REGARDING MEETINGS PROGRAMS: AMS Sectional Meeting programs do not appear in the print version of the Notices. However, comprehensive and continually updated meeting and program information with links to the abstract for each talk can be found on the AMS website. See http://www.ams.org/meetings/. Final programs for Sectional Meetings will be archived on the AMS website accessible from the stated URL and in an electronic issue of the Notices as noted below for each meeting.

Salt Lake City, Utah
University of Utah
October 7-8, 2006
Saturday - Sunday
Meeting #1019
Western Section
Associate secretary: Michel L. Lapidus
Announcement issue of Notices: August 2006
Program first available on AMS website: August 24, 2006
Program issue of electronic Notices: October 2006
Issue of Abstracts: Volume 27, Issue 3

Deadlines
For organizers: Expired
For consideration of contributed papers in Special Sessions: Expired
For abstracts: August 15, 2006

Invited Addresses
William Arveson, University of California Berkeley, Title to be announced.
Alexei Borodin, California Institute of Technology, Title to be announced.
Izabella Joanna Laba, University of British Columbia, Title to be announced.
Darren Long, University of California Santa Barbara, Title to be announced.

Special Sessions
Commutative Algebra (Code: SS 3A), Paul Roberts, Anurag K. Singh, and Oana Veliche, University of Utah.
Complex Geometry, Kaehler Groups, and Related Topics (Code: SS 9A), Terrence Napier, Lehigh University, Mohan Ramachandran, State University of New York at Buffalo, and Domingo Toledo, University of Utah.
Floer Methods in Low-dimensional Topology (Code: SS 8A), Alexander Felshtyn and Uwe Kaiser, Boise State University.
Harmonic Analysis: Trends and Perspectives (Code: SS 1A), Alex Iosevich, University of Missouri, and Michael T. Lacey, Georgia Institute of Technology.
Interface of Stochastic Partial Differential Equations and Gaussian Analysis (Code: SS 7A), Davar Khoshnevisan, University of Utah, and Eulalia Nualart, University of Paris XIII.
Low Dimensional Topology and Geometry (Code: SS 4A), Mladen Bestvina and Kenneth W. Bromberg, University of Utah.
Mathematics Motivated by Physics (Code: SS 5A), Aaron J. Bertram, Yuan-Pin Lee, and Eric R. Sharpe, University of Utah.
Noncommutative Dynamical Systems (Code: SS 12A), William B. Arveson, University of California Berkeley,
Meetings & Conferences


Nonconvex Variational Problems: Recent Advances and Applications (Code: SS 10A), Marian Bocea, North Dakota State University and University of Utah, and Andrej Cherkaev, University of Utah.

Nonlinear Differential Equations: Methods and Applications (Code: SS 2A), David G. Costa, University of Nevada, and Zhi-Qiang Wang, Utah State University.

Number Theory (Code: SS 14A), Jasbir Singh Chahal, Brigham Young University, and Machiel van Frankenhuijsen, Utah Valley State College.

Random Motion in Random Media (Code: SS 11A), Firas Rassoul-Agha, University of Utah, and Tom Schmitz, Swiss Federal Institute of Technology (ETH), Zurich.


Ibragimov and Nageswari Shanmugalingam, University of Cincinnati.

Applied Algebraic Geometry and Cryptography (Code: SS 3A), Jintai Ding, Jason Eric Gower, and Timothy J. Hodges, University of Cincinnati, Lei Hu, Chinese Academy of Sciences, and Dieter S. Schmidt, University of Cincinnati.

Birational Geometry (Code: SS 2A), Mirel Constantin Caibar and Gary P. Kennedy, Ohio State University.

Boundary Value Problems for Differential Equations with Applications (Code: SS 11A), Xiaojie Hou, Philip L. Korman, and Bingyu Zhang, University of Cincinnati.

Ergodic Theory (Code: SS 1A), Nikos Frantzikinakis, Pennsylvania State University, Bryna R. Kra, Northwestern University, and Mate Wierdl, University of Memphis.

Financial and Actuarial Mathematics (Code: SS 12A), Srđjan D. Stojanovic and Ning Zhong, University of Cincinnati.

Geometric Combinatorics (Code: SS 6A), Ezra N. Miller, University of Minnesota, and Igor Pak, Massachusetts Institute of Technology.

Limit Theorems of Probability Theory (Code: SS 9A), Włodzimierz Bryc and Magda Peligrad, University of Cincinnati.


Nonlinear Functional Analysis and Applications (Code: SS 5A), S. P. Singh and Bruce Watson, Memorial University of Newfoundland.

Nonlinear Partial Differential and Its Applications (Code: SS 7A), Changyou Wang, University of Kentucky, and Guan Bo, Ohio State University.

Optimal Controls and Stochastic Differential Games (Code: SS 14A), Michael J. McAsey and Libin Mou, Bradley University.

Physical Knotting and Linking (Code: SS 13A), Eric J. Rawdon, University of St. Thomas, Kenneth C. Millett, University of California Santa Barbara, and Jonathan Simon, University of Iowa.

Recent Results on Operator Algebras (Code: SS 7A), Herbert Halpern, Gary Weiss, Costel Peligrad, Shuang Zhang, and Victor G. Kaftal, University of Cincinnati.

Cincinnati, Ohio
University of Cincinnati

October 21–22, 2006
Saturday - Sunday

Meeting #1020
Central Section
Associate secretary: Susan J. Friedlander
Announcement issue of Notices: August 2006
Program first available on AMS website: September 7, 2006
Program issue of electronic Notices: October 2006
Issue of Abstracts: Volume 27, Issue 3

Deadlines
For organizers: Expired
For consideration of contributed papers in Special Sessions: Expired
For abstracts: August 29, 2006

Invited Addresses
Suncica Canic, University of Houston, Title to be announced.
Bryna R. Kra, Northwestern University, Title to be announced.
Ezra N. Miller, University of Minnesota, Title to be announced.
Jon G. Wolfson, Michigan State University, Title to be announced.

Special Sessions
Algebraic Coding Theory—Honoring the Retirement of Vera Pless (Code: SS 8A), William Cary Huffman, Loyola University, and Jon-Lark Kim, University of Louisville.
Analysis and Potential Theory on Metric Spaces (Code: SS 4A), Thomas Bieske, University of South Florida, and Zair

Storrs, Connecticut
University of Connecticut

October 28–29, 2006
Saturday - Sunday

Meeting #1021
Eastern Section
Associate secretary: Lesley M. Sibner
Announcement issue of Notices: August 2006
Meetings & Conferences

Program first available on AMS website: September 14, 2006
Program issue of electronic Notices: October 2006
Issue of Abstracts: Volume 27, Issue 4

Deadlines
For organizers: Expired
For consideration of contributed papers in Special Sessions: Expired
For abstracts: September 6, 2006

Invited Addresses
Changfeng Gui, University of Connecticut, Storrs, Title to be announced.
Niranjan Ramachandran, University of Maryland, College Park, Zeta
Kannan Soundararajan, University of Michigan, Pretentious characters and the Polya-Vinogradov inequality.
Katrin Wehrheim, Massachusetts Institute of Technology, Floer theories in symplectic topology and gauge theory.

