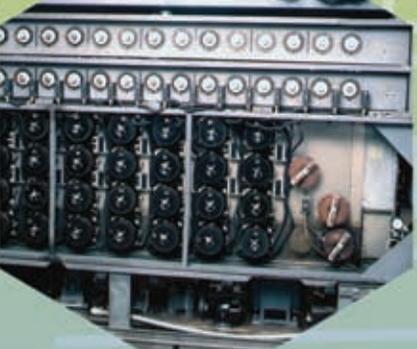
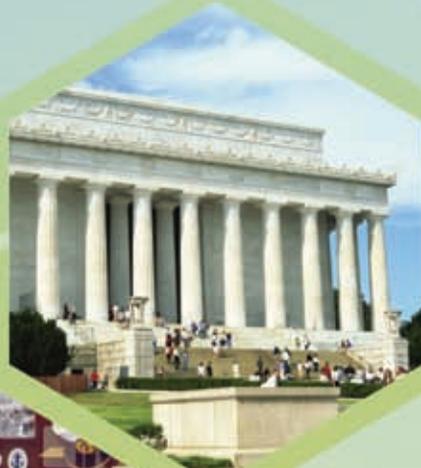


Notices

of the American Mathematical Society

October 2008

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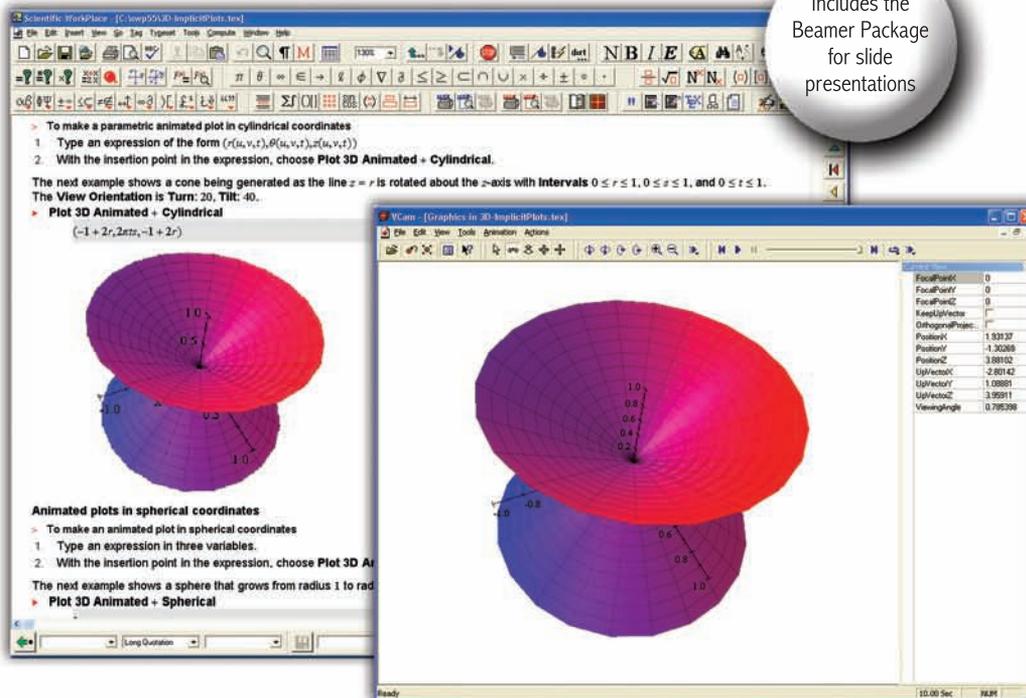
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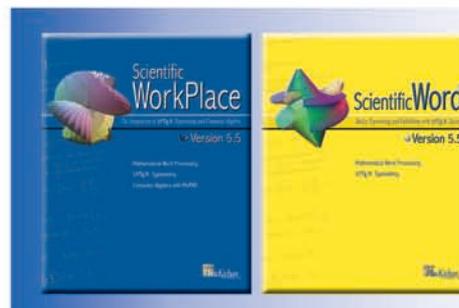


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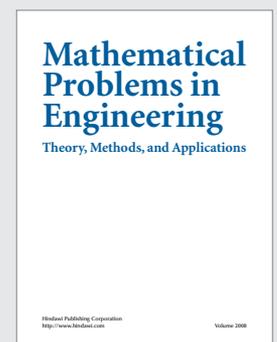
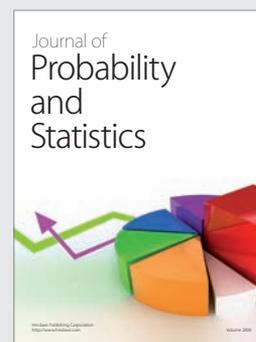
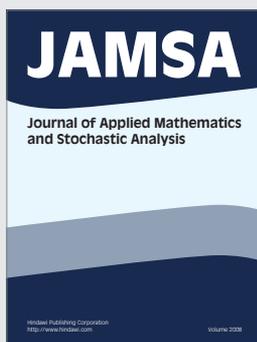
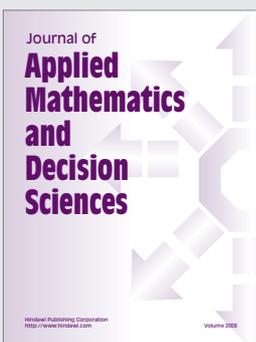
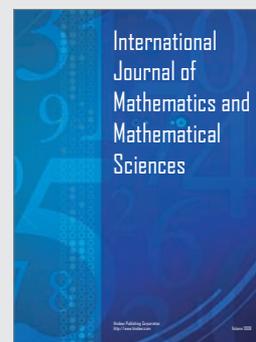
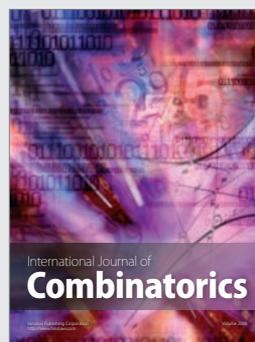
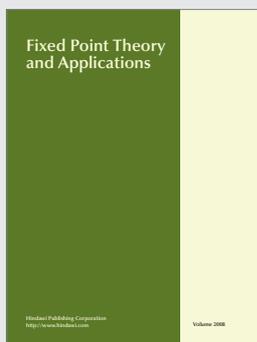
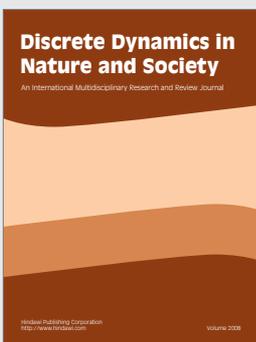
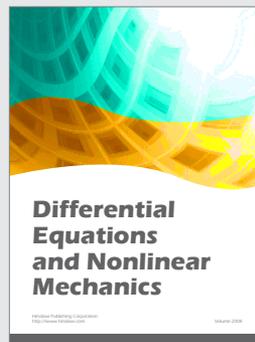
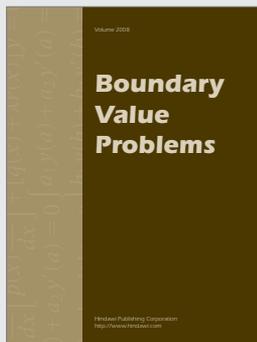
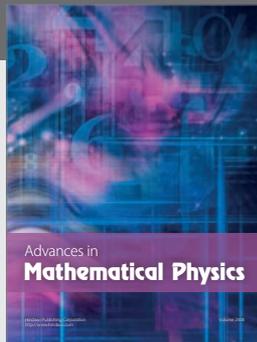
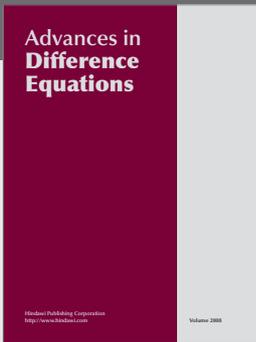
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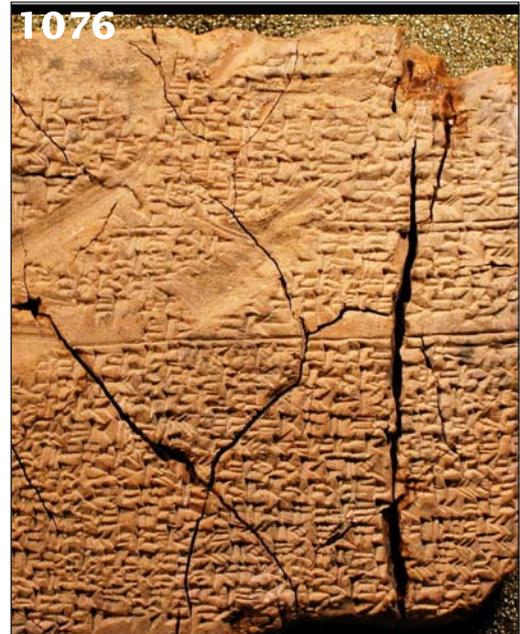
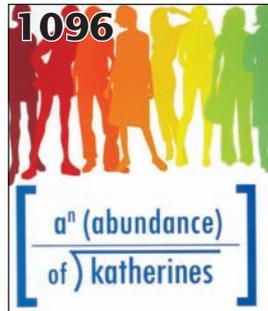
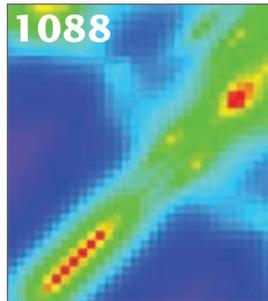
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Features

1076 A Remarkable Collection of Babylonian Mathematical Texts

Jöran Friberg

Mesopotamian cuneiform texts from as long ago as two millennia before the common era reveal mathematical knowledge of an often surprising depth. In this article, based on his book of the same name, the author offers a selection of some of this remarkable mathematics writing.

1088 Uncovering a New L -function

Andrew R. Booker

An L -function is a complex function given by an Euler product (generally, an infinite product of reciprocals of polynomials in an exponential) continued to an entire function, except for finitely many poles on the vertical line through 1, which in addition satisfies a functional equation. The Riemann zeta function is the prototype. Here, the author surveys the notion of L -function and presents some computations regarding a recent discovery.

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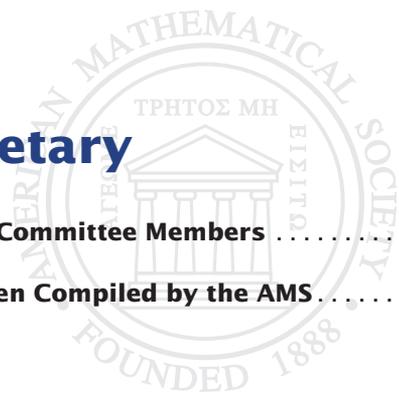
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Is the Public Hungry for Math?

At the end of 2007 CNN compiled a list of the top news stories of the year. A third of the stories were about celebrities behaving badly (Anna Nicole Smith's death from a drug overdose, Barry Bond's steroid use, Paris Hilton's drunk driving conviction, Britney Spears's child custody battle, Michael Vick's arrest for dog-fighting, etc.). None of the stories concerned mathematics, of course, or even science or technology. Sadly, the list accurately reflects the choices the news media makes throughout the year in deciding what stories are of interest to the American public.

Call me a starry-eyed optimist, but I beg to differ.

While the director's office at the Institute for Mathematics and its Applications—which has been my headquarters for the last seven years—is admittedly not the best place to gauge the interests of John Q. Public, some of the IMA's activities and some of my own involve public outreach, and in a broad segment of the public I regularly observe curiosity about contemporary math research and how it impacts our world, and a hunger for the sort of intellectual stimulation that comes from exploring mathematics.

The IMA hosts a public lecture series called *Math Matters*. Four times a year I recruit a distinguished mathematician who is also a superb expositor and lay before him or her a daunting challenge: to get across a message about math—how exciting it is and how central a role it plays in understanding our world and shaping our lives—to a very diverse and mostly nonexpert audience ranging from high schoolers to retirees, and to do so in fifty entertaining minutes to boot. The speakers have consistently risen to the challenge and the audience for the series has steadily grown, so that it now numbers several hundred. You can view most of the lectures in the IMA's video library available from our website.

Recently my optimistic thesis received remarkable support from an unlikely source: YouTube. YouTube—for any readers of this column who are completely removed from popular culture—is a Google-owned website at which about a hundred million user-contributed videos can be viewed. In June 2007, a colleague, Jonathan Rogness, and I completed a short mathematical video entitled *Möbius Transformations Revealed* and posted it to YouTube. (You can read more about our video in an article to appear in the November 2008 issue of the *Notices*, including the little-known theorem it demonstrates.) As I write this column, the video has been viewed by about one and a half million people and joined YouTube's "Top Favorites of All Time" category. In comparison, the most popular video about Anna Nicole Smith, a brief segment from Fox News entitled *Anna Nicole Wacked Out Of Her Mind In Clown Makeup!*, was posted five months earlier but has 10% fewer viewers and does not come close in the favorites category. Perhaps the public indeed wants to hear less about naughty celebrities and more about math.

The story of how *Möbius Transformations Revealed* came into being lends further support to my thesis. About a decade ago I prepared some short animations for a graduate class I was teaching to give students a better geometrical sense of Möbius transformations (linear fractional transformations of the complex plane). Then, in January 2007, occurred a confluence of three events. First, I was contacted by a Canadian filmmaker, Jean Bergeron, who had found the old anima-

tion where I had tucked it away on the Web, and asked if I could produce it in higher resolution. He wanted to include it in a documentary he was making for Canadian television about mathematical aspects of the work of Dutch artist M.C. Escher, including Escher's use of Möbius transformations and conformal mapping, but particularly the wonderful story of the mathematical completion of Escher's *Print Gallery* by Hendrik Lenstra, reported in the *Notices* in April 2003. Second, I attended a talk by Jon Rogness on his use of high-end graphics in teaching and began a discussion with him in which he suggested we collaborate on a joint project. Third, the National Science Foundation announced an International Science and Engineering Visualization Challenge.

Jon and I decided to submit a video entry to the NSF contest. Möbius transformations were on my mind thanks to Bergeron's request, and I had recently learned a different and very visual characterization of them that reveals that the inherently 2-dimensional Möbius transformations become simpler when viewed in three dimensions. This result became the basis of *Möbius Transformations Revealed*.

Four months later we sent the completed video to the NSF challenge, where it won an honorable mention. At the same time, we posted it to YouTube, as a simple way to share the video with a few friends and colleagues. While I hoped that some others would stumble upon it and find it interesting, even at my most optimistic I would never have anticipated the response it would generate. As viewers enjoyed the video and posted comments at YouTube and in blogs, the viewing rate rose, peaking at about *three views per second* for several days. More than 4,000 comments left by viewers clearly demonstrate a hunger for math in many quarters.

When we shared the video with Jean Bergeron, the filmmaker who had contacted me five months earlier for his documentary on Escher, he was interested in incorporating part of it in his film, but it was difficult, because the film production was just about complete. He needed us to re-render a portion of the video in much higher definition on a very tight schedule. I agreed, but set a price: the U.S. premier of his film should take place at the IMA. We struck a deal.

Bergeron's brilliant documentary film *Achieving the Unachievable* was screened in Minneapolis in November 2007, following by a week its world premier in Montreal. The film was not only beautiful, but also intellectually challenging, as it explored many aspects of the mathematics in Escher's work. We made a big effort to get word about the premier out to the community and drew an audience of 700, ranging from middle school students to math professors to art collectors. They sat rapt throughout the showing, and burst into thunderous applause at the conclusion. They were clearly a public hungry for math.

The American news media certainly does not play to this public interest in mathematics. Unfortunately, for the most part, neither do we mathematicians. Whether it be one-on-one, in discussions with nonmathematicians, or by organizing events like public lectures that reach a larger audience, I hope that some readers will take up the challenge.

—Douglas N. Arnold
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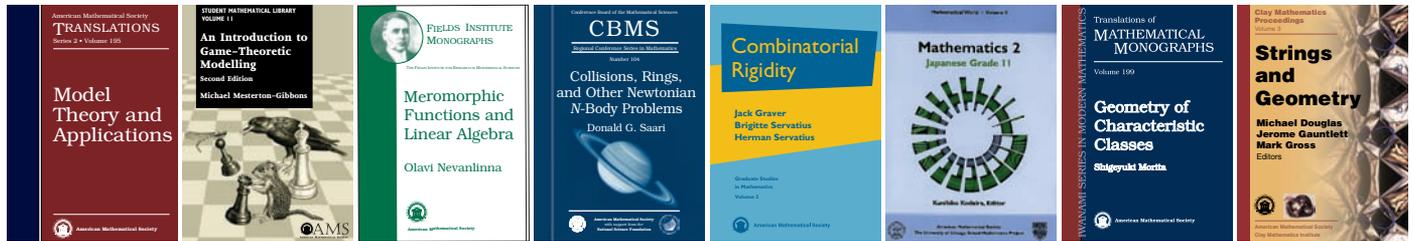
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Correction to “From the Fundamental Theorem of Algebra to Astrophysics...”

In our paper “From the fundamental theorem of algebra to astrophysics: A ‘harmonious’ path”, *Notices* 55 (6), 2008, 666–674 (the paragraph preceding Corollary 1 and the last sentence of Corollary 1 on page 670), we cited a parity result on the number of lensed images versus the number of lensing masses and credited S. H. Rhie. This result was actually found earlier by Arlie O. Petters: page 1918 of his paper “Morse theory and gravitational microlensing”, *J. Math. Phys.* 33 (5), 1992, 1915–31, and page 432 of the book *Singularity Theory and Gravitational Lensing* by A. O. Petters, H. Levine, and J. Wambsganss, Birkhauser, Boston (2001). We are grateful to Petters for pointing this out and we take this opportunity to correct this error.

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(Received June 26, 2008)

Editor’s Note: More on Cake Cutting

Theodore P. Hill has found “serious mathematical errors” in the article “Better ways to cut a cake” by Steven J. Brams, Michael A. Jones, and Christian Klamler (BJK) which appeared in the December 2006 *Notices* and supplied analysis and detailed counterexamples in a document entitled “Cutting cakes correctly”, not reproduced here, now available at <http://arXiv.org>. Hill’s counterexamples and comments, which have been checked by an expert referee, verify the following mistakes:

1. The well-known “cut-and-choose” procedure is not Pareto-optimal, as BJK claims, although it is if one assumes 3 additional hypotheses:

(a) the cake is one dimensional,
(b) all the player measures are absolutely continuous with respect to each other, and

(c) all player measures are absolutely continuous with respect to Lebesgue measure.

2. There are problems in the definition of two of BJK’s procedures: their Surplus Procedure (SP) and Equitability Procedure (EP). These may not be well-defined. Also according to the definition of Pareto-optimal given by BJK, SP and EP are not Pareto-optimal.

3. BJK’s definition of “strategy-vulnerable” and “strategy-proof” are flawed. The player measures might all be identical. Because BJK did not take this into account when making their definition, every procedure happens to be “strategy-proof”. Indeed, BJK’s proof of Theorem 1 assumes implicitly that the player measures are different (their argument only works if the 50–50 points a and b are different).

(The above comments are a paraphrase of the report the referee gave the *Notices*.)

Brams and his colleagues have examined Hill’s analysis and, with the referee’s permission, the latter’s report on that analysis, and offered the following corrections:

1. While the model we develop on p. 1315 (after the introduction on p. 1314) does explicitly assume a one-dimensional cake, we did not explicitly assume that player measures are absolutely continuous with respect to each other and to Lebesgue measure, which are necessary for some of our theoretical results to hold.

2. The latter two assumptions are also necessary for our two cake-cutting procedures, the Surplus Procedure (SP) and the Equitability Procedure (EP), to be well-defined.

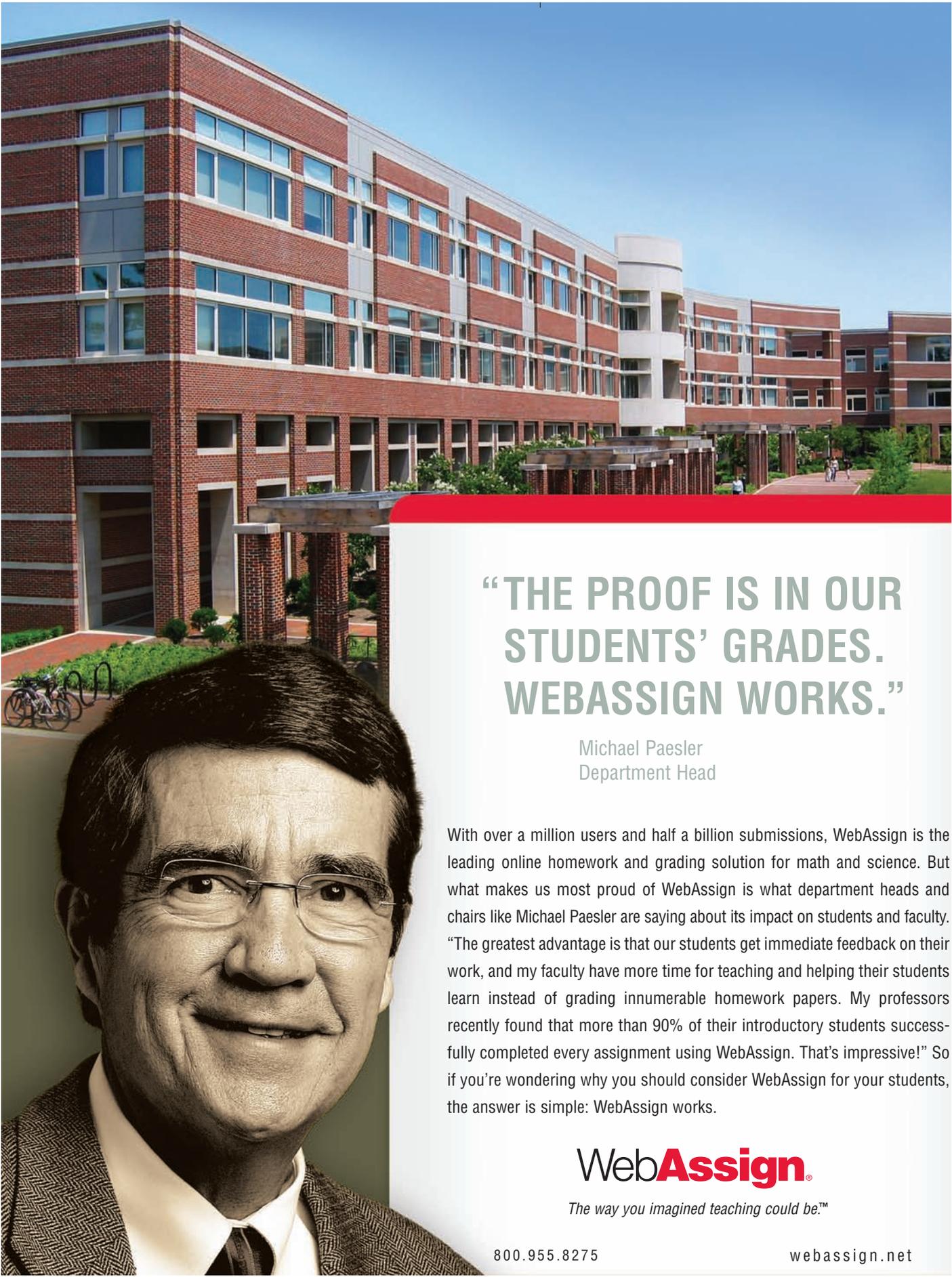
3. Our definition of strategy-proofness implicitly assumes that player measures are not identical. In the exceptional case in which they are, SP and EP may be strategy-vulnerable. Our omission of this exceptional case can be rectified by substituting “do at least as well and

sometimes better” for “do assuredly better” in our definition of strategy-vulnerability on p. 1316.

The *Notices* is grateful to Hill for his work, to our anonymous referee for carefully checking that work and the original article, and to Brams *et al* for supplying their updates.

And a final editorial comment: precision and exposition are not necessarily incompatible, although when they do conflict the *Notices* tends to favor the second, or rather encourage authors to do so. And the *Notices* also encourages correspondence from readers setting the mathematical record straight.

—Andy Magid
Editor



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Michael Paesler
Department Head

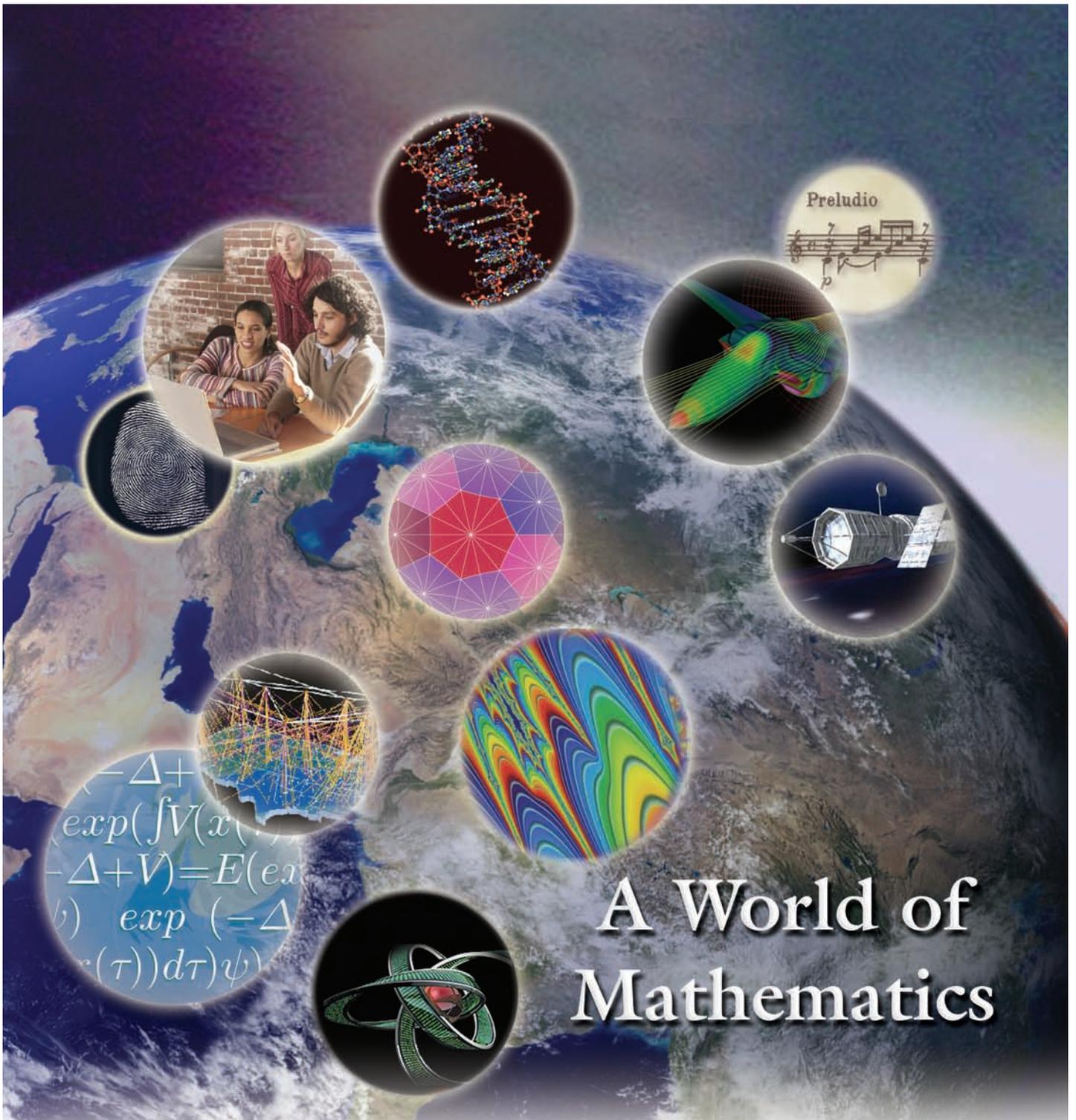
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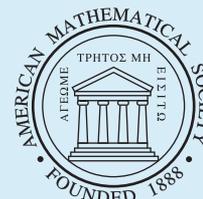
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A Remarkable Collection of Babylonian Mathematical Texts

Jöran Friberg

About 120 new Mesopotamian mathematical cuneiform texts, all from the Norwegian Schøyen Collection, are published in the author's book *A Remarkable Collection of Babylonian Mathematical Texts*, Springer (2007). Most of the texts are Old Babylonian (1900–1600 BC), but some are older (Sumerian), or younger (Kassite). In addition to the presentation and discussion of these new texts, the book contains a broad and fairly thorough account of important aspects of Mesopotamian mathematics in general, from its beginnings in the late 4th millennium BC till its last manifestations in the late 1st millennium BC.¹

The present paper contains brief presentations of a selection of interesting mathematical cuneiform texts in the Schøyen Collection (tablet numbers beginning with MS). Actually, the sub-collection of mathematical cuneiform texts in the Schøyen Collection is so extensive that it is possible to use examples from it to follow in detail the progress of Old Babylonian scribe school students in handwriting and computational ability from the first year student's elementary multiplication exercises written with large and clumsy number signs to the accomplished model student's advanced mathematical problem texts written in a sure hand and with almost microscopically small cuneiform signs.

A beginner's multiplication exercises with large number signs. Figure 1 shows an example

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An earlier version of this paper (in Swedish) was published in Normat 52:4 (2004).

¹More about Mesopotamian/Babylonian mathematics and about its apparent impact on Egyptian and Greek mathematics can be found in the author's *Unexpected Links Between Egyptian and Babylonian Mathematics*, World Scientific (2005), and in the sequel *Amazing Traces of a Babylonian Origin in Greek Mathematics*, World Scientific (2007).

of a young student's *multiplication exercises*, beginning with the computation, *in terms of sexagesimal numbers in floating place value notation*, of the product $50 \times 45 = 37\ 30$. (The corresponding result in decimal numbers is, of course, $50 \times 45 = 2,250 = 37 \times 60 + 30$.) Note that there was no cuneiform number sign for zero, but instead there were separate number signs for the ones, from 1 to 9 (upright wedges), and for the tens, from 10 to 50 (oblique wedges). In the transliteration to modern number signs (to the left in Figure 1) the tens are written with a little circle in the upper right corner.

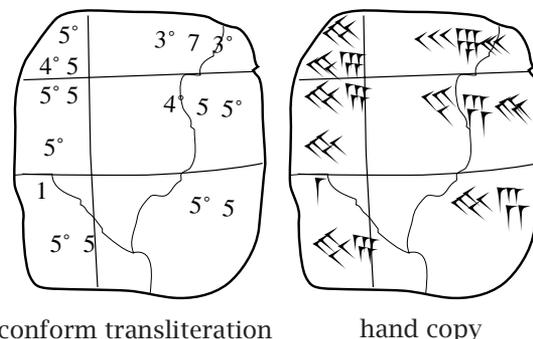


Figure 1. MS 2728. An Old Babylonian clay tablet with three multiplication exercises.

Arithmetical table texts with sexagesimal numbers. For computations of this kind, Babylonian scribe school students could make use of *sexagesimal multiplication tables*, which they first copied from the teacher's master copy and then, at best, learned by heart. Figure 2 shows what such sexagesimal multiplication tables could look like.

This is a multiplication table listing multiples of the *head number* 12 (here in transliteration to modern number signs and letters). The repeatedly occurring word *a.rá* is a Sumerian loan word in the Babylonian text, meaning "times".

In the table are listed the products of 12 and all integers from 1 to 19, as well as all the tens from 20 to 50. The last two lines of the table assert that

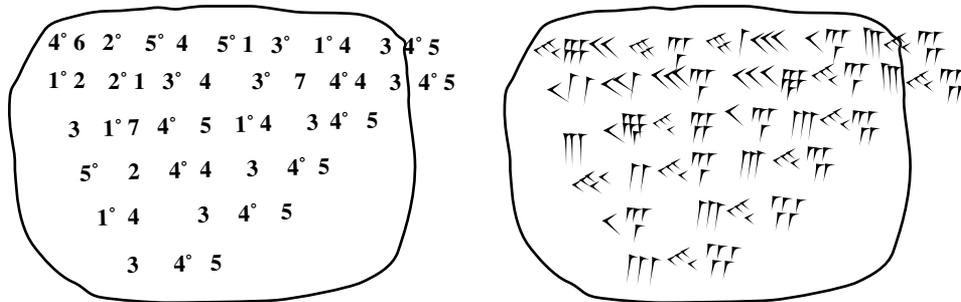


Figure 5. MS 2242. A descending table of powers, with powers of the regular number 3 45 (= sq. 15).

Then, one at a time, a factor 3 45 is removed until at the end

$$(3\ 45)^2 = 14\ 03\ 45 \text{ and } (3\ 45)^1 = 3\ 45.$$

Note that 3 45 (225) is the square of 15 and the reciprocal of 16, the square of 4.



Figure 6. The sexagesimal number 13 22 50 54 59 09 29 58 26 43 17 31 51 06 40 = 20^5 . Written in two lines on the obverse of the tablet and continued onto the reverse.



Figure 7a. A division exercise: 1 01 01 01 divided by 13 = 4 41 37.

Two different division methods can be observed in Babylonian mathematics. The first method was used when a sexagesimal number a should be divided by a *regular* sexagesimal number b . Then the first step was to compute the reciprocal of b , called in Sumerian *igi b*, probably meaning “the *opposite* number to b ”, and the second step was to compute a/b as $a \times \text{igi } b (= a \times 1/b)$. However, if b was a *non-regular* sexagesimal number, another method had to be used. One case of this kind appears in the next example (Figures 7a and 7b). There three numbers recorded below each other at first sight look like 4, 13, and 4 41 37. A

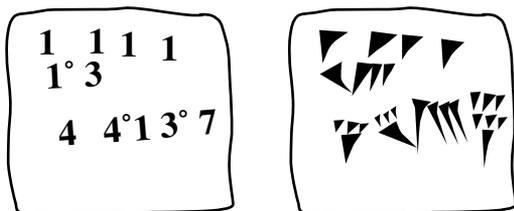


Figure 7b. MS 2317. A sexagesimal division problem with the non-regular divisor 13.

closer look reveals that the first number really is 1 01 01 01. (The zeros, indicating missing tens, are inserted here for clarity.) The small clay tablet is probably an *assignment*, a problem that a student was required to take home with him, and to return to the teacher the next morning with the correct solution. What the student had to do in this case was to show that 1 01 01 01 divided by 13 is 4 41 37.

How a division problem of this kind could be solved is shown by a similar but 500-years-older division exercise in a mathematical cuneiform text from the city Ebla. The method used in the Ebla text is that a number of successively more complicated division problems are solved, one after the other, until the desired result is reached. Thus, if one wants to divide, for instance, 1 01 01 01 by 13, the first step is to divide 1 00 by 13. The result is that

$$1\ 00 = 13 \times 4 + 8 \\ (1\ 00/13 = 4 \text{ with the remainder } 8).$$

(Double zeros, indicating missing sixties, are inserted here for clarity.) In the next couple of steps, one sees that

$$1\ 00\ 00 = 13 \times 4\ 36 + 12, \text{ and} \\ 1\ 00\ 00\ 00 = 13 \times 4\ 36\ 55 + 5.$$

If the results are added together one gets the final result that

$$1\ 01\ 01\ 01 = 1\ 00\ 00\ 00 + 1\ 00\ 00 + 1\ 00 + 1 \\ = 13 \times (4\ 36\ 55 + 4\ 36 + 4) + (5 + 12 + 8 + 1) \\ = 13 \times 4\ 41\ 35 + 26 = 13 \times 4\ 41\ 37.$$

Therefore, the answer to the division problem is that 1 01 01 01 divided by 13 is 4 41 37. From a modern point of view the method can be explained as follows, in terms of *infinite sexagesimal fractions* and *common fractions*:

$$1/13 = ;04\ 36\ 55\ 23\dots \\ (= 4/60 + 36/(60 \cdot 60) + \dots),$$

and

$$1\ 01\ 01\ 01 \times 1/13 = 4\ 36\ 55\ 5/13 + \\ 4\ 36\ 12/13 + 4\ 8/13 + 1/13 = \\ 4\ 41\ 37.$$

Solutions in table form to combined market rate problems. The clay tablet in Figure 8 contains two computations, both of the same kind. In the first computation, four different commodities (wares) have the “market rates” 1, 2, 3, and 4, all listed in column 1 of table a. What that means is that 1 weight or volume unit of the first commodity, or 2 of the second, or 3 of the third, or 4 of

1 gín kù.babbar				
a	1	1	2° 8 4° 8	2° 8 4° 8
	2	3°	1° 4 2° 4	2° 8 4° 8
	3	2°	9 3° 6	2° 8 4° 8
	4	1° 5	7 1° 2	2° 8 4° 8
b	1	gín kù.b		
	2	3°	2° 8 7 3°	5° 6 1° 5
	3	2°	1° 8 4° 5	5° 6 1° 5
	1° 5	4	3 4° 5	5° 6 1° 5
	6	1°	9 2° 2 3°	5° 6 1° 5

Figure 8. MS 2830. Two computations of combined market rates.

the fourth, can be bought for 1 shekel of silver (in Sumerian 1 gín kù.babbar). Apparently, the question is how much a person can buy for 1 shekel of silver if *equal amounts* are bought of all four commodities.

The first step of the solution algorithm is the computation of the “unit price” for each commodity. It is 1 shekel for 1 unit of the first commodity, 1/2 (= ;30) shekel for 1 unit of the second commodity, and so on. These values are listed in column 2 as the numbers

$$1, 30(= ;30 = 1/2), 20(= ;20 = 1/3),$$

and

$$15(= ;15 = 1/4).$$

Consequently, the “combined unit price” for 1 unit of each commodity is

$$(1 + ;30 + ;20 + ;15) \text{ shekels} = 2;05 \text{ shekels.}$$

Now, the reciprocal of

$$2;05 = 2 \frac{1}{12} = 25/12$$

is

$$\begin{aligned} 12/25 &= (12/5)/5 = (2;24)/5 = ;28 \ 48 \\ &= 28/60 + 48/60^2. \end{aligned}$$

Therefore, ;28 48 units of each commodity can be bought for 1 shekel of silver, as noted in column 4 of table a. The prices paid for ;28 48 units of each kind are listed in column 3. They are ;28 48 shekel for the first commodity, ;14 24 shekel for the second, and so on. It is easy to check that the sum of the prices recorded in column 3 is precisely 1 shekel. Indeed,

$$\begin{aligned} (& ;28 \ 48 + ;14 \ 24 + ;09 \ 36 + ;07 \ 12) \text{ shekels} \\ &= 1 \text{ shekel.} \end{aligned}$$

Clearly, then, the object of the exercise was to compute the “combined market rate” ;28 48.

Geometric exercises. Old Babylonian round or square “hand tablets”, hastily inscribed with numbers or geometric figures, seem to have been a kind of brief notes, written down by scribe school students more or less attentively listening to a teacher’s explanation of how a mathematical problem should be solved. It is likely that, precisely as in the case of the small clay tablet in Figure 7a, each student was supposed to go home with his hand tablet and spend part of the evening writing down a detailed version of the solution procedure, to be brought back to school the next day.

In Figure 9 is shown an example of such a hand tablet, with a diagram showing a parallel trapezoid divided in three parts by two transversals parallel to the base and the top of the trapezoid. A reasonable interpretation of this text is that the student was expected to find the lengths of the four parallel straight lines in the case when it is known that the two transversals divide the long side (or, rather, the height) of the trapezoid in three parts of length 10, 20, and 30 “rods” (1 rod = 6 meters), while the whole trapezoid is divided in three parts of which the first and the third have the same area, 1 40 square rods. If the lengths of the four parallel straight lines are called p, q, r, s , then a problem of this kind can be replaced by *four linear equations for four unknowns*:

$$\begin{aligned} (p + q)/2 \times 10 &= 1 \ 40, \\ (r + s)/2 \times 30 &= 1 \ 40, \\ (p - q)/10 &= (q - r)/20 = (r - s)/30 \end{aligned}$$

The solution to this system of equations is indicated in the diagram:

$$p = 10 \ 50, q = 9 \ 10, r = 5 \ 50, s = 50.$$

The example demonstrates a clear distinction between Babylonian and Greek mathematics: While Greek geometry was *abstract and reasoning*, Babylonian geometry was *concrete and numerical*.

This distinction is also demonstrated by the next example, an elaborate diagram on another hand tablet (Figure 10). Here three parallel trapezoids of the same form and size are joined to

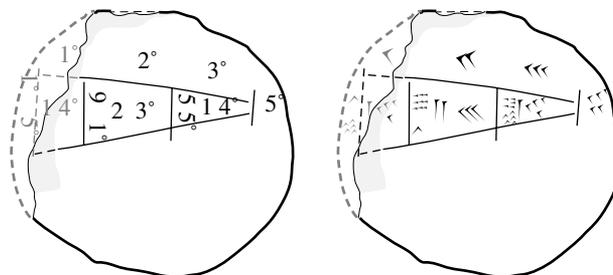


Figure 9. MS 3908. A parallel trapezoid divided by two parallel transversals.

are the Babylonian approximations to what we call $1/\pi$ and $1/(4\pi)$.) Therefore the circumference a of the circle can be computed as the solution to the quadratic equation

$$\text{sq. } (;20a + 2b) - ;05 \times \text{sq. } a = B,$$

or, since $\text{sq.};20-;05 = ;0640-;05 = ;0140 = \text{sq.};10$, and $4 \times ;20 = 1;20$,

$$\text{sq. } (;10a) + 1;20 b \times a + \text{sq. } (2 b) = B$$

Apparently, as indicated in two places in the diagram, $b = 15$, and, as indicated by the notations near the left edge of the clay tablet, $\text{sq. } (2b) = \text{sq. } 30 = 15 \text{ } 00$. Therefore, the equation above for a can be reduced to

$$\begin{aligned} \text{sq. } (;10a) + 20 \times a + 15 \text{ } 00 &= B, \text{ or} \\ \text{sq. } (;10a + 1 \text{ } 00) &= B + 45 \text{ } 00. \end{aligned}$$

Counting backwards from the most likely solution, one finds that the given value for B probably was 39 36;33 45. With this value for B , the equation for a becomes

$$\begin{aligned} \text{sq. } (;10a + 1 \text{ } 00) &= 39 \text{ } 36;33 \text{ } 45 + 45 \text{ } 00 \\ &= 1 \text{ } 24 \text{ } 36;33 \text{ } 45 = \text{sq. } 1 \text{ } 11;15. \end{aligned}$$

Consequently,

$$\begin{aligned} ;10a + 1 \text{ } 00 &= 1 \text{ } 11;15, \text{ so that} \\ a &= 1 \text{ } 07;30, \quad ;20a = 22;30, \text{ and } s = 52;30. \end{aligned}$$

Note that the value $s = 52;30$ is recorded along the side of the square, and that the corresponding value $\text{sq. } s = 45 \text{ } 56;15$ is recorded near the middle of the square.

An Old Sumerian metric table of rectangles.

The oldest mathematical text in the Schøyen Collection (Figure 12) is an Old Sumerian table text from ED III (the Early Dynastic III period, c. 2600–2350 BC). It is so old that the sexagesimal numbers appearing in it are written without the use of place value notation, with special number signs not only for 1 and 10 but also for 60 and $10 \cdot 60$. The sign for 60 is a larger variant of the sign for 1, and the sign for $10 \cdot 60$ is the sign for 60 with the sign for 10 inside. In addition, the text is so old that numbers are not written with cuneiform (wedge-like) number signs but with rounded signs, punched into the clay of the tablet with a round stylus used only for numbers.