Special Sessions
Algebraic Geometry and Moduli Spaces (Code: SS 12A), Dan Abramovich, Brown University, and Ralph M. Kaufmann, University of Connecticut, Storrs.
Algebraic and Analytic Combinatorics (Code: SS 11A), Richard Ehrenborg and Margaret A. Readdy, University of Kentucky and MIT.
Analysis and Probability on Fractals (Code: SS 3A), Robert S. Strichartz, Cornell University, and Alexander Teplyaev, University of Connecticut, Storrs.
Combinatorial Methods in Equivariant Topology (Code: SS 1A), Tara Holm, University of Connecticut, Storrs, and Tom C. Braden, University of Massachusetts, Amherst.
Computability Theory in Honor of Manuel Lerman's Retirement (Code: SS 4A), Joseph S. Miller and David Reed Solomon, University of Connecticut, Storrs.
Geometric Analysis (Code: SS 9A), Jesse Ratzkin, University of Connecticut, and Rob Kusner, University of Massachusetts.
Geometric Structures Related to Quantum Field Theory (Code: SS 14A), Roman Fedorov and Ivan Mirkovic, University of Massachusetts, Amherst.
Homotopy Theory of Compactified Moduli Spaces (Code: SS 15A), Thomas J. Lada, North Carolina State University, and Jim Stasheff, University of North Carolina, Chapel Hill.
Nonlinear Elliptic and Parabolic Equations (Code: SS 5A), Yung-Sze Choi, Changfeng Gui, and Joseph McKenna, University of Connecticut, Storrs.
Nonlinear Geometric PDEs (Code: SS 10A), Wenxiong Chen, Yeshiva University, and Zheng-Chao Han, Rutgers University.

Number Theory (Code: SS 2A), Keith Conrad, University of Connecticut, Storrs, David Pollack, Wesleyan University, and Thomas A. Weston, University of Massachusetts, Amherst.
Undergraduate Mathematics Education (Code: SS 8A), Tom Roby, Fabiana Cardetti, and Tom DeFranco, University of Connecticut, Storrs.

Fayetteville, Arkansas
University of Arkansas

November 3-4, 2006
Friday - Saturday
Meeting #1022
Southeastern Section
Associate secretary: Matthew Miller
Announcement issue of Notices: September 2006
Program first available on AMS website: September 21, 2006
Program issue of electronic Notices: November 2006
Issue of Abstracts: Volume 27, Issue 4

Deadlines
For organizers: Expired
For consideration of contributed papers in Special Sessions: Expired
For abstracts: September 12, 2006

Invited Addresses
R. P. Anstee, UBC, Vancouver, Canada, Forbidden configurations, a survey.
Arun Ram, University of Wisconsin, Space walks: Combinatorics, representations, spherical functions, and p-compact groups.
Donald G. Saari, University of California Irvine, Mathematics of voting.
Andras Vasy, Massachusetts Institute of Technology, Scattering theory on symmetric spaces and N-body scattering.

Special Sessions
Algebraic Combinatorics (Code: SS 6A), Marcelo Aguiar, University of Texas A&M, and Claudia Malvenuto, University of Rome “La Sapienza”.
Analytic Number Theory and Modular Forms (Code: SS 2A), Matthew Boylan and Gang Yu, University of South Carolina.
Meetings & Conferences

Boundary Operators in Real and Complex Domains (Code: SS 3A), Loredana Lanzani, University of Arkansas, Fayetteville, and David E. Barrett, University of Michigan, Ann Arbor.

Combinatorial Representation Theory (Code: SS 5A), Arun Ram, University of Wisconsin-Madison, and Frank Sottile, University of Texas A&M.

Dirac Operators in Analysis and Geometry (Code: SS 1A), John Ryan, University of Arkansas, Marius Mitrea, University of Missouri, and Mircea Martin, Baker University.

Evolution Equations in Physics and Mechanics (Code: SS 4A), John P. Albert, University of Oklahoma, Jerry L. Bona, University of Illinois at Chicago, and Jiahong Wu, Oklahoma State University.

Extremal and Probabilistic Combinatorics (Code: SS 9A), Jerrold R. Griggs, University of South Carolina, and Peter Keevash, California Institute of Technology.

Progress on Problems in Mathematical Fluid Dynamics (Code: SS 8A), Ning Ju and Jiahong Wu, Oklahoma State University.

Scattering Theory and Wave Propagation (Code: SS 7A), Tanya J. Christiansen, University of Missouri, Columbia, and Andreas Vasy, Stanford University.

Subelliptic PDEs and Sub-Riemannian Geometry (Code: SS 10A), Luca Capogna, University of Arkansas, Scott Pauls, Dartmouth College, and Jeremy T. Tyson, University of Illinois, Urbana-Champaign.

Accommodations

Participants should make their own arrangements directly with a hotel of their choice as early as possible. Special rates have been negotiated with the hotels listed below. Rates quoted do not include sales tax of 13%. The AMS is not responsible for rate changes or for the quality of the accommodations. When making a reservation, participants should state that they are with the AMS Sectional Meeting/University of Arkansas Math Department. Cancellation and early checkout policies vary; be sure to check when you make your reservation.

Radisson Hotel Fayetteville, 70 North East Ave., Fayetteville, AR 72701; phone: 479-442-5555, fax: 479-442-2105; US$80/single or double; free high speed Internet, heated indoor/outdoor pool, fitness center, restaurant and lounge in hotel; other restaurants within walking distance; about one mile from the meeting rooms on campus. Deadline for reservations is October 5, 2006. Be sure to check cancellation and early checkout policies.

Sleep Inn Fayetteville, 728 Mill Ave., Fayetteville, AR 72703; 479-587-8700 (phone or fax); US$29/single or double, some rooms available with refrigerator/microwave; rates include complimentary coffee and continental breakfast, free wireless Internet, adjacent to Chill’s and Colton Steakhouse restaurants, several others about a block away; about 5 miles from the meeting rooms on campus, however, the free Razorback Bus (red route) passes near the hotel to the Union on campus (meeting buildings are about a five-minute walk from the Union). The bus leaves from the Garland Transit Facility hourly beginning at 7:00 a.m. (until 10:00 p.m.) and should pass by the hotel at about 7:15 a.m.; it’s approximately a 40-minute ride to the Union, and there is no service either day between 11:00 a.m. and noon. Deadline for reservations is October 19, 2006. Be sure to check cancellation and early checkout policies.

Inn at Carnall Hall, 465 N. Arkansas Ave., Fayetteville, AR 72701; 479-582-0400 or 800-295-9118; US$50/single or double (Dept. of Math rate). Free Internet access and in-room coffee makers; directly on campus, about 1/4 mile from the meeting rooms. See www.innatcarnallhall.com. We have no special block of rooms at this hotel; those interested should book early as this property will most likely sell out because of limited availability.

Food Service

Information on nearby dining experiences will be listed in the program.

Local Information

The university’s website is http://www.uark.edu/home/; the department of mathematics is at http://www.uark.edu/depts/mathinfo.

Other Activities

Book Sales: Examine the newest titles from the AMS! Many of the AMS books will be available at a special 50% discount available only at the meeting. Complimentary coffee will be served courtesy of AMS Member Services.

AMS Editorial Activity: An acquisitions editor from the AMS book program will be present to speak with prospective authors. If you have a book project that you would like to discuss with the AMS, please stop by the book exhibit.

Parking

The most convenient parking to the meeting rooms is in the Harmon Avenue Parking Facility. The cost for hourly parking is US$1 for up to 4 minutes or US$10/day. If you leave within 20 minutes there is no charge (this allows drivers to conduct business at the Parking Office). Take a ticket from the dispenser upon entering and take this ticket with you. Upon returning, go to one of the pay stations on level one or six, insert your ticket to see what you owe, and pay the displayed amount. The machines take paper bills, coins, and credit or debit cards. Participants with valid handicap parking tags must pay the required amount and must also display a University of Arkansas handicap parking permit. See http://www.uark.edu/depts/parking/facilities/harmon_avenue.htm for instructions and other information for this facility.

Visitors to campus may purchase a temporary visitor permit at the Transit and Parking Department, 155 Razorback Road, Administrative Services Building, Room 131, Monday through Friday between 7:00 a.m. and 5:00 p.m. The Administrative Services Building is located across Razorback Road from Bud Walton Arena. Visitors will need vehicle make, vehicle model, vehicle year, and vehicle license number in order to complete the registration form before purchasing a temporary visitor hangtag. These
forms are available on site at the department or on the Parking webpage at http://www.uark.edu/parking. After the vehicle registration form is completed a cashier will issue a temporary one-day or multiple-day visitor hang-tag.

Temporary visitor parking permits allow parking in the following University of Arkansas parking lots: Faculty/Staff (yellow signs), Student (green signs), Remote (orange signs), and parking meters (gray meters only) without paying the posted meter fee. Access to many of these areas may be very limited on Friday because classes are held. The temporary visitor parking permit DOES NOT allow parking in the following parking areas: Reserved (blue signs), Resident Reserved (red signs), twenty-four-hour reserved spaces, parking garages, or the gold parking meters (unless you pay the meter fee). See the parking map at www.uark.edu/depts/parking/control/parkmap06.pdf for the locations of all lots (the meeting buildings are RCED: quadrant 4-E, and SCEN: quadrant 4-F).

Registration and Meeting Information
The meeting is on the campus of the University of Arkansas, Fayetteville. Invited Addresses will take place in the Reynolds Center (RCED) and Special Sessions will be scheduled in the Science and Engineering Building (SCEN). See http://rced.uark.edu/default.asp?show=map for a map.

The registration desk will be on the third floor of the Science and Engineering Building and will be open Friday, November 3, 7:30 a.m. to 4:00 p.m., and Saturday, November 4, 8:00 a.m. to noon. Fees are US$40 for AMS or CMS members, US$60 for nonmembers; and US$5 for students, unemployed mathematicians, and emeritus members. Fees are payable on site by cash, check, or credit card.

Travel and Campus Map
Northwest Arkansas Regional Airport (XNA) is about 26 miles from Fayetteville and is serviced by U.S. Airways, Northwest, Delta, and American Airlines. Check www.nwara.com for current information about the airport and its services, and answers to frequently asked questions.

Getting to the University by Car: For general directions and a map of the area see http://advancement.uark.edu/info/directions.html. A campus map is at http://cavern.uark.edu/rd_vcad/urel/info/campus_map/.

From the airport to campus: Turn east (left at airport exit) and go to Cave Springs. From Cave Springs, continue traveling east six miles on Hwy 264 to I-540. See directions from the North driving on I-540 South.

From the North: After Bella Vista, take I-540 South all the way to Fayetteville. From I-540, take the Hwy 112 exit (exit 66). Turn right on Hwy 112 and travel south for two miles until you reach the campus entrance at the corner of Garland Avenue and Cleveland Street. (After crossing the North Street intersection, Hwy 112 becomes Garland Avenue.)

From the East: Take Hwy 412 to I-540. See directions from North.

From the West: Take Hwy 412 east via Cherokee Turnpike from Tulsa, OK, to I-540 South. See directions from North.

From the South: Take I-40 to I-540 North (exit 7). From I-540 North to Razorback Road (exit 61). Turn right on Razorback Road, heading north. The campus entrance is located at the corner of Razorback Road and Sixth Street.

Car Rental
Avis is the official car rental company for the sectional meeting in Fayetteville, AR. All rates include unlimited free mileage. Weekend daily rates are available from noon Thursday–Monday at 11:59 p.m. Rates for this meeting are effective October 27, 2006–November 11, 2006 and begin at US$26.99/day (weekend rate). Should a lower qualifying rate become available at the time of booking, Avis is pleased to offer a 5% discount off the lower qualifying rate or the meeting rate, whichever is lowest. Rates do not include any state or local surcharges, tax, optional coverages, or gas refueling charges. Renters must meet Avis’ age, driver, and credit requirements. Reservations can be made by calling 800-331-1600 or online at http://www.avis.com. Meeting Avis Discount Number B159266.

Information for International Participants
Visa regulations are continually changing for travel to the United States. Visa applications may take from three to four months to process and require a personal interview, as well as specific personal information. International participants should view the important information about traveling to the U.S. found at http://www7.nationalacademies.org/visas/Traveling_to_US.html and http://travel.state.gov/visa/index.html. If you need a preliminary conference invitation in order to secure a visa, please send your request to dl s@ams.org.

If you discover you do need a visa, the National Academies website (see above) provides these tips for successful visa applications:

* Visa applicants are expected to provide evidence that they are intending to return to their country of residence. Therefore, applicants should provide proof of “binding” or sufficient ties to their home country or permanent residence abroad. This may include documentation of the following:
  - family ties in home country or country of legal permanent residence
  - property ownership
  - bank accounts
  - employment contract or statement from employer stating that the position will continue when the employee returns;

* Visa applications are more likely to be successful if done in a visitor’s home country than in a third country;

* Applicants should present their entire trip itinerary, including travel to any countries other than the United States, at the time of their visa application;

* Include a letter of invitation from the meeting organizer or the U.S. host, specifying the subject, location and dates of the activity, and how travel and local expenses will be covered;
* If travel plans will depend on early approval of the visa application, specify this at the time of the application;
* Provide proof of professional scientific and/or educational status (students should provide a university transcript). This list is not to be considered complete. Please visit the websites above for the most up-to-date information.

Weather
Weather conditions in Fayetteville during early November are mild. Temperatures range from around 63 degrees F. during the day to around 53 degrees F at night.

New Orleans, Louisiana

New Orleans Marriott and Sheraton New Orleans Hotel

January 5–8, 2007
Friday - Monday

Meeting #1023
Joint Mathematics Meetings, including the 113th Annual Meeting of the AMS, 90th Annual Meeting of the Mathematical Association of America (MAA), annual meetings of the Association for Women in Mathematics (AWM) and the National Association of Mathematicians (NAM), and the winter meeting of the Association for Symbolic Logic (ASL), with sessions contributed by the Society for Industrial and Applied Mathematics (SIAM).

Associate secretary: Susan J. Friedlander
Announcement issue of Notices: October 2006
Program first available on AMS website: November 1, 2006
Program issue of electronic Notices: January 2007
Issue of Abstracts: Volume 28, Issue 1

Deadlines
For organizers: Expired
For consideration of contributed papers in Special Sessions: Expired
For abstracts: September 26, 2006

Joint Invited Addresses
Bryna R. Kra, Northwestern University, Dynamics of integer sets (AMS-MAA Invited Address).