The first six lines of this text can be interpreted as a “metric table of rectangle sides and areas”. In each line are recorded first the length of the short side of a rectangle (Sum.: sag), then the length of the long side, and finally the area of the rectangle (Sum.: aša₅). In all the six lines, the long side is 60 times as long as the short side. This artificially imposed condition is enough to show that the text is mathematical rather than “practical” (a surveyor’s work notes). In the transliteration below of the six

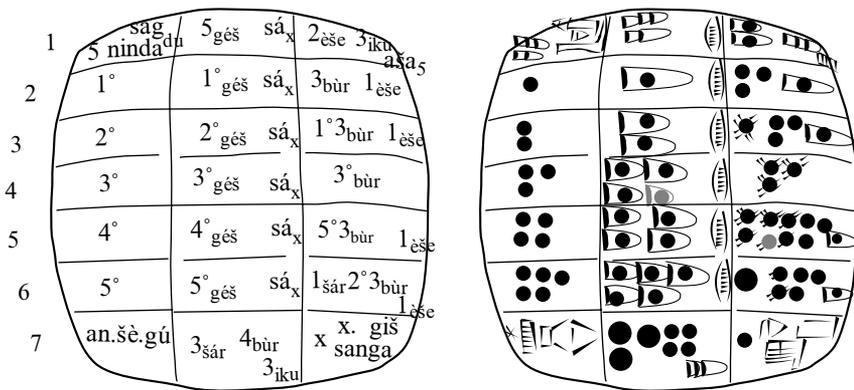


Figure 12. MS 3047. An Old Sumerian metric table of rectangle sides and areas.

lines of the metric table of rectangles, the following Sumerian terms are used:

1 gēš = sixty, 1 iku = sq. (10 rods),
1 ēše = 6 iku, 1 būr = 3 ēše, 1 šár =
sixty būr.

The seventh line gives the sum (Sumerian: an.šè.gú) of the six computed areas. This line may have been added to the six lines of the metric multiplication table in order to artificially give the exercise the appearance of a practical text!

The sum can be computed as follows:

5 rods × 5 gēš (rods) = 2 ēše 3 iku (2 1/2 ēše)
10 × 10 gēš = 3 būr 1 ēše (10 ēše)
20 × 20 gēš = 13 būr 1 ēše (40 ēše)
30 × 30 gēš = 30 būr (90 ēše)
40 × 40 gēš = 53 būr 1 ēše (160 ēše)
50 × 50 gēš = 1 šár 23 būr 1 ēše (250 ēše)
sum 3 šár 4 būr 3 iku (552 1/2 ēše)

Babylonian labyrinths of a previously unknown type. Two clay tablets in the Schøyen Collection are inscribed with labyrinths. Both labyrinths are of completely new types, which is greatly surprising, since up till now all known ancient drawings or depictions of labyrinths have been either simple and uninteresting or diverse variants of the classical “Greek” or “Mycenaean” labyrinth. One of the new Babylonian labyrinths is the one in Figures 13 and 13a. Unlike the classical labyrinth it is (fairly) symmetrical, and there are two openings into the labyrinth. If you enter through one of the openings, you will ultimately exit through the other one. (Due to a misinterpretation of an unclear photo, an unsymmetrical version of the labyrinth with two dead ends at the center was proposed in section 8.3a of my book *A Remarkable Collection*. I am very grateful to Tony Phillips for pointing out the mistake. The same easily corrected mistake was made in section 8.3c of the book in the case of a more complicated Babylonian rectangular labyrinth with two open and eight closed gates.) The labyrinth is skillfully and exactly drawn, which

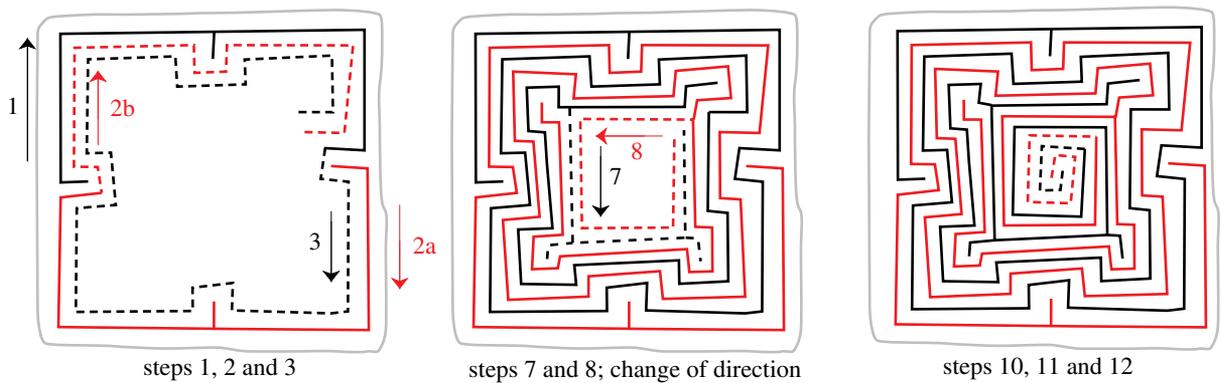


Figure 13. MS 4515. The step-wise algorithm for the construction of the Babylonian square labyrinth. In steps 1 and 2a, the outer walls are constructed, with two open and two closed gates. After step 2a, alternatingly red follows black, at a constant distance, or black follows red, at the same constant distance.



Figure 13a. A Babylonian square labyrinth.

would hardly have been possible if the one who drew it had not used a cleverly devised algorithm for the drawing of the labyrinth. Moreover, that algorithm must have been totally different from the well known algorithm for the construction of a classical Greek labyrinth.

Generating rules for rational solutions to the “Pythagorean equation”. There are six larger “problem texts” in the Schøyen Collection, with more or less explicit questions, solution procedures, and answers. In Figure 14 is exhibited an example of an Old Babylonian problem text. One of the surprises in this new text is the set of five exercises in § 3. In each one of the five exercises,

a pair of *reciprocal sexagesimal numbers* is given, called *igi* and *igi.bi*. In § 3 e, for instance,

igi = 1 12 and *igi.bi* = 50 (floating values).

It is easy to check that (with appropriately chosen absolute values) $igi \times igi.bi = 1;12 \times ;50 = 1$. With these given values, the first step of the procedure is the computation of the half-sum

$(igi + igi.bi)/2 = (1;12 + ;50)/2 = 1;01$.

Then are computed, in succession,

sq. 1;01 = 1;02 01, sq. 1;01 - 1 = ;02 01, and the square side sqs. ;02 01 = ;11.

In the last line of the exercise, ;11 is called “the 5th short side” (Sum.: sag ki.5).

Similarly in § 3 d, where *igi* = 1;20, *igi.bi* = ;45, so that $(igi + igi.bi)/2 = 1;02\ 30$, sq. 1;02 30 = 1;05 06 15, sq. 1;02 30 - 1 = ;05 06 15, and the “4th short side” = sqs. ;05 06 15 = ;17 30. It is clear that the purpose of each one of the five exercises is to construct a rectangle with rational sides and rational diagonal, “normalized” in the sense that the long side = 1. The basic idea is to let the rational diameter be a *half-sum* of the form $(igi + igi.bi)/2$, with $igi \times igi.bi = 1$, at the same time as the long side is required to be 1. Then the short side will automatically be a *half-difference* of the form $(igi - igi.bi)/2$, and therefore rational. It is easy to check that in § 3 e, for instance, $(1;12 - ;50)/2 = ;11$ = the 5th short side.

It is explicitly shown by these five exercises that Old Babylonian mathematicians were aware of the fact that arbitrarily many rectangles with rational sides *u*, *s*, and diagonal *d* can be constructed by use of the “generating rule”

$$d, u, s = (igi + igi.bi)/2, 1, (igi - igi.bi)/2,$$

where *igi*, *igi.bi* are arbitrarily chosen regular sexagesimal numbers with $igi \times igi.bi = 1$. Now, there are always integers *p* and *q* such that

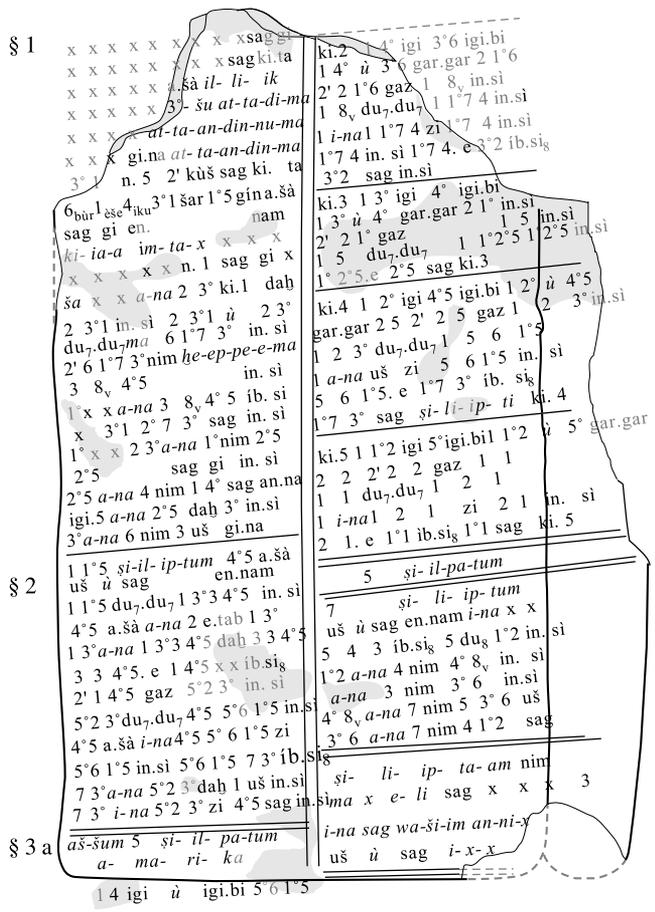


Figure 14. MS 3971. Transliteration of an Old Babylonian mathematical problem text.

$igi = p/q$ and $igi.bi = q/p$, so that
 $(igi + igi.bi)/2, 1, (igi - igi.bi)/2$
 $= \{(sq. p + sq. q), 2 p \times q, (sq. p - sq. q)\}/(2 p \times q)$.

This Old Babylonian generating rule for the rational sides and diagonal of a rectangle is essentially identical to the modern generating rule, of Greek origin, for the rational sides of a right-angled triangle. (Note, however, that according to Old Babylonian conventions, p/q must be a regular sexagesimal number and $(igi - igi.bi)/2 < 1$, in other words $sq. p - sq. q < 2 p \times q$.)

It is interesting that the examples in § 3 of the new text in Figure 14 strongly support the interpretation of the famous table text Plimpton 322 suggested by the present author already in a paper in *Historia Mathematica* in 1981!

The Babylonian diagonal rule in 3 dimensions.
 In Figure 15 is shown the reverse of a small fragment in the Schøyen Collection of a large mathematical text with mixed problems. The text is possibly Kassite (post-Old Babylonian). By luck, the fragment contains a perfectly preserved summary of the various kinds of problems appearing in the text. No other known large Babylonian problem

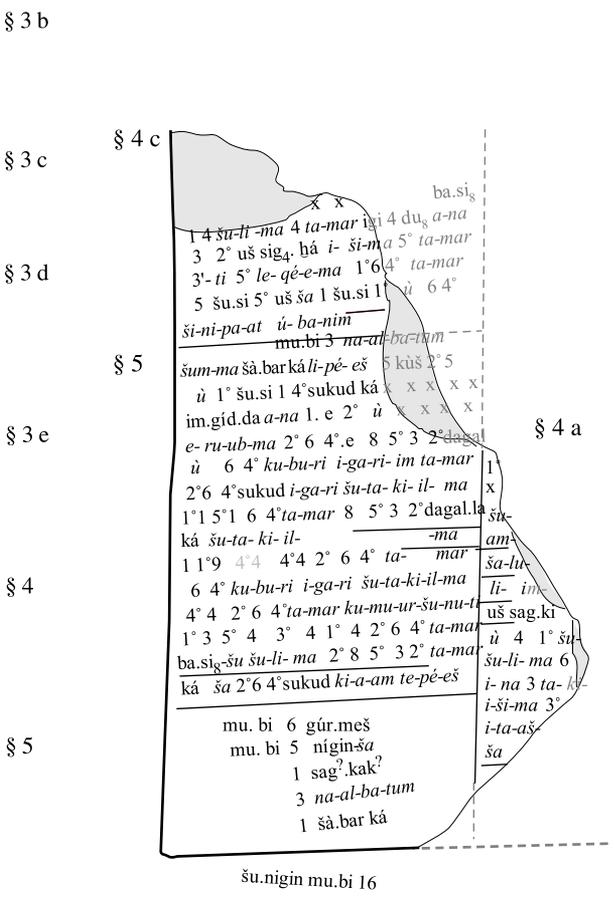


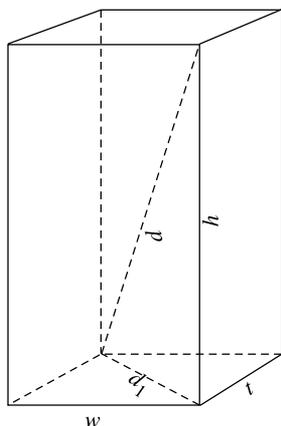
Figure 15. MS 3049, reverse. A problem for an "inner diagonal", and a summary.

text, except a second text in the Schøyen Collection (see Figure 17), contains a similar summary.

According to the summary, the whole text originally contained 16 exercises, or, more precisely, 6 problems for "circles" (Sum.: gúr.meš), 5 problems for "squares" (Sum.: nigin), 1 problem for a "triangle" (Sum.: sag.kak), 3 problems for "brick molds" (trapezoids?) (Bab.: na-al-ba-tum), and 1 problem for an "inner diagonal of a gate" (Sum.: ša.bar ká). The problem for an inner diagonal (perfectly preserved on the reverse of the fragment) is a totally unexpected surprise in a Babylonian mathematical text (see Figure 16).

The object of the exercise is a gate in a city wall. The height h of the gate is "5 cubits and 10 fingers" = $5 \frac{1}{3}$ cubits = ;26 40 (rods), the width w is ;08 53 20, and the thickness t of the city wall is ;06 40. The "inner diagonal" d of the gate is computed as follows, by use of a three-dimensional version of the Old Babylonian "diagonal rule" (incorrectly known as the "Pythagorean equation"):

$$sq. d = sq. h + sq. w + sq. t = ;11 51 06 40 + ;01 19 00 44 26 40 + ;00 44 26 40 = ;13 54 34 14 26 40, d = sqs. ;13 54 34 14 26 40 = ;28 53 20.$$



$$\begin{aligned}
 h &= 0;26\ 40\ \text{rods} = 12/27\ \text{rods} \\
 w &= 0;08\ 53\ 20\ \text{rods} = 4/27\ \text{rods} \\
 t &= 0;06\ 40\ \text{rods} = 3/27\ \text{rods} \\
 d &= 0;28\ 53\ 20\ \text{rods} = 13/27\ \text{rods} \\
 d_1 &= 5/27\ \text{rods} \quad (\text{the bottom diagonal})
 \end{aligned}$$

$$\text{sq. } d = \text{sq. } h + \text{sq. } d_1$$

$$\text{sq. } d_1 = \text{sq. } w + \text{sq. } t$$

$$\text{sq. } d = \text{sq. } h + \text{sq. } w + \text{sq. } t$$

Figure 16. The construction of the data in the problem for an “inner diagonal of a gate”.

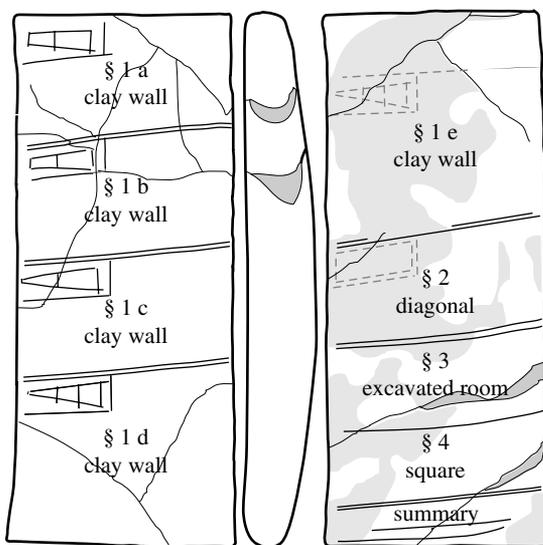


Figure 17. MS 3052. A mathematical problem text with 4 themes and a summary.

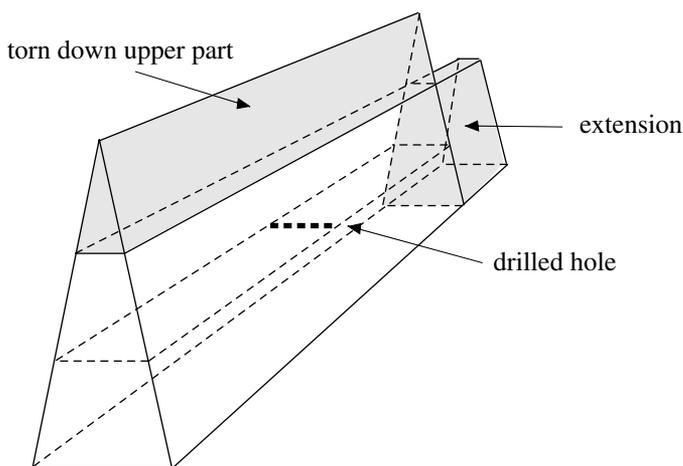


Figure 18. MS 3052 § 1 d. A clay wall with an extension and a hole.

An explanation for the complicated form of the data is easy to find, since

$$h = ;26\ 40 = 12/27, w = ;08\ 53\ 20 = 4/27, t = ;06\ 40 = 3/27, \text{ and } d = ;28\ 53\ 20 = 13/27.$$

Therefore, the given values of the parameters for the gate can be understood as

$$d, h, w, t = 1/27 \cdot (13, 12, 4, 3).$$

The “diagonal quartet” (13, 12, 4, 3) is a solution in integers to the equation

$$\text{sq. } d = \text{sq. } h + \text{sq. } w + \text{sq. } t.$$

It is obvious that it was constructed through a combination of the two “diagonal triples” (13, 12, 5) and (5, 4, 3). The idea must have been that if d_1 is the diagonal of the bottom rectangle of the gate, then

$$\text{sq. } d = \text{sq. } h + \text{sq. } d_1 \text{ with } \text{sq. } d_1 = \text{sq. } w + \text{sq. } t.$$

Therefore, $d, h, d_1 = 1/27 \cdot (13, 12, 5)$ and $d_1, w, t = 1/27 \cdot (5, 4, 3)$.

Complicated stereometric problems disguised as problems for clay walls. The clay tablet shown in outline in Figure 17 is a problem text in the Schøyen Collection with a well preserved obverse but a much less well preserved reverse. Just like the text in Figure 15, this text ends with a summary of the four themes appearing in it.

According to the summary, § 2 is a problem for a “diagonal”. It is, actually, an *igi-igi.bi* problem of the same kind as the exercises in § 3 of MS 3971 (Figure 14). The theme of § 3 is an “excavated room”, and the theme of § 4 a “square”. The theme of § 1, which contains 5 exercises, is a “clay wall”. The 5 associated diagrams, looking like depictions of the cross sections of 5 clay walls. Some of the problems in this paragraph are quite complicated and lead to equations that are solved by use of really surprising solution procedures. No Babylonian mathematical texts with similar problems or solution procedures have been published earlier.

The problem in § 1 a is about a clay wall with a trapezoidal cross section. The trapezoid has a given height, 6 cubits, a given base, 3 cubits, and a given top, 1/3 cubit. The length of the clay wall is given, too, 3 00 rods. Now the clay wall has to be extended by 20 rods. The material for the extension is obtained through tearing down the upper part of the original clay wall. The question is how much lower the new wall will become. The answer is 1 1/2 cubit lower.

The clay wall in § 1 b has again a trapezoidal cross section. The length, height, and volume of the clay wall are given. At a certain height over the ground a hole drilled through the clay wall has a given length. The question is how wide the clay wall is at the base and at the top.

In § 1 c, which is similar to § 1 b, the clay wall has a triangular cross section, and the problem in

§ 1 d (Figure 18) is a combination of the problems in §§ 1 a and 1 c. It is likely that the problem in the damaged § 1 e was a combination of the problems in §§ 1 a and 1 b.

Apparently, § 1 of the text in Figure 17 is an excerpt from some large and systematically organized Old Babylonian “theme text” with elegantly devised problems.

The weight of a colossal icosahedron made of 20 finger-thick copper plates. Perhaps the most interesting mathematical cuneiform text in the Schøyen Collection is the one shown in Figure 19. It is a small clay tablet with a minute script and an unusual terminology. It is probably Kassite, that is from the time *after* the Old Babylonian period in Mesopotamia (the second half of the second millennium BC). Only one mathematical problem text from the Kassite period was published earlier.

The text begins with a curious computation of the number of certain “gaming-piece fields”. If this translation of the corresponding Sumerian term in the text is correct, then “gaming-piece fields” must be geometric figures looking, in some way, like gaming-pieces. The number N of such figures is computed in the following way:

Given is a “constant” 6.

This constant is diminished by 1, and the remainder is multiplied by 4.

The result is that $N = (6 - 1) \cdot 4 = 20$.

The next step of the procedure is the computation, in the following way, of the area A of a “gaming-piece field” with the side 3 cubits:

3 cubits = ;15 rods, $1/2 \cdot 3$ cubits = ;07 30 rods,

$1/2 \cdot 3$ cubits \times 3 cubits = ;01 52 30 sq. rods,

$1/8 \cdot$;01 52 30 sq. rods = ;00 14 03 45 sq. rods,

$A =$ (;01 52 30 - ;00 14 03 45) sq. rods = ;01 38 26 15 sq. rods.

The computation shows that “gaming-piece field” is a term with the meaning “equilateral triangle”. Indeed, if s is the side of an equilateral triangle, then the area of the triangle is

$$A = 1/2 \cdot \text{sq. } s \cdot \sqrt{3}/2.$$

The same equation for the area of an equilateral triangle is used in the text in Figure 19, but with $\sqrt{3}/2$ replaced by the approximation $1 - 1/8 = 7/8$. This means that the approximation used for $\sqrt{3}$ was $7/4$, which is a good approximation, since $\text{sq. } 7/4 = 49/16 = 3 \frac{1}{16} (= 3;03 \text{ 45})$.



Figure 19. MS 3876. A computation of the weight of a colossal icosahedron.

In the last part of the text is computed the weight of a “horn figure” composed of $(6 - 1) \cdot 4 = 20$ gaming-piece figures (equilateral triangles) made of 1 finger thick copper plates. The first step of this part of the procedure is the computation of the combined area of the 20 gaming-piece figures:

$$\begin{aligned} 20 A &= 20 \cdot ;01 \text{ 38 26 15 sq. rods} \\ &= ;32 \text{ 48 45 sq. rods.} \end{aligned}$$

Next is computed the combined volume V of the 20 triangular copper plates, all 1 finger thick. To understand the computation, one must know that 1 finger = $1/30$ cubit = ;02 cubit, and that the Babylonian basic volume unit was 1 sq. rod \times 1 cubit. Therefore,

$$\begin{aligned} V &= ;32 \text{ 48 45 sq. rods} \times ;02 \text{ cubit} \\ &= ;01 \text{ 05 37 30 sq. rods} \times 1 \text{ cubit.} \end{aligned}$$

The last step in the procedure is a multiplication by the number 1 12, called “the constant for copper”. What this means can be explained as follows:

According to a Babylonian conventional computation rule,

1 talent is the weight of a square copper plate with the side 1 cubit and 1 finger thick, where 1 talent = 1 00 minas = 1 00 00 shekels (approximately 30 kg).

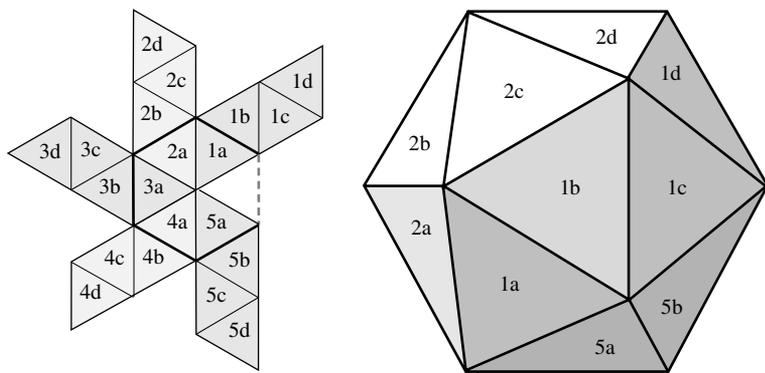


Figure 20. How an icosahedron can be formed by folding a plane figure.

Alternatively, since 1 rod = 12 cubits and 1 cubit = 30 fingers,

1 12 00 talents is the weight of 1 volume unit (1 sq. rod \times 1 cubit) of copper.

Consequently, the weight of the “horn figure” is

$$\begin{aligned}
 W &= ;01\ 05\ 37\ 30 \text{ sq. rods} \\
 &\times 1 \text{ cubit} \cdot 1\ 12\ 00 \text{ talents/1 sq.rod} \\
 &\times 1 \text{ cubit} = 1\ 18;45 \text{ talents (c. 2360 kg)}.
 \end{aligned}$$

After this explanation of all the computations in the Kassite text in Figure 19, it remains only to explain the meaning of the term “horn figure”: *Which figure can be constructed by use of 20 equilateral triangles, where 20 is computed as $(6 - 1) \cdot 4$?*

The only possible answer seems to be that “horn figure” was the name for a regular polyhedron with 20 faces, more precisely what we call an *icosahedron*, a term of Greek origin. The explanation for the curious computation of the number 20 can then be that an icosahedron can be constructed by folding together in an appropriate way a plane figure composed of $(6 - 1) \cdot 4$ equilateral triangles joined together in the way shown in Figure 20, left. The first step in the construction of that plane figure is to remove an equilateral triangle from a regular hexagon, leaving 6 - 1 equilateral triangles. The next step is to form 6 - 1 chains of four equilateral triangles, in Figure 20, left called 1a - 1d, 2a - 2d, etc. The result of the folding together of the figure composed of 6 - 1 chains is shown in Figure 20, right.

Many surprises in Babylonian mathematics.

The six Babylonian problem texts in the Schøyen Collection amply confirm the empirical rule that *all new Babylonian problem texts tend to contain surprises*. What this means is that still very little is known about the true extent of Babylonian mathematics. Why that is so is probably because *very few of the known Babylonian cuneiform texts are well organized original theme texts* produced by some of the extraordinarily talented but anonymous

mathematicians who laid the foundation for Babylonian mathematics. What is known, so far, is mainly a large number of excerpts from table texts, and various simple exercises, written by scribe school students at a relatively elementary level, often full of errors. A much smaller number of known advanced exercises were probably copied by older students from the teachers’ treasured original theme texts. There are also several known mathematical “recombination texts”, large clay tablets apparently produced by enterprising teachers who more or less systematically collected and wrote down together such copies of parts of the original theme texts. For all these reasons, the picture we presently have of Babylonian mathematics at the most advanced level is probably far from complete.

Other examples of color photographs like the ones in this article can be found at <http://cdli.uci.edu> by searching for author Friberg. More information can be found at the author’s homepage <http://www.geocities.com/jranfrib>.

The American Mathematical Society and the Pacific Institute for the Mathematical Sciences present

The AMS Einstein Public Lecture in Mathematics

Freeman Dyson Birds and Frogs



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Professor Emeritus
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Saturday, October 4

6:00 p.m.

University of British Columbia

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Room 2

Some mathematicians are birds, others are frogs. Birds fly high in the air and survey broad vistas of mathematics out to the far horizon. They delight in concepts that unify our thinking and bring together diverse problems from different parts of the landscape. Frogs live in the mud below and see only the flowers that grow nearby. They delight in the details of particular objects, and they solve problems one at a time. I happen to be frog, but many of my best friends are birds. The main theme of the talk is this: mathematics needs both birds and frogs. Mathematics is rich and beautiful because birds give it broad visions and frogs give it intricate details. Mathematics is both great art and important science, because it combines generality of concepts with depth of structures. It makes no sense to claim that birds are better than frogs because they see farther, or that frogs are better than birds because they see deeper. The world of mathematics is both broad and deep, and we need birds and frogs working together to explore it.

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Uncovering a New L -function

Andrew R. Booker

In March of this year, my student, Ce Bian, announced the computation of some “degree 3 transcendental L -functions” at a workshop¹ at the American Institute of Mathematics (AIM). This article aims to explain some of the motivation behind the workshop and why Bian’s computations are striking. I begin with a brief background on L -functions and their applications; for a more thorough introduction, see the survey article by Iwaniec and Sarnak [2].

L -functions and the Selberg Class

There are many objects that go by the name of L -function, and it is difficult to pin down exactly what one is. In one of his last published papers [5], the late Fields medalist A. Selberg tried an axiomatic approach, basically by writing down the common properties of the known examples. This resulted in what is generally known as the “Selberg class”. Before discussing the list of axioms, it is helpful to consider a few concrete examples.

The simplest and most familiar example of an L -function is the *Riemann ζ -function*,

$$\zeta(s) = \sum_{n=1}^{\infty} n^{-s} = \prod_{p \text{ prime}} \frac{1}{1 - p^{-s}},$$

which encodes information about the prime numbers. Using either formula above, one can see that $\zeta(s)$ is an analytic function of complex numbers s with $\Re(s) > 1$. However, as discovered by Riemann, ζ has an analytic continuation to the entire complex

plane, with the exception of a simple pole at $s = 1$. Moreover, it satisfies a “functional equation”: If

$\gamma(s) = \Gamma_{\mathbb{R}}(s) := \pi^{-s/2} \Gamma(s/2)$ and $\Lambda(s) = \gamma(s)\zeta(s)$ then

$$(1) \quad \Lambda(s) = \Lambda(1 - s).$$

By manipulating the ζ -function using the tools of complex analysis (some of which were discovered in the process), one can deduce the famous Prime Number Theorem, that there are asymptotically about $\frac{x}{\log x}$ primes $p \leq x$ as $x \rightarrow \infty$.

Other L -functions reveal more subtle properties. For instance, inserting a multiplicative character $\chi : (\mathbb{Z}/q\mathbb{Z})^{\times} \rightarrow \mathbb{C}$ in the definition of the ζ -function, we get the so-called *Dirichlet L -functions*,

$$L(s, \chi) = \prod_{p \text{ prime}} \frac{1}{1 - \chi(p)p^{-s}}.$$

(Here we extend the definition of χ by setting $\chi(p) = 0$ when p divides q .) It turns out that these also continue to entire functions and satisfy a functional equation similar to (1): If

$$\gamma(s, \chi) = \begin{cases} \Gamma_{\mathbb{R}}(s) & \text{if } \chi(-1) = 1, \\ \Gamma_{\mathbb{R}}(s + 1) & \text{if } \chi(-1) = -1 \end{cases} \quad \text{and} \\ \Lambda(s, \chi) = \gamma(s, \chi)L(s, \chi)$$

then

$$(2) \quad \Lambda(s, \chi) = \epsilon_{\chi} q^{1/2-s} \Lambda(1 - s, \bar{\chi}),$$

where ϵ_{χ} is a certain constant of absolute value 1 and $\bar{\chi}$ is the conjugate character. The Dirichlet L -functions encode information about primes in arithmetic progressions, which is revealed by manipulations similar to those for the ζ -function; in particular, Dirichlet’s theorem says that the primes distribute themselves evenly among the invertible residue classes modulo q .

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¹Computing arithmetic spectra, March 9–14, 2008.

Another example arises from arithmetic geometry. Given an elliptic curve E of the form $y^2 = x^3 + ax + b$ with $a, b \in \mathbb{Q}$, one can consider the number of solutions, $\#E(\mathbb{F}_p)$, to its defining equation reduced modulo prime numbers p . Based on the fact that about half of the numbers mod p are squares, a simple heuristic analysis suggests that there are roughly p such solutions, and indeed a theorem of Hasse implies the sharp bound $|p - \#E(\mathbb{F}_p)| < 2\sqrt{p}$. Thus, it is natural to consider the normalized quantity $\lambda(p) = \frac{p - \#E(\mathbb{F}_p)}{\sqrt{p}}$. (As in the case of the Dirichlet L -functions, there are finitely many primes for which the definition needs some adjustment, such as those dividing the denominators of a and b . The *conductor* of E is an integer N whose prime factorization contains all of these exceptional primes.) We can then associate an L -function, called a *Hasse-Weil L -function* in this case, given by the product

$$L(s, E) = \prod_{p \text{ prime}} \frac{1}{1 - \lambda(p)p^{-s} + \chi_N(p)p^{-2s}},$$

where $\chi_N(p) = 0$ if p divides N and 1 otherwise. Again from the definition and Hasse's bound we see that $L(s, E)$ is analytic for $\Re(s) > 1$. However, the Shimura-Taniyama-Weil conjecture, now a theorem of Wiles et al., implies that $L(s, E)$ continues to an entire function and satisfies a functional equation: If

$$\begin{aligned} \gamma(s, E) &= \Gamma_{\mathbb{R}}(s)\Gamma_{\mathbb{R}}(s + 1) \quad \text{and} \\ \Lambda(s, E) &= \gamma(s, E)L(s, E) \end{aligned}$$

then

$$\Lambda(s, E) = \epsilon_E N^{1/2-s} \Lambda(1-s, E),$$

for a certain $\epsilon_E \in \{\pm 1\}$. As is now well known, the analytic properties of these L -functions lie at the heart of Wiles' proof of Fermat's Last Theorem.

So what do these examples have in common? One difficulty with Selberg's approach is that it is not obvious which properties should be considered intrinsic and which not, and there is no general agreement on that point. A few things are clear, however:

- An L -function should be given by an *Euler product*. In all known cases, it takes the form

$$L(s) = \prod_{p \text{ prime}} \frac{1}{f_p(p^{-s})},$$

where f_p is a polynomial of a fixed degree $r \geq 1$, with the exception of at most finitely many primes p , for which the degree can be smaller than usual. Moreover, the product should converge absolutely for s with $\Re(s) > 1$, and thus define an analytic function in that region.

- $L(s)$ should continue to an entire function, with the exception of at most finitely many poles on the line $\Re(s) = 1$. Moreover, the analytically continued function should satisfy a functional equation of the following form: If

$$\begin{aligned} \gamma(s) &= \prod_{j=1}^r \Gamma_{\mathbb{R}}(s + \mu_j) \quad \text{and} \\ \Lambda(s) &= \gamma(s)L(s), \end{aligned}$$

for certain complex constants μ_j , then

$$\Lambda(s) = \epsilon N^{1/2-s} \overline{\Lambda(1-\bar{s})},$$

where N is a positive integer and ϵ is a constant of absolute value 1. (Note that the above examples are all of this form; in particular, $\Lambda(s, \bar{\chi}) = \overline{\Lambda(\bar{s}, \chi)}$.)

It is also expected that all of the functions in the Selberg class satisfy an analogue of the *Riemann hypothesis*, i.e., all zeros of the completed function $\Lambda(s)$ should have real part $\frac{1}{2}$. It would seem sensible to include that as an axiom, but for the fact that not a single instance of the Riemann hypothesis is yet known to be true!

Langlands' Philosophy

Another common feature of the examples above is that they are all generating functions for sequences that occur naturally in number theory. In order to extract the information that they contain, one needs to know the nice analytic properties (i.e., analytic continuation and functional equation) that the generating functions possess. However, as is apparent from the example of elliptic curves, those properties can be difficult to establish. Fortunately, we have a source of L -functions with good analytic properties, known as *automorphic forms* or *modular forms*. The problem is thus reduced to showing that an L -function of arithmetic interest is equal to one arising from an automorphic form; this is in fact what Wiles et al. proved in their resolution of the Shimura-Taniyama-Weil conjecture.

The study of automorphic forms is a discipline in its own right, called the *Langlands program*, after R. P. Langlands, who was arguably the first to understand the scope for applying them to number theory. In particular, Langlands predicted the existence of certain "functorial transfers" between different types of automorphic forms, which may be viewed as a (largely conjectural) set of rules governing the expected equalities of L -functions.

Maass Forms

After accounting for all of these equalities, it turns out that there are far more automorphic forms, each with an associated L -function, than there are L -functions that can be properly interpreted as generating functions. Thus, there are many so-called "transcendental L -functions", which are

associated to automorphic forms but not obviously connected to number theory. The most classical examples are known as *Maass forms*, after H. Maass, who was the first to construct them. These are functions f on the hyperbolic upper half plane $\mathbb{H} = \{z = x + iy \in \mathbb{C} : y > 0\}$, equipped with the Riemannian metric $ds^2 = \frac{dx^2 + dy^2}{y^2}$, which are modular, in the sense that

$$(3) \quad f\left(\frac{az + b}{cz + d}\right) = f(z)$$

for all matrices $\begin{pmatrix} a & b \\ c & d \end{pmatrix}$ in a discrete subgroup Γ of $SL(2, \mathbb{R})$, the group of orientation-preserving isometries of \mathbb{H} .

The prototypical case is $\Gamma = SL(2, \mathbb{Z})$, for which an even Maass form² has a Fourier series expansion of the type

$$(4) \quad f(z) = \sum_{n=1}^{\infty} \lambda(n) \sqrt{y} K_{ir}(2\pi ny) \cos(2\pi nx),$$

where r and $\lambda(n)$ are certain real constants and K_{ir} is the classical K -Bessel function. Thus, to describe a Maass form completely, one need only specify the numbers r and $\lambda(n)$. For any choice of these data, f is an eigenfunction of the hyperbolic Laplace operator $\Delta = \text{div} \circ \text{grad} = y^2 \left(\frac{\partial^2}{\partial x^2} + \frac{\partial^2}{\partial y^2} \right)$, of eigenvalue $\frac{1}{4} + r^2$. However, there is only a discrete set of values of r and $\lambda(n)$ for which (4) is invariant under $SL(2, \mathbb{Z})$. Given such a form, the associated L -function is the series

$$L(s, f) = \sum_{n=1}^{\infty} \lambda(n) n^{-s},$$

which converges absolutely for $\Re(s) > 1$. However, as a consequence of the $SL(2, \mathbb{Z})$ -invariance of f , $L(s, f)$ continues to an entire function and satisfies the following functional equation: If

$$\gamma(s, f) = \Gamma_{\mathbb{R}}(s + ir) \Gamma_{\mathbb{R}}(s - ir) \quad \text{and} \\ \Lambda(s, f) = \gamma(s, f) L(s, f)$$

then

$$\Lambda(s, f) = \Lambda(1 - s, f).$$

Moreover, by choosing a suitable basis for the $(\frac{1}{4} + r^2)$ -eigenspace³ of Δ , one can always ensure that the coefficients $\lambda(n)$ are multiplicative as a function of n , which is equivalent to the existence of an Euler product formula

$$L(s, f) = \prod_{p \text{ prime}} \frac{1}{1 - \lambda(p)p^{-s} + p^{-2s}}.$$

Thus, these functions belong to the Selberg class.

²Meaning even as a function of x . There are also odd forms, which have cosine replaced by sine in their Fourier expansions.

³The eigenspaces are conjectured to be simple, and all numerical evidence to date supports this conclusion. Thus, if f is normalized so that $\lambda(1) = 1$ then $\lambda(n)$ is automatically multiplicative.

With a few exceptions arising from instances of the Langlands functoriality conjectures, no explicit examples of Maass forms are known. In fact, the data associated to a typical Maass form are believed to be transcendental, which explains the terminology above; thus, in a sense one can never know a typical form exactly, and all constructions of them are approximate and numerical. (This is in contrast to the more classical *holomorphic modular forms*, which have algebraic data and can be described by explicit formulas.)

Applications

That begs the question why number theorists should be interested in these functions at all. The answer lies in the relatively recent realization that in order to deduce information about a single L -function (an algebraic one, say), it is often beneficial to embed it in a “family” of similar L -functions and study the whole set of them at once.⁴ Many examples and applications of this notion are discussed in the survey paper by Michel [3]. I highlight two recent examples here.

- Hilbert’s 11th problem asks which algebraic integers in a number field are represented by values of a fixed quadratic form (e.g., which ones are sums of three squares?). It was only recently solved completely by J. Cogdell, I. Piatetski-Shapiro, and P. Sarnak [1], utilizing the full spectral theory of Maass forms over number fields.
- The following problem was raised at the AIM workshop in March:

Given a large number $X > 0$, how quickly can one determine the structure of the ideal class groups of the quadratic fields $\mathbb{Q}(\sqrt{d})$ for $0 < d < X$?

If one is allowed to assume the truth of the (generalized) Riemann hypothesis then there are known algorithms for computing such class groups very quickly—in “essentially linear time” $O_{\varepsilon}(X^{1+\varepsilon})$ for each $\varepsilon > 0$. The catch is that one cannot be sure that the results of the computation are correct without the Riemann hypothesis. However, given a fast algorithm for computing the eigenvalues and Fourier coefficients of Maass forms, such as the one discussed below, it turns out that one can certify the results of the computation unconditionally, again in essentially linear time. This has been implemented in practice by M. Jacobson et al., and is currently the

⁴While the applications to L -functions are recent, this method of attack was already familiar to number theorists from Deligne’s proof of the Weil conjectures, including a finite analogue of the Riemann hypothesis that remains some of our best evidence to date in favor of the version for L -functions.

fastest known method of computing real quadratic class groups!

The Workshop

In recognition of the important role that computation plays concerning automorphic forms and L -functions, the AIM workshop in March was an attempt to unify and extend the known computational techniques. More precisely, it addressed the following question:

To what extent can we

- (A) compute the data (i.e., Laplacian eigenvalues and Fourier coefficients) of automorphic forms, and
- (B) prove theorems about them?

There are good reasons for separating the question into two parts; while there is a long history of computations of this type, most notably algorithms for Maass forms due to H. Stark and D. Hejhal, the issue of *rigorously proving* the correctness of the computations has only recently been addressed. Moreover, in many situations, such as when giving numerical evidence for a conjecture, rigorous results are not necessary and may even be overkill. With that in mind, the sort of answer that we seek to this question is again best illustrated by the case of $SL(2, \mathbb{Z})$, for which we have the following:

- (A) Some 50,000 values of r have been computed approximately (to 6 or 7 decimal place precision), with heuristic justifications of their correctness, including some very large values (which are computationally more difficult). This is work of H. Then, based on an algorithm of Hejhal.
- (B) The first 2000 r -values (in increasing order of size) have been rigorously computed to better than 40 decimal place accuracy. The eigenspaces turn out to be simple, and for each one the first several Fourier coefficients have been rigorously computed. This is work in preparation with A. Strömbergsson, based on joint work with A. Venkatesh. Moreover, in this case we have the following theoretical result:

Theorem. *Given $\Lambda, D \geq 0$, there is an algorithm that will compute all discrete eigenvalues of Δ on $SL(2, \mathbb{Z}) \backslash \mathbb{H}$ in $[0, \Lambda]$ to within 10^{-D} in polynomial time in Λ, D . Up to standard heuristic assumptions (the simplicity of the spectrum, in particular) that can be checked at run time, this also yields the first several Fourier coefficients of each form.*

These results represent the best that one can hope for in terms of computation. However, it would be misleading to describe them as typical; nearly all success so far has been limited to the classical Maass forms and holomorphic modular forms. Indeed, “most” of the automorphic forms

of interest have never been observed directly. I describe some of these more general forms in the next section.