AMS Invited Addresses
Manjul Bhargava, Princeton University, Title to be announced.

Peter D. Lax, New York University-Courant Institute, Title to be announced (AMS Josiah Willard Gibbs Lecture).

Andrei Okounkov, Princeton University, Title to be announced (AMS Colloquium Lectures).

Bjorn Poonen, University of California Berkeley, The abc conjecture.

Victor S. Reiner, University of Minnesota, Minneapolis, New combinatorics from the invariant theory of reflection groups.

Andras Vasy, Stanford University, Diffraction by edges.
Margaret H. Wright, New York University-Courant Institute, Title to be announced.

AMS Special Sessions
Some sessions are cosponsored with other organizations. These are noted within the parenthesis at the end of each listing, where applicable.

Arithmetic Geometry (Code: SS 38A), Matthew H. Baker, Georgia Institute of Technology, and Bjorn Poonen, University of California Berkeley.

Arithmetic of Function Fields (Code: SS 33A), Allison M. Pacelli, Williams College, and Michael J. Rosen, Brown University.

Arrangements and Related Topics (Code: SS 1A), Daniel C. Cohen, Louisiana State University, and Anne V. Shepler, University of North Texas.

Calculus of Variations and Nonlinear PDEs: Theory and Applications (Code: SS 2A), Marian Bocea and Cristina M. Popovici, North Dakota State University.

Coding Theory and Its Applications (Code: SS 3A), Roxana N. Smarandache, University of Notre Dame and San Diego State University, and Pascal O. Vontobel, Massachusetts Institute of Technology.

Cohomology and Representation Theory (Code: SS 4A), Jon F. Carlson and Daniel K. Nakano, University of Georgia, and Julia Pevtsova, University of Washington.

Commutative Algebra and Algebraic Geometry (Code: SS 5A), Paul C. Roberts, Anurag K. Singh, and Oana Veliche, University of Utah.

Computational Algebraic and Analytic Geometry for Low-Dimensional Varieties (Code: SS 39A), Mika K. Seppälä, Florida State University, Tanush T. Shaska, Oakland University, and Emil J. Volcheck, Association for Computing Machinery.

Continuous and Discrete Integrable Systems and Their Applications (Code: SS 6A), Wen-Xiu Ma, University of South Florida, Taixi Xu, Southern Polytechnic State University, and Bao-Feng Feng and Zhijun Qiao, University of Texas-Pan American.

Dynamic Programming (Code: SS 7A), Gerald C. Kobylski and Randal Hickman, United States Military Academy.


Financial Mathematics (Code: SS 9A), Jean-Pierre Fouque, University of California Santa Barbara, Craig A. Nolder, Florida State University, Knut Solna, University of California Irvine, and Thaleia Zariphopoulou, University of Texas Austin.

Fixed Point Theory, Dynamics, and Group Theory (Code: SS 10A), Michael R. Kelly, Loyola University, and Peter N. Wong, Bates College.
Frames and Wavelets in Harmonic Analysis, Geometry, and Applications (Code: SS 11A), Palle E. T. Jorgensen, University of Iowa, David R. Larson, Texas A&M University, Peter R. Massopust, Institute of Biomathematics and Biometry, Neuenberg, and Technical University of Munich, and Gestur Olafsson, Louisiana State University.


Invariant Theory (Code: SS 18A), Mara D. Neusel, Texas Tech University, and Frank D. Grosshans, West Chester University.

Knots, 3-manifolds, and Their Invariants (Code: SS 19A), Oliver T. Dasbach, Louisiana State University, and Xiaosong Lin, University of California Riverside.

Logical Methods in Computational Mathematics (Code: SS 20A), Saugata Basu, Georgia Institute of Technology, and Charles N. Delzell, Louisiana State University (AMS-ASL).

Mapping Class Groups and Handlebodies (Code: SS 21A), Tara E. Brendle, Louisiana State University, and William R. Vautaw, Southeastern Louisiana University.

Math Circles and Similar Programs for Students and Teachers (Code: SS 22A), Morris Kalka, Tulane University, Hugo Rossi, Mathematical Sciences Research Institute, Tatiana Shubin, San Jose State University, Zvezdelina E. Stankova, Mills College, Daniel H. Ullman, George Washington University, and Paul A. Zeitz, University of San Francisco (AMS-MAA).

Mathematical Techniques in Musical Analysis (Code: SS 23A), Robert W. Peck, Louisiana State University, Julian Hook, Indiana University-Bloomington, and Rachel W. Hall, Saint Joseph's University.

Mathematics and Education Reform (Code: SS 37A), William H. Barker, Bowdoin College, Dale R. Oliver, Humboldt State University, Bonnie S. Saunders, University of Illinois at Chicago, and Michael Starbird, University of Texas, Austin (AMS-MAA-MER).

Microlocal Analysis and Singular Spaces (Code: SS 36A), Paul A. Loya, Binghamton University, and Andras Vasy, Massachusetts Institute of Technology.

Nonlinear Variational Inclusion Problems and Optimization Theory (Code: SS 24A), Ram U. Verma, University of Toledo, and International Publications.

Nonlinear Analysis in Inverse and Variational Problems (Code: SS 25A), M. Zuhair Nashed, University of Central Florida, and Otmar Scherzer, University of Innsbruck.

Numerical Relativity (Code: SS 26A), Alexander M. Alekseenko, California State University Northridge, and Arup Mukherjee, Montclair State University.

Radon Transforms, Convex Geometry, and Geometric Analysis (Code: SS 27A), Eric L. Grinberg, University of New Hampshire, Peter Kuchment, Texas A&M University, Gestur Olafsson, Louisiana State University, Eric Todd Quinto, Tufts University, and Boris S. Rubin, Louisiana State University.

Recent Advances in Mathematical Biology, Ecology, and Epidemiology (Code: SS 28A), Lih-Iing Roeger and Linda J. Allen, Texas Tech University, and Sophia Jang, University of Louisiana at Lafayette.

Recent Developments in Analysis and Numerics of Geophysical Fluid Dynamics Problems (Code: SS 29A), Jie Shen, Purdue University, and Shouhong Wang, Indiana University.

Recent Developments in Floer Homology (Code: SS 30A), Scott J. Baldridge, Louisiana State University, Ronald A. Fintushel, Michigan State University, Thomas E. Mark, Southeastern Louisiana University, and Brendan E. Owens, Louisiana State University.

Representation Theory and the Theta Correspondence (Code: SS 31A), Wee Teck Gan, University of California San Diego, Hongyu He, Louisiana State University, and Anhagreit Paul, Western Michigan University.


Structure Theory for Matroids and Graphs (Code: SS 32A), Joseph P. Kung, University of North Texas, and Bogdan S. Oporowski and James G. Oxley, Louisiana State University.

Time Scales: Dynamic Equations with Applications (Code: SS 34A), Martin J. Bohner, University of Missouri-Rolla, and Allan C. Peterson, University of Nebraska-Lincoln.

Universal Algebra and Order (Code: SS 35A), John W. Snow, Sam Houston State University, and Japheth Wood, Chatham College.
Meetings & Conferences

Davidson, North Carolina

Davidson College

March 3-4, 2007
Saturday - Sunday

Meeting #1024
Southeastern Section
Associate secretary: Matthew Miller
Announcement issue of Notices: January 2007
Program first available on AMS website: January 18, 2007
Program issue of electronic Notices: March 2007
Issue of Abstracts: Volume 28, Issue 2

Deadlines
For organizers: Expired
For consideration of contributed papers in Special Sessions:
   November 14, 2006
For abstracts: January 9, 2007

Invited Addresses
Nigel Boston, University of Wisconsin, Madison, Title to be announced.
Chaim Goodman-Strauss, University of Arkansas at Fayetteville, Title to be announced.
Andrew J. Granville, University of Montreal, Title to be announced (Erdős Memorial Lecture).
Alex Iosevich, University of Missouri-Columbia, Analysis, combinatorics, and arithmetic of incidence theory.
Shrawan Kumar, University of North Carolina, Eigenvalue problem for Hermitian matrices and its generalization to arbitrary reductive groups.

Special Sessions
Between Harmonic Analysis, Number Theory, and Combinatorics (Code: SS 1A), Alex Iosevich, University of Missouri-Columbia, Michael T. Lacey, Georgia Institute of Technology, and Konstantin Oskolkov, University of South Carolina.
Commutative Rings and Monoids (Code: SS 5A), Evan G. Houston and Thomas G. Lucas, University of North Carolina, Charlotte.
Computational Group Theory (Code: SS 3A), Arturo Magidin, University of Louisiana at Lafayette, Luise Charlotte Kappe, Binghamton University, and Robert F. Morse, University of Evansville.
Representation Theory and Galois Cohomology in Number Theory (Code: SS 4A), Jan Mináč, University of Western Ontario, and John R. Swallow, Davidson College.

Oxford, Ohio

Miami University

March 16-17, 2007
Friday - Saturday

Meeting #1025
Central Section
Associate secretary: Susan J. Friedlander
Announcement issue of Notices: January 2007
Program first available on AMS website: February 1, 2007
Program issue of electronic Notices: March 2007
Issue of Abstracts: Volume 28, Issue 2

Deadlines
For organizers: August 16, 2006
For consideration of contributed papers in Special Sessions:
   November 28, 2006
For abstracts: January 23, 2007

Invited Addresses
Sergey Fomin, University of Michigan, Title to be announced.
Naichung Conan Leung, University of Minnesota, Title to be announced.
Emil J. Straube, Texas A&M University, Title to be announced.
Shouhong Wang, Indiana University, Title to be announced.

Special Sessions
Combinatorial and Geometric Group Theory (Code: SS 5A), John Donnelly, Mount Union College, and Daniel Farley, Mathematisches Institut Einsteinstrasse and Miami University.
Finite Geometry and Combinatorics (Code: SS 3A), Mark A. Miller, Marietta College.
Geometric Topology (Code: SS 2A), Jean-François Lafont, SUNY Binghamton and Ohio State University, and Ivonne J. Ortiz, Miami University.
Graph Theory (Code: SS 4A), Tao Jiang, Zevi Miller, and Dan Pritikin, Miami University.
Large Cardinals in Set Theory (Code: SS 1A), Paul B. Larson, Miami University, Justin Tatch Moore, Boise State University, and Ernest Schimmerling, Carnegie Mellon University.
Hoboken, New Jersey
Stevens Institute of Technology
April 14-15, 2007
Saturday - Sunday
Meeting #1026
Eastern Section
Associate secretary: Lesley M. Sibner
Announcement issue of Notices: February 2007
Program first available on AMS website: March 8, 2007
Program issue of electronic Notices: April 2007
Issue of Abstracts: Volume 28, Issue 2

Deadlines
For organizers: September 14, 2006
For consideration of contributed papers in Special Sessions:
December 26, 2006
For abstracts: February 27, 2007

Invited Addresses
Neal Koblitz, University of Washington, Title to be announced.
Florian Luca, Universidad Nacional Autónoma de México, Title to be announced.
Natasa Pavlovic, Princeton University, Title to be announced.
Elisabeth Werner, Case Western Reserve University, Title to be announced.

Special Sessions
Affine Invariants, Randomness, and Approximation in Convex Geometry (Code: SS 2A), Elisabeth Werner, Case Western Reserve University, and Artem Zvavitch, Kent State University.
Automorphic Forms and Arithmetic Geometry (Code: SS 5A), Gautam Chinta, City College of New York, and Paul E. Gunnells, University of Massachusetts, Amherst.
Convex Sets (Code: SS 1A), David Larman, University College London, and Valeriu Soltan, George Mason University.
Differential Algebra (Code: SS 4A), Phyllis J. Cassidy, Smith College and The City College of CUNY, Richard C. Churchill, Hunter College and The Graduate Center of CUNY, Li Guo and William F. Keigher, Rutgers University at Newark, and Jerald J. Kovacic and William Sit, The City College of CUNY.
Fourier Analysis and Convexity (Code: SS 3A), Alexander Koldobsky, University of Missouri, Columbia, and Dmitry Ryabogin, Kansas State University.
Languages and Groups (Code: SS 6A), Sean Cleary, The City College of New York and CUNY Graduate Center, Murray J. Elder, Stevens Institute of Technology, and Gretchen Ostheimer, Hofstra University.

Tucson, Arizona
University of Arizona
April 21-22, 2007
Saturday - Sunday
Meeting #1027
Western Section
Associate secretary: Michel L. Lapidus
Announcement issue of Notices: February 2007
Program first available on AMS website: March 8, 2007
Program issue of electronic Notices: April 2007
Issue of Abstracts: Volume 28, Issue 2

Deadlines
For organizers: September 21, 2006
For consideration of contributed papers in Special Sessions:
January 2, 2007
For abstracts: February 27, 2007

Invited Addresses
Liliana Borcea, Rice University, Title to be announced.
James Cushing, University of Arizona, Tucson, Title to be announced.
Hans Lindblad, University of California, San Diego, Title to be announced.
Vinayak Vatsal, University of British Columbia, Vancouver, Title to be announced.

Special Sessions
Inverse Problems for Wave Propagation (Code: SS 2A), Liliana Borcea, Rice University.
Representations of Algebras (Code: SS 1A), Frauke Maria Bleher, University of Iowa, Birge K. Huisgen-Zimmermann, University of California Santa Barbara, and Dan Zacharia, Syracuse University.