Higher Degree Automorphic Forms

An alternative way to realize the upper half plane is as the quotient of its isometry group by the stabilizer of any point, i.e., $SL(2, \mathbb{R})/SO(2, \mathbb{R})$. This, in turn, is isomorphic to the projective quotient $GL(2, \mathbb{R})/O(2, \mathbb{R}) \cdot \mathbb{R}^\times$, and any element of the latter group has (by the *Iwasawa decomposition*) a unique representative of the form $\begin{pmatrix} y & x \\ & 1 \end{pmatrix}$ with $y > 0$, which is associated via these identifications to the element $x + iy \in \mathbb{H}$. Expressing the elements in this form has the advantage that the linear fractional transformations in (3) turn into left-multiplication by group elements.

Another advantage is that it is now clear how to generalize the upper half plane and automorphic forms to higher-dimensional spaces; one simply replaces $SL(2, \mathbb{R})$ by a Lie group, $SO(2, \mathbb{R})$ by a maximal compact subgroup, and Γ by a co-finite (with respect to Haar measure) discrete subgroup. For example, “degree 3 hyperbolic space” is the quotient

$$SL(3, \mathbb{R})/SO(3, \mathbb{R}) \cong GL(3, \mathbb{R})/O(3, \mathbb{R}) \cdot \mathbb{R}^\times,$$

and the Iwasawa decomposition in this case says that any element has a unique representative of the form $z = xy$, where

$$x = \begin{pmatrix} 1 & x_{12} & x_{13} \\ & 1 & x_{23} \\ & & 1 \end{pmatrix} \quad \text{and} \quad y = \begin{pmatrix} y_1 y_2 & & \\ & y_1 & \\ & & 1 \end{pmatrix},$$

with $x_{12}, x_{13}, x_{23}, y_1, y_2 \in \mathbb{R}$ and $y_1, y_2 > 0$. Taking $\Gamma = SL(3, \mathbb{Z})$ gives rise to degree 3 automorphic forms, which are functions on the double coset space $SL(3, \mathbb{Z}) \backslash SL(3, \mathbb{R})/SO(3, \mathbb{R})$. Such forms have a Fourier expansion akin to (4), but with a two-parameter set of coefficients, $\lambda(n, m) \in \mathbb{C}$:

$$(5) \quad f(z) = \sum_{g \in \Gamma_\infty^2 \backslash \Gamma^2} \sum_{n=1}^{\infty} \sum_{m=1}^{\infty} \frac{\lambda(n, m)}{nm} W_{u,v} \left(\begin{pmatrix} nm & & \\ & m & \\ & & 1 \end{pmatrix} g z \right).$$

Here Γ^2 consists of all integer matrices of the form $\begin{pmatrix} a & b \\ c & d \end{pmatrix}$ with determinant ± 1 , $\Gamma_\infty^2 \subset \Gamma^2$ is the subgroup of unipotent ones, and $W_{u,v}$ is “Jacquet’s Whittaker function”. The latter is a suitable replacement for the classical K -Bessel function and cosine from (4); in degree 3 it has two parameters, $u, v \in \mathbb{R}$, which are analogous to the parameter r .

The associated L -function in this case is given by the Dirichlet series

$$L(s, f) = \sum_{n=1}^{\infty} \lambda(n, 1) n^{-s},$$

converging absolutely for $\Re(s) > 1$. Again it is always possible to choose the form so that we have

an Euler product formula, this time of the form (6)

$$L(s, f) = \prod_{p \text{ prime}} \frac{1}{1 - \lambda(p, 1)p^{-s} + \overline{\lambda(p, 1)}p^{-2s} - p^{-3s}}.$$

Moreover, it turns out that f is determined by its L -function, in the following sense. Let \tilde{f} be the “dual” form, for which (u, v) is replaced by (v, u) and the $\lambda(n, m)$ by their complex conjugates. Then we have the following identity, due to Bump:

$$\sum_{n=1}^{\infty} \sum_{m=1}^{\infty} \frac{\lambda(n, m)}{n^{s_1} m^{s_2}} = \frac{L(s_1, f)L(s_2, \tilde{f})}{\zeta(s_1 + s_2)}.$$

In particular, this shows that all $\lambda(n, m)$ are determined by the 1-dimensional sequence $\lambda(n, 1)$. Thus, working with the L -function eliminates some of the redundancy that is present in the Fourier expansion (5).

The Converse Theorem

One can also define so-called “twisted” L -functions, as follows. Let χ be a Dirichlet character of conductor q . Then we define $L(s, f \times \chi) = \sum_{n=1}^{\infty} \lambda(n, 1)\chi(n)n^{-s}$. Further, if χ has parity $a \in \{0, 1\}$, meaning $\chi(-1) = (-1)^a$, then we set

$$y(s, u, v, \chi) = \Gamma_{\mathbb{R}}\left(s + a - i\frac{2u + v}{3}\right) \Gamma_{\mathbb{R}}\left(s + a + i\frac{u - v}{3}\right) \Gamma_{\mathbb{R}}\left(s + a + i\frac{u + 2v}{3}\right)$$

and $\Lambda(s, f \times \chi) = y(s, u, v, \chi)L(s, f \times \chi)$.

It follows from the fact that f is an automorphic form that all of the twisted L -functions have nice analytic properties. In particular, $\Lambda(s, f \times \chi)$ has analytic continuation to an entire function and satisfies the following functional equation relating f to its dual and χ to its conjugate:

$$(7) \quad \Lambda(s, f \times \chi) = \epsilon_{\chi}^3 q^{3(1/2-s)} \Lambda(1-s, \tilde{f} \times \overline{\chi}),$$

where ϵ_{χ} is the factor from (2).

Remarkably, these analytic properties actually characterize the degree 3 automorphic forms; precisely, we have the follow result:

Theorem (Jacquet, Piatetski-Shapiro, Shalika). *Suppose $L(s, f)$ is an Euler product of the form given in (6) such that all complete twisted L -functions $\Lambda(s, f \times \chi)$ extend to entire functions of finite order and satisfy (7). Then $L(s, f)$ is the L -function of a degree 3 automorphic form.*

Similar results are known for automorphic forms of arbitrary degree, although the set of objects that one must twist by grows with the degree. (For instance, for degree 4 one has to twist by all degree 2 automorphic forms, including the Maass forms.) Collectively these results are known simply as the “converse theorem”. They give strong support to Langlands’ philosophy that automorphic forms are

the right source for L -functions with nice analytic properties, and they have found many applications in the Langlands program. For instance, the theorem above is the key point in the proof of one of the first cases of Langlands’ conjectures to be confirmed, called the *Gelbart-Jacquet lift*; given a Maass form with parameters r and $\lambda(p)$, it associates a degree 3 automorphic form with parameters $u = v = 2r$ and $\lambda(p, 1) = \lambda(p)^2 - 1$. This application in turn motivated the proof of the theorem.

Bian’s Computations

Besides its theoretical uses, the converse theorem also points to a method for computing automorphic forms, as follows. For his computations, Bian considered the following smooth sums, which are linear functionals on a sequence $\lambda(n)$ of complex numbers, with parameters $u, v, X > 0$ and χ a Dirichlet character:

$$(8) \quad S(\{\lambda(n)\}, u, v, X, \chi) = \frac{1}{\sqrt{X}} \sum_{n=1}^{\infty} \lambda(n)\chi(n)F_{u,v}(n/X, \chi),$$

where $F_{u,v}(y, \chi) = \frac{1}{2\pi i} \int_{\Re(s)=1} \mathcal{Y}(s, u, v, \chi)y^{-s} ds$. This F is related to Jacquet’s Whittaker function $W_{u,v}$, and it has properties similar to those of the K -Bessel function, i.e., it oscillates for small y , but eventually settles down (at a point depending on u and v) and tends rapidly to 0 as $y \rightarrow \infty$. Thus, with the cost of a small error, the series in (8) can be truncated at a point roughly proportional to X . If one imagines choosing the $\lambda(n)$ randomly from a fixed distribution of mean 0, then the sum is the result of taking a random walk of length X in the complex plane; the central limit theorem predicts that such a sum typically has size on the order of \sqrt{X} . Thus, for a random choice of the $\lambda(n)$ ’s, S should typically be of size 1.

However, if the $\lambda(n)$ happen to be the coefficients of the L -function of an automorphic form, then S has a very different behavior. Precisely, the analytic properties and functional equation (7) of the twisted L -functions are equivalent, by Mellin inversion, to the identity

$$(9) \quad S(\{\lambda(n, 1)\}, u, v, X, \chi) = \epsilon_{\chi}^3 \overline{S(\{\lambda(n, 1)\}, u, v, q^3/X, \chi)}.$$

For X much larger than q^3 , the right-hand side is a short sum, and thus S is very small. Moreover, (9) gives a linear equation relating the real and imaginary parts of the $\lambda(n, 1)$, which can be tested for any X at least as large as the point of symmetry, $q^{3/2}$. In particular, if we consider only the central point $X = q^{3/2}$ for every Dirichlet character χ of conductor $q \leq Q$, then we get a system of equations involving roughly $Q^{3/2}$ unknowns. The key point is that there are asymptotically about $\frac{18}{\pi^4} Q^2$ such

characters as $Q \rightarrow \infty$. Thus, if Q is large enough then we will have an overdetermined system, and for a given choice of parameters u and v we can test the consistency of the system of equations by computing the least squares solution.

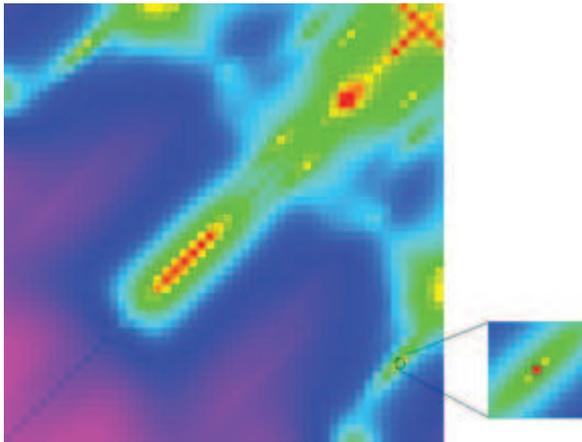


Figure 1. Bian’s initial scan and first example.

Bian’s computations followed this approach, though he used more values of X in order to reduce Q and relied on other known data about the possible locations of (u, v) . In particular, using a completely different method, S. Miller [4], who was the first to prove existence of the degree 3 forms in question (non-constructively), had earlier ruled out values of u and v that are both smaller than about 10. We also know the first several Gelbart-Jacquet lifts, which occur on the line $u = v$; the first has $u = v = 19.06739\dots$. Thus, Bian elected to search the square region with $10 \leq u, v \leq 20$. With parameters of that size, it turns out that for each choice of u and v one ends up with a (non-sparse) system of equations in about 10,000 real variables. One important practical point is that solving such systems is now well within the capabilities of a standard desktop PC; it seems unlikely that it could have been done a decade ago⁵.

Above is an image of Bian’s initial scan, which contains about 2,500 sample points. The “hot” areas indicate places where the system of equations is close to consistent. The inset image shows a zoomed and rescaled version around the warm point near the lower right-hand corner, which was Bian’s first example. This indeed turns out to correspond to an automorphic form, with parameters $(u, v) \approx (18.902415, 11.761250)$, as do three

⁵However, after seeing Bian’s results at the workshop, David Farmer, Sally Koutsoliotas, and Stefan Lemurell presented a similar method that seems to detect degree 3 forms with substantially smaller systems of equations. It remains to be seen which method, or combination of the two, will be preferable in the long run.

other points that Bian zoomed in on before the workshop⁶.

Checking the Results

One of the ironies of our lack of concrete examples of higher degree automorphic forms is that we have many conjectures about objects that have never been observed. However, when a purported example presents itself, these conjectures make it easy to tell whether the example is genuine or not.

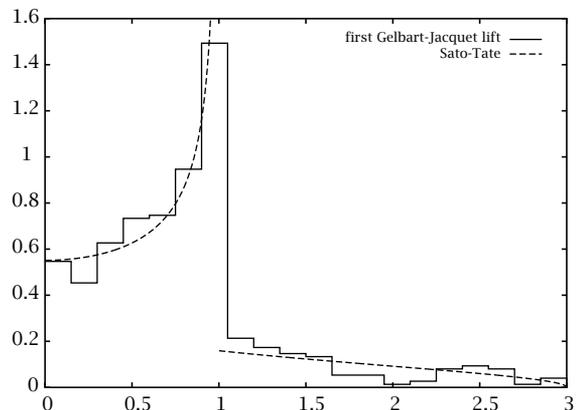
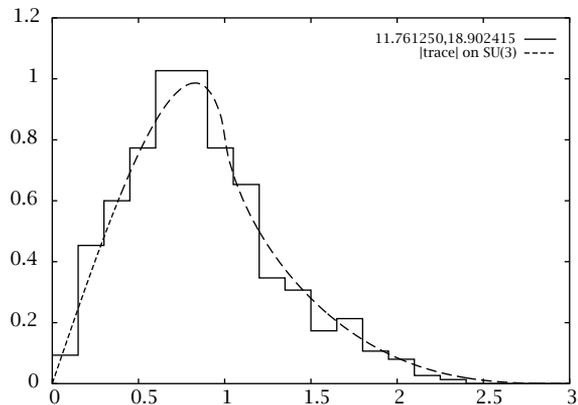


Figure 2. First 500 $|\lambda(p, 1)|$ for Bian’s first example vs. distribution of absolute trace on $SU(3, \mathbb{C})$ (top) and for first Gelbart-Jacquet lift vs. Sato-Tate distribution (bottom).

Firstly, as in the case of Maass forms for $SL(2, \mathbb{Z})$, the spectrum for these degree 3 forms is thought to be simple, meaning that there is at most one form for each pair (u, v) . One consequence is that the Dirichlet coefficients of any form will automatically be multiplicative; in particular, all $\lambda(n, 1)$ are determined by the ones for n prime.

⁶The very hot points on or near the $u = v$ line arise from another image of degree 2 forms, known as Eisenstein series; like the Gelbart-Jacquet lifts, these are well understood. The points of greatest interest lie off of the line of symmetry.

This turns out to be true (numerically, to several decimal places) for Bian's examples, a fact that was never imposed in the scanning process, which used only linear algebra.

A second, more thorough test is of the distribution of $\lambda(p, 1)$ for prime p . The Langlands conjectures imply that as $p \rightarrow \infty$, $\lambda(p, 1)$ has the same distribution as that of the trace of matrices chosen randomly from $SU(3, \mathbb{C})$ according to Haar measure. The top portion of Figure 2 compares a histogram of values of $|\lambda(p, 1)|$ from Bian's first example, for the first 500 primes, against the distribution of the absolute trace on $SU(3, \mathbb{C})$. The bottom shows a similar picture for the first Gelbart-Jacquet lift. The difference in behavior of these two examples is striking, but easy to explain; the Fourier coefficients of the lifted form are determined by those of the underlying Maass form, and hence their distribution is a distorted version of the distribution of the trace on $SU(2, \mathbb{C})$, the so-called *Sato-Tate distribution*, rather than that of a "generic" degree 3 automorphic form.

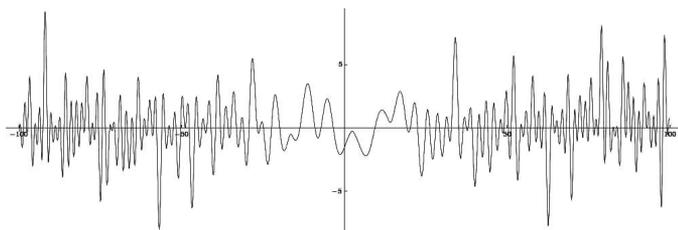


Figure 3. Plot of $L(s, f)$ along $\Re(s) = \frac{1}{2}$.

Yet a third prediction is the Riemann hypothesis. In an impressive display of computational prowess, M. Rubinstein tested this in real time at the workshop using Bian's data, as Bian and I were speaking. Figure 3 shows a graph of $L(\frac{1}{2} + it, f)$ for Bian's first example, with the phase divided out to make it real-valued, as computed by Rubinstein. The picture confirms that the first several zeros are in the expected location.

Given that Bian's examples pass all of these tests, there is very little room for doubt that he has computed genuine degree 3 automorphic forms. Nevertheless, there is still no *proof* of this. In essence, the computation of degree 3 forms has now reached the point where that of degree 2 Maass forms stood for over twenty years. The rigorous verifications and passage to degree 4 and higher should keep us busy for a few more!

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LEARNING

Book Review

An Abundance of Katherines

Reviewed by Oaz Nir

An Abundance of Katherines

John Green

Dutton Juvenile (2006)

US\$16.99, 256 pages

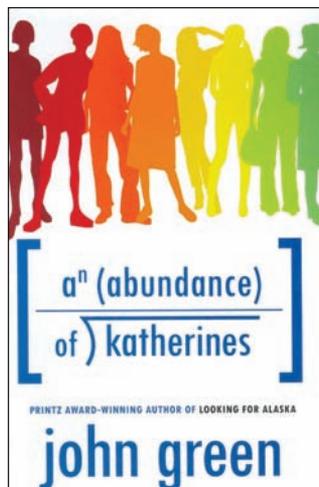
ISBN 978-0525476887

For the reader who takes an active interest in the idiosyncrasies of the intellectually gifted, and who is comfortable with the crude language and dismissive humor common to satire, John Green's *An Abundance of Katherines* is a pleasantly raucous comic experience, studded with some glimpses of insight. Gifted teenagers are Green's target audience, and he crafts the book specifically for that population.

It is a standard story. Hard-on-his-luck boy meets girl; he helps her realize she doesn't need her meaty boyfriend; he gets the girl; along the way, he learns something about life; he also helps her learn something about life; deep conversations occur long into the night, and kissing, too. All along, his *Sancho Panza* supports him; they have a fight; there is sexual jealousy between them; the sidekick feels taken for granted (because he is); they make up; the friend learns a valuable lesson. There is a road trip involved, although the travelers settle on a location rather quickly, and the new setting serves as a site of transformation for the protagonist. He gains a new perspective on his life, and on mathematics.

It is a tried and true story (but let's not be too hard here—how many stories have not been told yet?). What makes it worth reading—because it is—is the uniqueness of the characters, coupled

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with Green's distinctive voice. *An Abundance of Katherines* may be said to be a study of genius, and of the peculiar social dynamics that shape and color the experience of extremely talented youth.

Colin Singleton, former child prodigy, has just graduated from high school. He is hell-bent on having his own *Eureka moment*,

wherein he would finally think up a truly original thought and stake his immortal claim as a genius. In the meantime, he churns with a nervous energy, brimming with a self-doubt that borders on self-hatred. He gets joy out of little things: He has an encyclopedic brain and is always stating random facts that pop into his mind. He loves to anagram street signs, graffiti, any words he sees—spontaneous anagramming is “his greatest passion”. He seeks to pacify his overwhelming anxiety by having girlfriends; their words of approval—each “I love you”—helps him feel momentarily okay about himself. In fact, Colin has had nineteen girlfriends, all named Katherine.

Our starting point is Colin's dumping at the callous hands of Katherine XIX. Colin and Hassan Harbish, a crude, lazy, laughable boor and Colin's only friend, decide to take a summer road trip (Hassan's Lebanese descent is just too cute, as Colin himself is half-Jewish). Embarking from

Chicago, they make it as far as Gutshot, Tennessee—where they find everything they need: a summer job, relative anonymity, and a pretty girl for Colin to fall in love with. The girl is named Lindsey Lee Wells, which you'll notice is not the same as "Katherine"—but not to worry, for Lindsey's current boyfriend is named Colin (to avoid confusion, Hassan calls him TOC—"The Other Colin"), and so we see that the name game bodes well for our pair of star-crossed lovers. There ensues a summer full of growing pains and betrayal, great laughs and loves, life lessons—and a mathematical "Theorem of Underlying Katherine Predictability".

Green has found the right balance of seriousness and humor to make his subject matter appealing to teens—he places the characters in very real situations, but treats the situations with a slant of sarcasm. The lack of seriousness may strike adult readers as insensitive, but it would be wrong to criticize the book on this count—Green is writing to his intended audience, and he does so well.

A central theme is the distinction between prodigy and genius. Colin feels a profound dread that he is nothing more than a washed-up child prodigy, doomed to a life of base normalcy. He yearns to ascend to the hallowed rank of *genius*—to make an indelible mark on society and so secure his place in the world's intellectual history. As you might imagine, Colin is self-centered and self-deprecating. He doesn't have friends (well, only one) and complains about it regularly.

The distinction between prodigy and genius might strike a little too close to home with some adult readers. There are many prodigies—children who have a special talent, who achieve a certain limited fame—but the number of these prodigies who can focus their talents into a productive adult career is small. Green suggests that as they come of age, child prodigies feel an intense pressure to reach the next step and that in some cases this pressure can be overwhelming. In some ways, a more modest record of success as a child and young adult molds one's mindset into a healthier one—with less torment, it may be easier to achieve.

The notion of *being interesting* is another central theme. Colin yearns at every juncture to be interesting, to say interesting things, to appeal to his own sense of aesthetics by thinking up interesting things. He is a bad storyteller because he "always included extraneous details and tangents that interested only him." Hassan cajoles him into saying only interesting things by applying a stock rejoinder ("not interesting, kafir") whenever Colin's comments miss the mark. Lindsey's face is described as "not pretty so much as interesting-looking". Above all, Colin is drawn naturally to devote his mind to interesting things. In this way, Colin could have been a mathematician (well, if only he had a little more natural talent). For mathematicians,

sheer interest is sufficient to study some object. Curiosity and a (curious sense of) aesthetics has been a tremendous driving force in the development of mathematics. The well-written appendix by Daniel Biss, assistant professor at the University of Chicago and associate editor of the *Notices*, hints at the connections between these ideas. Biss does a stand-up job of communicating the basic concepts underlying the math woven throughout the novel. It is natural for the reader to wonder to what extent Biss himself associates with Colin and to what extent the relationship between Colin and Hassan approximate that of Green and Biss.

All along, Colin is trying to prove his Theorem, which is supposed to be his claim to genius. The Theorem aims to predict which of the two members of a romantic relationship will be the one to break up with the other. It's fairly morbid, really, but nevertheless we can understand how a super-intellectual, over-dumped kid would devote his brain to a task of this sort. Colin, like all of us, wants to understand—and control—the events of his life. In the end, his equation takes this form:

$$-D^7x^8 + D^2x^3 - \frac{x^2}{A^3} - Cx^2 - Px + \frac{1}{A} + 13P + \frac{\sin(2x)}{2} \left[1 + (-1)^{H+1} \frac{(x + \frac{11\pi}{2})^H}{|x + \frac{11\pi}{2}|^H} \right]$$

It is a cardinal rule in writing reviews not to give away the ending of the book. Whoops. That Colin initially thinks that such a formula is possible betrays his emotional immaturity. A turning point in the novel comes when Colin makes his Theorem fit all past cases (how many anagrams can you find for "overfitting"?), but also realizes that it can't possibly predict all future outcomes. For the mathematician, Colin's realization may strike a real chord. How is it that we move beyond the work that has already been done in our field and make a new contribution? And it adds a dimension to our understanding of young mathematicians—we see in Colin a transformation to a more mature mathematical mind, a transformation that the reader may remember experiencing for him/herself.

The process of discovery is described with Gothic, overwrought imagery:

For some reason, as he discarded equations left and right, the room seemed to grow warmer. Sweat pooled in the gauze bandage over his eyes, so he tore it off. He removed his shirt, wiping still-trickling blood from his face. Naked from the waist up, his vertebrae extruded from his skinny back as he hunched over the desk, working. He felt as he had never felt before—that he was close to an original concept.

In my own experience, math research is not quite so intense as this. But then again, I do applied math.

Green crafts the prose itself to entertain twenty-first century teens, and to that end he largely succeeds. The language is a crude vernacular, littered with images of body parts, fluids, sex acts. It's an attempt to be hip to the voice of today's youth, and it works. Parents be warned, though, that if you read the book, you may find yourself cringing at some turns-of-phrase, not limited to these gems:

- Shame about how we're gonna die here, though. I mean, seriously. An Arab and a half-Jew enter a store in Tennessee. It's the beginning of a joke, and the punch line is "sodomy".
- To Colin, tampons were a little bit like grizzly bears: he was aware of their existence, but he'd never seen one in the wild, and didn't really care to.

Teens may well *LOL* at these, and as an early-twenty-something myself, I have to plead guilty to chuckling at a few of Green's precious one-liners. At times his writing is crisp and witty, but it remains highly audience-specific. In addition, Green really nails a number of great passages. His vivid descriptions paint colorful, detailed scenes. Teenage readers will delight in the scene where Hassan and Colin first meet Lindsey at the tomb of the Archduke Franz Ferdinand (located in Gutshot, TN) and no less at the Monty Pythonesque boar hunt—a sequence that comes loaded with all the bells and whistles of sex and violence.

And in addition to that passage quoted earlier (a.k.a. "blood, sweat & math"), Green does at another time capture the experience of research with remarkable sharpness: "He kept at the formula, *haunted* by the feeling that his head was just about to wrap around something big and important" (emphasis added). That sort of drive is something most every mathematician can relate to.

An Abundance of Katherines also explores the role that parents play in the lives of gifted youth. Colin's father is an unyielding taskmaster, and some of his words to Colin border on the criminal. When Colin announces his intentions to take his road trip, his father responds, "Will you really be happy just driving around aimlessly? That doesn't seem like you. Frankly, it seems like *quitting*." And a moment later, he follows up with, "It pains me to say this, Colin, but if you wish to continue to grow intellectually, you need to work harder right now than you ever have before. Otherwise, you risk wasting your potential." His father's pressuring no doubt contributes to Colin's impossibly high standards for success.

It is worth delving a bit deeper. Indeed, Colin may have been doomed by Nature alone—even

though, in practice, he has both Nature and Nurture working against him. Without explicit pressure from his parents, an implicit reward system would likely have arisen by default, where parental praise would motivate Colin to keep achieving (because even parents who are careful to avoid pushing their children will nevertheless provide positive feedback—really, who wouldn't?). But his father's unending pushing and less-than-subtle criticism lead Colin's internal drive to grow to the point of excruciating insatiability.

As a book for young adults, *An Abundance of Katherines* contains a powerful central lesson. Each of the main characters learns a fundamental truth, which together may be summed up in the maxim: *Life is complicated; if you think you've figured it out, you haven't.*

By the novel's end, Colin no longer feels as if he's wasted his life—he sees the power of re-visioning the past and the promise of the unknowable future: it holds promise precisely because it is unknowable. Colin's attempts to use mathematics to predict it may have failed, but the failure is fortuitous. He has learned the important lesson that the power of mathematics has its limits, limits that we need not just accept, but actually rejoice in. True, things may not work out with Lindsey; true, he'll undoubtedly still feel that unyielding drive to excel—to fulfill his potential—and that comes with a tremendous pressure. But now he has undergone a change of mindset that gives us some hope, as companions in his story, that *this time* may be different, that he may be able to deal with the pressure that comes with greatness, that he may be able to live a productive *and* happy life.



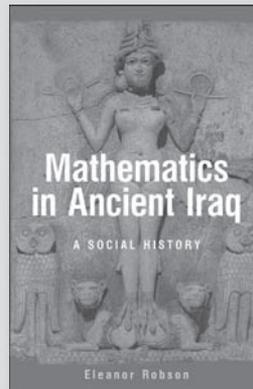
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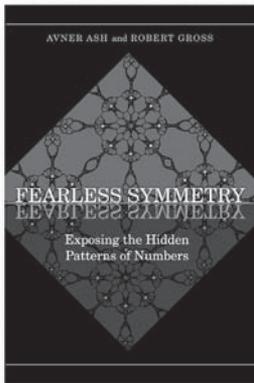
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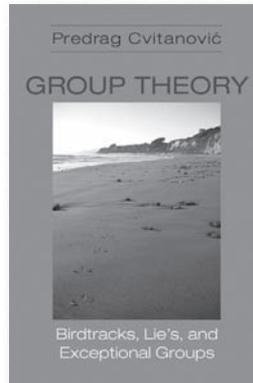
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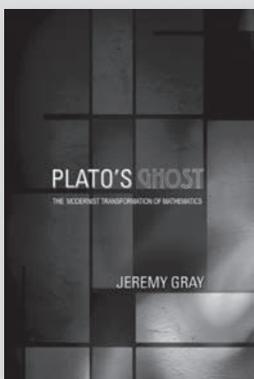


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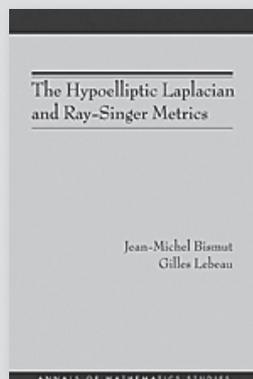
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WHAT IS . . .

Stable Commutator Length?

Danny Calegari

Kronecker allegedly once said, “God created the natural numbers; all the rest is the work of man.” But to a topologist, the natural numbers are just a tool for classifying orientable surfaces, by counting the number of handles (or *genus*).

Commutator length is the algebraic analogue of “number of handles” in group theory. If G is a group, and $a, b \in G$, the *commutator* of a and b is the element $aba^{-1}b^{-1} \in G$. The *commutator subgroup*, denoted $[G, G]$, is the group generated by all commutators, and for $g \in [G, G]$, the *commutator length* of g , denoted $cl(g)$, is the smallest number of commutators in G whose product is equal to g . The size of $[G, G]$ is one way of measuring the extent to which the group G fails to obey the commutative law $ab = ba$. If G is the fundamental group of a space X , and $g \in G$ is represented by a homologically trivial loop $\gamma \subset X$, the commutator length of g is the smallest genus of a surface that admits a map to X in such a way that the boundary of the surface maps to γ .

Estimating minimal genus is important in many areas of low-dimensional topology. A knot K in the 3-sphere bounds an orientable surface (in its complement) of some genus, called a *Seifert surface*. The least such genus is equal to the commutator length of the *longitude* of the knot, a certain distinguished conjugacy class in the group $\pi_1(S^3 - K)$. As another example, given a 3-manifold M , one can try to find the “simplest” 4-manifold W that bounds it. If M is a certain kind of 3-manifold—for instance, a surface bundle over a circle—one can ask for W to be a surface bundle over a surface, and try to estimate (from below) the genus of the base. This is tantamount to calculating the commutator length of an element in the *mapping class group* of

a surface (i.e., the group of self-homeomorphisms of a surface, up to isotopy).

Calculating commutator length (even in finite groups!) is notoriously difficult. A famous conjecture of Ore from 1951, whose proof was announced only very recently, says that in a finite, non-cyclic simple group, $cl = 1$ for all nonzero elements. So instead, one can stabilize the problem. The *stable commutator length* of g , denoted $scl(g)$, is the limit

$$scl(g) = \lim_{n \rightarrow \infty} \frac{cl(g^n)}{n}$$

Commutator length is subadditive in $[G, G]$, so this limit exists.

Computing stable commutator length is still difficult, but feasible in many cases. For instance, there now exist fast algorithms to compute scl in free groups. Since every group is a quotient of a free group, calculating scl on elements in a free group gives universal upper bounds on scl .

Figure 1 plots values of scl by frequency on 64,010 random elements of word length 32 in a free group on two generators. For simplicity, we restrict attention to a subclass of elements for which computation is particularly tractable, namely those represented by *alternating words*.

Some conspicuous features of this plot include the following:

- (1) the existence of a *spectral gap* between 0 and 0.5, and another gap immediately above 0.5
- (2) the non-discrete nature of the set of values attained
- (3) the relative abundance of elements for which $scl \in \frac{1}{2}\mathbb{Z}$, and (to a lesser extent) $\in \frac{1}{6}\mathbb{Z}$ and so on to other denominators, revealing a “self-similarity” in the histogram, and a power law for the size of the “spikes” of the form $\text{freq}(p/q) \sim q^{-\delta}$, reminiscent of similar power laws that arise in 1-dimensional dynamics (e.g. the phenomenon of *Arnol’d tongues*)

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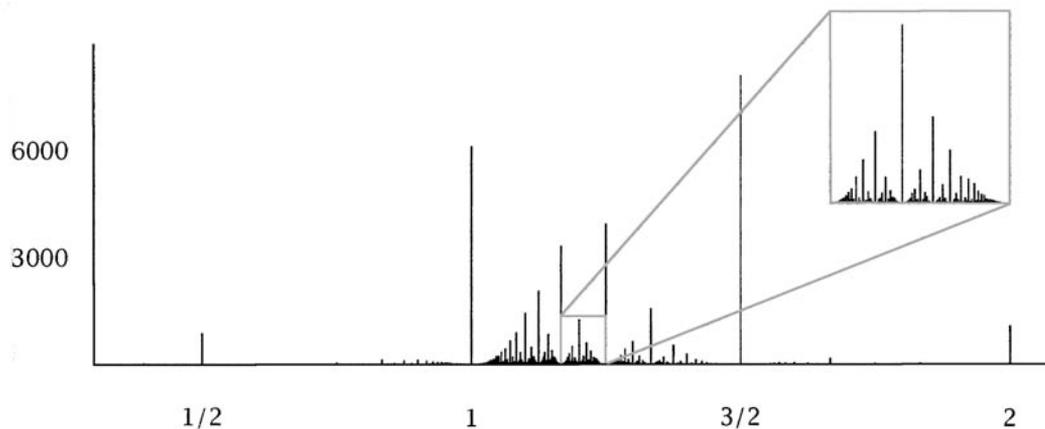


Figure 1. Values of scl on 64,010 alternating words of length 32. The horizontal axis is scl and the vertical axis is frequency.

See [2] for a theoretical explanation of some of these features; also see the references of [2] and [1] for further reading.

A fact hinted at in this figure is that the values of scl attained in a free group are all *rational*. This is not a universal phenomenon: there are examples of finitely presented groups with irrational scl, but interestingly enough, no known examples where scl is irrational and algebraic. This rationality (or otherwise) has consequences in dynamics. For certain groups G of homeomorphisms of the circle, there is a natural central extension \hat{G} of G with the property that rationality of stable commutator length in \hat{G} is directly related to the existence of periodic orbits in S^1 for elements $g \in G$. A similar relationship between rationality and dynamics exists for certain groups of symplectic matrices.

One can learn a lot about an invariant by studying when it vanishes. There are many important classes of groups G for which scl is identically zero on $[G, G]$, including

- (1) torsion groups
- (2) solvable groups, and more generally, amenable groups
- (3) $SL(n, \mathbb{Z})$ for $n \geq 3$, and many other lattices (uniform and nonuniform) in higher rank Lie groups
- (4) groups of piecewise-linear homeomorphisms of $[0, 1]$; Thompson's group of piecewise dyadic rational linear homeomorphisms of the circle

On the other hand, there are many other classes of groups for which scl is nonzero on typical elements, including

- (1) free groups, hyperbolic groups
- (2) mapping class groups
- (3) groups of area-preserving diffeomorphisms of surfaces

The problem of computing scl can be recast in homological terms, by counting triangles (or, formally, 2-chains) instead of genus. The (real)

singular chain groups of a space, and the terms in the bar resolution of a group, are vector spaces with canonical bases, and one can use these bases to make these vector spaces into *normed* spaces. *Bounded (co)-homology*, introduced by Gromov [3], arises when one studies the natural L^1 and L^∞ norms on these vector spaces using the tools of homological algebra. One can interpret stable commutator length as the infimum of the L^1 norm (suitably normalized) on chains representing a certain (relative) class in group homology.

The unit balls in the L^1 and L^∞ norms on finite-dimensional vector spaces are rational polyhedra. Computing the L^1 norm of a homology class is a kind of linear programming problem. In certain groups, computing scl reduces to a *finite-dimensional* linear programming problem, which explains the rationality of scl in some cases. The polyhedral nature of L^1 norms is manifest in several closely related contexts. Most well-known is the *Thurston norm* on the homology of a 3-manifold, which turns up again and again throughout low-dimensional topology, in the theories of taut foliations, symplectic 4-manifolds, quasigeodesic flows, Heegaard Floer homology, and so on.

Thus stable commutator length gives insight into bounded (co)-homology of groups and spaces, and conversely.

Further Reading

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Karp Receives 2008 Kyoto Prize



Richard M. Karp

James Pawson, and in the Arts and Philosophy category, to philosopher Charles Margrave Taylor.

The Work of Richard M. Karp

Richard M. Karp has made fundamental contributions to the development of the theory of computational complexity which began in the early 1970s by establishing the theory of NP-completeness, having a profound influence on the guiding principles for analysis and design of algorithms. He has also developed many practically relevant computer algorithms.

In particular, Karp created a technique for measuring the computational complexity of combinatorial problems by establishing complexity classes of equally hard-to-solve problems in accordance with the concept of polynomial-time reduction, and determining the class to which each problem would belong. In more concrete terms, Karp established the theory of NP-completeness by defining the complexity class P as problems for which polynomial-time algorithms of deterministic solutions exist, the complexity class NP as problems for which polynomial-time algorithms of non-deterministic solutions exist, and the NP-complete, which is a subclass of the complexity class NP to

which the hardest-to-solve problems belong. With this achievement, he revealed that many familiar problems which often appear in a wide range of optimization problems in operation research, and in areas related to computer science, are equally hard-to-solve problems belonging to the NP-complete class. He also deduced and disseminated a standard methodology for this process, making a dramatic leap in the theory of computation and algorithms that underpin computer science.

Among researchers of the theory of computation, the issue of whether complexity class P and complexity class NP are the same class or not is referred to as the “P versus NP problem”, which is an open problem of central interest in computer science, having also caught the interest of the mathematical community. As indicated by this fact, Karp not only added a new page to human wisdom by bringing computational complexity within the scope of scientific research, but also accelerated the development of algorithm engineering and had a significant influence on the guiding principles for the evaluation and design of algorithms for many of the problems extant in technological fields. Before his pioneering contributions, algorithms had to be designed individually for each of a plethora of technological problems. Karp freed algorithm design from this condition of manual labor and elevated it to a scientific technology.

In addition to these achievements, Karp has developed numerous individual algorithms with practical relevance, the most notable being the Edmonds-Karp algorithm. He played a central role in the development of computational complexity theory, which made notable advances in the early 1970s and after, and built a frame for the study of the theoretical computer science centered at the University of California, Berkeley, where he held a professorship and mentored many young researchers, thereby playing a leading role in the establishment of the theories of parallel algorithms and probabilistic algorithms. Over the last decade, he has stayed true to his belief that computer scientists should work on research themes that are

useful to other academic fields, particularly the life sciences, thereby making significant contributions to the study of algorithms in the bioinformatics field.

Biographical Sketch

Richard Manning Karp was born in 1935 in Boston, Massachusetts. He received his Ph.D. in applied mathematics in 1959 from Harvard University, under the direction of Anthony Oettinger. Karp was a research staff member at the IBM Thomas J. Watson Research Center from 1959 until 1968, when he became a professor at the University of California, Berkeley. He was a research scientist at the International Computer Science Institute (ICSI) from 1988 until 1995. He then spent four years at the University of Washington before returning to Berkeley, where he is now a University Professor. He is also a senior research scientist at ICSI.

His honors include the Delbert Ray Fulkerson Prize in Discrete Mathematics of the AMS and the Mathematical Programming Society (1979), the A. M. Turing Award of the Association for Computing Machinery (1985), the National Medal of Science (1996), the Harvey Prize of Technion-Israel Institute of Technology (1998), and the Benjamin Franklin Medal (2004). He is a member of the U.S. National Academy of Sciences and the U.S. National Academy of Engineering.

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Previous Kyoto Prize winners who have made contributions to the mathematical sciences are: Rudolf E. Kalman (1985), Claude E. Shannon (1985), John McCarthy (1988), I. M. Gelfand (1989), Edward Lorenz (1991), André Weil (1994), Donald E. Knuth (1996), Kyosi Itô (1998), Mikhael Gromov (2002), Simon A. Levin (2005), and Hirotugu Akaike (2006).

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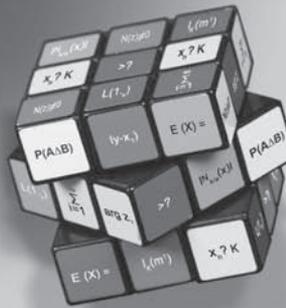
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Mathematics People

SIAM Prizes Awarded

The Society for Industrial and Applied Mathematics (SIAM) awarded a number of prizes at its annual meeting in July 2008 in San Diego, California.

VAN H. VU of Rutgers University has been awarded the George Pólya Prize for his work in combinatorial theory. He has developed fundamental concentration inequalities for random polynomials that are applicable to broader contexts than earlier inequalities. These inequalities have enabled the solution of long-standing problems in projective geometry, convex geometry, extremal graph theory, number theory, and theoretical computer science. The prize is given every two years for a notable application of combinatorial theory, approximation theory, complex analysis, number theory, orthogonal polynomials, probability theory, or mathematical discovery and learning. The prize carries a cash award of US\$20,000.

MAX GUNZBURGER of Florida State University has been awarded the W. T. and Idalia Reid Prize in Mathematics. He was recognized for his fundamental contributions to control of distributed parameter systems and computational mathematics. The prize is given for outstanding work in, or other contributions to, the broadly defined areas of differential equations and control theory. It carries a cash award of US\$10,000.

PHILIPPE TONDEUR of the University of Illinois, Urbana-Champaign, received the SIAM Prize for Distinguished Service to the Profession. He was honored for his extensive and highly effective advocacy for and support of the mathematical sciences.

DAVID I. GOTTLIEB of Brown University was named the John von Neumann Lecturer. He was honored for his work on spectral and high-order accurate numerical methods for partial differential equations and the applications of these methods to significant problems in science and engineering, including computational fluid dynamics, weather forecasting, and computational electromagnetism. The lectureship is awarded for outstanding and distinguished contributions to the field of applied mathematical sciences and for the effective communication of these ideas to the community.

DAAN HUYBRECHS of Katholieke Universiteit Leuven was awarded the DiPrima Prize for his dissertation

“Multiscale and hybrid methods for the solution of oscillatory integral equations”, in which he developed new solution methods for oscillatory integral methods and numerical methods to solve these equations. He showed how they can be applied to problems such as wave phenomena in engineering.

The SIAM Outstanding Paper Prizes have been awarded to the following researchers. VICENT CASELLES, Universitat Pompeu Fabra, Barcelona; ANTONIN CHAMBOLE, École Polytechnique; and MATTEO NOVAGA, University of Pisa, were honored for their joint paper “The discontinuity set of solutions of the TV denoising problem and some extensions”. The paper was published in *Multiscale Modeling and Simulation* 6, no. 3, (2007). SUBHASH KHOT, Georgia Institute of Technology, was honored for the paper “Ruling out PTAS for graph min-bisection, dense k -subgraph, and bipartite clique”, published in the *SIAM Journal on Computing* 36, no. 4, (2006). TODD KAPITULA, Calvin College; P. G. KEVREKIDIS, University of Massachusetts, Amherst; and ZHIGANG CHEN, San Francisco State University, were selected for their joint paper “Three is a crowd: Solitary waves in photorefractive media with three potential wells”, published in the *SIAM Journal on Applied Dynamical Systems* 5, no. 4, (2006).