Warsaw, Poland
University of Warsaw
July 31 – August 3, 2007
Tuesday – Friday
Meeting #1028
First Joint International Meeting between the AMS and the Polish Mathematical Society
Associate secretary: Susan J. Friedlander
Announcement issue of Notices: To be announced
Program first available on AMS website: To be announced
Program issue of electronic Notices: To be announced
Issue of Abstracts: To be announced

Deadlines
For organizers: To be announced
Meetings & Conferences

For consideration of contributed papers in Special Sessions:
To be announced
For abstracts: To be announced

Invited Addresses

Henryk Iwaniec, Rutgers University, *Title to be announced.*
Tomasz J. Luczak, Adam Mickiewicz University, *Title to be announced.*
Tomasz Mrowka, Massachusetts Institute of Technology, *Title to be announced.*
Ludomir Newelski, University of Wroclaw, *Title to be announced.*
Madhu Sudan, Massachusetts Institute of Technology, *Title to be announced.*
Anna Zdunik, Warsaw University, *Title to be announced.*

Chicago, Illinois

DePaul University

October 5-6, 2007
Friday - Saturday

Meeting #1029
Central Section
Associate secretary: Susan J. Friedlander
Announcement issue of Notices: August 2007
Program first available on AMS website: August 16, 2007
Program issue of electronic Notices: October 2007
Issue of Abstracts: Volume 28, Issue 3

Deadlines
For organizers: March 6, 2007
For consideration of contributed papers in Special Sessions: June 19, 2007
For abstracts: August 7, 2007

Invited Addresses

Matthew J. Gursky, University of Notre Dame, *Title to be announced.*
Alex Iosevich, University of Missouri, *Title to be announced.*
David E. Radford, University of Illinois at Chicago, *Title to be announced.*

New Brunswick, New Jersey

Rutgers University-New Brunswick, Busch Campus

October 6-7, 2007
Saturday – Sunday

Meeting #1030
Eastern Section
Associate secretary: Lesley M. Sibner
Announcement issue of Notices: August 2007
Program first available on AMS website: August 16, 2007
Program issue of electronic Notices: October 2007
Issue of Abstracts: Volume 28, Issue 3

Deadlines
For organizers: March 6, 2007
For consideration of contributed papers in Special Sessions: June 19, 2007
For abstracts: August 7, 2007

Invited Addresses

Sir Roger Penrose, University of Oxford, *Title to be announced* (Einstein Public Lecture in Mathematics).

Albuquerque, New Mexico

University of New Mexico

October 13-14, 2007
Saturday – Sunday

Meeting #1031
Western Section
Associate secretary: Michel L. Lapidus
Announcement issue of Notices: August 2007
Program first available on AMS website: August 30, 2007
Program issue of electronic Notices: October 2007
Issue of Abstracts: Volume 28, Issue 4

Deadlines
For organizers: March 13, 2007
For consideration of contributed papers in Special Sessions: June 26, 2007
For abstracts: August 21, 2007

Invited Addresses

Emmanuel Candès, California Institute of Technology, *Title to be announced.*
Alexander Polischuk, University of Oregon, Eugene, *Title to be announced.*
Eric Raines, University of California, Davis, *Title to be announced.*

William A. Stein, University of California, San Diego, SAGE: *Software for Algebra and Geometry Experimentation.*

**Murfreesboro, Tennessee**  
*Middle Tennessee State University*

**November 3-4, 2007**  
*Saturday - Sunday*

**Meeting #1032**  
Southeastern Section  
Associate secretary: Matthew Miller  
Announcement issue of Notices: September 2007  
Program first available on AMS website: September 20, 2007  
Program issue of electronic Notices: November 2007  
Issue of Abstracts: Volume 28, Issue 4

**Deadlines**  
For organizers: April 3, 2007  
For consideration of contributed papers in Special Sessions: July 17, 2007  
For abstracts: September 11, 2007

**Invited Addresses**  
Daniel K. Nakano, University of Georgia, *Title to be announced.*  
Carla D. Savage, North Carolina State University, *Title to be announced.*  
Sergei Tabachnikov, Pennsylvania State University, *Title to be announced.*

**Wellington, New Zealand**  
*To be announced*

**December 12-15, 2007**  
*Wednesday - Saturday*  
First Joint International Meeting between the AMS and the New Zealand Mathematical Society (NZMS).  
Associate secretary: Matthew Miller  
Announcement Issue of Notices: To be announced  
Program first available on AMS website: To be announced  
Program issue of electronic Notices: To be announced  
Issue of Abstracts: To be announced

**Deadlines**  
For organizers: To be announced

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**San Diego, California**  
*San Diego Convention Center*

**January 6-9, 2008**  
*Sunday - Wednesday*  
Joint Mathematics Meetings, including the 114th Annual Meeting of the AMS, 91st Annual Meeting of the Mathematical Association of America (MAA), annual meetings of the Association for Women in Mathematics (AWM) and the National Association of Mathematicians (NAM), and the winter meeting of the Association for Symbolic Logic (ASL), with sessions contributed by the Society for Industrial and Applied Mathematics (SIAM).  
Associate secretary: Michel L. Lapidus  
Announcement issue of Notices: October 2007  
Program first available on AMS website: November 1, 2007  
Program issue of electronic Notices: January 2008  
Issue of Abstracts: Volume 29, Issue 1

**Deadlines**  
For organizers: April 1, 2007  
For consideration of contributed papers in Special Sessions: To be announced  
For abstracts: To be announced

**New York, New York**  
*Courant Institute of New York University*

**March 22-23, 2008**  
*Saturday - Sunday*  
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: August 22, 2007  
For consideration of contributed papers in Special Sessions: To be announced  
For abstracts: To be announced
Meetings & Conferences

Baton Rouge, Louisiana
Louisiana State University, Baton Rouge
March 28-30, 2008
Friday - Sunday
Southeastern Section
Associate secretary: Matthew Miller
Announcement issue of Notices: To be announced
Program first available on AMS website: To be announced
Program issue of electronic Notices: To be announced
Issue of Abstracts: To be announced

Deadlines
For organizers: August 28, 2007
For consideration of contributed papers in Special Sessions: To be announced
For abstracts: To be announced

Bloomington, Indiana
Indiana University
April 4-6, 2008
Friday - Sunday
Central Section
Associate secretary: Susan J. Friedlander
Announcement issue of Notices: To be announced
Program first available on AMS website: To be announced
Program issue of electronic Notices: To be announced
Issue of Abstracts: To be announced

Deadlines
For organizers: September 4, 2007
For consideration of contributed papers in Special Sessions: To be announced
For abstracts: To be announced

Claremont, California
Claremont McKenna College
May 3-4, 2008
Saturday - Sunday
Southeastern Section
Associate secretary: Michel L. Lapidus
Announcement issue of Notices: To be announced
Program first available on AMS website: To be announced
Program issue of electronic Notices: To be announced
Issue of Abstracts: To be announced

Deadlines
For organizers: October 4, 2007
For consideration of contributed papers in Special Sessions: To be announced
For abstracts: To be announced

Rio de Janeiro, Brazil
Instituto Nacional de Matematica Pura e Aplicada (IMPA)
June 4-7, 2008
Wednesday - Saturday
First Joint International Meeting between the AMS and the Sociedade Brasileira de Matematica.
Associate secretary: Lesley M. Sibner
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

Vancouver, Canada
University of British Columbia and the Pacific Institute of Mathematical Sciences (PIMS)
October 4-5, 2008
Saturday - Sunday
Western Section
Associate secretary: Michel L. Lapidus
Announcement issue of Notices: To be announced
Program first available on AMS website: To be announced
Program issue of electronic Notices: To be announced
Issue of Abstracts: To be announced

Deadlines
For organizers: March 9, 2008
For consideration of contributed papers in Special Sessions: To be announced
For abstracts: To be announced
Middletown, Connecticut
Wesleyan University

October 11-12, 2008
Saturday - Sunday
Eastern Section
Associate secretary: Lesley M. Sibner
Announcement issue of Notices: To be announced
Program first available on AMS website: To be announced
Program issue of electronic Notices: To be announced
Issue of Abstracts: To be announced

Deadlines
For organizers: March 11, 2008
For consideration of contributed papers in Special Sessions:
    To be announced
For abstracts: To be announced

Huntsville, Alabama
University of Alabama, Huntsville

October 24-26, 2008
Friday - Sunday
Southeastern Section
Associate secretary: Matthew Miller
Announcement issue of Notices: To be announced
Program first available on AMS website: To be announced
Program issue of electronic Notices: To be announced
Issue of Abstracts: To be announced

Deadlines
For organizers: March 24, 2008
For consideration of contributed papers in Special Sessions:
    To be announced
For abstracts: To be announced

Shanghai, People’s Republic of China
Fudan University

December 17-21, 2008
Wednesday - Sunday
First Joint International Meeting Between the AMS and the
Shanghai Mathematical Society
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: August 29, 2008
For consideration of contributed papers in Special Sessions:
    To be announced
For abstracts: To be announced

Washington, District of Columbia
Marriott Wardman Park Hotel and Omni Shoreham Hotel

January 7-10, 2009
Wednesday - Saturday
Joint Mathematics Meetings, including the 115th Annual Meeting of the AMS, 92nd Annual Meeting of the Mathematical Association of America (MAA), annual meetings of the Association for Women in Mathematics (AWM) and the National Association of Mathematicians (NAM), and the winter meeting of the Association for Symbolic Logic (ASL), with sessions contributed by the Society for Industrial and Applied Mathematics (SIAM).
Associate secretary: Lesley M. Sibner
Announcement issue of Notices: October 2008
Program first available on AMS website: November 1, 2008
Program issue of electronic Notices: January 2009
Issue of Abstracts: Volume 30, Issue 1

Deadlines
For organizers: April 1, 2008
For consideration of contributed papers in Special Sessions:
    To be announced
For abstracts: To be announced

Urbana, Illinois
University of Illinois at Urbana-Champaign

March 27-29, 2009
Friday - Sunday
Southeastern 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 29, 2008
For consideration of contributed papers in Special Sessions:
    To be announced
For abstracts: To be announced
Meetings & Conferences

San Francisco, California

Moscone Center West and the San Francisco Marriott

January 6-9, 2010

Wednesday – Saturday
Joint Mathematics Meetings, including the 116th Annual Meeting of the AMS, 93rd Annual Meeting of the Mathematical Association of America (MAA), annual meetings of the Association for Women in Mathematics (AWM) and the National Association of Mathematicians (NAM), and the winter meeting of the Association for Symbolic Logic (ASL), with sessions contributed by the Society of Industrial and Applied Mathematics (SIAM).

Associate secretary: Matthew Miller
Announcement issue of Notices: October 2009
Program first available on AMS website: November 1, 2009
Program issue of electronic Notices: January 2010
Issue of Abstracts: Volume 31, Issue 1

Deadlines
For organizers: April 1, 2009
For consideration of contributed papers in Special Sessions:
To be announced
For abstracts: To be announced

New Orleans, Louisiana

New Orleans Marriott and Sheraton New Orleans Hotel

January 5-8, 2011

Wednesday – Saturday
Joint Mathematics Meetings, including the 117th Annual Meeting of the AMS, 94th Annual Meeting of the Mathematical Association of America, annual meetings of the Association for Women in Mathematics (AWM) and the National Association of Mathematicians (NAM), and the winter meeting of the Association for Symbolic Logic (ASL), with sessions contributed by the Society for Industrial and Applied Mathematics (SIAM).

Associate secretary: Susan J. Friedlander
Announcement issue of Notices: October 2010
Program first available on AMS website: November 1, 2010
Program issue of electronic Notices: January 2011
Issue of Abstracts: Volume 32, Issue 1

Deadlines
For organizers: April 1, 2010
For consideration of contributed papers in Special Sessions:
To be announced
For abstracts: To be announced

Boston, Massachusetts

John B. Hynes Veterans Memorial Convention Center, Boston Marriott Hotel, and Boston Sheraton Hotel

January 4-7, 2012

Wednesday – Saturday
Joint Mathematics Meetings, including the 118th Annual Meeting of the AMS, 95th 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), with sessions contributed by the Society for Industrial and Applied Mathematics (SIAM).

Associate secretary: Michel L. Lapidus
Announcement issue of Notices: October 2011
Program first available on AMS website: November 1, 2011
Program issue of electronic Notices: January 2012
Issue of Abstracts: Volume 33, Issue 1

Deadlines
For organizers: April 1, 2011
For consideration of contributed papers in Special Sessions:
To be announced
For abstracts: To be announced

San Diego, California

San Diego Convention Center and San Diego Marriott Hotel and Marina

January 9-12, 2013

Wednesday – Saturday
Joint Mathematics Meetings, including the 119th Annual Meeting of the AMS, 96th 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), with sessions contributed by the Society for Industrial and Applied Mathematics (SIAM).

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 1, 2012
For consideration of contributed papers in Special Sessions:
To be announced
For abstracts: To be announced
Meetings and Conferences of the AMS

Associate Secretaries of the AMS
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Eastern Section: Lesley M. Sibner, Department of Mathematics, Polytechnic University, Brooklyn, NY 11201-2900; e-mail: lsibner@duke.poly.edu; telephone: 718-260-3505.
Southeastern Section: Matthew Miller, Department of Mathematics, University of South Carolina, Columbia, SC 29208-0001, e-mail: miller@math.sc.edu; telephone: 803-777-3690.

The Meetings and Conferences section of the Notices gives information on all AMS meetings and conferences approved by press time for this issue. Please refer to the page numbers cited in the table of contents on this page for more detailed information on each event. Invited Speakers and Special Sessions are listed as soon as they are approved by the cognizant program committee; the codes listed are needed for electronic abstract submission. For some meetings the list may be incomplete. Information in this issue may be dated. Up-to-date meeting and conference information can be found at www.ams.org/meetings/.

Meetings:
2006
October 7-8 Salt Lake City, Utah p. 985
October 21-22 Cincinnati, Ohio p. 986
October 28-29 Storrs, Connecticut p. 986
November 3-4 Fayetteville, Arkansas p. 987

2007
January 5-8 New Orleans, Louisiana Annual Meeting p. 990
March 3-4 Davidson, North Carolina p. 992
March 16-17 Oxford, Ohio p. 992
April 14-15 Hoboken, New Jersey p. 993
April 21-22 Tucson, Arizona p. 993
July 31-August 3 Warsaw, Poland p. 993
October 5-6 Chicago, Illinois p. 994
October 6-7 New Brunswick, New Jersey p. 994
October 13-14 Albuquerque, New Mexico p. 994
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December 12-15 Wellington, New Zealand p. 995

2008
January 6-9 San Diego, California Annual Meeting p. 995
March 22-23 New York, NY p. 995
March 28-30 Baton Rouge, Louisiana p. 996
April 4-6 Bloomington, Indiana p. 996
May 3-4 Claremont, California p. 996

Important Information Regarding AMS Meetings
Potential organizers, speakers, and hosts should refer to page 296 in the February 2006 issue of the Notices for general information regarding participation in AMS meetings and conferences.