The SIAM Awards in the Mathematical Contest in Modeling were awarded to the following students. For Problem A, The Continuous Problem: Take a Bath, the awardees were AMY M. EVANS and TRACY L. STEPIEN of the University of Buffalo, State University of New York, for “Fighting the Waves: The Effect of North Pole Ice Cap Melt on Florida”. Their faculty advisor was John Ringland. For Problem B, The Discrete Problem: Creating Sudoku Puzzles, the winners were CHRISTOPHER CHANG, ZHOU FAN, and YI SUN of Harvard University for “hsolve: A Difficulty Metric and Puzzle Generator for Sudoku”. Their faculty advisor was Clifford Taubes.

The SIAM Student Paper Prizes were awarded to the following students: JEREMY BRANDMAN, University of California, Los Angeles, for “A Level-Set Method for Computing the Eigenvalues of Elliptic Operators Defined on Compact Hypersurfaces”; ROLAND GRIESMAIER, Johannes Gutenberg University of Mainz, Germany, for “An Asymptotic Factorization Method for Inverse Electromagnetic Scattering in Layered Media”; and DAVID KETCHESON,

University of Washington, for “Highly Efficient Strong Stability Preserving Runge-Kutta Methods with Low-Storage Implementations”.

—From a *SIAM* announcement

Prizes Presented at the ECM

The European Mathematical Society (EMS) awarded several prizes at the European Congress of Mathematics (ECM), held in Amsterdam in July 2008. The EMS prizes are awarded every four years in conjunction with the congress to recognize distinguished contributions in mathematics by young researchers not older than thirty-five years. The prize carries a cash value of €5,000 (approximately US\$8,000). The names of the awardees, their institutions, and brief descriptions of their honored work follow.

ARTUR AVILA of the Clay Mathematics Institute and Instituto Nacional de Matemática Pura e Aplicada (IMPA) in Brazil has achieved many important results in dynamical systems, especially in the theory of iterated rational maps and the Teichmüller geodesic flow, some of which provide final solutions to long-standing major problems. These include his proof (with Lyubich) that there are infinitely renormalizable Julia sets in the quadratic family $f(z) = z^2 + c$ with Hausdorff dimension strictly less than 2; his proof (with Jitomirskaya) of the “ten Martini conjecture” of B. Simon; his proof (with Viana) of the Kontsevich-Zorich conjecture on simplicity of the Lyapunov spectrum for the Teichmüller geodesic flow; his proof (with Forni) that almost every interval exchange that does not have the combinatorics of a rotation is weakly mixing; and his proof (with Gouëzel and Yoccoz) of exponential mixing for the Teichmüller flow.

ALEXEI BORODIN of the California Institute of Technology has made substantial contributions to the representation theory of “big” groups, combinatorics, interacting particle systems, and random matrix theory. A key observation of Borodin and Olshanski in the representation theory of big groups is that the irreducible characters for the group are associated with stochastic point processes. Borodin found a determinantal formula for the correlation functions of the so-called generalized regular representation of the infinite symmetric group and, with Olshanski, of the unitary group as well. Borodin analyzed the irreducible character associated with the generalized regular representation.

BEN GREEN of the University of Cambridge is best known for his result (with Terence Tao) that there exist arbitrarily long arithmetic progressions of primes. In earlier work he proved that every relative dense subset of the primes contains an arithmetic progression of length 3. One of the essential steps in the proof of the famous result with Tao is the discovery by Green that the work of Goldston and Yıldırım on short intervals between primes provided precisely the “random-like” superset of the primes that they needed.

OLGA HOLTZ of Technische Universität Berlin, Germany, and the University of California, Berkeley, has made

substantial contributions to several mathematical areas, including algebra, numerical linear algebra, approximation theory, theoretical computer science, and numerical analysis. Some of these include the proof of the Newton inequalities for M matrices, fundamental work on accurately evaluating polynomials in finite arithmetic, and the proof that all group-theory-based fast matrix multiplication methods are numerically stable.

BOÁZ KLARTAG of the Clay Mathematics Institute and Princeton University has solved a number of outstanding problems in asymptotic geometric analysis. He broke the record on the minimum number of symmetrization steps of convex bodies required to transform them into near balls. He proved a central limit theorem for convex bodies, a result that brought ideas in convex geometry into probability theory. With Fefferman he solved a fundamental problem on optimal extrapolation of smooth functions.

ALEXANDER KUZNETSOV of the Steklov Mathematical Institute in Moscow has made fundamental contributions to birational projective geometry, representation theory, mathematical physics, homological algebra, and noncommutative geometry. His work on birational projective geometry includes theories of homological Lefschetz decompositions, homological projective duality, and categorical resolutions of singularities.

ASSAF NAOR of the Courant Institute of Mathematical Sciences, New York University, has made groundbreaking contributions to functional analysis, the theory of algorithms, and combinatorics. He is the leading architect of the modern theory of nonlinear functional analysis. He and a variety of collaborators discovered an unpredicted threshold phenomenon in the nonlinear Dvoretzky theorem, found a nonlinear analogue of the cotype invariant, and proved a sophisticated nonlinear analogue of the celebrated Maurey-Pisier theorem.

LAURE SAINT-RAYMOND of École Normale Supérieure (ENS), Paris, has achieved outstanding results in nonlinear partial differential equations in the dynamics of gases and plasmas and also in fluid dynamics. Her most striking work concerns the study of the hydrodynamic limits of the equation of Boltzmann in the kinetic theory of gases, in which she answered a question posed by Riemann within the framework of his sixth problem. Recently, in collaboration with I. Gallagher, she has tried to understand the equations of rotation fluids within the limit where the number of Rossby tends to zero.

AGATA SMOKTUNOWICZ of the University of Edinburgh and the Institute of Mathematics of the Polish Academy of Sciences has solved a number of outstanding problems in noncommutative algebra. She has made the first significant progress in decades on some fundamental problems concerning nil rings. The most spectacular of these results is the construction, over any countable field, of a simple nil algebra. Other outstanding problems she has solved include the problem of polynomial rings over nil rings first posed by Amitsur in 1971, the proof of the Artin-Stafford Gap theorem for graded domains, and the first examples of finitely generated nil, but not nilpotent, algebras with polynomially bounded growth.

CÉDRIC VILLANI of the École Normale Supérieure, Lyon, has contributed greatly to the theory of nonequilibrium statistical mechanics, in particular in connection with the Boltzmann equation and the Landau equation in plasma physics. He proved the Cercignani conjecture and obtained (with Desvillettes) the first convergence result to a global Gaussian equilibrium for the Boltzmann equation without any smallness assumption. With Otto, he studied the link between diffusion equations, Talagrand inequalities, and logarithmic Sobolev inequalities. More recently, with Lott, he obtained a new characterization of Riemannian manifolds with bounded Ricci curvature from below in terms of convexity of the Boltzmann entropy with respect to optimal transportation (Monge-Kantorovich-Wasserstein) metrics.

The Felix Klein Prize, awarded to young scientists “for using sophisticated methods to give an outstanding solution to a concrete and difficult industrial problem”, has been awarded to JOSSELIN GARNIER of Université Paris 7. Garnier’s research is at the interface of stochastics and applied analysis and is applied to optics, wave propagation, and plasma physics. The prize citation notes that Garnier “is a leading scientist dealing with probabilistic aspects in the framework of partial differential equations, and has shown his ability to apply powerful theoretical tools to deal with real industrial problems.”

—From an EMS announcement

2008 D’Alembert and Decerf Prizes Announced

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

The d’Alembert Prize for 2008 has been awarded to MARIE-JOSÉ PESTEL, president of the Comité International des Jeux Mathématiques (CIJM). The cash value of the prize is €2,000 (approximately US\$3,170).

In addition, the SMF has awarded the Anatole Decerf Prize to ROBERT FERRÉOL for the website MATHCURVE, the Encyclopedia of Remarkable Mathematical Forms. The Decerf Prize was established to promote the pedagogy of mathematics.

—From an SMF announcement

YouTube Video Contest Winner

MACE MATEO of British Columbia is the winner of the “What Does ‘Math and Voting’ Mean to You?” YouTube video con-

test. Mateo received a warm congratulations and a check for US\$500 for his entry, *The Beatles—We Can Work It Out*, in which music from the Beatles accompanies illustrations of different voting methods. Participants were judged on creativity, how well their message was conveyed, the level of entertainment, quality of the video, and relevance to the theme. Resources for this year’s Mathematics Awareness Month help explain what makes votes matter, as well as how the voting system used affects the outcome, regardless of the context of the voting. A link to the video is available on the Mathematics Awareness Month website, <http://www.mathaware.org/index.html>.

—AMS Public Awareness Office

Prizes of the LMS

The London Mathematical Society (LMS) has awarded several prizes for 2008.

DAVID PREISS of the University of Warwick has been awarded the Pólya Prize in recognition of his outstanding contributions to analysis and geometric measure theory. NICHOLAS HIGHAM of the University of Manchester received the Fröhlich Prize in recognition of his leading contributions to numerical linear algebra and numerical stability analysis. KEVIN BUZZARD of Imperial College London was awarded the Senior Berwick Prize for his paper “Eigenvarieties”, published in volume 320 of the LMS Lecture Note Series, *L-functions and Galois Representations*, in 2007.

Four Whitehead Prizes were awarded. TIMOTHY BROWNING of the University of Bristol was selected for his “significant contributions on the interface of analytic number theory and arithmetic geometry concerning the number and distribution of rational and integral solutions to Diophantine equations”. TAMÁS HAUSEL of the University of Oxford was honored “for his investigations into hyperkähler geometry, which have led him to prove deep results in fields as diverse as the representation theory of quivers, mirror symmetry and Yang-Mills instantons”. MARTIN HAIRER of the University of Warwick was honored for his contributions to the theory of stochastic differential equations. NINA SNAITH of the University of Bristol was recognized for her work at the interface of random matrix theory and number theory.

—From an LMS announcement

Meza Awarded Blackwell-Tapia Prize

JUAN C. MEZA of Lawrence Berkeley National Laboratory has been awarded the 2008 Blackwell-Tapia Prize. According to the prize citation, he “has an exceptionally distinguished record as a mathematical scientist; an accomplished and effective head of a large department doing cutting-edge explorations in the computational sciences, computational mathematics, and future technologies;

and a role model and active advocate for others from groups underrepresented in the mathematical sciences.” His research interests are in nonlinear optimization with an emphasis on methods for parallel computing, and he has also worked on various scientific and engineering applications, including scalable methods for nanoscience, power grid reliability, molecular conformation problems, optimal design of chemical vapor deposition furnaces, and semiconductor device modeling.

Meza has chaired the Mathematical Sciences Research Institute (MSRI) Human Resources Advisory Committee and cochaired the annual Diversity Day workshops of the Society for Industrial and Applied Mathematics (SIAM). He has served on high-level advisory committees on diversity for major scientific organizations. He is also the recipient of the 2008 Distinguished Scientist Award from the Society for the Advancement of Chicanos and Native Americans in Science (SACNAS).

The Blackwell-Tapia Prize is awarded every two years in honor of the legacy of David H. Blackwell and Richard A. Tapia, two distinguished mathematical scientists who have been inspirations to more than a generation of African American, Latino/Latina, and Native American students and professionals in the mathematical sciences. The prize recognizes a mathematical scientist who has contributed and continues to contribute significantly to research in his or her field of expertise and who has served as a role model for mathematical scientists and students from underrepresented minority groups or contributed in other significant ways to addressing the problem of the underrepresentation of minorities in mathematics.

—Michael L. Minion, University of North Carolina

Iovita Awarded Ribenboim Prize

ADRIAN IOVITA of Concordia University has been awarded the 2008 Ribenboim Prize in Number Theory by the Canadian Number Theory Association (CNTA). The prize is given every two to four years for distinguished research in number theory by a mathematician who is Canadian or has connections to Canadian mathematics. Previous winners of the prize are Andrew Granville (1999), Henri Darmon (2002), Michael Bennett (2004), and Vinayak Vatsal (2006). Iovita received a certificate and medal and gave a plenary talk at the CNTA meeting in July 2008.

—From a Fields Institute announcement

Rao Receives National Award in Statistics

B. L. S. PRAKASA RAO of the University of Hyderabad, India, has been selected to receive the 2007–2008 National Award in Statistics for Senior Statisticians from the government of India.

According to the prize citation, “Rao is recognized internationally as a pioneer who laid the foundation of modern statistics, with multifaceted distinctions as a mathematician, researcher, scientist, and teacher.” He has made significant contributions to mathematics and to the theory and application of statistics. His work in multivariate analysis has been used in economic planning, weather prediction, medical diagnosis, tracking the movements of spy planes, and monitoring the course of spacecraft.

The National Award in Statistics was instituted by the Ministry of Statistics and Programme Implementation of the government of India to recognize “outstanding and meritorious research work in statistics”. The award, established in memory of P. V. Sukhatme, is given to senior Indian statisticians for lifetime contributions to the development of statistical systems in the field of applied/official statistics.

—Elaine Kehoe

Paul Erdős Award Recipients Announced

The 2008 recipients of the Paul Erdős Awards have been announced. They are HANS-DIETRICH (DIETER) GRONAU, Germany; BRUCE HENRY, Australia; and LEOU SHIAN, Taiwan.

Gronau has been chairman of the United Mathematical Olympiad Organization of Germany and is chief trainer, deputy leader, and team leader. He has also been a member of the organization of the Bundeswettbewerb Mathematik in West Germany and has overseen the unification of the two German competition organizations. Henry founded the Mathematics Challenge for Young Australians in 1991, an enrichment program supported by the Australian government that attracts about twenty-three thousand students annually. Shian founded the Invitational World Youth Mathematics Intercity Competition, which has been hosted by cities in Taiwan, the Philippines, India, and China. He founded the Regional Internet Mathematics Competition in Taiwan, has served as a member of the Taiwan Mathematical Olympiad Committee, and has been actively involved in training students to represent Taiwan in the International Mathematical Olympiad.

The Paul Erdős National Award is given by the World Federation of National Mathematics Competitions in recognition of mathematicians who have contributed to the development of mathematical challenges at the national level and to the enrichment of mathematics learning.

—World Federation of National Mathematics Competitions

Krzysztof P. Wojciechowski (1953–2008)

Krzysztof P. Wojciechowski was born in Szczecin, Poland, in 1953. He received his Ph.D. degree from the Polish Academy of Sciences under Bogdan Bojarski. He arrived in the U.S. in 1987, spent one year at Stony Brook University, and then moved to Indiana University-Purdue University Indianapolis (IUPUI), where he remained. He had a powerful impact on all who knew him, both mathematically and in many other ways. The main thrust of his work from the start was on the index theory of elliptic boundary value problems. His book, jointly written with Bernhelm Booß-Bavnbek, *Elliptic Boundary Problems for Dirac Operators*, established a language and provided tools for a generation of workers in the field. A central theme there was the study of the space of projections defining the boundary conditions as an infinite-dimensional Grassmannian. Using these ideas, the authors were able to prove the Bojarski conjecture relating the index of an elliptic operator on a closed manifold to the indices of boundary value problems obtained by cutting the manifold in pieces.

Krzysztof went on to study—partly with various other collaborators who were drawn into his world of extremely intricate and powerful calculations—secondary invariants of operators such as eta invariants and determinants on the Grassmannian, in particular cutting and pasting properties and the relation between zeta-function regularization and the Fredholm determinant.

Krzysztof loved life, his family, mathematics, literature, music, and judo. He was a world-class athlete and was actually World Judo Champion (for over-forty-five-year-olds). His enthusiasm about mathematics and his penetrating insights strongly influenced his colleagues and coworkers. He died far too young and was at the peak of his work. We can only imagine what he would have accomplished with more time.

—Bernhelm Booß-Bavnbek, Roskilde University, and
Jerry Kaminker, IUPUI

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Mathematics Opportunities

NSF Postdoctoral Research Fellowships

The National Science Foundation (NSF) awards Mathematical Sciences Postdoctoral Research Fellowships for appropriate research in areas of the mathematical sciences, including applications to other disciplines. A revised program announcement is available from the website http://www.nsf.gov/pubs/2008/nsf08582/nsf08582.htm?govDel=USNSF_25. The deadline for proposals is **October 15, 2008**.

—From an NSF announcement

AMS Epsilon Fund

The AMS Epsilon Fund awards grants to summer mathematics programs that support and nurture mathematically talented high school students in the United States. The deadline for application for summer 2009 programs is **December 15, 2008**. Application materials are available at <http://www.ams.org/outreach/epsilon.html> or by mail: Membership and Programs Department, American Mathematical Society, 201 Charles Street, Providence, RI 02904-2294; telephone 800-321-4267, ext. 4170; email: prof-serv@ams.org.

—AMS announcement

AMS-AAAS Mass Media Summer Fellowships

The American Association for the Advancement of Science (AAAS) sponsors the Mass Media Science and Engineering Summer Fellows Program, through which graduate students work during the summer in major media outlets. The AMS provides support each year for one or two graduate students in the mathematical sciences to participate in the program. In past years, the AMS-sponsored fellows have held positions at *Scientific American*, *Business Week*, Voice of America, Discovery Channel Online, National Geographic Television, *Popular Science*, *The Chicago Tribune*, and *Time* magazine.

Fellows receive a weekly stipend of US\$450, plus travel expenses, to work for ten weeks during the summer as reporters, researchers, and production assistants in media organizations. They observe and participate in the process by which events and ideas become news, improve their ability to communicate about complex technical subjects in a manner understandable to the public, and increase their understanding of editorial decision making and of how information is effectively disseminated. Each fellow attends an orientation and evaluation session in Washington, DC, and begins the internship in mid-June. Fellows submit interim and final reports to AAAS. A wrap-up session is held at the end of the summer.

Mathematical sciences faculty are urged to make their graduate students aware of this program. The deadline to apply for fellowships for the summer of 2009 is **January 15, 2009**. Further information about the fellowship program and application procedures is available online at <http://www.aaas.org/programs/education/MassMedia/> or applicants may contact Stacey Pasco, Manager, Mass Media Program, AAAS Mass Media Science and Engineering Fellows Program, 1200 New York Avenue, NW, Washington, DC 20005; telephone 202-326-6441; fax 202-371-9849; email: spasco@aaas.org.

Further information is also available at <http://www.ams.org/government/massmediaann.html> and through the AMS Washington Office, 1527 Eighteenth Street, NW, Washington, DC 20036; telephone 202-588-1100; fax 202-588-1853; email: amsdc@ams.org.

—AMS Washington Office

Enhancing the Mathematical Sciences Workforce in the Twenty-First Century

The long-range goal of the Enhancing the Mathematical Sciences Workforce in the Twenty-First Century (EMSW21) program of the National Science Foundation (NSF) is to increase the number of well-prepared U.S. citizens, nationals, and permanent residents who pursue careers in the mathematical sciences and in other NSF-supported disciplines. This program builds on the Vertical Integration of Research and Education (VIGRE) program and

includes a broadened VIGRE activity, an additional component for Research Training Groups (RTG), and another for Mentoring through Critical Transition Points (MCTP) in the Mathematical Sciences.

The VIGRE program supports projects that involve entire departments in the training process, from the start of the undergraduate career through the completion of a postdoctoral fellowship. The RTG program involves a group of researchers based in a subarea of the mathematical sciences or linked by a multidisciplinary theme and supports training at educational levels from undergraduate to postdoctoral within that focus. The MCTP program supports projects, either departmentally based or conducted by a large group of faculty members, that are aimed at critical transition points in the educational careers of students and junior researchers.

The DMS expects to make between nine and fifteen awards under this program in 2009. The deadline for proposals is **June 2, 2009**. For more information about the program and all of its components, see the website http://www.nsf.gov/publications/pub_summ.jsp?ods_key=nsf05595.

—From an NSF announcement

AWM Essay Contest

To increase awareness of women's ongoing contributions to the mathematical sciences, the Association for Women in Mathematics (AWM) is holding an essay contest for biographies of contemporary women mathematicians and statisticians in academic, industrial, and government careers.

The essays will be based primarily on interviews with women who are currently working in mathematical sciences careers. The contest is open to students in the following categories: 6th–8th grades, 9th–12th grades, and college undergraduates. At least one winning submission will be chosen from each category. Winners will receive a prize, and their essays will be published online at the AWM website. A grand prize winner will have his or her submission published in the *AWM Newsletter* as well. The tentative deadline for entries is **February 27, 2009**.

In addition to student entries, organizers are currently seeking women mathematicians to volunteer as the subjects of these essays. For more information, see <http://www.awm-math.org/biographies/contest.html>.

—From an AWM announcement

PIMS Postdoctoral Fellows

The Pacific Institute for the Mathematical Sciences (PIMS) invites nominations of outstanding young researchers in the mathematical sciences for Postdoctoral Fellowships for the year 2009–2010. Candidates must be nominated by one or more scientists or departments affiliated with PIMS, or by a department (or departments) affiliated with PIMS. The fellowships are intended to supplement support made

available through such a sponsor. The Institute expects to support up to 20 fellowships tenable at any of its Canadian member universities: Simon Fraser University, the University of Alberta, the University of British Columbia, the University of Calgary, the University of Victoria, University of Regina, and the University of Saskatchewan, as well as at the University of Lethbridge (a PIMS affiliate).

For the 2008–2009 competition, the amount of the award is CA\$20,000 and the sponsor(s) is (are) required to provide additional funds to finance a minimum stipend of CA\$40,000 (plus benefits).

Award decisions are made by the PIMS PDF Review Panel based on excellence of the candidate, potential for participation in PIMS programs, and potential for involvement with PIMS partners. PIMS Postdoctoral Fellows will be expected to participate in all PIMS activities related to the Fellow's area of expertise and will be encouraged to spend time at other sites. To ensure that PIMS Postdoctoral Fellows are able to participate fully in Institute activities, they may not teach more than two single-term courses per year.

Nominees must have a Ph.D. or equivalent (or expect to receive a Ph.D. by December 31, 2009) and be within three years of their Ph.D. at the time of the nomination (i.e., the candidate must have received her or his Ph.D. on or after January 1, 2006). The fellowship may be taken up at any time between April 1, 2009, and January 1, 2010. The fellowship is for one year and is renewable for at most one additional year.

Nominations must include: 1) **curriculum vitae**, 2) **statement of research interests**, 3) **three letters of reference** (including one from a sponsoring professor), and 4) **statement of anticipated support from the sponsor**.

Deadline for Nominations: The sponsors should send the complete nomination package to: Attn: PIMS PDF Competition, Pacific Institute for the Mathematical Sciences, 200 – 1933 West Mall, University of British Columbia, Vancouver, BC V6T 1Z2 Canada. Nominations must be received by **December 12, 2008**. For more information, visit: <http://www.pims.math.ca/scientific/postdoctoral>.

PIMS accepts no responsibility for incomplete packages, or for individual components of a nomination package being sent to any of our offices.

—From a PIMS announcement

News from AIM

The American Institute of Mathematics (AIM) seeks proposals for (a) five-day focused workshops (for up to 32 fully funded participants) in all areas of the mathematical sciences, and (b) SQuaRES—which are teams of 4–8 mathematical scientists that spend one week at AIM collaborating on a specific project. The deadline for proposing a workshop or a SQuaRE is **November 1, 2008**. Detailed information about AIM programs, upcoming workshops, and application forms for proposals can be found at <http://www.aimath.org>.

—AIM announcement

Inside the AMS

AMS Department Chairs Workshop

This annual one-day workshop for chairs and leaders of departments of mathematical sciences will be held a day before the start of the Joint Mathematics Meetings in Washington, DC, on Sunday, January 4, 2009, from 8:00 a.m. to 6:30 p.m. The workshop format is intended to stimulate discussion among attending chairs and workshop leaders. Sharing ideas and experiences with peers provides a form of department chair therapy, creating an environment that enables attending chairs to address departmental matters from new perspectives.

Past workshop sessions have focused on a range of issues facing departments today, including personnel issues (staff and faculty), long-range planning, hiring, promotion and tenure, budget management, assessments, outreach, stewardship, junior faculty development, communication, and departmental leadership.

There is a registration fee for the workshop, which is in addition to and separate from the Joint Meetings registration. An invitation to attend the workshop will be sent to department chairs this fall. Information will also be posted on the AMS website. For further information, please contact the AMS Washington Office at 202-588-1100 or amsdc@ams.org.

—AMS Washington Office

AMS Sponsors Exhibition on Mathematics and Cardiology

The AMS sponsored an exhibit entitled “Mathematics and Cardiology: Partners for the Future” presented by Suncica Canic of the University of Houston at the 14th annual Coalition for National Science Funding (CNSF) Exhibition held June 25, 2008, on Capitol Hill in Washington, DC.

Canic showed how sophisticated mathematics can be used to improve design of vascular prostheses, called stents, and stent-grafts used in nonsurgical repair of aortic abdominal aneurysm (AAA) and coronary artery disease (CAD). By studying fluid-structure interaction between blood flow and motion of vascular walls, researchers from the Department of Mathematics at the University of Houston, together with cardiologists from the Texas Heart Institute in Houston, have been able to show that certain stents and stent-grafts used in AAA

repair have suboptimal performance. This has led to the abandonment of the use of bare Wallstent in AAA repair and the design of a new stent-graft with improved blood flow characteristics.

The main ideas in this work came from a mathematical proof of the existence of a solution to the underlying fluid-structure interaction problem, which led to the design of a sophisticated computational fluid-structure interaction algorithm that was used in modeling and simulation of the performance of vascular prostheses implanted in the human body.

The research presented was supported by the National Science Foundation (NSF), the National Institutes of Health, the Texas Higher Education Board, and the Texas Heart Institute.

The CNSF Exhibition is an annual event that 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 policymakers on Capitol Hill.

CNSF is an alliance of over 110 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 director of its Washington Office, works to increase the federal investment in the NSF.

Previous AMS exhibits at CNSF exhibitions include:

- *Computational Models for Cardiovascular Disease Assessment and Surgery Design*, presented by Dalin Tang, Worcester Polytechnic Institute
- *Disease Prediction and Treatment Design*, presented by Eva K. Lee, Georgia Institute of Technology
- *Mathematics for Advanced Composites Technology*, presented by Robert Lipton, Louisiana State University
- *Mathematical Modeling of Swimming Organisms*, presented by Lisa Fauci and Nick Cogan, Tulane University
- *Mathematics of Sea Ice*, presented by Kenneth M. Golden, University of Utah
- *Liquid Films and Image Inpainting*, presented by Andrea Bertozzi, Duke University
- *Undergraduate Research Opportunities Made Possible by NSF*, presented by John Bush, Massachusetts Institute of Technology
- *Computer Simulation of Blood Flow in the Heart*, presented by Charles S. Peskin, Courant Institute of Mathematical Sciences, New York University

- *Mathematical Foundations of Image Analysis and Computational Vision*, presented by Don McClure, Brown University

- *Ergodic Theory*, presented by Doug Lind, University of Washington

- *The Energy of Knots*, presented with JPBM by Jonathan K. Simon, University of Iowa, and Gregory R. Buck, Saint Anselm College

For information on the annual CNSF exhibition and reception, please visit the CNSF website, <http://www.cnsf.org>.

—Anita Benjamin, AMS Washington Office



From the AMS Public Awareness Office

Fibonacci Numbers in Nature poster. Download the PDF file of a small version of this poster (printable on 8.5 by 11 inches or A4-size paper), or request a copy on the AMS Printable Posters

webpage at <http://www.ams.org/ams/ams-printable-posters.html>.

The Profession. The AMS website features a collection of resources about and for the profession. Visitors can easily find a wealth of information, including:

- Data on the Profession (annual surveys from 1957 to the present and forms to submit data)
- Information for Department Leaders (workshops, awards, culture statements)
- Mathematics People (directories, biographical sources, “What do mathematicians do?”)
- Mathematics Education (a selection of articles that have appeared in *Notices* and “Teaching Tips”)
- For Students (resources for high school, undergraduate, and graduate students)
- AMS Outreach Projects (Mathematics Programs That Make a Difference, AMS Award for Exemplary Program or Achievement in a Mathematics Department, Conferences on Promoting Undergraduate Research in Mathematics, Arnold Ross Lecture Series, AMS Book and Journal Donation Program, *Towards Excellence*)

- Funding and Fellowships (for individuals and departments)

See <http://www.ams.org/outreach>.

—Annette Emerson and Mike Breen, AMS Public Awareness Officers, paoffice@ams.org

Deaths of AMS Members

C. ARNE ARENBERG, retired, from Evanston, IL, died on January 27, 2003. Born on September 3, 1917, he was a member of the Society for 35 years.

PATRICIA M. BLITCH, professor, Lander University, died in 2008. Born on December 20, 1951, she was a member of the Society for 30 years.

DAN BUTNARIU, professor, University of Haifa, died on July 4, 2008. Born on February 1, 1951, he was a member of the Society for 23 years.

LEONARDO D’ATTORRE, from Thousand Oaks, CA, died on October 8, 2006. Born on February 2, 1920, he was a member of the Society for 47 years.

EDWIN G. EIGEL, from Fairfield, CT, died on April 7, 2008. Born on June 4, 1932, he was a member of the Society for 52 years.

JAMES K. FEIBLEMAN, professor emeritus, Tulane University, died on September 14, 1987. Born on July 13, 1904, he was a member of the Society for 19 years.

WILLIAM FORMAN, professor, Brooklyn College, CUNY, died on July 24, 1998. Born on October 16, 1914, he was a member of the Society for 49 years.

DETLEF GROMOLL, professor, SUNY at Stony Brook, died on May 31, 2008. Born on May 13, 1938, he was a member of the Society for 41 years.

NARAIN D. GUPTA, professor, University of Manitoba, died on April 11, 2008. Born on July 27, 1936, he was a member of the Society for 40 years.

VADIM KOMKOV, retired, Texas Tech University, died on May 14, 2008. Born on August 18, 1919, he was a member of the Society for 42 years.

J. C. MARK, retired staff member, Los Alamos National Laboratory, died on March 2, 1997. Born on July 6, 1913, he was a member of the Society for 50 years.

DONALD L. PILLING, from Vienna, VA, died on May 26, 2008. Born on June 4, 1943, he was a member of the Society for 37 years.

ELDON E. POSEY, professor emeritus, University of North Carolina, Greensboro, died on May 7, 2008. Born on January 25, 1921, he was a member of the Society for 58 years.

DANIEL RIDER, professor, University of Wisconsin, Madison, died on July 11, 2008. Born on July 23, 1938, he was a member of the Society for 45 years.

EVA A. WINTER, from Lenexa, KS, died on June 13, 2006. Born on January 28, 1920, she was a member of the Society for 63 years.

KRZYSZTOF P. WOJCIECHOWSKI, professor, Indiana University–Purdue University, Indianapolis, died on June 28, 2008. Born on October 15, 1953, he was a member of the Society for 21 years.

Just published **Coming soon**

A Posteriori Estimates for Partial Differential Equations

Sergey Repin

Sergey Repin

■ A Posteriori Estimates for Partial Differential Equations

Approx. 370 pages. Hardcover.

RRP € [D] 64.00 / *US\$ 80.00

ISBN 978-3-11-019153-0

Radon Series on Computational and Applied Mathematics 4



Mats Gyllenberg / Dimitrii S. Silvestrov

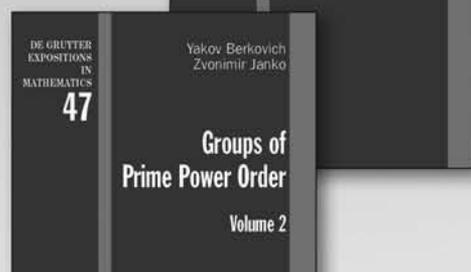
■ Quasi-Stationary Phenomena in Nonlinearly Perturbed Stochastic Systems

Approx. 560 pages. Hardcover.

RRP € [D] 128.00 / *US\$ 189.00

ISBN 978-3-11-020437-7

de Gruyter Expositions in Mathematics 44



Yakov Berkovich

■ Groups of Prime Power Order Volume 1

Approx. 440 pages. Hardcover.

RRP € [D] 98.00 / *US\$ 145.00

ISBN 978-3-11-020418-6

de Gruyter Expositions in Mathematics 46

To be published: October 2008



Yakov Berkovich / Zvonimir Janko

■ Groups of Prime Power Order Volume 2

Approx. 520 pages. Hardcover.

RRP € [D] 98.00 / *US\$ 145.00

ISBN 978-3-11-020419-3

de Gruyter Expositions in Mathematics 47

To be published: October 2008



Pei-Chu Hu / Chung-Chun Yang

■ Distribution Theory of Algebraic Numbers

Approx. 500 pages. Hardcover.

RRP € [D] 118.00 / *US\$ 175.00

ISBN 978-3-11-020536-7

de Gruyter Expositions in Mathematics 45

To be published: November 2008

de Gruyter
Berlin · New York

www.degruyter.com

**For orders placed in North America.
Prices are subject to change.
Prices do not include postage and handling.*

Reference and Book List

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

Contacting the Notices

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

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

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

Upcoming Deadlines

September 9, 2008: Full proposals for NSF International Research Fellow Awards. Contact the program officer, Susan Parris, 703-292-8711, `sparris@nsf.gov`; or visit the website http://www.nsf.gov/funding/pgm_summ.jsp?pims_id=5179&org=NSF.

September 15, 2008: Nominations for Sloan Research Fellowships. See http://www.sloan.org/programs/fellowship_brochure.shtml or contact Sloan Research Fellowships, Alfred P. Sloan Foundation, 630 Fifth Avenue, Suite 2550, New York, New York 10111-0242.

September 19, 2008: Full proposals for NSF Focused Research Groups. See http://www.nsf.gov/funding/pgm_summ.jsp?pims_id=5671&org=DMS.

September 30, 2008: Applications for spring 2009 semester of Math in Moscow. See <http://www.mccme.ru/mathinmoscow> or write to: Math in Moscow, P.O. Box 524, Wynnwood, PA 19096; fax: +7095-291-65-01; email: `mim@mccme.ru`. For information on AMS scholarships see <http://www.ams.org/outreach/mimoscow.html> or write to: Math in Moscow Program, Membership and Programs Department, American Mathematical Society, 201 Charles Street, Providence RI 02904-2294; email: `student-serv@ams.org`.

September 30, 2008: Nominations for 2008 Information-Based Complexity Young Researcher Award.

Contact Joseph Traub at `traub@cs.columbia.edu`.

October 1, 2008: Applications for AWM Travel Grants. See <http://www.awm-math.org/travelgrants.html>; telephone: 703-934-0163; email: `awm@awm-math.edu`; or contact Association for Women in Mathematics, 11240 Waples Mill Road, Suite 200, Fairfax, VA 22030.

October 15, 2008: Applications for NSF Mathematical Sciences Postdoctoral Research Fellowships. See http://www.nsf.gov/funding/pgm_summ.jsp?pims_id=5301&org=DMS.

October 15, 2008: Proposals for NSA Mathematical Sciences Program research grants. See <http://www.nsa.gov/msp/index.cfm> or contact the program director, Michelle Wagner (`mdwagn4@nsa.gov`), or the program administrator, Barbara Johnson (`ba-`

Where to Find It

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

AMS Bylaws—November 2007, p. 1366

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AMS Officers 2006 and 2007 Updates—May 2008, p. 629

AMS Officers and Committee Members—October 2008, p. 1122

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NRC Mathematical Sciences Education Board—April 2008, p. 515

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Program Officers for Federal Funding Agencies—October 2008, p. 1116 (DoD, DoE); December 2007, p. 1359 (NSF); December 2007, p. 1526 (NSF Mathematics Education)

Program Officers for NSF Division of Mathematical Sciences—November 2007, p. 1358

Stipends for Study and Travel—September 2008, p. 983

john1@nsa.gov), telephone 301-688-0400.

October 15, 2008: Proposals for NSF Postdoctoral Research Fellowships. See http://www.nsf.gov/funding/pgm_summ.jsp?pims_id=5301&org=DMS.

November 1, 2008: Applications for November review for the National Academies Postdoctoral and Senior Research Associateship Programs. See <http://www7.nationalacademies.org/rap/index.html> or contact Research Associateship Programs, National Research Council, Keck 568, 500 Fifth Street, NW, Washington, DC 20001; telephone 202-334-2760; fax 202-334-2759; email: rap@nas.edu.

November 15, 2008: Target date for receipt of applications for NSA Mathematics Sabbatical Program. See <http://www.nsa.gov/msp/index.cfm> or contact the program director, Michelle Wagner (mdwagn4@nsa.gov), or the program administrator, Barbara Johnson (bajohn1@nsa.gov), telephone 301-688-0400.

December 1, 2008: Applications for AMS Centennial Fellowships. See <http://www.ams.org/employment/centflyer.html>; write to the Membership and Programs Department, American Mathematical Society, 201 Charles Street, Providence, RI 02904-2294; send email to prof-serv@ams.org; or call 401-455-4060.

January 15, 2009: Applications for AMS-AAAS Mass Media Summer Fellowships. See "Mathematics Opportunities" in this issue.

December 15, 2008: Applications for AMS Epsilon Fund grants. See "Mathematics Opportunities" in this issue.

February 1, 2009: Applications for AWM Travel Grants. See <http://www.awm-math.org/travelgrants.html>; telephone: 703-934-0163; email: awm@awm-math.edu. The postal address is: Association for Women in Mathematics, 11240 Waples Mill Road, Suite 200, Fairfax, VA 22030.

February 27, 2009: Submissions for Association for Women in Mathematics (AWM) essay contest. See "Mathematics Opportunities" in this issue.

April 15, 2009: Applications for fall 2009 semester of Math in Moscow. See <http://www.mccme.ru/>

mathinmoscow or write to: Math in Moscow, P.O. Box 524, Wynnewood, PA 19096; fax: +7095-291-65-01; email: mim@mccme.ru. For information on AMS scholarships see <http://www.ams.org/outreach/mimoscow.html> or write to: Math in Moscow Program, Membership and Programs Department, American Mathematical Society, 201 Charles Street, Providence RI 02904-2294; email: student-serv@ams.org.

May 8, 2009: Applications for AWM Travel Grants. See <http://www.awm-math.org/travelgrants.html>; telephone: 703-934-0163; email: awm@awm-math.edu. The postal address is: Association for Women in Mathematics, 11240 Waples Mill Road, Suite 200, Fairfax, VA 22030.

June 2, 2009: Proposals for NSF's Enhancing the Mathematical Sciences Workforce in the Twenty-First Century program. See "Mathematics Opportunities" in this issue.

October 1, 2009: Applications for AWM Travel Grants. See <http://www.awm-math.org/travelgrants.html>; telephone: 703-934-0163; email: awm@awm-math.edu. The postal address is: Association for Women in Mathematics, 11240 Waples Mill Road, Suite 200, Fairfax, VA 22030.

DoD Mathematics Staff

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

Defense Advanced Research Projects Agency

Defense Sciences Office
3701 North Fairfax Drive
Arlington, VA 22203-1714
703-526-6630
<http://www.darpa.mil/dso>

Applied and Computational Mathematics Program

Discovery and Exploitation of Structure in Algorithms

Dennis Healy, Program Manager
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Todd Hughes, Program Manager

Predicting Real Optimized Materials

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Book ListList

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.

**An Abundance of Katherines*, by John Green. Dutton Juvenile Books, September 2006. ISBN-13:978-0-5254-7688-7. (Reviewed in this issue.)

**Amongst Mathematicians: Teaching and Learning Mathematics at University Level*, by Elena Nardi. Springer, November 2007. ISBN-13: 978-0-387-37141-2.

**The Archimedes Codex*, by Reviel Netz and William Noel. Weidenfeld and Nicolson, May 2007. ISBN-13: 978-0-29764-547-4. (Reviewed September 2008.)

**Benjamin Franklin's Numbers: An Unsung Mathematical Odyssey*, by Paul C. Pasles. Princeton University Press, October 2007. ISBN-13: 978-0-6911-2956-3.

**The Book of Numbers: The Secret of Numbers and How They Changed the World*, by Peter J. Bentley. Firefly Books, February 2008. ISBN-13: 978-15540-736-10.

**The Calculus Wars: Newton, Leibniz, and the Greatest Mathematical Clash of All Time*, by Jason Socrates Bardi. Thunder's Mouth Press, April 2007. ISBN-13: 978-1-5602-5992-3.

**A Certain Ambiguity: A Mathematical Novel*, by Gaurav Suri and Hartosh Singh Bal. Princeton University Press, June 2007. ISBN-13: 978-0-6911-2709-5. (Reviewed February 2008.)

**Descartes: A Biography*, by Desmond Clarke. Cambridge University Press, March 2006. ISBN 0-521-82301-3. (Reviewed January 2008.)

**Digital Dice*, by Paul J. Nahin. Princeton University Press, March 2008. ISBN-13: 978-06911-269-82.

**Dimensions*, by Jos Leys, Etienne Ghys, and Aurélien Alvarez. DVD, 117

minutes. Available at <http://www.dimensions-math.org>.

**Discovering Patterns in Mathematics and Poetry*, by Marcia Birken and Anne C. Coon. Rodopi, February 2008. ISBN-13: 978-9-0420-2370-3.

**Does Measurement Measure Up?: How Numbers Reveal and Conceal the Truth*, by John Henshaw. Johns Hopkins University Press, March 2006. ISBN-13: 978-0-8018-8375-0.

**Euclidean and Non-Euclidean Geometries: Development and History*, fourth revised and expanded edition, by Marvin Jay Greenberg. W. H. Freeman, September 2007. ISBN-13: 978-0-7167-9948-1.

**Flatland—The Movie: A Journey of Many Dimensions*. Flatworld Productions, 2007. Special Educator Edition DVD, <http://store.flatlandthemovie.com>. (Reviewed November 2007.)

**Fly Me to the Moon: An Insider's Guide to the New Science of Space Travel*, by Edward Belbruno. Princeton University Press, January 2007. ISBN-13: 978-0-6911-2822-1. (Reviewed April 2008.)

**Geekspeak: How Life + Mathematics = Happiness*, by Graham Tattersall. Collins, September 2008. ISBN-13: 978-00616-292-42.

**Geometric Folding Algorithms: Linkages, Origami, Polyhedra*, by Erik D. Demaine and Joseph O'Rourke. Cambridge University Press, July 2007. ISBN-13: 978-05218-57574.

**The Golden Section: Nature's Greatest Secret (Wooden Books)*, by Scott Olsen. Walker and Company, October 2006. ISBN-13: 978-08027-153-95.

**Group Theory in the Bedroom, and Other Mathematical Diversions*, by Brian Hayes. Hill and Wang, April 2008. ISBN-13: 978-0-8090-5219-6.

**Guesstimation: Solving the World's Problems on the Back of a Cocktail Napkin*, by Lawrence Weinstein and John A. Adam. Princeton University Press, April 2008. ISBN-13: 978-0-6911-2949-5.

**A History of Abstract Algebra*, by Israel Kleiner. Birkhäuser, October 2007. ISBN-13: 978-0-8176-4684-4.

**How Mathematicians Think: Using Ambiguity, Contradiction, and Paradox to Create Mathematics*, by William Byers. Princeton University Press, May

2007. ISBN-13: 978-0-6911-2738-5. (Reviewed December 2007.)

How Round Is Your Circle, by John Bryant and Chris Sangwin. Princeton University Press, January 2008. ISBN-13: 978-0-6911-3118-4.

Impossible?: Surprising Solutions to Counterintuitive Conundrums, by Julian Havil. Princeton University Press, April 2008. ISBN-13: 978-0-6911-3131-3.

The Indian Clerk, by David Leavitt. Bloomsbury USA, September 2007. ISBN-13: 978-15969-1040-9. (Reviewed September 2008.)

An Introduction to Gödel's Theorems, by Peter Smith. Cambridge University Press, August 2007. ISBN-13: 978-0-521-67453-9.

Irreligion: A Mathematician Explains Why the Arguments for God Just Don't Add Up, by John Allen Paulos. Hill and Wang, December 2007. ISBN-13: 978-0-8090-591-95. (Reviewed August 2008.)

Karl Pearson: The Scientific Life in a Statistical Age, by Theodore M. Porter. Princeton University Press, (new edition) December 2005. ISBN-13: 978-0-6911-2635-7. (Reviewed December 2007.)

The Legacy of Mario Pieri in Geometry and Arithmetic, by Elena Anne Marchisotto and James T. Smith. Birkhäuser, May 2007. ISBN-13: 978-0-8176-3210-6.

Leonhard Euler, a Man to Be Reckoned With, by Andreas K. Heyne and Alice K. Heyne. Birkhäuser, 2007. ISBN-13: 978-3-7643-8332-9. (Reviewed March 2008.)

Logic's Lost Genius: The Life of Gerhard Gentzen, by Eckart Menzler-Trott, Craig Smorynski (translator), Edward R. Griffor (translator). AMS-LMS, November 2007. ISBN-13: 978-0-8218-3550-0.

Making Mathematics Work with Needlework: Ten Papers and Ten Projects, edited by Sarah-Marie Belcastro and Carolyn Yackel. A K Peters, September 2007. ISBN-13: 978-1-5688-1331-8.

Math Doesn't Suck: How to Survive Middle-School Math without Losing Your Mind or Breaking a Nail, by Danica McKellar. Hudson Street Press, August 2007. ISBN-13: 978-1-5946-3039-2.

Mathematical Mind-Benders, by Peter Winkler. A K Peters, August 2007. ISBN-13: 978-1-5688-1336-3.

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More Sex Is Safer Sex: The Unconventional Wisdom of Economics, by Steven E. Landsburg. Free Press, April 2007. ISBN-13: 978-1-416-53221-7. (Reviewed June/July 2008.)

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**The Princeton Companion of Mathematics*, edited by Timothy Gowers (June Barrow-Green and Imre Leader, associate editors). Princeton University Press, November 2008. ISBN-13: 978-06911-188-02.

The Probability of God: A Simple Calculation That Proves the Ultimate Truth, by Stephen D. Unwin. Three Rivers Press, October 2004. ISBN-13: 978-1-4000-5478-7. (Reviewed February 2008.)

Pursuit of Genius: Flexner, Einstein, and the Early Faculty at the Institute for Advanced Study, by Steve Batterson. A K Peters, June 2006. ISBN 1-56881-259-0. (Reviewed August 2008.)

The Pythagorean Theorem: A 4000-Year History, by Eli Maor. Princeton University Press, May 2007. ISBN-13: 978-0-6911-2526-8.

Random Curves: Journeys of a Mathematician, by Neal Koblitz. Springer, December 2007. ISBN-13: 978-3-5407-4077-3.

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Thinking about Gödel and Turing: Essays on Complexity, 1970-2007, by Gregory J. Chaitin. World Scientific, August 2007. ISBN-13: 978-9-8127-0895-3.

The Triumph of Numbers: How Counting Shaped Modern Life, by I. B. Cohen. W. W. Norton, July 2006. ISBN-13: 978-0-393-32870-7. (Reviewed December 2007.)

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Unknown Quantity: A Real and Imaginary History of Algebra, by John Derbyshire. Joseph Henry Press, May 2006. ISBN 0-309-09657-X. (Reviewed May 2008.)

Useless Arithmetic: Why Environmental Scientists Can't Predict the Future, by Orrin Pilkey and Linda Pilkey-Jarvis. Columbia University Press, February 2007. ISBN 0-231-13212-3. (Reviewed April 2008.)

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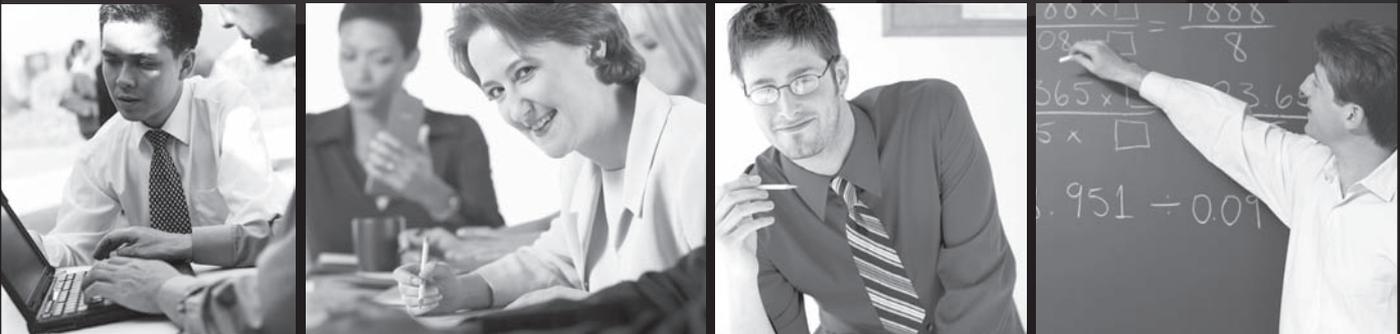
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1. Officers
 - 1.1. Liaison Committee
2. Council
 - 2.1. Executive Committee of the Council
3. Board of Trustees
4. Committees
 - 4.1. Committees of the Council
 - 4.2. Editorial Committees
 - 4.3. Committees of the Board of Trustees
 - 4.4. Committees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

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

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	Bernd Sturmfels	2010
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Associate Secretaries	Susan J. Friedlander	2009
	Michel L. Lapidus	2009
	Matthew Miller	2008
	Lesley M. Sibner	2008
Treasurer	John M. Franks	2008
Associate Treasurer	Donald E. McClure	2008

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	John M. Franks
	Eric M. Friedlander
Chair	James G. Glimm

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	Matthew Miller	2008
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Associate Treasurer	Donald E. McClure	2008

2.0.2. Representatives of Committees

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Colloquium	Paul J. Sally Jr.	2011
Executive Committee	Sylvain E. Cappell	2009
Journal of the AMS	Robert K. Lazarsfeld	2009
Mathematical Reviews	Jonathan I. Hall	2008
Mathematical Surveys and Monographs	J. Tobias Stafford	2008
Mathematics of Computation	Chi-Wang Shu	2011
Proceedings	Ronald Fintushel	2009
Transactions and Memoirs	Robert Guralnick	2008

2.0.3. Members at Large

Robert L. Devaney	2009	Frank S. Quinn	2009
Rebecca F. Goldin	2010	Katherine St. John	2009
William M. Goldman	2008	Marjorie Senechal	2009
Craig L. Huneke	2008	Joseph H. Silverman	2010
Judy Anita Kennedy	2008	Francis Edward Su	2009
Bryna Kra	2010	Judy L. Walker	2008
Ken Ono	2008	Sarah J. Witherspoon	2010
Irena Peeva	2010		

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

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Ruth M. Charney	2010
Robert J. Daverman	<i>ex officio</i>
James G. Glimm	<i>ex officio</i>
Robert Guralnick	2008
Craig L. Huneke	2011

3. Board of Trustees

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Chair	John M. Franks	<i>ex officio</i>
	Eric M. Friedlander	2009
	James G. Glimm	<i>ex officio</i>
	Linda Keen	2008
Secretary	Donald E. McClure	<i>ex officio</i>
	Karen Vogtmann	2012
	Carol S. Wood	2011

4. Committees

4.1. Committees of the Council

Standing Committees

4.1.1. Editorial Boards

	Eric Bedford	2009
	Robert L. Bryant	2008
	Robert J. Daverman	<i>ex officio</i>
Chair	Sergei Gelfand	<i>ex officio</i>
	Stephen Lichtenbaum	2008
	Alan W. Reid	2010
	Catherine Sulem	2010
	Irena Swanson	2009

4.1.2. Nominating Committee

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

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	Percy Deift	2010
	Thomas C. Hales	2009
	Roger Howe	2009
	M. Susan Montgomery	2008
	Louise A. Raphael	2010
Chair	Hema Srinivasan	2009
	Lisa M. Traynor	2008
	Richard A. Wentworth	2010

Special Committees

4.1.3. First-Year College Mathematics Experience, Task Force on

	David M. Bressoud	2008
	Ruth M. Charney	2008
	David H. Collingwood	2008
	James G. Glimm	2008
	Raymond L. Johnson	2008
	Dan Kannan	2008
	Judy Anita Kennedy	2008
	William James Lewis	2008
	William G. McCallum	2008
	Robert E. Megginson	2008
	Robert F. Olin	2008
	Donald G. Saari	2008
	Alan C. Tucker	2008

4.1.4. Preparation for Technical Careers Advisory Board, Working Group on

	Solomon Friedberg	2008
	Peter E. Haskell	2008
	Andy R. Magid	2008
	Paul J. Sally Jr.	2008
	W. Stephen Wilson	2008

4.1.5. Search Committee for the Editor of the Notices of the AMS

	Robert J. Daverman	2009
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	James Glimm	2009
	Rebecca Goldin	2009
	Judy Anita Kennedy	2009

4.2. Editorial Committees

4.2.1. Abstracts Editorial Committee

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	Michel L. Lapidus
	Matthew Miller
	Lesley M. Sibner

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Book Reviews Editor	Robert L. Devaney	2008
Chief Editor	Susan J. Friedlander	2008
Consultant	Jane Kister	2008

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Lawrence Craig Evans	2008	Paul H. Rabinowitz	2011
Edward Frenkel	2008	Panagiotis E. Souganidis	2010
Mark Goresky	2011	Yuri Tschinkel	2008
Andrew J. Granville	2008	Michael Wolf	2011
Bryna R. Kra	2008		
Barry Mazur	2008		

Associate Editors for Book Reviews

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Steven G. Krantz	2008	Philip E. Protter	2008
Peter Kuchment	2011	Lisa Traynor	2008

4.2.3. Collected Works

Chair	Dusa McDuff	2008
	Elias M. Stein	2008
	William A. Veech	2011

4.2.4. Colloquium

	Yuri Manin	2009
Chair	Paul J. Sally Jr.	2011
	Peter Sarnak	2008

4.2.5. Contemporary Mathematics

	George E. Andrews	2011
Chair	Dennis DeTurck	2011
	Abel Klein	2011
	Martin Strauss	2011

4.2.6. Graduate Studies in Mathematics

Chair	David A. Cox	2008
	Steven G. Krantz	2009
	Rafe Mazzeo	2011
	Martin G. Scharlemann	2011

4.2.7. Journal of the AMS

	Weinan E	2009
Chair	Robert K. Lazarsfeld	2009
	John W. Morgan	2009
	Karl Rubin	2011
	Oded Schramm	2011
	Terence Tao	2011

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Mark Goresky	2011	Victor S. Reiner	2009
Alexander Kechris	2008	Richard L. Taylor	2008
Robert Edward Kottwitz	2008	Avi Wigderson	2008
Peter Kronheimer	2008	Lia-Sang Young	2011

4.2.8. Mathematical Reviews

AMS staff contact: Kevin F. Clancey

	Lisa Fauci	2008
	Cameron Gordon	2011
Chair	Jonathan I. Hall	2008
	Peter Maass	2008
	Tadao Oda	2009
	Trevor D. Wooley	2008

4.2.9. Mathematical Surveys and Monographs

	Jerry L. Bona	2009
	Ralph L. Cohen	2009
	Michael G. Eastwood	2009
Chair	J. Tobias Stafford	2008
	Benjamin Sudakov	2011

4.2.10. Mathematics of Computation

	Susanne C. Brenner	2008
	Ronald F. Cools	2011
	Igor Shparlinski	2011
Chair	Chi-Wang Shu	2011

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Bernardo Cockburn	2011	Christoph Schwab	2011
Arjeh M. Cohen	2008	Jie Shen	2011
Jean-Marc Couveignes	2011	Chris J. Smyth	2009
Ricardo G. Duran	2009	Michael Stillman	2008
Ivan P. Gavrilyuk	2011	Daniel B. Szyld	2009
Viviette Girault	2008	Denis Talay	2009
Ernst Hairer	2011	Tao Tang	2008
Fred J. Hickernell	2011	Paul Tseng	2008
John McKay	2009	Hans W. Volkmer	2011
Francis J. Narcowich	2011	Jinchao Xu	2009

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William Casselman	2009	Peter C. Sarnak	2009
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Lisette de Pillis	2009	John R. Swallow	2009
Susan J. Friedlander	2009	Lisa M. Traynor	2009

4.2.12. Proceedings

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	Richard Bradley	2010
	Ted C. Chinburg	2009
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	Walter Craig	2008
	Alexander N. Dranishnikov	2011
Chair	Ronald A. Fintushel	2009
	Paul Goerss	2008
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	James Haglund	2009
	Jonathan I. Hall	2010
	Jane Hawkins	2009
	Birge Huisgen-Zimmerman	2009
	Marius Junge	2010
	Nigel Kalton	2011
	Julia Knight	2008
	Bryna Kra	2011
	Michael T. Lacey	2008
	Gail R. Letzter	2010
	Wen-Ching Winnie Li	2009
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	Varghese Mathai	2011
	Ken Ono	2008
	Daniel Ruberman	2009
Coordinating	Andreas Seeger	2008
	Mei-Chi Shaw	2008
	Hart F. Smith	2010
Coordinating	Chuu-Lian Terng	2009
	Tatiana Toro	2010
	Bernd Ulrich	2009
	Edward C. Waymire	2011
	Michael Weinstein	2008
	Richard Wentworth	2009
Coordinating	Jon Wolfson	2009

4.2.13. Proceedings of Symposia in Applied Mathematics

	Mary C. Pugh	2009
	Leonid Ryzhik	2011
Chair	Eitan Tadmor	2011

4.2.14. Transactions and Memoirs

	Dan Abramovich	2010
	Alejandro Adem	2008
	Richard Bass	2011
	Mark Feighn	2011
Chair	Robert Guralnick	2008
	Lisa Claire Jeffrey	2008
	Yunping Jiang	2011
	Alexander Kleshchev	2008
	Steffan Lempp	2011
	William P. Minicozzi II	2010
	Alexander Nagel	2010
	Peter Polacik	2010
	Gustavo Alberto Ponce	2009
	Jonathan Rogawski	2011
	Dimitri Shlyakhtenko	2010
	Robert J. Stanton	2009
	John R. Stembridge	2009
	Daniel I. Tartaru	2010
	Mina Teicher	2008

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 S.-Y. Cheng
 Chair Tsit-Yuen Lam
 Tai-Ping Liu
 Chung-Chun Yang

4.2.16. Translation from Japanese

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 Masamichi Takesaki 1999

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4.2.17. Conformal Geometry and Dynamics

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 Mario Bonk 2009
 Sun-Yung Alice Chang 2010
 Chair Gaven Martin 2011
 Yair N. Minsky 2008
 Susan Mary Rees 2011
 Caroline Series 2008

4.2.18. History of Mathematics

Joseph W. Dauben 2011
 Peter L. Duren 2011
 Chair Karen H. Parshall 2011
 Michael I. Rosen 2008

4.2.19. Representation Theory

Jens Carsten Jantzen 2008
 Chair George Lusztig 2008
 Dragan Milicic 2008
 Henrik Schlichtkrull 2009
 Freydoon Shahidi 2008
 David A. Vogan 2009

4.2.20. Student Mathematics Library

Gerald B. Folland 2008
 Chair Robin Forman 2011
 Brad G. Osgood 2011
 Michael Starbird 2008

4.2.21. University Lecture Series

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 Eric M. Friedlander 2008
 Nigel Higson 2009
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Standing Committees

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 Karen H. Parshall 2009
 Anthony V. Phillips 2008

4.5.2. Books and Journal Donations Steering Committee

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 James G. Glimm *ex officio*
 Carolyn S. Gordon 2008
 Ruth Haas 2008
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 Louis H. Kauffman 2008
 Tai-Ping Liu 2008
 Jonathan Christopher Mattingly 2008
 Chair Mark Rieffel 2008
 Stephen Smale 2008
 Tara Smith 2008
 Yuri Tschinkel 2008

Officers and Committee Members

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	Michael Bowman	2009
	Roger Chalkley	2010
	Sherry Chang	2010
	Michael J. Falk	2009
Co-chair	Kristine K. Fowler	2008
	Silvio Levy	2009
	Yunliang Yu	2010

4.5.5. Publications

AMS staff contact: Erin Buck.

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	Robert J. Daverman	<i>ex officio</i>
	Robert L. Devaney	2009
	Roman J. Dvilewicz	2010
	John H. Ewing	<i>ex officio</i>
	Eric M. Friedlander	2008
	Sergei Gelfand	<i>ex officio</i>
	James G. Glimm	<i>ex officio</i>
	Jacques Hurtubise	2008
	Stephen Lichtenbaum	2008
	John Luecke	2008
Chair	Ken Ono	2008
	Joseph H. Silverman	2010
	Elias M. Stein	2008

4.6. Program and Meetings

Standing Committees

4.6.1. Meetings and Conferences

AMS staff contact: Ellen Maycock

	Robert J. Daverman	<i>ex officio</i>
	John H. Ewing	<i>ex officio</i>
	Ryan Garibaldi	2010
	James G. Glimm	<i>ex officio</i>
	Aloysius G. Helminck	2010
	Judy Anita Kennedy	2008
	John C. Meakin	2008
	David B. Meredith	2009
	Irena Peeva	2010
	Catherine A. Roberts	2008
Chair	Katherine St. John	2009
	Ann Trenk	2010
	Carol S. Wood	2008

4.6.2. Program Committee for National Meetings

	Robert Calderbank	2009
	Gui-Qiang Chen	2009
Chair	Gregory Cherlin	2008
	Robert J. Daverman	<i>ex officio</i>
	Lisa Claire Jeffrey	2008
	Vaughn F. R. Jones	2010
	Robion C. Kirby	2009
	Dana Randall	2010
	Bernard Russo	<i>ex officio</i>

4.6.3. Short Course Subcommittee

Chair	Joe P. Buhler	2008
	Peter E. Castro	2009
	Yuval Peres	2009
	Daniel Rockmore	2010
	Chi-Wang Shu	2010
	Lisa G. Townsley	2009
	Joseph C. Watkins	2008

4.6.4. Central Section Program Committee

	F. Michael Christ	2008
Chair	James Wesley Cogdell	2008
	Susan J. Friedlander	<i>ex officio</i>
	Bryna Kra	2009
	Shmuel A. Weinberger	2009

4.6.5. Eastern Section Program Committee

Chair	Robert H. Gilman	2008
	Andrew Granville	2008
	Charles David Levermore	2009
	Lesley M. Sibner	<i>ex officio</i>
	John Smillie	2009

4.6.6. Southeastern Section Program Committee

Chair	Nicholas J. Kuhn	2008
	Matthew Miller	<i>ex officio</i>
	Stanslav A. Molchanov	2009
	Victoria Ann Powers	2009
	John G. Ratcliffe	2008

4.6.7. Western Section Program Committee

	Bruce K. Driver	2008
	Michel L. Lapidus	<i>ex officio</i>
Chair	Jonathan Rogawski	2008
	Jennifer C. Schultens	2009
	Brad Shelton	2008
	Ravi D. Vakil	2009

4.6.8. Agenda for Business Meetings

Chair	Robert J. Daverman	<i>ex officio</i>
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4.6.9. Arnold Ross Lecture Series Committee

	Brian Conrad	2008
	Thomas C. Hull	2010
Chair	Frank Morgan	2009
	Dan Rockmore	2009

4.6.10. Colloquium Lecture

	Persi W. Diaconis	2008
Chair	Peter Sarnak	2010
	Lai-Sang Young	2009

4.6.11. Gibbs Lecturer for 2009 and 2010, Committee to Select

Chair	Weinan E	2009
	Barry Simon	2009
	Peter Winkler	2009

4.7. Status of the Profession

Standing Committees

4.7.1. Academic Freedom, Tenure, and Employment Security

	William K. Allard	2010
	Ronald G. Douglas	2010
	Michael K. May	2010
	Stephen B. Robinson	2009
Chair	Ratnasingham Shivaji	2008
	Lorenzo Traldi	2009
	Robert L. Wilson	2008

4.7.2. Education

AMS staff contact: Samuel M. Rankin III.

	John B. Conway	2008
	Robert J. Daverman	<i>ex officio</i>
	John H. Ewing	<i>ex officio</i>
	Michael E. Gage	2010
	James G. Glimm	<i>ex officio</i>
	William Mark Goldman	2008
	Lawrence Firman Gray	2009
	Deborah Hughes Hallett	2010
Chair	William McCallum	2008
	James E. McClure	2009
	Harriett S. Pollatsek	2009
	Frank S. Quinn	2008
	Wilfried Schmid	2008
	Ronald J. Stern	2008
	Sarah J. Witherspoon	2010

4.7.3. Fan Fund

Chair	Weinan E	2009
	Lizhen Ji	2008
	Tsit-Yuen Lam	2010

4.7.4. Human Rights of Mathematicians

Chair	Margaret Bayer	2010
	Alexander Beilinson	2008
	Alfonso Castro	2008
	Eduardo Cattani	2009
	Joel L. Lebowitz	2009
	Wen-Ching Winnie Li	2009
	Parimala Raman	2010
	Norbert H. Schlomiuk	2008
	Joseph C. Watkins	2010

4.7.5. Profession

AMS staff contact: Ellen J. Maycock.

Chair	Alejandro Adem	2009
	Bruce Blackadar	2010
	James H. Curry	2008
	Robert J. Daverman	<i>ex officio</i>
	James A. Donaldson	2009
	Charles L. Epstein	2010
	John H. Ewing	<i>ex officio</i>
	James G. Glimm	<i>ex officio</i>
Chair	Craig L. Huneke	2008
	Linda Keen	2008
	Chawne M. Kimber	2008
	Bryna Kra	2010
	Ronald L. Lipsman	2008
	Susan Loewy	2010
	Francis Edward Su	2009

4.7.6. Professional Ethics

Chair	Sheldon Axler	2009
	Michael Beals	2009
	David B. Leep	2010
	Lance L. Littlejohn	2009
Chair	Catherine A. Roberts	2008
	William Trotter	2010

4.7.7. Science Policy

AMS staff contact: Samuel M. Rankin III.

Chair	George E. Andrews	<i>ex officio</i>
	Gunnar Carlsson	2010
	Robert J. Daverman	<i>ex officio</i>
	James W. Demmel	2010
	John H. Ewing	<i>ex officio</i>
	James G. Glimm	<i>ex officio</i>
	Rebecca F. Goldin	2010
	Robert P. Lipton	2008
	William McCallum	2008
	Konstantin Mischaikow	2010
	Marjorie Senechal	2009
	Freydoon Shahidi	2009
Chair	Ronald J. Stern	2009
	Karen Vogtmann	2008
	Judy L. Walker	2008
	Nolan Wallach	2008

4.7.8. Young Scholars Awards

Terms expire on June 30.

Chair	David L. Ferguson	2009
	Irwin Kra	2011
	Sergei Tabachnikov	2010
	Jeremy T. Teitelbaum	2010

4.8. Prizes and Awards

Standing Committees

4.8.1. AMS Public Policy Award Selection Committee

	George E. Andrews	2008
	James G. Glimm	2008
	Ronald J. Stern	2008

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

	Carolyn R. Mahoney	2009
	Paul J. Sally Jr.	2009
	Richard A. Tapia	2011

4.8.3. The Stefan Bergman Trust Fund

Chair	Ronald Coifman	2009
	Richard B. Melrose	2008
	Elias M. Stein	2010

4.8.4. Centennial Fellowships

Terms expire on June 30.

Chair	Adebisi Agboola	2010
	Richard T. Durrett	2009
	David R. Larson	2010
	Judith A. Packer	2010
	Susan Tolman	2009
Chair	Kevin Zumbrun	2009
		2010

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

Chair	Georgia Benkart	2010
	Stephen J. Greenfield	2009
	Carl R. Riehm	2008

4.8.6. Joseph L. Doob Prize

	Andrew J. Granville	2012
	Robin C. Hartshorne	2012

Officers and Committee Members

4.8.7. Math in Moscow Program—Travel Support

Terms expire on June 30.

Chair	Vladimir V. Chernov	2010
	Askold Khovanskii	2009
	Leonid Korolov	2010

4.8.8. Menger Prize, Committee to Select the Winner of the

Terms expire on May 31.

Chair	Edward A. Connors	2010
	Gregory E. Fasshauer	2011
	Doron Levy	2010
	David R. Scott	2009

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

	Carolyn S. Gordon	2009
	Efim I. Zelmanov	2009
	_____	2009
	_____	2009
	_____	2009

4.8.10. National Awards and Public Representation

	George E. Andrews	<i>ex officio</i>
	Robert J. Daverman	<i>ex officio</i>
Chair	James G. Glimm	<i>ex officio</i>
	Peter D. Lax	2009
	Dusa McDuff	2008

4.8.11. David P. Robbins Prize

	Jonathan Borwein	2008
	Jeffrey C. Lagarias	2008
	David I. Lieberman	2008
	Richard P. Stanley	2008
	Robin Thomas	2008

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

Chair	Benedict H. Gross	2009
	Jane M. Hawkins	2011
	Sijue Wui	2011

4.8.13. Steele Prizes

	Enrico Bombieri	2009
	Russell Caflisch	2009
	L. Craig Evans	2008
	Lisa Claire Jeffrey	2009
	Nicholas Katz	2008
	Gregory F. Lawler	2010
	Richard M. Schoen	2010
Chair	Julius L. Shaneson	2008
	Richard P. Stanley	2009

4.8.14. Whiteman Prize for 2009, Committee to Select the Winner of the

	Bruce C. Berndt	2008
	Keith J. Devlin	2008
Chair	Harold M. Edwards	2008

Special Committees

4.8.15. Cole Prize, Committee to Select the Winner of the

Chair	Alexander Beilinson	2008
	David Harbater	2008
	Victor Kac	2008

4.8.16. Exemplary Program or Achievement by a Mathematics Department, Committee to Select the Winner of the Prize for

Chair	Steven A. Bleiler	2009
	Amy Cohen	2010
	William Burkley Jacob	2010
	Karl W. Knight	2008
	Roger Wiegand	2009

4.9. Institutes and Symposia

Standing Committees

4.9.1. Liaison Committee with AAS

	Edward F. Aboufadel	<i>ex officio</i>
	Douglas Arnold	2008
	Jere Confrey	<i>ex officio</i>
	Keith Devlin	<i>ex officio</i>
	Mark L. Green	2009
	John Harer	2009
	William H. Jaco	<i>ex officio</i>
Chair	Carl Pomerance	<i>ex officio</i>
	Mary Beth Ruskai	2009
	Donald G. Saari	<i>ex officio</i>

4.10. Joint Committees

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

	Kathryn E. Brenan (SIAM)	2009
	Sandra Clarkson (ASA)	2010
	Carolyn Connell (MAA)	2010
	Christine Escher (AMS)	2009
	Priscilla Greenwood (Cindy) (IMS)	2009
	Jennifer Hontz (MAA)	2008
Chair	Janine E. Janosky (ASA)	2009
	Nicole Lazar (ASA)	2008
	Xihong Lin (IMS)	2010
	Maura Mast (AWM)	2010
	Kathleen M. O'Hara (AMS)	2010
	C. Lanette Poteete-Young (MAA)	2008
	Mary Silber (SIAM)	2008
	Margaret F. Symington (AMS)	2007
	Lynda Wiest (NCTM)	2010
	_____ (AWM)	2009

4.10.2. AMS-ASA-IMS-MAA-SIAM Data Committee

AMS staff contact: James W. Maxwell.

	Richard J. Cleary (MAA)	2008
	Richard M. Dudley (AMS)	2009
	John W. Hagood (AMS)	2009
	Abbe H. Herzig (AMS)	2008
	Ellen Kirkman (MAA)	2010
	David J. Lutzer (MAA)	2008
	James W. Maxwell (AMS)	<i>ex officio</i>
	Joanna B. Mitro (AMS)	2010
	Bart S. Ng (SIAM)	2009
Chair	Polly Phipps (ASA)	2009
	Douglas C. Ravenel (AMS)	2010
	Jianguo Sun (IMS)	2009
	Marie A. Vitulli (AMS)	2010

4.10.3. AMS-ASA-MAA-SIAM Joint Policy Board for Mathematics

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

James Crowley (SIAM)	2009
Robert J. Daverman (AMS)	2008
John H. Ewing (AMS)	2009
Joseph A. Gallian (MAA)	2008
James G. Glimm (AMS)	2008
Martin Golubitsky (SIAM)	2008
Peter A. Lachenbruch (ASA)	2009
Cleve Moler (SIAM)	2008
Steve Pierson (ASA)	2008
Tina H. Straley (MAA)	2008
Philippe Tondeur (MAA)	2010
Ronald Wasserstein (ASA)	2010

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

Chair James D. Stasheff (AMS)

AMS Subcommittee Members

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

ASL Subcommittee Members

Chair	Veronica Becher	2011
	Max Dickmann	2011
	Andrei Morozov	2011
	Hiroakira Ono	2011
	Kai Wehmeier	2011
	Feng Ye	2011

IMS Subcommittee Members

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

4.10.5. AMS-MAA Committee on Cooperation

All members of this committee serve *ex officio*.

George E. Andrews (AMS)
David Bressoud (MAA)
Robert J. Daverman (AMS)
John H. Ewing (AMS)
Joseph A. Gallian (MAA)
James G. Glimm (AMS)
Martha J. Siegel (MAA)
Tina H. Straley (MAA)

4.10.6. AMS-MAA Committee on Mathematicians with Disabilities

Yousef Alavi (MAA)	2009
Curtis Bennett (MAA)	2008
Benson S. Farb (AMS)	2010
Theresa C. Michnowicz (MAA)	2009
Judith R. Miller (AMS)	2008
Amanda W. Peet (AMS)	2010

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

David C. Carothers (MAA)	2009
John D. Eggers (AMS)	2009
Diane L. Herrmann (AMS)	2009
Janet M. McShane (AMS)	2008
Dennis Pence (MAA)	2010
Stephen Robinson (AMS)	2010
George T. Yates (MAA)	2011
————(MAA)	2010

4.10.8. AMS-MAA Joint Archives Committee

Chair	William W. Dunham (MAA)	2008
	Mary W. Gray (MAA)	2009
	Kenneth R. Meyer (AMS)	2010
	Karen H. Parshall (AMS)	2009
	Anthony V. Phillips (AMS)	2008
	James J. Tattersall (MAA)	2009

4.10.9. AMS-MAA Joint Meetings Committee

All members of this committee serve *ex officio*.

Chair	Robert J. Daverman
	John H. Ewing
Consultant	Penny Pina
	Tina H. Straley
	James J. Tattersall

4.10.10. AMS-MAA Exhibits Advisory Subcommittee

Chair	Cheryl Adams
	Jessica Azzerad
	Robert J. Daverman
	Norma Flores
	John Grafton
	Elizabeth Huber
	Bob Mathews
	Penny Pina
	Bob Pirtle
	Sandi Lynn Scherer
	Tanja Swijnenberg
	James J. Tattersall
	Joan Weiss

4.10.11. AMS-MAA Joint Program Committee for the Washington, DC, Meeting January 5–8, 2009

Ronald Coifman (AMS)
Joe Gallian (MAA)
Gregory F. Lawler (AMS)
Dan Ullman (MAA)

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

AMS staff contact: Ellen Maycock.

Edward F. Aboufadel (AMS)	2009
Thomas C. Craven (AMS)	2010
E. McKay Hyde (SIAM)	2010
Ellen Maycock (AMS)	<i>ex officio</i>
Michael Pearson (MAA)	<i>ex officio</i>
Margaret Robinson (MAA)	2009
Lee Seitelman (SIAM)	2008
James Tattersall (MAA)	2010
Linda Thiel (SIAM)	<i>ex officio</i>
Chair Sarah J. Witherspoon (AMS)	2008
————(MAA)	2010

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

	Georgia M. Benkhart (MAA)	2010
	James H. Curry (SIAM)	2010
	Maeve L. McCarthy (SIAM)	2010
	Michael E. Orrison Jr. (AMS)	2010
Chair	Kannan Soundararajan (AMS)	2009
	Paul Zorn (MAA)	2009

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

Terms expire on October 30.

Chair	Peter Jones	2008
	George Papanicolaou	2008
	Terence Chi-Shen Tao	2008

Special Committee

4.10.15. AMS-Shanghai Mathematical Society (SMS) Joint Program Committee, December 17–21, 2008

	Robert L. Bryant	
	Gui-Qiang Chen	
	Susan J. Friedlander	<i>ex officio</i>
	Shou-Wu Zhang	

5. Representatives

5.0.1. American Association for the Advancement of Science

Terms expire on February 21.

Section A	Donald G. Saari	2009
Section Q	Jere Confrey	2009

5.0.2. Canadian Mathematical Society

	Robert Devaney	2008
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5.0.3. Commission on Professionals in Science and Technology

	Polly Phipps	2007
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5.0.4. Committee on the American Mathematics Competition (MAA)

Term expires on June 30.

	Kiran S. Kedlaya	2009
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5.0.5. Conference Board of the Mathematical Sciences

	James G. Glimm	2008
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5.0.6. Delbert Ray Fulkerson Prize Selection Committee

	Daniel J. Kleitman	2009
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5.0.7. MAA Committee on Undergraduate Program in Mathematics (CUPM)

	Alfonso Castro	2008
	Mario Umberto Martelli	2008

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

Term expires on October 31.

	David Kinderlehrer	2008
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Statistics on Women Mathematicians Compiled by the AMS

At its August 1985 meeting the Council of the AMS approved a motion to regularly assemble and report in the *Notices* information on the relative numbers of men versus women in at least the following categories: membership in the AMS, invited hour addresses at AMS meetings, speakers at Special Sessions at AMS meetings, percentage of women speakers in AMS Special Sessions by gender of organizers, and members of editorial boards of AMS journals.

It was subsequently decided that this information would be gathered by determining the sex of the individuals in the above categories based on name identification if no other means was available and that additional information on the number of Ph.D.'s granted to women would also be collected using the AMS-ASA-IMS-MAA-SIAM Annual Survey. Since name identification was used, the information for some categories necessitated the use of three classifications:

Male: names that were obviously male

Female: names that were obviously female

Unknown: names that could not be identified as clearly male or female (e.g., only initials given, non-gender-specific names, etc.)

The following is the twenty-second reporting of this information. Updated reports will appear annually in the *Notices*.

Invited Hour Address Speakers at AMS Meetings (1998-2007)

Male:	384	84%
Female:	71	16%
Unknown:	0	0%
Total:	455	

Speakers at Special Sessions at AMS Meetings (2003-2007)

Male:	9,814	81%
Female:	2,138	18%
Unknown:	212	2%
Total:	12,164	

Percentage of Women Speakers in AMS Special Sessions by Gender of Organizers (2007)

Special Sessions with at Least One Woman Organizer

Male:	749	74%
Female:	250	25%
Unknown:	18	2%
Total:	1,017	

Special Sessions with No Women Organizers

Male:	1,185	82%
Female:	221	15%
Unknown:	38	3%
Total:	1,444	

2007 Members of the AMS Residing in the U.S.

Male:	14,360	67%
Female:	3,691	17%
Unknown:	3,249	15%
Total:	21,300	

Trustees and Council Members

	2004	2005	2006	2007
Male:	29 71%	30 71%	27 66%	27 66%
Female:	12 29%	12 29%	14 34%	14 34%
Total:	41	42	41	41

Members of AMS Editorial Committees

	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Male:	182 85%	198 86%	186 85%	190 85%	195 85%	189 84%	180 84%	184 83%	193 84%	194 84%
Female:	31 15%	32 14%	33 15%	34 15%	35 15%	35 16%	34 16%	38 17%	36 16%	36 16%
Total:	213	230	219	224	230	224	214	222	229	230

Ph.D.'s Granted to U.S. Citizens

	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Male:	423 72%	367 66%	379 71%	343 69%	291 70%	341 68%	347 68%	355 72%	399 72%	396 69%
Female:	163 28%	187 34%	158 29%	151 31%	127 30%	158 32%	166 32%	141 28%	153 28%	180 31%
Total:	586	554	537	494	418	499	513	496	552 516	576

Mathematics Calendar

Please submit conference information for the Mathematics Calendar through the Mathematics Calendar submission form at <http://www.ams.org/cgi-bin/mathcal-submit.pl>. The most comprehensive and up-to-date Mathematics Calendar information is available on the AMS website at <http://www.ams.org/mathcal/>.

October 2008

* 8–9 **Math Institutes Modern Mathematics Workshop**, Salt Palace Convention Center, 100 S. West Temple, Salt Lake City, Utah.

Description: This is the first workshop sponsored by all the US-based Math Institutes and seventh in a series sponsored by the Mathematical Sciences Research Institute on contemporary research in mathematics. Each institute will focus on their upcoming programs for the academic year 2009–2010. All presentations will be expository, intended for mathematical scientists and students not necessarily working in these areas, but interested in learning about new developments and the possibility of spending some time at any of the participating math institutes. We anticipate an audience composed of graduate students, postdocs, and mid-career faculty. There will be a separate program aimed at undergraduates on Thursday, October 9, 2009.

Information: http://www.msri.org/calendar/workshops/WorkshopInfo/459/show_workshop; email: nick@msri.org.

* 14–17 **Promoting Diversity at the Graduate Level in Math: A National Forum**, The Mathematical Sciences Research Institute, 17 Gauss Way, Berkeley, California, 94720-5070

Description: Cultivating diversity and broadening participation of historically underrepresented groups in the mathematical sciences are national goals that are identified by the National Science Foundation as “essential components of the innovation engine that drives the nation’s economy.”

Goal: To stimulate, identify, and disseminate successful models that improve retention of underrepresented groups in graduate programs in mathematics. The conference will provide a forum for the interchange of information among the key constituencies involved in

graduate education: research universities, small colleges, and graduate students. Representatives will have the opportunity to improve the articulation between undergraduate and graduate training. Department representatives will be encouraged to leave the conference with an appropriate plan for action.

Information: http://www.msri.org/calendar/workshops/WorkshopInfo/458/show_workshop; email: nick@msri.org.

November 2008

* 6–8 **Workshop on infinite-dimensional Lie groups and related functional analysis**, University of Paderborn, Paderborn, Germany.

Description: The workshop strives to bring together researchers from infinite-dimensional Lie theory and researchers in related areas of functional analysis, to familiarize each other with their ways of thinking, recent progress and typical problems. To foster these goals, there will be four introductory mini-courses, as well as several invited talks of an expository or survey character. The program is also apt to give young researchers (and researchers from neighboring areas) an introduction to infinite-dimensional calculus and the theory of infinite-dimensional Lie groups, including an impression of the state of the art.

Topics: Infinite-dimensional Lie groups; infinite-dimensional calculus and analyticity; spaces of continuous, smooth or analytic functions; differentiability properties of typical non-linear maps; properties of locally convex direct limits.

Organizers: Helge Glückner and Elke Wolf (Paderborn).

Information: <http://www2.math.uni-paderborn.de/index.php?id=7670>; email: glockner@math.upb.de.

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 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. 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/>.

* 20–22 **Statistical Regularization and Qualitative Constraints: Inference Algorithms, Asymptotics and Applications**, University of Gottingen, Germany.

Scope: To bring in contact international researchers with interests in statistical regularization and the members of the newly founded German-Swiss (DFG-SNF) research group FOR916, in order to initiate scientific exchange between the group and the community.

Speakers: Tony Cai (University of Pennsylvania), Rama Cont (Columbia University/CMAP Ecole Polytechnique), Jose Manuel Corcuera (Universitat de Barcelona), Jean-Pierre Florens (Universite Toulouse I), Peter Gottschalk (Boston College), Janine Illian (University of St Andrews), Karl Kunisch (University of Graz), Guillaume Lecue (Universite Paris VI), Oliver B. Linton (London School of Economics and Political Science), Nicolai Meinshausen (University of Oxford), Ya'acov Ritov (The Hebrew University of Jerusalem), Naftali Tishby (The Hebrew University-Givat-Ram), Alexandr Tsybakov (Universite Paris VI).

Scientific Board: The members of the research group FOR916: Joachim Buhmann, Peter Buhmann, Lutz Dumbgen, Sara von der Geer, Bernd Fitznerberger, Thorsten Hohage, Enno Mammen, Axel Munk, Martin Schlather, Stefan Sperlich, Jeannette Woerner.

Local Organization: Axel Munk, Klaus Frick.

Contact and Details: For details and registration please visit <http://www.stochastik.math.uni-goettingen.de/forschergruppe/conference> or contact: for916@math.uni-goettingen.de.

February 2009

* 16–21 **III School and Workshop on Mathematical Methods in Quantum Mechanics**, Casa della Gioventù, Bressanone/Brixen, Italy.

Aim: To present the state of the art in some challenging open problems in Quantum Mechanics from the point of view of Mathematical Physics. It is mainly addressed to young people interested in working on the subject.

Topics: Quantum systems with magnetic fields, quantum transport theory, decoherence and entanglement, classical behaviour in quantum systems, scattering and spectral analysis for Schroedinger operators, quantum chaos, adiabatic and semiclassical methods, nonlinear Schroedinger equations.

Organizing Committee: R. Adami (Milano), L. Barletti (Firenze), F. Cardin (Padova), G. Dell'Antonio (Roma La Sapienza and SISSA), R. Figari (Napoli), S. Graffi (Bologna), G. Panati (Roma La Sapienza), M. Pulvirenti (Roma La Sapienza), A. Sacchetti (Modena), A. Teta (L'Aquila).

Financial support: Some financial support will be available for young participants.

Information: <http://www.MMQM.unimore.it>; email: andrea.sacchetti@unimore.it.

March 2009

* 27–29 **GSCC09: Fifth Annual Graduate Student Combinatorics Conference**, University of Kentucky, Lexington, Kentucky.

Description: The GSCC is a conference by graduate students for graduate students. In addition to two keynote addresses by Richard Stanley, participants have the opportunity to meet their peers from across the country and give short talks on their research or other topics of interest.

Information: <http://www.ms.uky.edu/~gsc/>; email: gsc@ms.uky.edu.

May 2009

* 4–8 **Stochastic and Deterministic Spatial Modeling in Population Dynamics**, American Institute of Mathematics, Palo Alto, California.

Description: This workshop, sponsored by AIM and the NSF, has the objective of generating new ideas about how to model spatial problems arising in epidemiology, ecology, evolution, and other areas involving population dynamics. Some specific techniques that will be examined include patch models, or metapopulations, interacting particle systems and their diffusion limits, graphical models, agent based models, branching diffusions, “small world” models.

Information: <http://aimath.org/ARCC/workshops/populationmodel.html>; email: ebasor@aimath.org.