Abstracts
Speakers should submit abstracts on the easy-to-use interactive Web form. No knowledge of \LaTeX{} is necessary to submit an electronic form, although those who use \LaTeX{} may submit abstracts with such coding, and all math displays and similarly coded material (such as accent marks in text) must be typeset in \LaTeX{}. Visit http://www.ams.org/cgi-bin/abstracts/abstract.pl. Questions about abstracts may be sent to abs-inform@ams.org. 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.)
June 16-July 6, 2007: Joint Summer Research Conferences, Snowbird, Utah.
July 8-July 12, 2007: von Neumann Symposium on Sparse Representation and High-Dimensional Geometry, Snowbird, Utah.
OUTSTANDING SCHOLARSHIP

The Art of Mathematics
Coffee Time in Memphis
Béla Bollobás
The questions posed in this collection range in difficulty: the most challenging offer a glimpse of deep results that engage mathematicians today; even the easiest prompt readers to think about mathematics. All come with solutions, many with hints, and most with illustrations.
$85.00: Hardback: 0-521-87228-6: 360pp
$34.99: Paperback: 0-521-69395-0

Automorphic Forms and L-Functions for the Group GL(n,R)
Dorian Goldfeld
This book provides a self-contained introduction to the theory of L-functions in a style accessible to graduate students with a basic knowledge of classical analysis, complex variable theory, and algebra.

Cambridge Studies in Advanced Mathematics
$90.00: Hardback: 0-521-83771-5: 588pp

Percolation
Béla Bollobás and Oliver Riordan
Percolation theory was initiated some fifty years ago as a mathematical framework for the study of random physical processes such as flow through a disordered porous medium. This book presents classical results in a way that is accessible to non-specialists and describes recent results.
$70.00: Hardback: 0-521-87232-4: 330pp

Methods in Banach Space Theory
Edited by Jesus M. F. Castillo and William B. Johnson
This book presents an overview of modern Banach space theory in sixteen papers that reflect the wide expanse of the subject. Researchers working in Banach space theory, functional analysis, or operator theory will find much of interest here.
London Mathematical Society Lecture Note Series
$70.00: Paperback: 0-521-68568-0: 368pp

Multiple Scattering
Interaction of Time-Harmonic Waves with N Obstacles
Paul Martin
This book is the first devoted to multiple scattering. The author covers a variety of techniques, describing first the single-obstacle methods and then extending them to the multiple-obstacle case.
Encyclopedia of Mathematics and its Applications
$140.00: Hardback: 0-521-86554-9: 450pp

Percolation
Béla Bollobás and Oliver Riordan

Multiplicative Number Theory I
Classical Theory
Hugh L. Montgomery and R. C. Vaughan
Prime numbers are the multiplicative building blocks of natural numbers. Understanding their overall influence and especially their distribution gives rise to central questions in mathematics and physics. This book comprehensively covers all the topics met in first courses on multiplicative number theory and the distribution of prime numbers.
Cambridge Studies in Advanced Mathematics
$85.00: Hardback: 0-521-84903-9: 850pp

Synthetic Differential Geometry
Anders Kock
This second edition of Kock's classic text from 1981 includes many notes, comments on developments in the field from the intermediate years, and almost 100 new bibliographic entries.
London Mathematical Society Lecture Note Series
$55.00: Paperback: 0-521-68738-1: 246pp

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New and Noteworthy from Springer

Tales of Physicists and Mathematicians
Simon Gindikin, Rutgers University, New Jersey

- The work is engagingly written and will be enjoyed by those who love mathematics and physics. 
- Choice
- This lively and entertaining book tells 'tales' of Cardano, Galileo, Huygens, Pascal, Gauss... thus this book is not a scholarly discussion of the history of science readable only by experts, but a far more valuable work: a readable introduction to the scientific work discussed and the historical context (both scientific and social) in which it took place. ... Zentralblatt MATH

This revised and greatly expanded second edition of the classic Russian text contains a wealth of new information about the lives and accomplishments of more than a dozen scientists throughout history.


Compact Lie Groups
Mark R. Sepanski, Baylor University, Texas

Assuming no prior knowledge of Lie groups, this book covers the structure and representation theory of compact Lie groups. Topics include the construction of the spin groups, Schur orthogonality, the Peter-Weyl Theorem, Plancherel Theorem, Maximal Torus Theorem, Commutator Theorem, Weyl Integration and Character Formulas, the Highest Weight Classification, and the Borel-Weil Theorem.

2006, approx. 176 pp. (Graduate Texts in Mathematics, Vol. 235) Hardcover 0-387-30263-8 ≈ $49.95

Analysis and Probability
Wavelets, Signals, Fractals
Palle E.T. Jorgensen, University of Iowa

This systematic presentation of wavelets, signals, fractals emphasizes the unity of basis constructions and their expansions; and their use. The book brings together tools from engineering and from math, especially from signal and image processing, and from harmonic analysis and operator theory.

2006, approx. 294 pp. 58 illus. (Graduate Texts in Mathematics, Vol. 234) Hardcover 0-387-29519-4 ≈ $49.95

An Introduction to Operators on the Hardy-Hilbert Space
Peter Rosenthal, University of Toronto, ON, Canada and Ruben A. Martinez-Avendaño, University Autonoma del Estado de Hidalgo, Mexico


Deformations of Algebraic Schemes
Edoardo Sernesi, Università Roma Tre, Rome, Italy

This self-contained account of deformation theory in classical algebraic geometry brings together for the first time results previously scattered in the literature, with relatively little-known proofs that are of everyday relevance to algebraic geometries. It also includes applications to the construction and properties of Severi varieties of families of plane nodal curves, space curves, deformations of quotient singularities, Hilbert schemes of points, and local Picard functors. Many examples are included.

2006, 342 pp. (Grundlehren der mathematischen Wissenschaften, Vol. 334) Hardcover 3-540-30608-0 ≈ $119.00

Functional Equations and How to Solve Them
Christopher G. Small, University of Waterloo, Canada

Over the years, a number of books have been written on the theory of functional equations. However, very little has been published which helps readers to solve functional equations in mathematics competitions and mathematical problem solving. This book fills that gap. The emphasis is on the development of those tools which are most useful in assigning a family of solutions to each functional equation in explicit form. The difficulty of problems varies greatly, from those accessible to any high school student who has read the chapter carefully to those that will be a reasonable challenge to advanced students studying for the International Mathematical Olympiad or the William Lowell Putnam Competition.

2007, approx. 132 pp. 14 illus. (Problem Books in Mathematics) Hardcover 0-387-34534-5 ≈ $69.95

General Relativity
N.M.J. Woodhouse, Oxford University, UK

Based on a course given at Oxford over many years, this book is a short and concise exposition of the central ideas of general relativity. The basic theory is presented using techniques, such as phase-plane analysis, that will already be familiar to mathematicians undergraduates, and numerous problems are provided to test understanding. The various chapters include the theoretical background to contemporary observational tests - in particular the detection of gravitational waves and the verification of the Lens-Thirring precession - and some introductory cosmology, to tempt the reader to further study.

2006, 232 pp. 33 illus. (Springer Undergraduate Mathematics Series) Softcover 1-84628-486-4 ≈ $39.95

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