* 17–21 **SIAM Conference on Applications of Dynamical Systems (DS09)**, Snowbird Ski and Summer Resort, Snowbird, Utah.

Description: The application of dynamical systems theory to areas outside of mathematics has proven to be an exciting and fruitful endeavor. These applications are highly diverse and interdisciplinary, ranging over such fields as Biology, Chemistry, Physics, Engineering, Finance, and Industrial Mathematics. This conference strives to achieve a good mixture of applications and the mathematics that informs them. The goals of the meeting are a cross-fertilization between the different fields of the applications, and increased communication between the mathematicians who build the theory and the scientists who use it.

Information: <http://www.siam.org/meetings/ds09/>; email: wilden@siam.org.

* 25–29 **6th European Conference on Elliptic and Parabolic Problems**, Hotel Serapo, Gaeta, Italy.

Topics: Besides elliptic and parabolic issues, the topics of the conference include geometry, free boundary problems, fluid mechanics, evolution problems in general, calculus of variations, homogenization, control, modeling and numerical analysis. In addition to the plenary talks parallel sessions and minisymposia will be organized.

Information: <http://www.math.uzh.ch/gaeta2009>; email: shafrir@math.technion.ac.il.

* 25–29 **14th International Conference on Gambling & Risk Taking**, Harrah's Lake Tahoe, Stateline, Nevada.

Description: This groundbreaking conference was established in 1974 as a venue for the presentation of academic research on gambling issues. It is broad-based in topic matter and draws the best international academic researchers, as well as government and industry representatives, and professional gamblers. To submit an abstract or to find out more, please visit our website.

Information: <http://www.unr.edu/gaming>; email: dcrowthe@unr.edu.

June 2009

* 3–15 **Interactions Between Hyperbolic Geometry, Quantum Topology and Number Theory Workshop**, Columbia University, New York, New York.

Description: The workshop will feature minicourses in hyperbolic geometry, quantum topology and number theory given by world renowned experts and is aimed at graduate students and recent Ph.D.'s. Support is available for the workshop and conference participants mainly in the form of housing. We also expect to provide partial travel support. Funding is provided by the NSF through an FRG grant. Detailed information about support, speakers and participants will be announced soon on the conference homepage.

Information: <http://www.math.columbia.edu/~volconf09/>; email: achampanerkar@jaguar1.usouthal.edu.

* 14–27 **ESI workshop on large cardinals and descriptive set theory**, Esi, Vienna, Austria.

Description: This workshop is open to the set theory community at large, and will also include introductory lectures accessible to the general mathematical community. There is no registration fee, everybody is welcome to attend.

Program Committee: S. Friedman (Uni. Wien, Austria), M. Goldstern (TU Wien, Austria), R. Jensen (Humboldt-Uni., Germany), A. Kechris (Caltech, USA), W.H. Woodin (UC Berkeley, USA).

Topics: Large Cardinals and Descriptive Set Theory; including: Inner model theory for a supercompact, the PCF and the Omega conjecture, the consistency of superstrongs with fine structure theory, the inner model hypothesis; Borel and analytic equivalence relations and graphs, Fraisse limits, topological dynamics and Ramsey theory, countable equivalence relations, measure preserving actions and rigidity theory, theory of turbulence, classification problems in ergodic theory.

Information: http://www.logic.univie.ac.at/conferences/2009_esi/; email: kellner@fsmat.at.

* 18–19 **2nd IMA International Conference on Mathematics in Sport**, University of Groningen, The Netherlands.

Description: The term Sport is interpreted liberally here and includes: Games and pastimes; gambling and on-line gaming; lotteries; and general fitness and health-related activities.

Topics: Econometrics in sport; competitive strategy; match outcome models; decision support systems; analysis of sporting technologies; analysis of rules and adjudication; performance measures and

models; optimization of sports performance; mathematics education and sport, optimal tournament design and scheduling; computationally intensive methods.

Information: <http://online.ima.org.uk/>; email: pam.bye@ima.org.uk.

* 22-26 **The 10th European Congress of Stereology and Image Analysis**, University of Milan, 20133 Milan, Italy.

Description: The aim of ECS10 is to bring together leading scientists working in the areas of (but not limited to), stereology, geometrical and topological tools: 2d and 3d shape factors, norms, metrics, gauges, discrete geometry, main mathematical and physical transforms: fourier, Karhunen-Loève, Walsh-Hadamard, wavelets, time-frequency, stochastic geometry and related statistical methods, spatial processes, pattern analysis, texture evaluation, fractals, image enhancement, 3D reconstruction, colour images, micro- and nano-structures, biology and medicine, biotechnology, agriculture, materials, tomography, x-ray Scanner, PET-scan..., high resolution imaging in remote sensing, vision, industrial control, real time aspects, electronic architectures, microelectronics, secure information systems

Information: <http://ecs10.mat.unimi.it/>; email: ecs10@mat.unimi.it.

July 2009

* 1-3 **International Conference of Applied and Engineering Mathematics 2009**, Imperial College London, London, United Kingdom.

Description: The conference ICAEM'09 is held under the World Congress on Engineering 2009. The WCE 2009 is organized by the International Association of Engineers (IAENG), and serves as good platforms for the engineering community members to meet with each other and to exchange ideas. The last IAENG conferences in 2008 attracted a total of over seven hundred participants from over 30 countries. All submitted papers will be under peer review and accepted papers will be published in the conference proceeding (ISBN: 978-988-17012-5-1). The accepted papers will also be considered for publication in the special issues and in edited books. Draft Paper Submission Deadline: March 2, 2009.

Information: <http://www.iaeng.org/WCE2009/ICAEM2009.html>; email: wce@iaeng.org.

* 14-24 **The 19th International Conference on Banach algebras**, Beledwo, Poland.

Description: The theme of the meeting will be "Banach algebras and their applications".

Organizers: H. G. Dales (Leeds, UK), K. Jarosz (Illinois, USA), and A. Soltysiak (Poznan, Poland). The honorary president of the meeting is Wieslaw Zelazko (Warsaw).

Supporter: This meeting is supported by the Polish Academy of Sciences.

Plenary speakers: David Blecher (Houston, USA), Jean Esterle (Bordeaux I, France), Gilles Godefroy (Paris VI, France), Sophie Grivaux (Lille I, France), Viktor Losert (Vienna, Austria), Matthias Neufang (Ottawa, Canada), Eve Oja (Tartu, Estonia), Alexei Pirkovskii (Moscow, Russia), Gilles Pisier (Texas A&M, USA and Paris VI, France), Thomas Ransford (Québec, Canada), Charles Read (Leeds, UK), Zhong-Jin Ruan (Urbana-Champaign, USA), Stefaan Vaes (Leuven, Belgium), Stanislaw Woronowicz (Warsaw, Poland).

Information: <http://www.siue.edu/MATH/BA2009/>.

* 14-January 15 **Call for Papers: 14th International Conference on Gambling and Risk Taking**, University of Nevada, Reno, at Harrah's Lake Tahoe, Nevada.

Description: We are looking for persons interested in submitting an abstract for the 14th International Conference on Gambling and Risk Taking.

Topics: Research topics vary in nature, however those of interest may include: Mathematical & quantitative analysis of gambling, econometric modeling of gaming industries, and gaming companies, economic of gambling.

Information: To view the Call for Papers, please visit: <http://www.unr.edu/gaming>; email: dcrowthe@unr.edu.

fundació FERRAN SUNYER I BALAGUER

Institut d'Estudis Catalans



Call for the 17th edition of the Ferran Sunyer i Balaguer Prize

The prize will be awarded for a **mathematical monograph** of an expository nature presenting the latest developments in an active area of research in Mathematics.

The prize consists of **12.000 euros** and the winning monograph will be published in **Birkhäuser Verlag's** series "Progress in Mathematics".

DEADLINE FOR SUBMISSION:

December 4, 2008

<http://ffsb.iec.cat>

City University of Hong Kong is one of eight tertiary institutions funded by the Government of the Hong Kong Special Administrative Region through the University Grants Committee of Hong Kong. A young and dynamic institution, the University aspires to be internationally recognized as a leading university in the Asia-Pacific region through excellence in professional education and applied research. It has a growing international reputation, as evidenced by its surge up the rankings of the world's top 200 universities according to the Times Higher Education Supplement. The mission of the University is to nurture and develop the talents of students and to create applicable knowledge in order to support social and economic advancement. Currently, approximately 26,000 students are enrolled in over 180 programmes ranging from associate degrees to PhD. The medium of instruction is English.

The University invites applications for the following posts. Candidates with applied research achievements will receive very positive consideration. Relevant experience in business and industry will be a definite asset.

Associate Professor/Assistant Professor (2 posts) Department of Mathematics [Ref. A/539/49]

Duties: Teach undergraduate and postgraduate courses, supervise research students, conduct research in areas of Applied Mathematics, and perform any other duties as assigned.

Requirements: A PhD in Mathematics/Applied Mathematics/Statistics with an excellent research record.

Salary and Conditions of Service

Salary offered will be highly competitive and commensurate with qualifications and experience. Appointment will be on a fixed-term gratuity-bearing contract. Fringe benefits include annual leave, medical and dental schemes, and housing benefits where applicable.

Application and Information

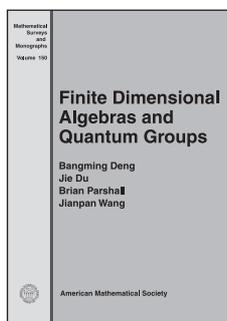
Further information about the posts and the University is available at <http://www.cityu.edu.hk>, or from the Human Resources Office, City University of Hong Kong, Tat Chee Avenue, Kowloon, Hong Kong [Fax: (852) 2788 1154 or (852) 2788 9334; email: hroj@cityu.edu.hk]. Please send an application letter enclosing a current curriculum vitae to the Human Resources Office by **16 January 2009**. Please quote the reference of the post applied for in the application and on the envelope.

The University reserves the right to consider late applications and nominations, and to fill or not to fill the positions. Personal data provided by applicants will be used for recruitment and other employment-related purposes.

New Publications Offered by the AMS

To subscribe to email notification of new AMS publications, please go to <http://www.ams.org/bookstore-email>.

Algebra and Algebraic Geometry



Finite Dimensional Algebras and Quantum Groups

Bangming Deng, *Beijing Normal University, People's Republic of China*, **Jie Du**, *University of New South Wales, Sydney, Australia*, **Brian Parshall**, *University of Virginia, Charlottesville, VA*, and **Jianpan Wang**, *East China*

Normal University, Shanghai, People's Republic of China

The interplay between finite dimensional algebras and Lie theory dates back many years. In more recent times, these interrelations have become even more strikingly apparent. This text combines, for the first time in book form, the theories of finite dimensional algebras and quantum groups. More precisely, it investigates the Ringel–Hall algebra realization for the positive part of a quantum enveloping algebra associated with a symmetrizable Cartan matrix and it looks closely at the Beilinson–Lusztig–MacPherson realization for the entire quantum \mathfrak{g}_n .

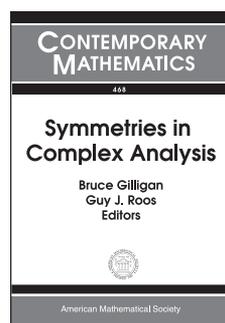
The book begins with the two realizations of generalized Cartan matrices, namely, the graph realization and the root datum realization. From there, it develops the representation theory of quivers with automorphisms and the theory of quantum enveloping algebras associated with Kac–Moody Lie algebras. These two independent theories eventually meet in Part 4, under the umbrella of Ringel–Hall algebras. Cartan matrices can also be used to define an important class of groups—Coxeter groups—and their associated Hecke algebras. Hecke algebras associated with symmetric groups give rise to an interesting class of quasi-hereditary algebras, the quantum Schur algebras. The structure of these finite dimensional algebras is used in Part 5 to build the entire quantum \mathfrak{g}_n through a completion process of a limit algebra (the Beilinson–Lusztig–MacPherson algebra). The book is suitable for advanced graduate students. Each chapter concludes

with a series of exercises, ranging from the routine to sketches of proofs of recent results from the current literature.

Contents: Getting started; *Quivers and their representations:* Representations of quivers; Algebras with Frobenius morphisms; Quivers with automorphisms; *Some quantized algebras:* Coxeter groups and Hecke algebras; Hopf algebras and universal enveloping algebras; Quantum enveloping algebras; *Representations of symmetric groups:* Kazhdan–Lusztig combinatorics for Hecke algebras; Cells and representations of symmetric groups; The integral theory of quantum Schur algebras; *Ringel–Hall algebras:* A realization for the \pm -part; Ringel–Hall algebras; Bases of quantum enveloping algebras of finite type; Green's theorem; *The BLM algebra:* A realization for quantum \mathfrak{g}_n ; Serre relations in quantum Schur algebras; Constructing quantum \mathfrak{g}_n via quantum Schur algebras; *Appendices:* Varieties and affine algebraic groups; Quantum linear groups through coordinate algebras; Quasi-hereditary and cellular algebras; Bibliography; Index of notation; Index of terminology.

Mathematical Surveys and Monographs, Volume 150

December 2008, approximately 763 pages, Hardcover, ISBN: 978-0-8218-4186-0, LC 2008028975, 2000 *Mathematics Subject Classification:* 05E10, 16G20, 16W35, 17B37, 20C08; 16G70, 20C30, 20G05, 20G42, **AMS members US\$95**, List US\$119, Order code SURV/150



Symmetries in Complex Analysis

Bruce Gilligan, *University of Regina, Saskatchewan, Canada*, and **Guy J. Roos**, *Université de Poitiers, France*, Editors

The theme of this volume concerns interactions between group actions and problems in complex analysis.

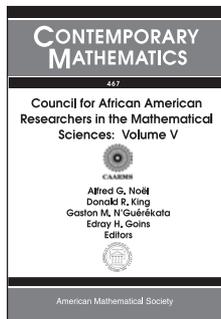
The first four articles deal with such topics as representation kernels in representation theory, complex automorphisms and holomorphic equivalence of domains, and geometric description of exceptional symmetric domains. The last article is devoted to Seiberg–Witten equations and Taubes correspondence on symplectic 4-manifolds.

Contents: **J. Hilgert**, Reproducing kernels in representation theory; **A. Huckleberry**, Actions of complex Lie groups and the

Borel-Weil correspondence; **J.-J. Loeb**, On complex automorphisms and holomorphic equivalence of domains; **G. Roos**, Exceptional symmetric domains; **A. Sergeev**, Seiberg-Witten equations and pseudoholomorphic curves; Index.

Contemporary Mathematics, Volume 468

October 2008, 230 pages, Softcover, ISBN: 978-0-8218-4459-5, LC 2008016477, 2000 *Mathematics Subject Classification*: 17C40, 22E46, 32A25, 32L25, 32M15, 32F45, 32Q45, 32U05, 53C28, 58E20, **AMS members US\$55**, List US\$69, Order code CONM/468



Council for African American Researchers in the Mathematical Sciences: Volume V

Alfred G. Noël, *University of Massachusetts, Boston, MA*,
Donald R. King, *Northeastern University, Boston, MA*, **Gaston M. N'Guérékata**, *Morgan State*

University, Baltimore, MD, and **Edray H. Goins**, *Purdue University, West Lafayette, IN*, Editors

This volume contains articles based on talks presented at the Thirteenth Conference of African American Researchers in the Mathematical Sciences (CAARMS), held at Northeastern University and the University of Massachusetts, Boston on June 19–22, 2007. The representation theory of Lie groups and its applications were a major focus of the talks. An overview is included of the recent achievements of the Atlas of Lie Groups Project and the work that remains to be done by the Atlas Project to fully understand the unitary representations of reductive groups. Other articles highlight the significance of scientific computing in Lie Theory and applications of the representation theory of Lie groups to the physics of black holes. This volume contains two research papers not related to Lie Theory: one on the geometry of coisotropic submanifolds of Poisson manifolds and one on recent results on the structure of the set of ultrafilters on the collection of finite subsets of an infinite set. It concludes with a survey of CAARMS12 participants.

For volumes based on previous CAARMS proceedings, see:

African Americans in Mathematics (volume 34 in the AMS series, DIMACS), *African Americans in Mathematics: Volume II* (volume 252 in the AMS series Contemporary Mathematics), *African Americans in the Mathematical Sciences: Volume III* (volume 275 in the Contemporary Mathematics series) and *Volume IV* (volume 284 in the Contemporary Mathematics series).

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

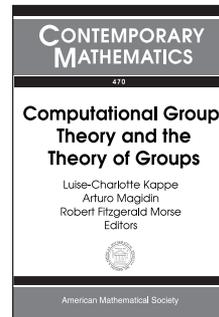
Contents: **A. Pantano**, **A. Paul**, and **S. A. Salamanca-Riba**, The omega-regular unitary dual of the metaplectic group of rank 2; **F. L. Williams**, A resolvent trace formula for the BTZ black hole with conical singularity; **A. Wade**, On the geometry of coisotropic submanifolds of Poisson manifolds; **A. D. Grainger**, Remarks on ultrafilters on the collection of finite subsets of an infinite set; **A. G. Noël**, The atlas of Lie groups and representations: Scope and successes; **A. G. Noël**, Maximal tori of reductive centralizers of nilpotents in exceptional complex symmetric spaces: A

computational approach; **W. A. Massey**, **D. Raphael**, and **E. N. Walker**, A survey of CAARMS12 participants.

Contemporary Mathematics, Volume 467

October 2008, 152 pages, Softcover, ISBN: 978-0-8218-4457-1, LC 2008015382, 2000 *Mathematics Subject Classification*: 22Exx, **AMS members US\$47**, List US\$59, Order code CONM/467

Applications



Computational Group Theory and the Theory of Groups

Luise-Charlotte Kappe, *Binghamton University, State University of New York, NY*,
Arturo Magidin, *University of Louisiana at Lafayette, LA*,
and **Robert Fitzgerald Morse**,
University of Evansville, IN, Editors

The power of general purpose computational algebra systems running on personal computers has increased rapidly in recent years. For mathematicians doing research in group theory, this means a growing set of sophisticated computational tools are now available for their use in developing new theoretical results.

This volume consists of contributions by researchers invited to the AMS Special Session on Computational Group Theory held in March 2007. The main focus of the session was on the application of Computational Group Theory (CGT) to a wide range of theoretical aspects of group theory. The articles in this volume provide a variety of examples of how these computer systems helped to solve interesting theoretical problems within the discipline, such as constructions of finite simple groups, classification of p -groups via coclass, representation theory and constructions involving free nilpotent groups. The volume also includes an article by R. F. Morse highlighting applications of CGT in group theory and two survey articles.

Graduate students and researchers interested in various aspects of group theory will find many examples of Computational Group Theory helping research and will recognize it as yet another tool at their disposal.

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

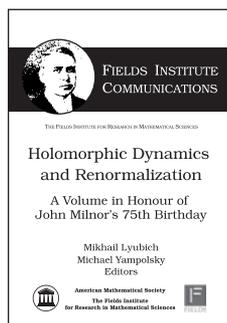
Contents: **R. F. Morse**, On the application of computational group theory to the theory of groups; **B. Benesh**, A classification of certain maximal subgroups of alternating groups; **R. D. Blyth**, **P. Moravec**, and **R. F. Morse**, On the nonabelian tensor squares of free nilpotent groups of finite rank; **H. Dietrich**, **B. Eick**, and **D. Feichtenschlager**, Investigating p -groups by coclass with GAP; **G. Ellis**, Homological algebra programming; **T. S. Foguel** and **M. F. Ragland**, Groups with a finite covering by isomorphic abelian subgroups; **D. Garrison** and **L.-C. Kappe**, On some subnormality conditions in metabelian groups; **A. Hulpke**, Normalizer calculation using automorphisms; **D. Joyner** and **D. Kohel**, Group theory in SAGE; **H. K. Kim** and **G. O. Michler**, Simultaneous constructions of the sporadic groups Co_2 and Fi_{22} ; **G. O. Michler**, Constructing simple groups

from irreducible subgroups of $GL_n(2)$; **J. G. Rainbolt**, Dickson polynomials and the norm map between the Hecke algebras of Gelfand–Graev representations; **A. Seress** and **K. Yang**, On orbit equivalent, two-step imprimitive permutation groups.

Contemporary Mathematics, Volume 470

November 2008, 286 pages, Softcover, ISBN: 978-0-8218-4365-9, LC 2008019987, 2000 *Mathematics Subject Classification*: 20-06, 20B40, 20C40, 20D08, 20D15, 20D35, 20F12, 20F18, 20J05, **AMS members US\$63**, List US\$79, Order code CONM/470

Differential Equations



Holomorphic Dynamics and Renormalization

A Volume in Honour of John Milnor's 75th Birthday

Mikhail Lyubich, *University of Toronto, ON, Canada, and SUNY at Stony Brook, NY*, and **Michael**

Yampolsky, *University of Toronto, ON, Canada*, Editors

The papers collected in this volume reflect some of the directions of research in two closely related fields: Complex Dynamics and Renormalization in Dynamical Systems.

While dynamics of polynomial mappings, particularly quadratics, has by now reached a mature state of development, much less is known about non-polynomial rational maps. The reader will be introduced into this fascinating world and a related area of transcendental dynamics by the papers in this volume. A graduate student will find an area rich with open problems and beautiful computer simulations.

A survey by V. Nekrashevych introduces the reader to iterated monodromy groups of rational mappings, a recently developed subject that links geometric group theory to combinatorics of rational maps. In this new language, many questions related to Thurston's theory of branched coverings of the sphere can be answered explicitly.

Renormalization theory occupies a central place in modern Complex Dynamics. The progress in understanding the structure of the Mandelbrot set, polynomial Julia sets, and Feigenbaum-type universalities stems from renormalization techniques. Renormalization of circle maps and rotation domains, such as Siegel disks, can be understood in the context of the classical KAM theory. Corresponding phenomena in higher dimensions, such as universal scaling in area-preserving maps in 2D, on the boundary of KAM, pose a challenging problem. A survey by H. Koch and several other papers in the volume will introduce the reader to this direction of study.

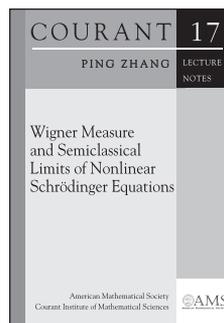
Titles in this series are co-published with the Fields Institute for Research in Mathematical Sciences (Toronto, Ontario, Canada).

Contents: **A. Bonifant** and **J. Milnor**, Schwarzian derivatives and cylinder maps; **Holomorphic dynamics:** **V. Nekrashevych**,

Symbolic dynamics and self-similar groups; **D. K. Childers**, Are there critical points on the boundaries of mother hedgehogs?; **L. DeMarco**, Finiteness for degenerate polynomials; **R. L. Devaney**, Cantor webs in the parameter and dynamical planes of rational maps; **A. A. Glutsyuk**, Simple proofs of uniformization theorems; **C. L. Petersen** and **P. Roesch**, The Yoccoz combinatorial analytic invariant; **L. Rempe** and **D. Schleicher**, Bifurcation loci of exponential maps and quadratic polynomials: Local connectivity, triviality of fibers, and density of hyperbolicity; **J. Rückert**, Rational and transcendental Newton maps; **D. Schleicher**, Newton's method as a dynamical system: Efficient root finding of polynomials and the Riemann ζ function; **V. Timorin**, The external boundary of M_2 ; **Renormalization:** **H. Koch**, Renormalization of vector fields; **O. Díaz-Espinosa** and **R. de la Llave**, Renormalization of arbitrary weak noises for one-dimensional critical dynamical systems: Summary of results and numerical explorations; **H. L. Eliasson** and **S. B. Kuksin**, KAM for the nonlinear Schrödinger equation—A short presentation; **M. Yampolsky**, Siegel disks and renormalization fixed points.

Fields Institute Communications, Volume 53

October 2008, 395 pages, Hardcover, ISBN: 978-0-8218-4275-1, LC 2008028776, 2000 *Mathematics Subject Classification*: 20E08, 37B10, 37F10, 37F20, 37F25, 37F45, 37F50, 37K55, 37E20, **AMS members US\$95**, List US\$119, Order code FIC/53



Wigner Measure and Semiclassical Limits of Nonlinear Schrödinger Equations

Ping Zhang, *Academy of Mathematics and Systems Science, Chinese Academy of Sciences, Beijing, People's Republic of China*

This book is based on a course entitled “Wigner measures and semiclassical limits of nonlinear Schrödinger equations,” which the author taught at the Courant Institute of Mathematical Sciences at New York University in the spring of 2007. The author's main purpose is to apply the theory of semiclassical pseudodifferential operators to the study of various high-frequency limits of equations from quantum mechanics. In particular, the focus of attention is on Wigner measure and recent progress on how to use it as a tool to study various problems arising from semiclassical limits of Schrödinger-type equations.

At the end of each chapter, the reader will find references and remarks about recent progress on related problems. The book is self-contained and is suitable for an advanced graduate course on the topic.

Titles in this series are co-published with the Courant Institute of Mathematical Sciences at New York University.

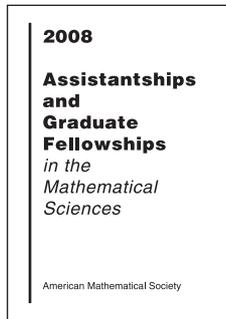
Contents: The classical WKB method; Wigner measure; The limit from the one-dimensional Schrödinger-Poisson to Vlasov-Poisson equations; Semiclassical limit of Schrödinger-Poisson equations; Semiclassical limit of the cubic Schrödinger equation in an exterior domain; Incompressible and compressible limits of coupled systems of nonlinear Schrödinger equations; High-frequency limit of the Helmholtz equation; Global solutions to (3.14); Denseness of

polynomials; Global existence of a solution to (5.1); Global smooth solution to (6.1); Bibliography.

Courant Lecture Notes, Volume 17

October 2008, 197 pages, Softcover, ISBN: 978-0-8218-4701-5, LC 2008028025, 2000 *Mathematics Subject Classification*: 35Q40, 35Q55, **AMS members US\$24**, List US\$30, Order code CLN/17

General and Interdisciplinary



Assistantships and Graduate Fellowships in the Mathematical Sciences 2008

From a review of a previous edition:

This directory is a tool for undergraduate mathematics majors seeking information about graduate programs in mathematics.

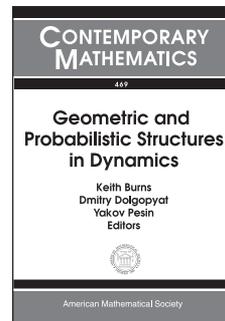
Although most of the information can be gleaned from the Internet, the usefulness of this directory for the prospective graduate student is the consistent format for comparing different mathematics graduate programs without the hype. Published annually, the information is up-to-date, which is more than can be said of some Websites. Support for graduate students in mathematics is a high priority of the American Mathematical Society, which also provides information for fellowships and grants they offer as well as support from other societies and foundations. The book is highly recommended for academic and public libraries.

— *American Reference Books Annual*

This valuable reference source brings together a wealth of information about resources available for graduate study in mathematical sciences departments in the U.S. and Canada.

November 2008, approximately 100 pages, Softcover, ISBN: 978-0-8218-4704-6, **Individual member US\$18**, List US\$23, Order code ASST/2008

Geometry and Topology



Geometric and Probabilistic Structures in Dynamics

Keith Burns, *Northwestern University, Evanston, IL*, **Dmitry Dolgopyat**, *University of Maryland, College Park, MD*, and **Yakov Pesin**, *Pennsylvania State University, University Park, PA*, Editors

University, University Park, PA, Editors

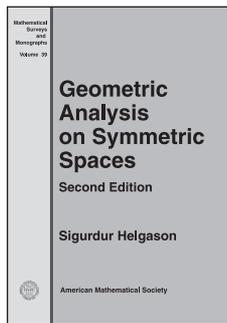
This book presents a collection of articles that cover areas of mathematics related to dynamical systems. The authors are well-known experts who use geometric and probabilistic methods to study interesting problems in the theory of dynamical systems and its applications. Some of the articles are surveys while others are original contributions. The topics covered include: Riemannian geometry, models in mathematical physics and mathematical biology, symbolic dynamics, random and stochastic dynamics.

This book can be used by graduate students and researchers in dynamical systems and its applications.

Contents: **G. Levin**, Quasiconformal deformation of multipliers; **V. Bakhtin** and **Y. Kifer**, Nonconvergence examples in averaging; **W. Ballmann** and **S. Buyalo**, Periodic rank one geodesics in Hadamard spaces; **V. Baladi** and **M. Tsujii**, Dynamical determinants and spectrum for hyperbolic diffeomorphisms; **M. Boyle**, Open problems in symbolic dynamics; **H. Bruin** and **M. Jakobson**, New examples of topologically equivalent S-unimodal maps with different metric properties; **D. Burago** and **S. Ivanov**, A remark on the group of PL-homeomorphisms in dimension one; **D. Dolgopyat**, Fermi acceleration.; **P. Eberlein**, Riemannian 2-step nilmanifolds with prescribed Ricci tensor; **G. Forni**, On the Greenfield-Wallach and Katok conjectures in dimension three; **M. Freidlin**, Metastability and stochastic resonance for multiscale systems; **M. Gromov**, Mendelian dynamics and Sturtevant's paradigm; **S. Newhouse**, **M. Berz**, **J. Grote**, and **K. Makino**, On the estimation of topological entropy on surfaces; **S. P. Novikov**, Dynamical systems and differential forms. Low dimensional Hamiltonian systems.; **M. Pollicott** and **R. Sharp**, Periodic orbits and holonomy for hyperbolic flows; **F. R. Hertz**, **M. A. R. Hertz**, and **R. Ures**, On existence and uniqueness of weak foliations in dimension 3; **Y. G. Sinai** and **C. Ulcigrai**, A limit theorem for Birkhoff sums of non-integrable functions over rotations.

Contemporary Mathematics, Volume 469

November 2008, 340 pages, Softcover, ISBN: 978-0-8218-4286-7, LC 2008016613, 2000 *Mathematics Subject Classification*: 37D20, 37D25, 37D40, 37D45, 37E05, 37H10, 37C85, 60G07, 70H05, **AMS members US\$79**, List US\$99, Order code CONM/469



Geometric Analysis on Symmetric Spaces

Second Edition

Sigurdur Helgason,
Massachusetts Institute of Technology, Cambridge, MA

This book gives the first systematic exposition of geometric analysis on Riemannian symmetric spaces and its

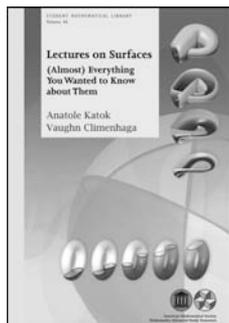
relationship to the representation theory of Lie groups. The book starts with modern integral geometry for double fibrations and treats several examples in detail. After discussing the theory of Radon transforms and Fourier transforms on symmetric spaces, inversion formulas, and range theorems, Helgason examines applications to invariant differential equations on symmetric spaces, existence theorems, and explicit solution formulas, particularly potential theory and wave equations. The canonical multitemporal wave equation on a symmetric space is included. The book concludes with a chapter on eigenspace representations—that is, representations on solution spaces of invariant differential equations. Known for his high-quality expositions, Helgason received the 1988 Steele Prize for his earlier books *Differential Geometry, Lie Groups and Symmetric Spaces* and *Groups and Geometric Analysis*. Containing exercises (with solutions) and references to further results, this revised edition would be suitable for advanced graduate courses in modern integral geometry, analysis on Lie groups, and representation theory of Lie groups.

This item will also be of interest to those working in algebra and algebraic geometry and analysis.

Contents: A duality in integral geometry; A duality for symmetric spaces; The Fourier transform on a symmetric space; The Radon transform on X and on X_0 . Range questions; Differential equations on symmetric spaces; Eigenspace representations; Solutions to exercises; Bibliography; Symbols frequently used; Index.

Mathematical Surveys and Monographs, Volume 39

October 2008, approximately 645 pages, Hardcover, ISBN: 978-0-8218-4530-1, 2000 *Mathematics Subject Classification*: 43A85, 53C35, 22E46, 22E30, 43A90, 44A12, 32M15; 53C65, 31A20, 43A35, 35L05, 14M17, 17B25, 22F30, **AMS members US\$71**, List US\$89, Order code SURV/39.R



Lectures on Surfaces

(Almost) Everything You Wanted to Know about Them

Anatole Katok and Vaughn Climenhaga,
Pennsylvania State University, University Park, PA

Surfaces are among the most common and easily visualized mathematical objects,

and their study brings into focus fundamental ideas, concepts, and methods from geometry, topology, complex analysis, Morse theory, and group theory. At the same time, many of those notions appear in a technically simpler and more graphic form than in their general “natural” settings.

The first, primarily expository, chapter introduces many of the principal actors—the round sphere, flat torus, Möbius strip, Klein bottle, elliptic plane, etc.—as well as various methods of describing surfaces, beginning with the traditional representation by equations in three-dimensional space, proceeding to parametric representation, and also introducing the less intuitive, but central for our purposes, representation as factor spaces. It concludes with a preliminary discussion of the metric geometry of surfaces, and the associated isometry groups. Subsequent chapters introduce fundamental mathematical structures—topological, combinatorial (piecewise linear), smooth, Riemannian (metric), and complex—in the specific context of surfaces.

The focal point of the book is the Euler characteristic, which appears in many different guises and ties together concepts from combinatorics, algebraic topology, Morse theory, ordinary differential equations, and Riemannian geometry. The repeated appearance of the Euler characteristic provides both a unifying theme and a powerful illustration of the notion of an invariant in all those theories.

The assumed background is the standard calculus sequence, some linear algebra, and rudiments of ODE and real analysis. All notions are introduced and discussed, and virtually all results proved, based on this background.

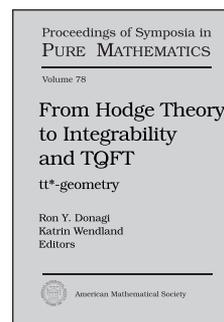
This book is a result of the MASS course in geometry in the fall semester of 2007.

Contents: Various ways of representing surfaces and basic examples; Combinatorial structure and topological classification of surfaces; Differentiable structure on surfaces: Real and complex; Riemannian metrics and geometry of surfaces; Topology and smooth structure revisited; Suggested reading; Hints; Index.

Student Mathematical Library, Volume 46

December 2008, approximately 303 pages, Softcover, ISBN: 978-0-8218-4679-7, LC 2008029299, 2000 *Mathematics Subject Classification*: 51-01, 53-01, 57N05; 53A05, 57R05, **AMS members US\$39**, List US\$49, Order code STML/46

Mathematical Physics



From Hodge Theory to Integrability and TQFT

tt*-geometry

Ron Y. Donagi, *University of Pennsylvania, Philadelphia, PA*, and Katrin Wendland, *University of Augsburg, Germany*, Editors

Ideas from quantum field theory and string theory have had an enormous impact on geometry over the last two decades. One extremely fruitful source of new mathematical ideas goes back to the works of Cecotti, Vafa, et al. around 1991 on the geometry of topological field theory. Their tt*-geometry (tt* stands for topological-antitopological) was motivated by physics, but it turned out to unify ideas from such separate branches of mathematics as singularity theory, Hodge theory, integrable systems, matrix models, and Hurwitz spaces.

The interaction among these fields suggested by tt^* -geometry has become a fast moving and exciting research area.

This book, loosely based on the 2007 Augsburg, Germany workshop "From tQFT to tt^* and Integrability", is the perfect introduction to the range of mathematical topics relevant to tt^* -geometry. It begins with several surveys of the main features of tt^* -geometry, Frobenius manifolds, twistors, and related structures in algebraic and differential geometry, each starting from basic definitions and leading to current research. The volume moves on to explorations of current foundational issues in Hodge theory: higher weight phenomena in twistor theory and non-commutative Hodge structures and their relation to mirror symmetry. The book concludes with a series of applications to integrable systems and enumerative geometry, exploring further extensions and connections to physics.

With its progression through introductory, foundational, and exploratory material, this book is an indispensable companion for anyone working in the subject or wishing to enter it.

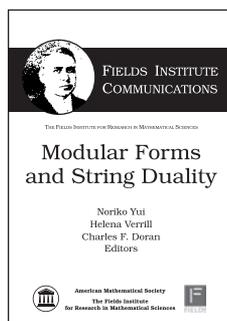
This item will also be of interest to those working in geometry and topology.

Contents: C. Sabbah, Universal unfoldings of Laurent polynomials and tt^* structures; K. Saito and A. Takahashi, From primitive forms to Frobenius manifolds; C. Hertling and C. Sevenheck, Twistor structures, tt^* -geometry and singularity theory; V. Cortés and L. Schäfer, Differential geometric aspects of the tt^* -equations; L. Katzarkov, M. Kontsevich, and T. Pantev, Hodge theoretic aspects of mirror symmetry; C. Simpson, A weight two phenomenon for the moduli of rank one local systems on open varieties; L. K. Hoevenaars, Associativity for the Neumann system; A. A. Gerasimov and S. L. Shatashvili, Two-dimensional gauge theories and quantum integrable systems; V. Bouchard and M. Mariño, Hurwitz numbers, matrix models and enumerative geometry; A. Neitzke and J. Walcher, Background independence and the open topological string wavefunction.

Proceedings of Symposia in Pure Mathematics, Volume 78

November 2008, 304 pages, Hardcover, ISBN: 978-0-8218-4430-4, LC 2008027339, 2000 *Mathematics Subject Classification*: 14C30, 14D07, 14D21, 14N35, 53C43, 53D45, 81R12, 81T30, 81T45, **AMS members US\$60**, List US\$75, Order code PSPUM/78

Number Theory



Modular Forms and String Duality

Noriko Yui, *Queen's University, Kingston, ON, Canada*, Helena Verrill, *Louisiana State University, Baton Rouge, LA*, and Charles F. Doran, *University of Washington, Seattle, WA*, Editors

Modular forms have long played a key role in the theory of numbers, including most famously the proof of Fermat's Last Theorem. Through its quest to unify the spectacularly successful theories of quantum mechanics and general relativity, string theory has long suggested deep connections between branches of mathematics such as topology,

geometry, representation theory, and combinatorics. Less well-known are the emerging connections between string theory and number theory. This was indeed the subject of the workshop *Modular Forms and String Duality* held at the Banff International Research Station (BIRS), June 3–8, 2006. Mathematicians and physicists alike converged on the Banff Station for a week of both introductory lectures, designed to educate one another in relevant aspects of their subjects, and research talks at the cutting edge of this rapidly growing field.

This book is a testimony to the BIRS Workshop, and it covers a wide range of topics at the interface of number theory and string theory, with special emphasis on modular forms and string duality. They include the recent advances as well as introductory expositions on various aspects of modular forms, motives, differential equations, conformal field theory, topological strings and Gromov–Witten invariants, mirror symmetry, and homological mirror symmetry. The contributions are roughly divided into three categories: arithmetic and modular forms, geometric and differential equations, and physics and string theory.

The book is suitable for researchers working at the interface of number theory and string theory.

This item will also be of interest to those working in algebra and algebraic geometry and mathematical physics.

Titles in this series are co-published with the Fields Institute for Research in Mathematical Sciences (Toronto, Ontario, Canada).

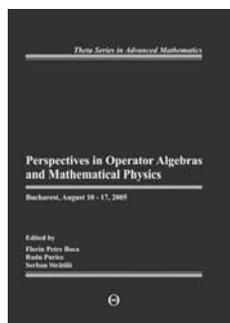
Contents: *Aspects of arithmetic and modular forms:* S. Kadir and N. Yui, Motives and mirror symmetry for Calabi–Yau orbifolds; S. Kharel, M. Lynker, and R. Schimmrigk, String modular motives of mirrors of rigid Calabi–Yau varieties; E. Lee, Update on modular non-rigid Calabi–Yau threefolds; L. Long, Finite index subgroups of the modular group and their modular forms; *Aspects of geometric and differential equations:* G. Almkvist, D. van Straten, and W. Zudilin, Apéry limits of differential equations of order 4 and 5; J. Stienstra, Hypergeometric systems in two variables, quivers, dimers and dessins d'enfants; D. Zagier and A. Zinger, Some properties of hypergeometric series associated with mirror symmetry; W. Zudilin, Ramanujan-type formulae for $1/\pi$: A second wind?; *Aspects of physics and string theory:* M. Ballard, Meet homological mirror symmetry; V. Bouchard, Orbifold Gromov–Witten invariants and topological strings; T. Gannon, Conformal field theory and mapping class groups; S. Gukov and H. Murakami, $SL(2, \mathbb{C})$ Chern–Simons theory and the asymptotic behavior of the colored Jones polynomial; J. Walcher, Open strings and extended mirror symmetry.

Fields Institute Communications, Volume 54

October 2008, 297 pages, Hardcover, ISBN: 978-0-8218-4484-7, LC 2008028173, 2000 *Mathematics Subject Classification*: 11Fxx, 14Gxx, 14J32, 14N35, 33Cxx, 81T30, **AMS members US\$87**, List US\$109, Order code FIC/54

New AMS-Distributed Publications

Analysis



Perspectives in Operator Algebras and Mathematical Physics

Conference Proceedings, Bucharest, August 10-17, 2005

Florin Petre Boca, *University of Illinois, Urbana, IL*, and **Radu Purice** and **Șerban Strătilă**,

Institute of Mathematics, Bucharest, Romania, Editors

The volume represents the proceedings of the conference "Operator Algebras and Mathematical Physics 3", held in Bucharest, Romania, in August 2005. It contains eight refereed papers on the following topics:

- holomorphic representations of Jacobi algebras
- groupoid C^* -algebras
- the reduced C^* -algebra of the Thompson group F
- classical low-energy scattering for a two-body system
- compact quantum groups
- Schrödinger operators and the Fermi golden rule
- boundary topological invariants in some physical systems
- index and homology of pseudodifferential operators on manifolds with boundary

A publication of the Theta Foundation. Distributed worldwide, except in Romania, by the AMS.

Contents: **S. Berceanu**, A holomorphic representation of the multidimensional Jacobi algebra; **M. R. Buneci**, Groupoid categories; **I. Chifan** and **G. Picioroagă**, C^* -estimates for averaging sums of elements in the Thompson group F ; **J. Dereziński** and **E. Skibsted**, Classical scattering at low energies; **R. Dumitru**, Unitary representations of compact quantum groups; **A. Jensen** and **G. Nenciu**, On the Fermi golden rule: degenerate eigenvalues; **J. Kellendonk** and **S. Richard**, Topological boundary maps in physics; **S. Moroianu** and **V. Nistor**, Index and homology of pseudodifferential operators on manifolds with boundary.

International Book Series of Mathematical Texts

June 2008, 148 pages, Hardcover, ISBN: 978-973-87899-1-3, 2000 *Mathematics Subject Classification*: 00B25, 35-06, 46-06, 47-06, **AMS members US\$30**, List US\$38, Order code THETA/11



Hot Topics in Operator Theory

Conference Proceedings, Timișoara, June 29–July 4, 2006

Ronald G. Douglas, *Texas A&M University, College Station, TX*, **Jean Esterle**, *University of Bordeaux I, Talence, France*,

Dumitru Gaspar, *West University of Timișoara, Timisoara, Romania*, **Dan Timotin**, *Institute of Mathematics, Bucharest, Romania*, and **Florian-Horia Vasilescu**, *University of Lille I, Villeneuve d'Ascq, France*, Editors

The volume represents the proceedings of the 21st International Conference on Operator Theory, held in Timisoara, Romania, in 2006. Three of the included papers are surveys on active areas of research:

- renormalization group in algebraic quantum field theory
- composition operators on Hardy-Orlicz and Banach-Orlicz spaces
- operator ideals on Hilbert spaces

The remaining fourteen papers contain original research on a wide variety of topics:

- single operator theory
- Banach algebras
- C^* -algebras
- von Neumann algebras
- Hilbert and Banach modules
- differential and integral operators
- noncommutative probability
- spectral theory

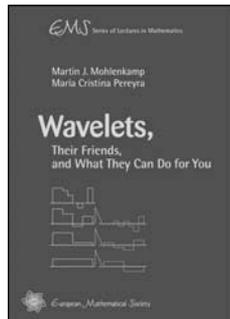
A publication of the Theta Foundation. Distributed worldwide, except in Romania, by the AMS.

Contents: **A. M. Bikchentaev**, Local convergence in measure on semifinite algebras. III; **I. Biswas**, **G. Misra**, and **C. Varughese**, Geometric invariants from the resolution for the quotient module along a multi-dimensional grid; **M. R. Buneci**, Borel morphisms and C^* -algebras; **G. Cassier** and **L. Suciu**, Mapping theorems and similarity to contractions for classes of A -contractions; **A. Colojoară**, Symmetric algebra of $\mathcal{L}(X, F)$ as an algebra of polynomials; **R. Conti**, **C. D'Antoni**, and **G. Morsella**, Renormalization group in algebraic quantum field theory: past, present and future; **R. G. Douglas**, Essentially reductive Hilbert modules. II; **M. Joița**, Countably generated Hilbert modules, multiplier modules, and stable isomorphisms of locally C^* -algebras; **V. Kaftal** and **G. Weiss**, A survey on the interplay between arithmetic mean ideals, traces, lattices of operator ideals, and an infinite Schur–Horn majorization theorem; **L. D. Lemle**, L^∞ -uniqueness of Schrödinger operators restricted in an open domain; **M. Megan** and **L. Buliga**, Nonuniform exponential trichotomy for linear difference equations in Banach spaces; **M. Megan** and **C. Stoica**, Equivalent definitions for uniform exponential trichotomy of evolution operators in Banach spaces; **H. Queffélec**, Composition operators on Hardy–Orlicz and Bergman–Orlicz spaces of the disk; **F. Rădulescu**, The von Neumann algebra of the non-residually finite Baumslag group

$(a, b|ab^3a^{-1} = b^2)$ embeds into R^ω ; S. M. Stoian, Spectral properties for locally bounded operators; L. Suciu, Block representation for A -contractions; L. Zielinski, Eigenvalue asymptotics for a class of Jacobi matrices.

International Book Series of Mathematical Texts

June 2008, 229 pages, Hardcover, ISBN: 978-973-87899-2-0, 2000 *Mathematics Subject Classification*: 00B25, 46-06, 47-06, **AMS members US\$45**, List US\$56, Order code THETA/12



Wavelets, Their Friends, and What They Can Do for You

Martin J. Mohlenkamp, *Ohio University, Athens, OH*, and María Cristina Pereyra, *University of New Mexico, Albuquerque, NM*

These notes introduce the central concepts surrounding wavelets and their applications. By focusing on the essential ideas and arguments, the authors enable readers to get to the heart of the matter as quickly as possible. A list of references guides readers interested in further study to the appropriate places in the literature for detailed proofs and real applications.

The authors begin with the notion of time-frequency analysis, present the multiresolution analysis and basic wavelet construction, introduce the many friends, relatives, and mutations of wavelets, and finally, give a selection of applications.

This book is suitable for beginning graduate students and above. A preliminary chapter containing some of the prerequisite concepts and definitions is included for reference.

A publication of the European Mathematical Society (EMS). Distributed within the Americas by the American Mathematical Society.

Contents: Preliminaries; Time-frequency analysis; Multiresolution analysis and wavelets; Friends, relatives, and mutations of wavelets; Assorted applications; References and further reading.

EMS Series of Lectures in Mathematics, Volume 8

July 2008, 119 pages, Softcover, ISBN: 978-3-03719-018-0, 2000 *Mathematics Subject Classification*: 42-01, 42C40, 65T60, **AMS members US\$26**, List US\$32, Order code EMSSERLEC/8

Ruth I. Michler Prize



The Association for Women in Mathematics invites applications for the third annual Ruth I. Michler Memorial Prize. A \$45,000 prize will be awarded to a woman, recently promoted to associate professor or the equivalent, for a semester of mathematical research without teaching obligations in the Mathematics Department of Cornell University. A supplemental housing/subsistence stipend award of \$3,000 will be provided. Office space, library access, and computing facilities will be provided by Cornell. The application deadline is Nov. 1 for the award to be used during the 2009–10 academic year.

www.awm-math.org/michlerprize.html



Cornell University



UMASS
AMHERST

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Department of Mathematics & Statistics**

The Department of Mathematics and Statistics (www.math.umass.edu) invites applications for two tenure-track positions in Mathematics and Statistics at the Assistant Professor level subject to the availability of funds. The search will encompass the following areas: Algebra and Number Theory, Algebraic Geometry and Representation Theory, Analysis and Partial Differential Equations, Applied and Computational Mathematics, Differential Geometry and Topology, Mathematical Physics, Probability, and Statistics. Exceptional promise in research and a commitment to outstanding teaching at all levels of the curriculum are expected. The University of Massachusetts Amherst is developing excellence initiatives in the areas of Renewable Energy, Clean Water, Nanomaterials, and Biomedicine. Candidates interested in interdisciplinary work in these and other areas are encouraged to apply. Outstanding candidates at the Associate or Full Professor levels may also be considered should funding become available.

Applications should be submitted electronically through the AMS website mathjobs.org. Alternatively, applicants may send a curriculum vitae, research and teaching statements, and arrange to have three letters of recommendation sent to: Search Committee, Department of Mathematics and Statistics, Lederle Graduate Research Center, 710 North Pleasant St., Amherst, MA 01003-9305.

Review of applications for tenure-track positions will begin October 1, 2008. Applications will continue to be accepted until all positions are filled. The department is committed to the development of a diverse faculty, student body, and workplace. Women and members of minority groups are encouraged to apply.

The University of Massachusetts is an Affirmative Action/Equal Opportunity Employer.

AMS Policy for Employment Advertisements

While the American Mathematical Society (AMS) does not screen ads for compliance, the Society expects all institutions posting advertisements in AMS publications to comply with the equal opportunity laws that apply in the jurisdictions in which they are located. Federal law prohibits employers in the United States from discriminating on the basis of race, color, national origin, religion, sex, age or disability. Applicants should be aware that institutions outside of the United States may not be legally bound to conform to these or similar requirements, and are advised to inform themselves of conditions that may exist at the institutions to which they apply. The AMS reserves the right to reject any advertisement.

The AMS strongly supports equal opportunity in employment. Despite increasing participation at many levels, low rates of retention and promotion of women and underrepresented minorities remain a serious concern, particularly at doctoral-granting institutions. Therefore, AMS members, both individual and institutional, are urged to examine frequently their policies and procedures to see in what ways they may facilitate careers in mathematics research for women and underrepresented minorities. Resources can be found at the website: <http://www.ams.org/employment/equalopportunity.html>

Classified Advertisements

Positions available, items for sale, services available, and more

CALIFORNIA

MATHEMATICAL SCIENCES RESEARCH INSTITUTE Berkeley, CA

MSRI invites applications for 40 Research Professors, 200 Research Members, and 30 semester-long Post-Doctoral Fellows, in the following programs: Symplectic and Contact Geometry and Topology (August 17, 2009, to May 21, 2010), Tropical Geometry (August 17, 2009, to December 18, 2009), Homology Theories of Knots and Links (January 11, 2010, to May 21, 2010). Some invitations may be made in other areas, so applications from candidates in all fields are welcome. Research professorships are intended for senior researchers who will be making key contributions to a program including the mentoring of postdoctoral fellows and who will be in residence for three or more months. Research memberships are intended for researchers who will be making contributions to a program and who will be in residence for one or more months. Post-doctoral fellowships are intended for recent Ph.D.'s (some semester-long fellowships may be combined to allow fellows to participate in the full academic year program. Candidates with other interest may also apply for a semester fellowship in the Complementary Program). Applications must be complete, including all letters of reference. Application deadlines: Research Professorships, October 01, 2008; Research Memberships, December 01, 2008; Post-doctoral Fellowships, December 01, 2008. Application information http://www.msri.org/propapps/applications/application_material. Programatic information: Symplectic and

Contact Geometry and Topology http://www.msri.org/calendar/programs/ProgramInfo/257/show_program.

Tropical Geometry http://www.msri.org/calendar/programs/ProgramInfo/255/show_program.

Homology Theories of Knots and Links http://www.msri.org/calendar/programs/ProgramInfo/258/show_program.

000066

UNIVERSITY OF CALIFORNIA, LOS ANGELES Department of Mathematics Faculty Positions Academic Year 2009-2010

The Department of Mathematics, subject to administrative approval, expects to make several tenure-track/tenure appointments in a wide range of possible fields. We also plan to make temporary and visiting appointments in the following categories 2-5. Depending on the level, candidates must give evidence of potential or demonstrated distinction in scholarship and teaching.

(1) Tenure-Track/Tenured Faculty Positions. Salary is commensurate with level of experience.

(2) E. R. Hedrick Assistant Professorships. Salary is US\$61,200 and appointments are for three years. The teaching load is four quarter courses per year.

(3) Computational and Applied Mathematics (CAM) Assistant Professorships. Salary is US\$61,200, and appointments are for three years. The teaching load is normally reduced to two or three quarter

courses per year by research funding as available.

(4) Program in Computing (PIC) Assistant Adjunct Professorships. Salary is US\$65,500. Applicants for these positions must show very strong promise in teaching and research in an area related to computing. The teaching load is four one-quarter programming courses each year and one seminar every two years. Initial appointments are for one year and possibly longer, up to a maximum service of four years.

(5) Assistant Adjunct Professorships and Research Postdocs. Normally appointments are for one year, with the possibility of renewal. Strong research and teaching background required. The salary range is US\$56,400-\$59,500. The teaching load for adjuncts is five quarter courses per year.

If you wish to be considered for any of these positions you must submit an application and supporting documentation electronically via <http://www.mathjobs.org>.

For fullest consideration, all application materials should be submitted on or before December 12, 2008. Ph.D is required for all positions.

UCLA and the Department of Mathematics have a strong commitment to the achievement of excellence in teaching and research and diversity among its faculty and staff. The University of California is an Equal Opportunity/Affirmative Action Employer. The University of California asks that applicants complete the Equal Opportunity Employer survey for Letters and Science, at the following URL: <http://cis.ucla.edu/facultysurvey>. Under Federal law, the University of California may employ only individuals who are legally authorized to work in the

Suggested uses for classified advertising are positions available, books or lecture notes for sale, books being sought, exchange or rental of houses, and typing services.

The 2008 rate is \$110 per inch or fraction thereof on a single column (one-inch minimum), calculated from top of headline. Any fractional text of 1/2 inch or more will be charged at the next inch rate. No discounts for multiple ads or the same ad in consecutive issues. For an additional \$10 charge, announcements can be placed anonymously. Correspondence will be forwarded.

Advertisements in the "Positions Available" classified section will be set with a minimum one-line headline, consisting of the institution name above body copy, unless additional headline copy is specified by the advertiser. Headlines will be centered in boldface at no extra charge. Ads will appear in the language in which they are submitted.

There are no member discounts for classified ads. Dictation over the telephone will not be accepted for classified ads.

Upcoming deadlines for classified advertising are as follows: November 2008 issue–August 28, 2008; December 2008 issue–October 1, 2008; January 2009

issue–October 28, 2008; February 2009 issue–November 26, 2008; March 2009 issue–December 29, 2008; April 2009 issue–January 29, 2009.

U.S. laws prohibit discrimination in employment on the basis of color, age, sex, race, religion, or national origin. "Positions Available" advertisements from institutions outside the U.S. cannot be published unless they are accompanied by a statement that the institution does not discriminate on these grounds whether or not it is subject to U.S. laws. Details and specific wording may be found on page 1373 (vol. 44).

Situations wanted advertisements from involuntarily unemployed mathematicians are accepted under certain conditions for free publication. Call toll-free 800-321-4AMS (321-4267) in the U.S. and Canada or 401-455-4084 worldwide for further information.

Submission: Promotions Department, AMS, P.O. Box 6248, Providence, Rhode Island 02940; or via fax: 401-331-3842; or send email to classes@ams.org. AMS location for express delivery packages is 201 Charles Street, Providence, Rhode Island 02904. Advertisers will be billed upon publication.

United States as established by providing documents specified in the Immigration Reform and Control Act of 1986.

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ILLINOIS

ILLINOIS WESLEYAN UNIVERSITY
Department of Mathematics
Tenure-Track Assistant
Professor of Mathematics

The Department of Mathematics and Computer Science at Illinois Wesleyan University invites applications for a tenure-track assistant professor of mathematics. Employment will begin in August 2009, and the teaching load will be six courses per year. All candidates must have a Ph.D. in mathematics with a specialization in number theory. Candidates are expected to have completed their Ph.D. by August 1, 2009.

Applicants for the position should submit by mail a letter of application, curriculum vitae, AMS Standard Cover Sheet, and a research and teaching statement, and have three letters of recommendation sent separately to: Mathematics Search Committee, Department of Mathematics and Computer Science, Illinois Wesleyan University, P.O. Box 2900, Bloomington, IL 61702-2900. Electronic applications are not normally accepted. Applications completed after November 1, 2008, may not receive full consideration. For further information, see <http://www2.iwu.edu/iwujobs/>.

Illinois Wesleyan is an Equal Opportunity Employer Committed to a Diverse Work Force.

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UNIVERSITY OF CHICAGO
Department of Mathematics

The University of Chicago Department of Mathematics invites applications for the following positions:

1. L. E. Dickson Instructor: This is open to mathematicians who have recently completed or will soon complete a doctorate in mathematics or a closely related field, and whose work shows remarkable promise in mathematical research and teaching. The appointment typically is for two years, with the possibility of renewal for a third year. The teaching obligation is up to four one-quarter courses per year. For applicants who are U.S. citizens or permanent residents, there is the possibility of reduced teaching and resources for summer support and travel from the department's VIGRE grant.

2. Assistant Professor: This is open to mathematicians who are further along in their careers, typically two or three years past the doctorate. These positions are intended for mathematicians whose work has been of outstandingly high caliber.

Appointees are expected to have the potential to become leading figures in their fields. The appointment is generally for three years, with a teaching obligation of three one-quarter courses per year.

Applicants will be considered for any of the positions above which seem appropriate. Complete applications consist of (a) a cover letter, (b) a curriculum vitae, (c) three or more letters of reference, at least one of which addresses teaching ability, and (d) a description of previous research and plans for future mathematical research. Applicants are strongly encouraged to include information related to their teaching experience, such as a teaching statement or evaluations from courses previously taught, as well as an AMS cover sheet. If you have applied for an NSF Mathematical Sciences Postdoctoral Fellowship, please include that information in your application, and let us know how you plan to use it if awarded.

Applications must be submitted online through <http://www.mathjobs.org>. Questions may be directed to: appt-sec@math.uchicago.edu. We will begin screening applications on December 1, 2008. Screening will continue until all available positions are filled. The University of Chicago is an Equal Opportunity/Affirmative Action Employer.

000047

LOUISIANA

LOUISIANA STATE UNIVERSITY
Department of Mathematics/Center for
Computation and Technology
Postdoctoral Researcher
(One or more positions)

The Department of Mathematics at Louisiana State University in partnership with the Center for Computation and Technology (CCT) invites applications for NSF VIGRE Postdoctoral Researcher positions in mathematics. Applications are invited for postdoctoral researcher(s) in Scientific Computing/Numerical Analysis. The teaching duties are the equivalent of one course each semester.

Required Qualifications: Ph.D. or an equivalent degree in mathematics or a related area. Additional Qualifications Desired: Mathematical scientists, who have potential for research excellence as well as commitment to graduate and undergraduate education.

These positions are designed to increase the participation of the department in interdisciplinary research with various other research groups on campus. The CCT (<http://www.cct.lsu.edu>) has a mission to enhance information technology efforts at LSU. Much of its funding is being used to create new faculty positions in the computational sciences across disciplines, including computational mathematics, computer science, nanotechnologies, astrophysics and relativity, fluid dynamics,

bio-informatics, and others. An offer of employment is contingent on a satisfactory pre-employment background check. Review of applications will begin December 1, 2008, but applications will be accepted and reviewed until candidates are selected. Applications should include the AMS Standardized Application Form, and enclose a full resume (including email address), a statement on research, and three letters of recommendation. Minorities and women are strongly encouraged to apply. To apply, we request that applicants use the secure AMS online application system at <http://www.mathjobs.org/jobs>. You may also write to: Hiring Committee, Department of Mathematics, Louisiana State University, Ref: #032992, Baton Rouge, LA 70803; email: profjobs@math.lsu.edu. LSU is an Equal Opportunity/Equal Access Employer.

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LOUISIANA STATE UNIVERSITY
Department of Mathematics/Center for
Computation and Technology
Postdoctoral Researcher
(One or more positions)

The Department of Mathematics at Louisiana State University invites applications for anticipated Postdoctoral Researcher positions in mathematics including NSF VIGRE postdoctoral positions. Applications are invited for positions in the areas of geometric analysis, geometry and topology, algebra, analysis, applied mathematics, and combinatorics. The teaching duties are the equivalent of one course each semester.

Required Qualifications: Ph.D. or an equivalent degree in mathematics. Additional Qualifications desired: Mathematicians, who have potential for research excellence as well as a commitment to graduate and undergraduate education. Special Requirements: VIGRE funded postdoctoral researchers must have authorization to work in the U.S.

An offer of employment is contingent on a satisfactory pre-employment background check. Review of applications will begin January 2, 2009, but applications will be accepted and reviewed until candidates are selected. Applications should include the AMS Standardized Application Form, and enclose a full resume (including email address), a statement on research, and three letters of recommendation. Minorities and women are strongly encouraged to apply. To apply, we request that applicants use the secure AMS online application system at <http://www.mathjobs.org/jobs>. You may also write to: Hiring Committee Department of Mathematics Louisiana State University Ref: #034149 Baton Rouge, LA 70803; email: profjobs@math.lsu.edu. LSU is an Equal Opportunity/Equal Access Employer

000050

MARYLAND

JOHNS HOPKINS UNIVERSITY
Department of Mathematics
Full Professor

The Department of Mathematics invites applications for one or more positions at the Associate Professor or Full Professor level in general areas of analysis, algebra, topology, number theory, and mathematical physics beginning Fall 2009 or later.

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 directly to: Appointments Committee, Department of Mathematics, Johns Hopkins University, 404 Krieger Hall, Baltimore, MD 21218. Application should include a vita, at least four letters of recommendation of which one specifically comments on teaching, and a description of current and planned research. Write to cpool@jhu.edu for questions concerning these positions. Applications received by November 17, 2008, will be given priority. The Johns Hopkins University is an Affirmative Action/Equal Opportunity Employer. Minorities and women candidates are encouraged to apply.

000045

JOHNS HOPKINS UNIVERSITY
Department of Mathematics
Non-Tenure-Track J. J. Sylvester
Assistant Professor
2008 Advertising

Subject to availability of resources and administrative approval, the Department of Mathematics solicits applications for non-tenure-track Assistant Professor positions beginning Fall 2009.

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 directly to: Appointments Committee, Department of Mathematics, Johns Hopkins University, 404 Krieger Hall, Baltimore, MD 21218. Application should include a vita, at least four letters of recommendation of which one specifically comments on teaching, and a description of current and planned

research. Write to cpool@jhu.edu for questions concerning these positions. Applications received by November 17, 2008, will be given priority. The Johns Hopkins University is an Affirmative Action/Equal Opportunity Employer. Minorities and women candidates are encouraged to apply.

000046

MASSACHUSETTS

BOSTON COLLEGE
Department of Mathematics
Tenure-Track Positions in
Number Theory and in
Geometry/Topology

The Department of Mathematics at Boston College invites applications for two tenure-track positions at the level of Assistant Professor beginning in September 2009, one in Number Theory and the second in Geometry/Topology. In exceptional cases, a higher level appointment may be considered. The teaching load for each position is three semester courses per year.

Requirements include a Ph.D. or equivalent in mathematics awarded in 2007 or earlier, a record of strong research combined with outstanding research potential, and demonstrated excellence in teaching mathematics.

A completed application should contain a cover letter, a description of research plans, a statement of teaching philosophy, curriculum vitae, and at least four letters of recommendation. One or more of the letters of recommendation should directly comment on the candidate's teaching credentials.

Applications completed no later than December 1, 2008 will be assured our fullest consideration. Please submit all application materials through <http://MathJobs.org>. If necessary, printed materials may otherwise be sent to:

Chair, Search Committee in Number Theory
 (resp. in Geometry/Topology)
 Department of Mathematics
 Boston College
 Chestnut Hill, MA 02467-3806

Applicants may learn more about the department, its faculty and its programs at <http://www.bc.edu/math>. Electronic inquiries concerning these positions may be directed to math-search-nt@bc.edu or math-search-gt@bc.edu. Boston College is an Affirmative Action/Equal Opportunity Employer. Applications from women, minorities and individuals with disabilities are encouraged.

000060

MASSACHUSETTS INSTITUTE OF TECHNOLOGY
Department of Mathematics

The Mathematics Department at MIT is seeking to fill positions at the level of Assistant Professor or higher for September 2009. Appointments are based on exceptional research contributions in pure mathematics. Appointees will be expected to fulfill teaching duties and pursue their own research program. Ph.D. required by employment start-date. We request that applications and other materials, including (a) curriculum vitae, (b) research description, and (c) three letters of recommendation be submitted online at <http://www.mathjobs.org>. Applications should be complete by **December 1, 2008**, to receive full consideration. We request that your reference letters be submitted by reviewers online via mathjobs.org. We will also accept recommendations sent as PDF attachments to pure@math.mit.edu, or in hardcopy mailed to: Pure Mathematics Committee, Room 2-345, Department of Mathematics, MIT, 77 Massachusetts Ave., Cambridge, MA 02139-4307. Please do not mail or email duplicates of items already submitted via mathjobs.org.

MIT is an Equal Opportunity, Affirmative Action Employer.

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MASSACHUSETTS INSTITUTE OF TECHNOLOGY
Department of Mathematics
C.L.E. Moore Instructorships in
Mathematics

These positions for September 2009 are open to mathematicians who show definite promise in research. Applicants with Ph.D.'s after June 2008 are strongly preferred. Appointees will be expected to fulfill teaching duties and pursue their own research program. We request that applications and other materials, including (a) curriculum vitae, (b) research description, and (c) three letters of recommendation, be submitted online at <http://www.mathjobs.org>. Applications should be complete by **December 1, 2008**, to receive full consideration. We request that your letters of reference be submitted by the reviewers online via <http://mathjobs.org>. We will also accept recommendations either as PDF attachments sent to: pure@math.mit.edu, or as paper copies mailed to: Pure Mathematics Committee, Room 2-345, Department of Mathematics, MIT, 77 Massachusetts Ave., Cambridge, MA 02139-4307. Please do not mail or email duplicates of items already submitted via mathjobs.org.

MIT is an Equal Opportunity, Affirmative Action Employer.

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**MASSACHUSETTS INSTITUTE OF
TECHNOLOGY**
Department of Mathematics
Applied Mathematics

The applied mathematics group at MIT is seeking to fill combined teaching and research positions at the level of Instructor, Assistant Professor, or higher, beginning September 2009. Ph.D. required by employment start-date. Appointments are mainly based on exceptional research qualifications. Candidates in all areas of applied mathematics, including physical applied mathematics, computational molecular biology, numerical analysis, scientific computation, and theoretical computer science will be considered. Current activities of the group include: combinatorics, operations research, theory of algorithms, numerical analysis, astrophysics, condensed matter physics, computational physics, fluid dynamics, geophysics, nonlinear waves, theoretical and computational molecular biology, material sciences, quantum computing and quantum field theory, but new hiring may involve other areas as well. We request that applications and other materials, including (a) curriculum vitae, (b) research description, and (c) three letters of recommendation be submitted online at: <http://www.mathjobs.org>, preferably well in advance of our deadline of **January 1, 2009**, since we will begin our deliberations in December. We request that your reference letters be submitted by reviewers online via <http://mathjobs>. We will also accept recommendations sent as PDF attachments to: applied@math.mit.edu, or in hardcopy mailed to: Applied Mathematics Committee, Room 2-345, Department of Mathematics, MIT, 77 Massachusetts Ave., Cambridge, MA 02139-4307. Please do not mail or email duplicates of items already submitted via mathjobs.

MIT is an Equal Opportunity, Affirmative Action Employer.

000075

**MASSACHUSETTS INSTITUTE OF
TECHNOLOGY**
Department of Mathematics
Statistics

The Department of Mathematics at MIT is seeking to fill combined teaching and research positions at the level of Instructor, Assistant Professor, or higher in STATISTICS or APPLIED PROBABILITY beginning September 2009. Appointments are mainly based on exceptional research qualifications. Ph.D. required by employment start-date. We request that applications and other materials, including (a) curriculum vitae, (b) research description, and (c) three letters of recommendation be submitted online at: <http://www.mathjobs.org>. Applications should be complete by **January 1, 2009**, to receive full consideration. We request that your

reference letters be submitted by reviewers online via <http://mathjobs>. We will also accept recommendations sent as PDF attachments to statistics@math.mit.edu, or in hardcopy mailed to: Committee on Statistics, Room 2-345, Department of Mathematics, MIT, 77 Massachusetts Ave., Cambridge, MA 02139-4307. Please do not mail or email duplicates of items already submitted via mathjobs.

MIT is an Equal Opportunity, Affirmative Action Employer.

000076

WILLIAMS COLLEGE
Mathematics & Statistics

The Williams College, Department of Mathematics and Statistics, invites applications for one tenure-track position in mathematics, beginning fall 2009, at the rank of assistant professor (in an exceptional case, a more advanced appointment may be considered). We are seeking a highly qualified candidate who has demonstrated excellence in teaching and research, and who will have a Ph.D. by the time of appointment.

Williams College is a private, coeducational, residential, highly selective liberal arts college with an undergraduate enrollment of approximately 2,000 students. The teaching load is two courses per 12-week semester and a winter term course every other January. In addition to excellence in teaching, an active and successful research program is expected.

Applicants are asked to supply a vita and have three letters of recommendation on teaching and research sent. Teaching and research statements are also welcome. Applications may be made online (<http://www.mathjobs.org/jobs>). Alternately, application materials and letters of recommendation may be sent to Olga R. Beaver, Chair of the Hiring Committee, Department of Mathematics and Statistics, Williams College, Williamstown, MA 01267. Evaluation of applications will begin on or after November 15 and will continue until the position is filled. For more information on the Department of Mathematics and Statistics, please visit <http://www.williams.edu/Mathematics>.

Williams College is committed to building and supporting a diverse population of faculty, staff and students, to fostering a varied and inclusive curriculum, and to providing a welcoming intellectual environment for all. As an EEO/AA employer, Williams encourages applications from all backgrounds. To learn more about Williams College, please visit <http://www.williams.edu>.

000048

MICHIGAN

UNIVERSITY OF MICHIGAN
Department of Mathematics

Pending authorization, the department invites applications for a Lecturer III in Mathematics to begin September 2009. 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 and activity 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, a statement of teaching philosophy and experience, evidence of teaching excellence, and the names of at least three references. Application materials should preferably be submitted electronically through the AMS website: <http://MathJobs.Org>. Alternatively, applications may be sent to: Personnel Committee, University of Michigan, Department of Mathematics, 2074 East Hall, 530 Church Street, Ann Arbor MI 48109-1043. Applications are considered on a continuing basis but candidates are urged to apply by November 1, 2008. Inquiries may be made by e-mail to: math-fac-search@umich.edu. More detailed information regarding the department may be found on our website: <http://www.math.lsa.umich.edu>. Women and minority candidates are encouraged to apply. The University of Michigan is an Equal Opportunity/Affirmative Action Employer.

000065

UNIVERSITY OF MICHIGAN
Department of Mathematics

Pending authorization, the Department of Mathematics 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 placement dossier consisting of a letter of application, curriculum vitae and three letters of recommendation; senior candidates should send a letter of application, curriculum vitae, and names of three suggested references. In all cases please provide a statement of teaching philosophy and experience, evidence of teaching excellence, and a statement of current and future research plans. Application materials should preferably be

submitted electronically through the AMS website <http://MathJobs.Org>. Alternatively, applications may be sent to: Personnel Committee, University of Michigan, Department of Mathematics, 2074 East Hall, 530 Church Street, Ann Arbor MI 48109-1043. Applications are considered on a continuing basis but candidates are urged to apply by November 1, 2008. Inquiries may be made by email to: math-fac-search@umich.edu. More detailed information regarding the department may be found on our website: <http://www.math.lsa.umich.edu>. Women and minority candidates are encouraged to apply. The University of Michigan is supportive of the needs of dual career couples and is an Equal Opportunity /Affirmative Action Employer.

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MINNESOTA

UNIVERSITY OF MINNESOTA Dunham Jackson Assistant Professor

This is a three-year appointment from fall semester 2009 through spring semester 2012, with a teaching load of 3 one-semester courses per academic year. Outstanding research and teaching abilities are required. Preference will be given to applicants whose research interests are compatible with those of the School. Applicants should have received or expect to receive a Ph.D. in mathematics no earlier than Jan. 1, 2008, and no later than August 25, 2009. Salary is competitive. For full consideration, applications and all supporting materials must be submitted electronically through <http://www.mathjobs.org> by December 1, 2008. Applications received after the deadline will be considered as positions remain. No paper submission is needed unless the candidate is unable to submit electronically, in which case letters may be sent to the following address:

Peter J. Olver, Professor and Head
School of Mathematics
University of Minnesota
127 Vincent Hall,
206 Church Street S.E.
Minneapolis, MN 55455

email: mathsrch@tc.umn.edu

Applicants must include the following: Cover letter; curriculum vitae; at least 4 letters of recommendation, one of which should address teaching ability; description of research; and a teaching statement. Reference letter writers should be asked to submit their letters online through <http://mathjobs.org>. If they are unable to do so, they may send their letters to the above mentioned address. In addition to your MathJobs application, the University of Minnesota requires all applicants to register at the website <http://employment.umn.edu>. At this site you should first click on the link "Search Positions". Enter Requisition Number 157121.

When the job listing appears click the "View" link in the Position Title field and then the button "Apply for this Posting". At this point you will be prompted to "Fill out a new Application". In your application, you should enter your name and optional demographic information. It is not necessary to fill out your complete contact information or to submit your other application material to this site.

The University of Minnesota is an Equal Opportunity Employer/Educator.

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UNIVERSITY OF MINNESOTA School of Mathematics

The School of Mathematics of the University of Minnesota is seeking outstanding candidates for 2-3 tenured or tenure-track faculty positions starting fall semester 2009. Candidates should have a Ph.D. or equivalent degree in mathematics or a closely related field and excellent records in both research and teaching.

For full consideration, applications and all supporting materials must be submitted electronically through <http://www.mathjobs.org> by December 1, 2008. Applications received after the deadline will be considered as positions remain. No paper submission is needed unless the candidate is unable to submit electronically, in which case letters should be sent to the following address:

Peter J. Olver, Professor and Head
School of Mathematics
University of Minnesota
127 Vincent Hall
206 Church Street S.E.
Minneapolis, MN 55455

email: mathsrch@tc.umn.edu

Applicants must include the following: Cover letter; curriculum vitae; at least 4 letters of recommendation, one of which should address teaching ability; and a research and teaching statement. Reference letter writers should be asked to submit their letters online through <http://mathjobs.org>. If they are unable to do so, they may send their letters to the above mentioned address. In addition to your MathJobs application, the University of Minnesota requires all applicants to register at the website <http://employment.umn.edu>. At this site you should first click on the link "Search Positions". Enter Requisition Number 157121 for tenure-track positions and 157113 for tenured positions.

When the job listing appears click the "View" link in the Position Title field and then the button "Apply for this Posting". At this point you will be prompted to "Fill out a new Application". In your application, you should enter your name and optional demographic information. It is not necessary to fill out your complete

contact information or to submit your other application material to this site.

The University of Minnesota is an Equal Opportunity Employer/Educator.

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NEW HAMPSHIRE

DARTMOUTH COLLEGE John Wesley Young Research Instructorship

The John Wesley Young Instructorship is a postdoctoral, two- to three-year appointment intended for promising Ph.D. graduates with strong interests in both research and teaching and whose research interests overlap a department member's. Current research areas include applied mathematics, combinatorics, geometry, logic, non-commutative geometry, number theory, operator algebras, probability, set theory, and topology. Instructors teach four ten-week courses distributed over three terms, though one of these terms in residence may be free of teaching. The assignments normally include introductory, advanced undergraduate, and graduate courses. Instructors usually teach at least one course in their own specialty. This appointment is for 26 months with a monthly salary of \$4,833 and a possible 12 month renewal. Salary includes two-month research stipend for Instructors in residence during two of the three summer months. To be eligible for a 2009-2011 Instructorship, candidate must be able to complete all requirements for the Ph.D. degree before September 2009. Applications may be obtained at <http://www.math.dartmouth.edu/recruiting/> or <http://www.mathjobs.org>. Position ID: 237-JWY. General inquiries can be directed to Annette Luce, Department of Mathematics, Dartmouth College, 6188 Kemeny Hall, Hanover, New Hampshire 03755-3551. At least one referee should comment on applicant's teaching ability; at least two referees should write about applicant's research ability. Applications received by January 5, 2009, receive first consideration; applications will be accepted until position is filled. Dartmouth College is committed to diversity and strongly encourages applications from women and minorities.

000078

NEW JERSEY

INSTITUTE FOR ADVANCED STUDY School of Mathematics

The School of Mathematics has a limited number of memberships, some with financial support for research in mathematics and computer science at the Institute during the 2009-2010 academic year. Candidates must have given evidence of ability

in research comparable at least with that expected for the Ph.D. degree.

During the academic year of 2009-2010, Enrico Bombieri of the School and Peter Sarnak of Princeton University/Institute for Advanced Study will lead a program on analytic number theory. The program will have an emphasis on analytic aspects, and particular topics that will be covered include the distribution of prime numbers, sieves, L functions, special sequences as well as additive and combinatorial methods, exponential sums, spectral analysis and modular forms.

Minicourses explaining some of the basic methods and tools connected with these topics will be held towards the beginning of each term, and a weekly seminar will take place on Tuesday afternoons. A week-long workshop highlighting recent developments connected with the program will be held in the spring.

Recently the School has established the von Neumann Early Career Fellowships. Six of these fellowships will be available for the 2009-2010 academic year. To be eligible for the von Neumann Fellowships, applicants should be at least 5 years following the receipt of their Ph.D. but not yet eligible to receive their first paid sabbatical.

The Veblen Research Instructorship is a three-year position which the School of Mathematics and the Department of Mathematics at Princeton University established in 1998. Three-year instructorships will be offered each year to candidates in pure and applied mathematics who have received their Ph.D. within the last three years. The first and third year of the instructorship will be spent at Princeton University and will carry regular teaching responsibilities. The second year will be spent at the Institute and dedicated to independent research of the instructor's choice.

Application materials may be requested from Applications, School of Mathematics, Institute for Advanced Study, Einstein Drive, Princeton, NJ 08540; email: applications@math.ias.edu. Application forms may be downloaded via a Web connection to: <http://www.math.ias.edu>. Application deadline is December 1.

The Institute for Advanced Study is committed to diversity and strongly encourages applications from women and minorities.

000054

RUTGERS UNIVERSITY, CAMDEN
Department of Mathematical Sciences
Joseph and Loretta Lopez
Endowed Chair in Mathematics

Applications and nominations are invited for the Joseph and Loretta Lopez Chair in Mathematics. The department seeks a distinguished scholar in mathematics with international reputation, well-established research and teaching record, and

demonstrated ability to generate external funding. This endowed chair is the first at the Camden Campus of Rutgers University. It is a tenured faculty position and the chair is for a 5-year renewable term. The holder of this chair will be a senior faculty member and a vigorous participant in the research, instruction, and service work of the Department of Mathematical Sciences. The holder will also be expected to play a vital role in the recently established Center for Computational and Integrative Biology. Applicants must demonstrate evidence of interest in the areas of mathematical and/or computational biology.

The appointment will commence on September 1, 2009. The salary and startup funds are highly competitive and negotiable. The department will begin reviewing applications on December 17 and continue its review until the position is filled. Applications should be sent to:

Professor Gabor Toth, Chair
Search Committee, Department of Mathematical Sciences
Rutgers University, Camden
Camden, New Jersey, 08102

Applicants should also arrange for at least four letters of recommendation to be sent. Rutgers University, Camden, is an Affirmative Action/Equal Opportunity Employer and encourages applications from women and minority group members.

000077

NEW YORK

CORNELL UNIVERSITY
Department of Mathematics

The Department of Mathematics at Cornell University invites applications for possible H.C. Wang Assistant Professors, non-renewable, 3-year term beginning July 1, 2009. Successful candidates are expected to pursue independent research at Cornell and teach three courses per year. A Ph.D. in mathematics is required. The department actively encourages applications from women and minority candidates.

Applicants are strongly encouraged to apply electronically at: <http://www.mathjobs.org>.

For information about our positions and application instructions, see: <http://www.math.cornell.edu/Positions/facpositions.html>. Applicants will be automatically considered for all eligible positions. Deadline December 1, 2008. Early applications will be regarded favorably. Cornell University is an Affirmative Action/Equal Opportunity Employer and Educator.

000069

CORNELL UNIVERSITY
Department of Mathematics

The Department of Mathematics at Cornell University invites applications for possible visiting positions, academic year

or one semester teaching positions (rank based on experience) beginning August 16, 2009. We are seeking candidates who have excellent teaching skills. Teaching load varies from 1-4 courses per year, depending on the individual and the availability of courses. Candidates with teaching and research interests compatible with current faculty are sought. A Ph.D. in mathematics or a related field is required. The department actively encourages applications from women and minority candidates.

Applicants are strongly encouraged to apply electronically at <http://www.mathjobs.org>.

For information about our positions and application instructions, see: <http://www.math.cornell.edu/Positions/facpositions.html>. Applicants will be automatically considered for all eligible positions. Deadline December 1, 2008. Early applications will be regarded favorably. Cornell University is an Affirmative Action/Equal Opportunity Employer and Educator.

000070

CORNELL UNIVERSITY
Department of Mathematics

The Department of Mathematics at Cornell University invites applications for two or more half-time visiting positions (rank based on experience) for mathematics professors on sabbatical/other leaves from colleges, universities, and engineering schools for our Teaching Program Visiting Faculty Positions beginning August 16, 2009. Candidates with substantial experience teaching undergraduate mathematics, and with teaching and research interests compatible with current faculty, are sought. Successful candidates are expected to pursue a program of study and/or research at Cornell. The normal duties are to teach two identical courses each semester. A Ph.D. in mathematics or a related field is required. The department actively encourages applications from women and minority candidates.

Applicants are strongly encouraged to apply electronically at <http://www.mathjobs.org>.

For information about these positions and application instructions, see: <http://www.math.cornell.edu/Positions/facpositions.html>. Deadline December 1, 2008. Cornell University is an Affirmative Action/Equal Opportunity Employer and Educator.

000071

NORTH CAROLINA

NORTH CAROLINA STATE UNIVERSITY
Department of Mathematics

The Mathematics Department at North Carolina State University invites applications

for up to three tenure-track, rank-open, positions beginning Fall 2009. We seek individuals whose research focuses on interdisciplinary mathematics. Two focus areas are applications to energy and the environment. Candidates must have a Ph.D. in the mathematical sciences, a record of successful postdoctoral experience, experience in interdisciplinary research, and a commitment to effective teaching at the undergraduate and graduate levels. Senior-level applicants must demonstrate a strong record of grant support and advising of Ph.D. students. The Department of Mathematics has strong research programs in both applied and pure mathematics. Many members of the department lead interdisciplinary research programs at both the local and national levels. More information about the department can be found at: <http://www.math.ncsu.edu>.

To submit your application materials, go to: <http://www.mathjobs.org/jobs/ncsu>. Include a vita, at least three letters of recommendation, and a description of current and planned research. You will then be given instructions to go to: <http://jobs.ncsu.edu/applicants/Central?quickFind=81073> and complete a Faculty Profile for the position. Write to: email: math-jobs@math.ncsu.edu for questions concerning this position.

NC State University is an Equal Opportunity and Affirmative Action Employer. In addition, NC State welcomes all persons without regard to sexual orientation. The College of Physical and Mathematical Sciences welcomes the opportunity to work with candidates to identify suitable employment opportunities for spouses or partners. Review of applications will begin on December 1, 2008.

000051

NORTH CAROLINA STATE UNIVERSITY Department of Mathematics

The Mathematics Department at North Carolina State University invites applications for a tenure-track, rank-open, position beginning Fall 2009. We seek individuals whose research focuses on modeling in Bio-Medical Mathematics and will play an active role in the Center for Quantitative Sciences in Biomedicine (CQSB), the Center for Research in Scientific Computing (CRSC) and the Bio-Math Program. The successful candidate will be expected to quickly provide scientific vision and leadership for the new CQSB. Preference will be given to applicants that have established a successful record of grant support and advising of Ph.D. students. Candidates must have a Ph.D. in the mathematical sciences, a record of successful postdoctoral experience or equivalent, experience in interdisciplinary research, and a commitment to effective

teaching at the undergraduate and graduate levels.

The Department of Mathematics has strong research programs in both applied and pure mathematics and provides/shares leadership for CQSB, CRSC and Bio-Math. More information about the department, CQSB and CRSC can be found at: <http://www.math.ncsu.edu>.

To submit your application materials, go to <http://www.mathjobs.org/jobs/ncsu>. Include a vita, at least three letters of recommendation, and a description of current and planned research. You will then be given instructions to go to: <http://jobs.ncsu.edu/applicants/Central?quickFind=81074> and complete a Faculty Profile for the position. Write to: math-jobs@math.ncsu.edu for questions concerning this position.

NC State University is an Equal Opportunity and Affirmative Action Employer. In addition, NC State welcomes all persons without regard to sexual orientation. The College of Physical and Mathematical Sciences welcomes the opportunity to work with candidates to identify suitable employment opportunities for spouses or partners. Review of applications will begin on December 1, 2008.

000052

OHIO

OHIO STATE UNIVERSITY AT LIMA Department of Mathematics Assistant Professor of Mathematics

The Ohio State University at Lima invites applications for a full-time, tenure-track Assistant Professor of Mathematics. The appointment will be made in the Department of Mathematics at The Ohio State University and begin in September 2009.

The search committee seeks mathematicians who can make a strong commitment to the teaching, research and outreach missions of The Ohio State University. The successful candidate will have the ability to teach the courses that the Department of Mathematics offers at the undergraduate level. The standard teaching load for the successful candidate will be six courses per academic year (Ohio State is on the quarter system), reduced to five courses for the first three years of service. An ability to teach courses in Computer Science and/or Statistics, as well as remedial math courses, will be desirable. The successful candidate will show the potential to create a strong record of service and scholarly research, and a demonstrated commitment to teaching excellence is essential.

Preference will be given to hiring a tenure-line faculty member with specialization in Numerical Analysis/Integral Equations. We will also consider applicants in all other areas compatible with research interests represented by our present

faculty roster (e.g. Ring Theory, Representation Theory and Model Theory).

Candidates must have a Ph.D. in hand at the time of appointment. Salary is competitive.

The Ohio State University at Lima is one of five campuses of The Ohio State University. Current enrollment on the Lima campus is 1,400 students and there are approximately 100 full- and part-time faculty in all academic departments. Ohio State Lima offers the first two years of the Ohio State general education curriculum and ten programs leading to baccalaureate degrees. Ohio State Lima also offers Master's degree programs in Education and Social Work.

The review of applications will begin November 7, 2008, and will continue until the position is filled. Please send a cover letter, a current curriculum vita, and three letters of recommendation to:

Mathematics Search Committee
c/o Kathy Baker, Office of Human Resources
Public Service Building 222
The Ohio State University at Lima
4240 Campus Drive
Lima OH 45804

Questions should be addressed to Dr. Javad Abdalkhani at Abdalkhani.1@osu.edu.

To build a diverse workforce Ohio State encourages applications from individuals with disabilities, minorities, veterans, and women. EEO/AA employer. The Ohio State University offers a comprehensive benefit package designed to provide a variety of choices to best fit your needs. Visit <http://hr.osu.edu/benefits/> to learn more about Ohio State's benefits. Ohio State is committed to providing a work environment that is healthy, supportive, and considerate of employees' work and personal life obligations. Additional information regarding work life programs, policies, and services is available at <http://hr.osu.edu/worklife/faculty.aspx>. For additional information about the Lima campus please see <http://www.lima.osu.edu>.

000080

PENNSYLVANIA

PENN STATE Department of Mathematics Faculty Positions

Subject to availability of funding, the Penn State Mathematics Department will seek to fill openings for S. Chowla Research Assistant Professors and for tenure and tenure-track faculty positions.

S. Chowla Research Assistant Professor:

Successful candidates will be new or recent Ph.D.'s with exceptional research potential and a commitment to excellence in teaching. These non-tenure-track appointments are for three years. Starting

salary is US\$49,000 for the nine month academic year. The Chowla program is designed to maximize the professional development of its participants and provides a research stipend. The department may in addition make other postdoctoral appointments for two or three year terms. Applicants for the Chowla position will automatically be considered for these positions. Initial offers will be made in January 2009.

Tenure and Tenure-Track Faculty Positions:

The department is seeking to fill positions in the area of algebra/number theory although candidates from all areas of mathematics will be considered. A Ph.D. degree or its equivalent is required.

Online application via <http://www.mathjobs.org> is strongly preferred. Review of applications will begin November 17 and will continue until positions are filled. Required application materials include:

- Online application
- 3 Reference Letters
- 1 or more letters should address in detail the candidate's abilities as a teacher
- Curriculum Vitae
- Publication List
- Research Statement
- Teaching Statement

Persons who are unable to apply using the <http://mathjobs.org> website or who do not wish to do so may send application materials to:

Search Committee
Department of Mathematics
Penn State University
107 McAllister Building
University Park, PA 16802

000053

**VILLANOVA UNIVERSITY
Department of Mathematical Sciences
Assistant Professor**

The Department of Mathematical Sciences invites applications for a tenure-track position at the assistant professor level starting August 2009. A Ph.D. in one of the Mathematical Sciences or near completion of the doctorate is required. All areas of Mathematical Sciences will be considered. Send application letter, graduate school transcripts, CV, and three letters of recommendation to: Dr. Douglas Norton, Chair, Dept. of Mathematical Sciences, Villanova University, Villanova, PA 19085. Villanova is a Catholic university sponsored by the Augustinian order. An AA/EEO employer, Villanova seeks a diverse faculty committed to scholarship, service, and especially teaching, who understand, respect, and can contribute to the University's mission and values. Review of applications begins 12/1/2008 and continues until the position is filled. Please see the department homepage at <http://www.villanova.edu/artsci/mathematics>.

000072

SOUTH CAROLINA

**UNIVERSITY OF SOUTH CAROLINA
Department of Mathematics
Tenure-track Assistant Professors**

Applications are invited for two tenure-track Assistant Professor positions in Applied and Computational Mathematics. The Department seeks accomplished individuals who will strengthen and/or complement current strengths in the department and who have genuine interest in interdisciplinary research. Candidates should have completed a doctorate degree in mathematics, engineering, physics, or a computation-related field at the time of hiring and have begun to amass a substantial record in research and teaching. The beginning date for the positions is August 16, 2009, or possibly as early as January 1, 2009 for qualified candidates.

For full consideration, all supporting material should be submitted electronically through <http://www.mathjobs.org> by November 15, 2008. The supporting material should include a detailed vita with a summary of research accomplishments and goals, a completed AMS Standard Cover Sheet, and four letters of recommendation. One letter should appraise the applicant's teaching abilities. In addition, a cover letter should be submitted through <http://mathjobs.org> addressed to: Hiring Committee, Department of Mathematics, University of South Carolina, Columbia, SC 29208. The email address hring@math.sc.edu can be used for further inquiries. Information about the department can be found on the Web at: <http://www.math.sc.edu>. The University of South Carolina is an Affirmative Action, Equal Opportunity Employer. Women and minorities are encouraged to apply. The University of South Carolina does not discriminate in educational or employment opportunities or decisions for qualified persons on the basis of race, color, religion, sex, national origin, age, disability, sexual orientation or veteran status.

000063

TEXAS

**TEXAS A&M UNIVERSITY
The Department of Mathematics**

The Department of Mathematics anticipates several openings for tenured, tenure-eligible, and visiting faculty positions beginning fall 2009. The field is open, but we particularly seek applications from individuals whose mathematical interests would augment and build upon existing strengths both within the Mathematics Department as well as other departments in the university. Salary, teaching loads, and start-up funds are competitive. For a tenured position the applicant should have an outstanding research reputation

and would be expected to fill a leadership role in the department. An established research program, including success in attracting external funding and supervision of graduate students, and a demonstrated ability and interest in teaching are required. Informal inquiries are welcome. For an assistant professorship, we seek strong research potential and evidence of excellence in teaching. Research productivity beyond the doctoral dissertation will normally be expected. We also have several visiting positions available. Our Visiting Assistant Professor positions are three-year appointments 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. A complete dossier should be received by December 15, 2008. Early applications are encouraged since the department will start the review process in October 2008. Applicants should send the completed "AMS Application Cover Sheet", a vita, a summary statement of research and teaching experience; and arrange to have letters of recommendation sent to: Faculty Hiring, Department of Mathematics, Texas A&M University, College Station, Texas 77843-3368. Further information can be obtained from: <http://www.math.tamu.edu/hiring>.

Texas A&M University is an Equal Opportunity Employer. The university is dedicated to the goal of building a culturally diverse and pluralistic faculty and staff committed to teaching and working in a multicultural environment and strongly encourages applications from women, minorities, individuals with disabilities, and veterans. The university is responsive to the needs of dual career couples.

000039

**Texas A&M University
Department of Mathematics
IAMCS-KAUST Postdoctoral Fellowships**

The Institute for Applied Mathematics and Computational Science (IAMCS) at Texas A&M University is pleased to invite applications for its IAMCS-KAUST Postdoctoral Fellowships.

IAMCS is an interdisciplinary research institute at Texas A&M University recently named as one of the four inaugural King Abdullah University of Science and Technology (KAUST) Global Research Partner Centers. Its core members number more than two dozen faculty from the fields of Mathematics, Statistics, Computer Science, and Engineering.

Fostering collaboration and interdisciplinary research anchored in the mathematical sciences are at the heart of IAMCS's mission. To that end, IAMCS emphasizes among its activities annual research themes. Its first two annual

themes are Computational Earth Science and Computational Material Science and Engineering. IAMCS postdoctoral candidates should have demonstrated interest and involvement in interdisciplinary research, and successful candidates will be encouraged to participate in the annual theme activities and to establish research collaborations exploring theme year topics. Moreover, each fellow will be invited to establish collaborations with KAUST faculty, postdocs and students as well as all of the KAUST Global Research Partner institutions and individual investigators. This offers an unprecedented opportunity for postdoctoral fellows to join a remarkable network of leading research institutions and eminent scholars assembled through the KAUST GRP program.

KAUST is a new graduate research university being rapidly developed by the Kingdom of Saudi Arabia at a site along the Red Sea a short distance north of Jeddah. When it opens in September 2009, it will offer world class, state-of-the-art research and instructional facilities supporting its core research and graduate programs in earth sciences, materials science and engineering, biosciences, and applied mathematics and computational science. A key element in KAUST's development as a premier graduate research university is its Global Research Partnership (GRP) program. The GRP consists of its Academic Excellence Alliance Partners, Research Center Partners and Individual Research Scholar Partners.

The IAMCS-KAUST Postdoctoral Fellowships at Texas A&M University are two year appointments with the possibility of extension to a third year. The fellowship stipend is US\$50K over 12 months plus fringe benefits. Interested individuals should submit their application materials (CV, research statement, and three letters of recommendation) to the email address: email: KAUST@tam.u.edu by December 15, 2008. IAMCS intends to select up to four IAMCS-KAUST Fellows.

Texas A&M University is an Equal Opportunity Employer. The university is dedicated to the goal of building a culturally diverse pluralistic faculty and staff committed to teaching and working in a multicultural environment and strongly encourages applications from women, minorities, and individuals with disabilities.

000042

UNIVERSITY OF TEXAS AT SAN ANTONIO
Mathematics Education
Associate/Full Professor

The Department of Mathematics in the College of Sciences at the University of Texas at San Antonio, a recognized, Hispanic-serving institution, invites applications for one tenured/tenure-track

position at the Associate/Full Professor level beginning Spring 2009.

Responsibilities include teaching both graduate and undergraduate courses that are offered either at the UTSA downtown campus, the 1604 campus, on public school campuses, and occasionally at night; serving on thesis and doctoral committees; conducting an active program of research; seeking grant funding; and providing service to the department, college, university, and community constituencies.

Associate/Full Professor Required Qualifications: (1) master's in Mathematics and doctorate in Mathematics Education or doctorate in Mathematics with a demonstrated record in Mathematics Education; (2) University teaching experience commensurate with position; and (3) evidence of research and publication record commensurate with position.

Associate/Full Professor Preferred Qualifications: (1) knowledge of current and emerging mathematics education methodologies, techniques, and theories; (2) university teaching and/or supervising/mentoring experience; (3) experience with instructional technology; (4) experience seeking external funding; and (5) experience in leadership roles.

Initial Screening: Qualified candidates must submit an application letter that addresses the required and preferred qualifications; current curriculum vitae; 1-2 page description of research agenda; 2-3 published, peer-reviewed articles; copies of official transcripts; names, addresses, email addresses, and telephone numbers of three references. The review of applications will begin immediately and will continue until the position is filled.

All applicants should send application materials to: Math Faculty Ad, c/o Wanda Crotty, Department of Mathematics at The University of Texas at San Antonio, One UTSA Circle, San Antonio, TX 78249, mathfacultyad@utsa.edu.

The UTSA is an Affirmative Action/Equal Employment Opportunity Employer. Women and minorities, veterans, and individuals with disabilities are encouraged to apply. Applicants who are selected for interviews must be able to show proof that they will be eligible and qualified to work in the United States. This position is pending budget approval.

000055

UTAH

UNIVERSITY OF UTAH
Department of Mathematics

The Department of Mathematics at the University of Utah invites applications for the following positions: Full-time tenure-track or tenured appointments at the level of assistant, associate, or full professor in all areas of mathematics. Special consideration will be given to candidates

in the area of statistics. Three-year Scott, Wylie, Burgess, and VIGRE Assistant Professorships, including Dual VIGRE Post Doctoral positions, depending on funding availability. Three-year Post Doctoral positions with the NSF-NIGMS grant on the Formation and Function of Physiological Gels. Please see our website at: <http://www.math.utah.edu/positions> for information regarding available positions, application requirements and deadlines. Applications must be completed through the website <http://www.mathjobs.org>. The University of Utah is an Equal Opportunity, Affirmative Action Employer and encourages applications from women and minorities, and provides reasonable accommodation to the known disabilities of applicants and employees. The University of Utah values candidates who have experience working in settings with students from diverse backgrounds and possess a strong commitment to improving access to higher education for historically underrepresented students.

000067

CANADA

UNIVERSITY OF ALBERTA
Department of Mathematical and Statistical Sciences
Assistant Professor, Mathematical Physics

The Department of Mathematical and Statistical Sciences at the University of Alberta invites applications for a tenure-track position in the area of Mathematical Physics. This position is at the Assistant Professor level, but an appointment at a higher level may be possible under exceptional circumstances.

The successful candidate will have established accomplishments and outstanding promise in research, as well as a strong commitment to graduate and undergraduate teaching. We offer an excellent research environment with a normal teaching load of three courses per year. A close fit with some of the existing research being presently conducted in the department is an asset but all areas of Mathematical Physics will be considered.

Alberta is one of the leading Mathematics Departments in Canada and has strong connections with other mathematical institutes, such as the Pacific Institute for the Mathematical Sciences (PIMS), Mathematics of Information Technology and Complex Systems (MITACS), and the Banff International Research Station (BIRS). For more information about the department, please visit our website at: <http://www.math.ualberta.ca>.

Applicants must hold a Ph.D. Degree or equivalent, and submit their curriculum vitae, a research statement, a teaching profile outlining experience and/or inter-

ests, and at least three confidential letters of reference to:

Arturo Pianzola, Chair
Department of Mathematical and Statistical Sciences
University of Alberta
Edmonton, Alberta, Canada T6G 2G1

Electronic submissions should be directed to: chairsec@math.ualberta.ca. The closing date for applications is November 7, 2008, or until a suitable candidate is found. Early applications are encouraged.

All qualified candidates are encouraged to apply; however, Canadians and permanent residents will be given priority.

The University of Alberta hires on the basis of merit. We are committed to the principle of equity in employment. We welcome diversity and encourage applications from all qualified women and men, including persons with disabilities, members of visible minorities, and Aboriginal persons.

000056

**UNIVERSITY OF ALBERTA
Department of Mathematical and
Statistical Sciences
Assistant Professor, Mathematical
Finance**

The Department of Mathematical and Statistical Sciences at the University of Alberta invites applications for a tenure-track position in the area of Mathematical Finance. This position is at the Assistant Professor level, but an appointment at a higher level may be possible under exceptional circumstances.

The successful candidate will have established accomplishments and outstanding promise in research, as well as a strong commitment to graduate and undergraduate teaching. We offer an excellent research environment with a normal teaching load of three courses per year. A close fit with some of the existing research being presently conducted in the department is an asset but all areas of Mathematical Finance will be considered.

Alberta is one of the leading Mathematics Departments in Canada and has strong connections with other mathematical institutes, such as the Pacific Institute for the Mathematical Sciences (PIMS), Mathematics of Information Technology and Complex Systems (MITACS), and the Banff International Research Station (BIRS). For more information about the department, please visit our website at: <http://www.math.ualberta.ca>.

Applicants must hold a Ph.D. Degree or equivalent, and submit their curriculum vitae, a research statement, a teaching profile outlining experience and/or interests, and at least three confidential letters of reference to:

Arturo Pianzola, Chair
Department of Mathematical and Statistical Sciences

University of Alberta
Edmonton, Alberta, Canada T6G 2G1

Electronic submissions should be directed to: chairsec@math.ualberta.ca. The closing date for applications is November 7, 2008, or until a suitable candidate is found. Early applications are encouraged.

All qualified candidates are encouraged to apply; however, Canadians and permanent residents will be given priority.

The University of Alberta hires on the basis of merit. We are committed to the principle of equity in employment. We welcome diversity and encourage applications from all qualified women and men, including persons with disabilities, members of visible minorities, and Aboriginal persons.

000057

**UNIVERSITY OF ALBERTA
Department of Mathematical and
Statistical Sciences
Assistant Professor, Mathematical
Biology**

The Department of Mathematical and Statistical Sciences at the University of Alberta invites applications for a tenure-track position in the area of Mathematical Biology. This position is at the Assistant Professor level, but an appointment at a higher level may be possible under exceptional circumstances.

We seek an individual who will fit into our applied mathematics program (dynamical systems, differential equations, numerical methods, fluid dynamics, and probability), and who complements the department's existing expertise in the mathematical modeling of cell biology, ecology, epidemiology, and physiology. Candidates must have a Ph.D. degree in Mathematics or cognate discipline, an excellent research record in Mathematical Biology, strong communication and teaching skills, and leadership potential. Postdoctoral experience is normally expected.

The successful candidate will develop an independent research program, supervise graduate students, and teach at both the graduate and undergraduate levels. We offer an excellent research environment with a normal teaching load of three courses per year. For more information about the department, please visit our website at: <http://www.math.ualberta.ca>.

Candidates have the opportunity to join the Centre for Mathematical Biology and participate in its activities. For more information about the Centre for Mathematical Biology, see <http://www.math.ualberta.ca/~mathbio>.

Applicants should submit their curriculum vitae, a research statement, a teaching profile outlining experience and/or

interests, and at least three confidential letters of reference to:

Arturo Pianzola, Chair
Department of Mathematical and Statistical Sciences
University of Alberta
Edmonton, Alberta, Canada T6G 2G1

Electronic submissions should be directed to: chairsec@math.ualberta.ca. The closing date for applications is November 7, 2008, or until a suitable candidate is found. Early applications are encouraged.

All qualified candidates are encouraged to apply; however, Canadians and permanent residents will be given priority. If suitable Canadian citizens or permanent residents cannot be found, other individuals will be considered.

The University of Alberta hires on the basis of merit. We are committed to the principle of equity in employment. We welcome diversity and encourage applications from all qualified women and men, including persons with disabilities, members of visible minorities, and Aboriginal persons.

000058

**UNIVERSITY OF WATERLOO
Department of Applied Mathematics
Tenure-Track Position in
Mathematical/Theoretical Physics**

Applications are invited for a tenure-track faculty position in the Department of Applied Mathematics at the University of Waterloo, in the field of Mathematical/Theoretical Physics, to begin on or after July 1, 2009. The position is at the Assistant Professor level and salary will commensurate with experience and research record. In exceptional cases, an appointment at a higher level may be possible. We are particularly interested in applicants with expertise in the areas of gravity, quantum gravity, or cosmology. Candidates should show evidence of outstanding potential in research and should have a strong background in both mathematics and physics. We are looking for applicants with enthusiasm for the supervision of graduate students and for teaching at both the undergraduate and graduate level. Waterloo is a very active and large centre for research in Mathematical Physics. The successful applicant may be considered for an Associate Membership at the independent Perimeter Institute for Theoretical Physics (<http://www.perimeterinstitute.ca>) and/or the Institute for Quantum Computing (<http://www.iqc.ca>) at the University of Waterloo. Applicants should send a curriculum vitae, including a statement of research interests and teaching philosophy, via email to: am-positions@math.uwaterloo.ca with "MP-position" in the subject line. Applicants should also arrange to have at least three reference letters emailed to this address. Alternatively applications and reference letters can be sent to K. G.

Lamb, Chairman, Department of Applied Mathematics, University of Waterloo, Waterloo, Ontario, Canada, N2L 3G1. The deadline for receiving applications is November 30, 2008. Applications received after this date will be considered until the position has been filled.

The Department of Applied Mathematics is part of the Faculty of Mathematics, which is a major centre for research in the mathematical sciences. The Faculty also includes the Department of Pure Mathematics, the Department of Combinatorics and Optimization, the Department of Statistics and Actuarial Science, as well as the School of Computer Science. We maintain close ties with the Faculties of Science and Engineering regarding both research and teaching, and we offer a joint undergraduate program in Mathematical Physics with the Department of Physics. Further information about the department may be obtained from our webpage at: http://www.math.uwaterloo.ca/AM_Dept.

The University of Waterloo encourages applications from all qualified individuals, including women, members of visible minorities, native peoples, and persons with disabilities. All qualified candidates are encouraged to apply; however, Canadian citizens and permanent residents will be given priority.

000061

UNIVERSITY OF WATERLOO
Department of Applied Mathematics
Tenure-Track Positions in
Quantum Information

Applications are invited for up to two tenure-track faculty positions in the Department of Applied Mathematics at the University of Waterloo, in the field of Quantum Information Theory, to begin on or after July 1, 2009. The positions are at the Assistant Professor level and salary will be commensurate with experience and research record. In exceptional cases, an appointment at a higher level may be possible. Applications in all areas of quantum information including, for example, the modeling of physical systems for quantum information processes, are encouraged. Candidates should show evidence of outstanding potential in research and should have a strong background in both mathematics and physics. We are looking for applicants with enthusiasm for the supervision of graduate students and for teaching at both the undergraduate and graduate level. Waterloo is a very active and large centre for research in Mathematical Physics. The successful applicants will be considered for an appointment as a faculty member of the Institute for Quantum Computing (<http://www.iqc.ca>) and for an Associate Membership at the independent Perimeter Institute for Theoretical Physics (<http://www.perimeterinstitute.ca>). Applicants should send a curriculum vitae, including a statement of research interests and teaching

philosophy, via email to: am-positions@math.uwaterloo.ca with "QI-position" in the subject line. Applicants should also arrange to have at least three reference letters emailed to this address. Alternatively applications and reference letters can be sent to K. G. Lamb, Chairman, Department of Applied Mathematics, University of Waterloo, Waterloo, Ontario, Canada, N2L 3G1. The deadline for receiving applications is November 30, 2008. Applications received after this date will be considered until the position has been filled.

The Department of Applied Mathematics is part of the Faculty of Mathematics, which is a major centre for research in the mathematical sciences. The Faculty also includes the Department of Pure Mathematics, the Department of Combinatorics and Optimization, the Department of Statistics and Actuarial Science, as well as the School of Computer Science. We maintain close ties with the Faculties of Science and Engineering regarding both research and teaching, and we offer a joint undergraduate program in Mathematical Physics with the Department of Physics. Further information about the department may be obtained from our webpage at: http://www.math.uwaterloo.ca/AM_Dept.

The University of Waterloo encourages applications from all qualified individuals, including women, members of visible minorities, native peoples, and persons with disabilities. All qualified candidates are encouraged to apply; however, Canadian citizens and permanent residents will be given priority.

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ENGLAND

University of Warwick
Department of Mathematics
Postdoctoral Fellowships in Geometric
Analysis (2 posts)

Fixed term contracts: 36 months and 28 months, commencing October 2009. More information on the group at: <http://www.warwick.ac.uk/~maseq>. See job reference: 59718-108 at: <http://www.warwick.ac.uk/go/jobs/research>. Closing Date: December 3, 2008. The university values diversity.

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SINGAPORE

NATIONAL UNIVERSITY OF SINGAPORE
Department of Mathematics

The Department of Mathematics at the National University of Singapore (NUS) invites applications for tenured, tenure-track and visiting (including post-doctoral) positions at all levels, beginning in August 2009.

NUS is a research intensive university that provides quality undergraduate and

graduate education. The department of Mathematics, which is one of the largest in the university, has about 70 faculty members and teaching staff whose expertise cover major areas of contemporary mathematical research.

We seek promising scholars and established mathematicians with outstanding track records in any field of pure and applied mathematics. The department offers internationally competitive salaries with start-up grants for research. The teaching load is particularly light for young scholars, in an environment conducive to research with ample opportunities for career development.

The Department is particularly interested in, but not restricted to considering, applicants specializing in any of the following areas:

* Geometric Analysis, Algebraic Geometry, Number Theory and Automorphic Forms, and Probability

* Computational Biology, Medical Imaging, Computational Materials Science and Nanoscience

Application materials should be sent to Search Committee via email (as PDF files) to: search@math.nus.edu.sg.

Please include the following supporting documentation in the application:

1. an American Mathematical Society Standard Cover Sheet;
2. a detailed CV including publications list;
3. a statement (max. of 3 pages) of research accomplishments and plan;
4. a statement (max. of 2 pages) of teaching philosophy and methodology. Please attach evaluation on teaching from faculty members or students of your current institution, where applicable;
5. at least three letters of recommendation including one which indicates the candidate's effectiveness and commitment in teaching. Please ask your referees to send their letters directly to: search@math.nus.edu.sg. Enquiries may also be sent to this email address.

Review process will begin on 15 October, and will continue until positions are filled.

For further information about the department, please visit <http://www.math.nus.edu.sg>.

000079

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Journal of Differential Geometry, volumes 1-59 complete, best offer. Respond to: blair@math.msu.edu

000059



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AMS

AMERICAN MATHEMATICAL SOCIETY

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Mathematical Sciences Employment Center

*Marriott Wardman Park Hotel, Washington, DC
January 5, 6, 7, and 8, 2009*

2009 Employment Center Schedule

October 22, 2008 Registration deadline for inclusion in Winter List books

December 15, 2008 Advance registration deadline. After this date, all registration activities will happen on site in Washington.

NEW HOURS:

Monday, January 5

8:00 a.m.–4:00 p.m. Registration and materials pickup

8:00 a.m.–7:00 p.m. Interview Center open (doors open at 8:00 a.m.; do not schedule before 9:00 a.m.)

Tuesday, January 6

8:00 a.m.–7:00 p.m. Interview Center open

Wednesday, January 7

8:00 a.m.–7:00 p.m. Interview Center open

Thursday, January 8

9:00 a.m.–12:00 noon Interview Center open

Note: Computer scheduling is no longer provided at the Employment Center. When deciding on a date for arriving, keep in mind that some employers will use Monday for making arrangements, and some employers will conduct interviews on Monday.

Changes for the 2009 Employment Center

The Employment Center no longer offers computer scheduling of appointments. Employers will be inviting candidates for interviews either by email or phone in advance of the meeting, or on site through messaging. All appointments will be set by employer invitation only, so an applicant has no guarantee of interviews.

The second major change for 2009 is the introduction of table types which better accommodate various stages in the hiring process. Tables for one or two interviewers per institution are offered in the “Quiet Area”. Tables for

employers needing three to six interviewers are located in the “Committee Table” area. Employers may opt for additional privacy in a curtained booth.

The Winter List of Employers and Winter List of Applicants books will still be printed and distributed to those who register by the October 22 deadline. Forms are not currently browsable on the Web, however, spreadsheets of applicant data will be sent to registered employers. It is impossible for any employers or applicants to participate privately; all names are displayed on lists posted on site.

The Employment Center offers a convenient and practical meeting place for those already present at the Joint Meetings. The focus of the Employment Center is on Ph.D. level mathematical scientists and those that seek to hire them from academia, business, and government. In the current job market, the majority of employers are seeking to meet a short list of applicants who applied for their open positions during the fall. Opportunities to meet employers with whom no previous contact was made still exist, but are more limited.

The Employment Center takes place on the first three days of the Joint Mathematics Meetings and the morning only of the last day. Registration for the JMM is required for those seeking to register for the Employment Center.

Employers: Important Changes To Note

New in 2009, all employers will be setting their own schedules, either in advance or on site. Computer scheduling has been discontinued. Table choices have been expanded to allow suitable accommodations at various stages of the hiring process:

- one or two interviews per table in the “Quiet Area” (US\$250)
- three to six interviewers per table in the “Committee Table” area (US\$350)
- one to four interviewers in the curtained booths (US\$425)

Also new in 2009 is the simplified schedule; 8:00 a.m. to 7:00 p.m. on Monday, Tuesday, and Wednesday, and 9:00 a.m.–noon on Thursday.

To set up interviews, employers are advised to peruse the Winter List for potential or existing applicants, and

contact those applicants in advance either by email or phone to arrange interview times. To set additional appointments on site, there is a paper Message Center with a folder for each participant; messages can be exchanged there.



Interviews are limited to open hours, which are Monday through Wednesday 8:00 a.m. to 7:00 p.m. and Thursday 9:00 a.m. to noon. Outside of those times, the room is completely unavailable, so, for instance, do not set an appointment to begin at 7:00 p.m. There are paper forms available on site to speed the issuing of invitations. All scheduling is the responsibility of the employer; computer scheduling is no longer offered.

Registered employers will be offered a spreadsheet of applicant data in early November, and a final version in December. However, the applicants can only depend on the printed Winter List books to learn about the employers so it is important for all employers to get their job listing form submitted online before the print deadline of October 22. See registration instructions, below. If the application deadline will have passed before January, or some other difficulty with accepting new applications exists, that should be mentioned on the listing form.

About the Winter List of Applicants

This booklet contains hundreds of résumés of applicants who registered by October 22 for the Employment Center. It will be mailed in December to all registered employers. 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. Additionally, a spreadsheet of applicant data will be emailed to all registered employers in October and a secondary set of data will be emailed in December.

Employers Not Planning To Interview

Employers who wish to display a one-page handout on site, but not obtain a table or conduct interviews, may do so at no charge by bringing their job ad to the Employment

Center desk during the open hours. There is no charge for this service. Please note that sets of handouts will not be accepted or allowed in the room. Forms for employers not interviewing will no longer be included in the Winter List book.

Employers: How To Register

Each interviewer should register and pay for the Joint Mathematics Meetings. One interviewer should also register for the Employment Center by completing the following steps:

Indicate on the Joint Meetings registration form (available electronically in early September 2008 at http://www.ams.org/amsmtgs/2110_intro.html) payment for the Employment Center employer fee. Indicate choice of tables. Mark all that apply.

Submit an Employer (job listing) Form electronically at <http://www.ams.org/emp-reg>. This form will be printed in the Winter List of Employers if it is received by October 22; otherwise it will be displayed on site.

It is important to register by the October 22 deadline in order for the employer form to be included in the Winter List of Employers. However, registration will be accepted up to December 15 for the normal fees or on site in Washington 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, each table type has a limit for the number of interviewers that can be present at the same time). If possible, interviewer 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.

The table types and fees have changed for 2009. Quiet Area tables accommodate up to two interviewers per table. They cost US\$250 if reserved in advance, and US\$330 if reserved after December 15. After the purchase of any table, a second Quiet Area table may be purchased for US\$100. Committee Tables accommodate between three and six interviewers and cost US\$350 in advance or US\$430 after December 15. Lastly, a Curtained Booth accommodating between one and six interviewers is available in advance for US\$425. Curtained Booths offer a slightly larger than normal table, and a little more visual privacy (although the noise level remains unchanged). Curtained Booths must be reserved by December 15; they cannot be obtained on site. 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 15 may register on site in Washington at the Joint Meetings registration desk. They must bring their receipt to the Employment Center desk between 8:00 a.m. and 4:00 p.m. on Monday, January 5, to receive their materials. Please

note that only Quiet Area and Committee Tables are available on site.

Applicants: Appointments Are by Invitation Only

The traditional system of computer scheduling is no longer offered at the Employment Center. Appointments are now set by employers by invitation, either in advance or on site in Washington. Employing institutions may look to the Winter List for new potential applicants, but the reality of today's job market is that by January, many deadlines have passed and many employers will use the Employment Center to meet existing candidates of interest. Applicants who have made job applications the previous fall and are on various short lists will find themselves with numerous interviews during the Employment Center. Applicants just beginning a job search will find themselves at a serious disadvantage.

Applicants: Making the Decision To Participate

For those who are currently on the job market, the Employment Center is a central meeting place for employers and applicants who are attending the Joint Mathematics Meetings. Interviews are arranged either in advance or on site by invitation of the employer. The Employment Center is a great resource not only for interviewing purposes, but also for finding out what jobs are available in the mathematical community, meeting other applicants, and making a personal connection with employers not possible on paper. However, there is no guarantee of interviews, and in fact some qualified applicants may find themselves with no interviews at all.

Many of the employers are academic mathematical sciences departments. There are a few nonacademic employers each year. There will ordinarily be no research-oriented postdoctoral positions listed or discussed at the Employment Center. Attention generally goes to versatile candidates who are well suited for teaching positions at bachelor's-granting colleges. Many appointments will go to applicants who applied for jobs in the fall and are now being sought out by the institutions for in person meetings during the Joint Mathematics Meetings. Through the Winter Lists and on-site lists, those employers who are still open to the possibility of recruiting new applicants will be arranging some interviews on site.

This year's list of participating employers will be printed in the Winter List of Employers, and mailed to registered applicants in December. The website (<http://www.ams.org/emp-reg>) maintains a list of employers who used the service in prior years.

Applicants pay a fee of US\$25 if registering in advance, and their forms are printed in the Winter List of Applicants. They receive the Winter List of Employers in the mail in December. On site, they have a personal Message Center folder for paper messages.

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. Last year, those who responded to a follow-up survey reported an average of three to six interviews in the Interview Center.



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 32 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.

Keep in mind that interviews arranged by the Employment Center represent only an initial contact with the employers and that hiring decisions are not made during or immediately following such interviews. A good outcome, in the following weeks or months, would be an invitation for a campus visit. In a recent survey, 65 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; 46 percent reported receiving at least one job offer in the months following the Employment Center. Of all responding applicants, 16 percent reported (in May) having no new job offers from any source.

Applicants are advised to bring:

- Many copies of a brief resume. The best format is back and front of one sheet. These may be given to employers at an interview, left with a note in the message center box of an employer, or left in one's own message folder for public use. Photocopying at a convention center or hotel is expensive.
- A few copies of standard application documents: generic cover letter, teaching/research statements, full vita, preprints, etc.
- Bring a list of job applications already made.
- Pack suitable clothing for job interviews; these could be scattered over a period of 3-4 days.

About the Cover

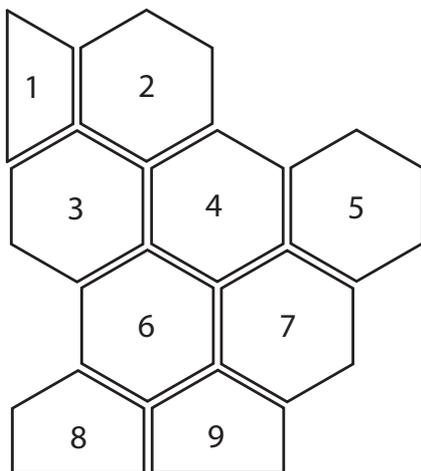
The site of the 2008 Joint Mathematics Meetings is Washington, D.C. Somewhat hidden among the better known tourist destinations in the neighborhood is one which is of particular interest, even fascination, to mathematicians—the Cryptologic Museum associated with the National Security Agency. The museum is in fact located almost right next to the main NSA building. Directions to find it, as well as some idea of what is to be found there, are available at the website

<http://www.nsa.gov/MUSEUM/>

Among the exhibits are many of the famous machines that were involved in the intense cryptological battles of World War II. Some of these are shown on the cover. You can learn more about them by looking at

<http://www.nsa.gov/public/publi00007.cfm>

The *Notices* is using the images from the NSA website courtesy of the National Security Agency.



Key to cover images:

1. Purple Analog
2. The German Enigma
3. Smithsonian Museum
4. U.S. Capitol Building
5. Lincoln Memorial
6. SIGABA
7. Enigma Machines
8. National Museum of African Art
9. U.S. Navy's Cryptanalytic Bombe

—Bill Casselman, Graphics Editor
(notices-covers@ams.org)

Applicants: REGISTER before October 22, 2008

Applicants will be registered when they have completed the following steps:

1. Register and pay for the Joint Mathematics Meetings. Look for “Registration” on the Joint Meetings website (available in early September, 2008).

2. Mark the “Employment Center Applicant fee” box on the Joint Meetings registration form and pay the appropriate fee.

3. Submit an Applicant (brief resume) Form electronically. Successful submission of the form will generate an on-screen acceptance message and an automatic email reply to the address given on the form. Each applicant form will be reproduced in a booklet, the Winter List of Applicants, and distributed to all registered employers. Applicant forms received after October 22, 2008, cannot be included in the booklet. The booklet allows employers more time to examine each candidate’s qualifications in advance.

Advance registration fees for applicants using the Employment Center services are US\$25 plus Joint Meetings registration fee, vs. US\$40 on-site registration fee plus Joint Meetings registration fee. Applicants registered by October 22 will receive their Employment Center materials two to three weeks in advance unless they request otherwise. The package will include all job announcements received from employers registered in advance.

After the October 22 Deadline

Registration for the Employment Center will continue after the October 22 deadline until the final registration deadline of December 15; however, the applicant form will NOT be included in the Winter List but will be posted on site at the Employment Center (a serious disadvantage). Those who do not register by December 15 must register on site at the Joint Meetings Registration Desk and pay the higher fees.

Registering on Site

Registering on site is possible, at the US\$40 rate, on Monday. 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. Most employers will not notice an applicant form which arrives on Monday. Registration on site is advisable only for those who already have interview invitations and would like a message center folder for employers to leave messages in.

Applicants who need to register on site for the Employment Center must go to the Joint Meetings registration desk and pay for the Employment Center. They should receive a receipt which needs to be brought to the Employment Center to complete the registration process.

Questions about Employment Center registration and participation can be directed to Steve Ferrucci, AMS Membership and Programs Department, at 800-321-4267, ext. 4113 or, by email to emp-info@ams.org.

Photos on previous pages are courtesy of Joe Orlando, Inc.

AMS Short Course

Quantum Computation and Quantum Information

Washington, DC, January 3–4, 2009

**Organized by
Samuel J. Lomonaco, University of Maryland
Baltimore County**

It is planned that lecture notes will be available to those who register for this course. Advance registration fees are: member of the AMS-US\$96; nonmember-US\$130; student, unemployed, emeritus-US\$44. On-site fees are: member of the AMS-US\$130; nonmember-US\$160; student, unemployed, emeritus-US\$65. Registration and housing information can be found in this issue of the *Notices*; see the section “Registering in Advance and Hotel Accommodations” in the announcement for meetings in Washington, DC. The registration form is at the back of this issue.

For the latest up to date information on this AMS Short Course, please refer to the URL: <http://www.csee.umbc.edu/~lomonaco/ams-short-course-2009.html>.

General Introduction

The Nobel Laureate Richard Feynman was one of the first individuals to observe that there is an exponential slow down when computers based on classical physics, i.e., classical computers, are used to simulate quantum systems. Richard Feynman then went on to suggest that it would be far better to use computers based on quantum mechanical principles, i.e., quantum computers, to simulate quantum systems. Such quantum computers should be exponentially faster than their classical counterparts.

Interest in quantum computation suddenly exploded when Peter Shor devised an algorithm for quantum computers that could factor integers in polynomial time. The fastest known algorithm for classical computers factors much more slowly, i.e., in superpolynomial time. Shor’s algorithm meant that, if quantum computers could be built, then cryptographic systems based on integer factoriza-

tion, e.g., RSA, could easily be broken. These cryptographic systems are currently extensively used in banking and in many other areas. Lov Grover then went on to create a quantum algorithm that could search data bases faster than anything possible on a classical computer. These algorithms are based on physical principles not implementable on classical computers, quantum superposition and quantum entanglement.

As a result, the race to build a quantum computer is on. But the mathematical, physical, and engineering challenges to do so are formidable, and are a worthy challenge for the best scientific minds. One of the chief obstacles to creating a quantum computer is quantum decoherence. By this we mean that quantum systems want to wander from their computational paths and quantum entangle with the rest of the environment.

This short course focuses on the mathematical challenges involved in the development of quantum computers, quantum algorithms, and quantum information, challenges worthy of the best mathematical minds. It is hoped that, as a result of this course, many mathematicians will be enticed into working on the grand challenge of quantum computation and information.

The short course will begin with an overview of quantum computation and information, given in an intuitive and conceptual style. No prior knowledge of quantum mechanics will be assumed.

In particular, the short course will begin with an introduction to the strange world of the quantum. Such concepts as quantum superposition, Heisenberg’s uncertainty principle, the “collapse” of the wave function, and quantum entanglement (i.e., EPR pairs) will be introduced. This will also be interlaced with an introduction to Dirac notation, Hilbert spaces, unitary transformations, quantum measurement.

Some of the topics covered in the course will be:

- 1) Mathematical models of quantum computation
- 2) Quantum algorithms
- 3) Quantum information theory
- 4) Quantum error-correcting codes

- 5) Quantum complexity theory
- 6) The mathematical structure of quantum entanglement and locality
- 7) Topological quantum computing
- 8) Quantum knots
- 9) Implementation issues from a mathematical perspective

Each topic will be explained and illustrated with simple examples.

The course will end with a list of the grand challenges of quantum computation, i.e., a list of mathematical problems that must be solved to make the concept of a quantum computer a reality. This will be followed by a panel discussion on the topic “The Past, Present, and Future of Quantum Computation and Quantum Information”.

A Rosetta Stone for Quantum Computing

Samuel Lomonaco, University of Maryland Baltimore County (UMBC)

This talk will give an overview of quantum computing in an intuitive and conceptual fashion. No prior knowledge of quantum mechanics will be assumed.

The talk will begin with an introduction to the strange world of the quantum. Such concepts as quantum superposition, Heisenberg’s uncertainty principle, the “collapse” of the wave function, and quantum entanglement (i.e., EPR pairs) are introduced. This part of the talk will also be interlaced with an introduction to Dirac notation, Hilbert spaces, unitary transformations, quantum measurement, and the density operator.

Simple examples will be given to explain and to illustrate such concepts as quantum measurement, quantum teleportation, quantum dense coding, and the first quantum algorithm, i.e., the Deutsch-Jozsa algorithm.

The PowerPoint slides for this talk will be posted at the URL: <http://www.csee.umbc.edu/~lomonaco/Lectures.html>.

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Quantum Algorithms

Peter Shor, Massachusetts Institute of Technology

We will briefly review the quantum factoring and search algorithms, and then survey recent progress that has been made in quantum algorithms.

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Concentration of Measure Effects in Quantum Information

Patrick Hayden, McGill University

Quantum information theory studies methods for compressing, transmitting, correcting and encrypting data in a quantum mechanical world. From a mathematical perspective, however, it is in many ways the asymptotic theory of finite dimensional inner product spaces. In these high-dimensional spaces, concentration of measure effects are ubiquitous, and they lead to many surprising applications in the quantum information context. This course will survey some of the highlights, including how to send 2 qubits using only 1, how to encrypt a quantum message using almost no secret key, and how to beat the famous “teleportation” protocol.

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- [2] P. HAYDEN, W. C. LEUNG, P. W. SHOR, and A. WINTER, Randomizing quantum states, *Commun. Math. Phys.* **250**, no. 2, (2004), pp. 371-391.
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Quantum Error Correction and Fault Tolerance

Daniel Gottesman, Perimeter Institute

Errors are likely to be a serious problem for quantum computers, both because they are built of small components and because qubits are inherently more vulnerable to error than classical bits because of processes such as decoherence. Consequently, to build a large quantum computer, we will likely need quantum error-correcting codes, which split up quantum states among a number of qubits in such a way that it is possible to correct for small errors. I will give an overview of the theory of quantum error correction and a brief discussion of fault-tolerant quantum computation, which applies quantum error-correcting codes to allow more reliable quantum computations. I will cover Shor’s 9-qubit code, stabilizer codes, CSS codes, and the threshold theorem, which says that arbitrarily long reliable quantum computations are possible, provided the

error rate per gate or time step is below some constant threshold value.

References

- [1] D. GOTTESMAN, An Introduction to Quantum Error Correction, in *Quantum Computation: A Grand Mathematical Challenge for the Twenty-First Century and the Millennium*, S. J. Lomonaco Jr., ed., Amer. Math. Soc., Providence, RI, 2002, pp. 221-235, quant-ph/0004072.
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Riemannian Geometry of Quantum Computation

Howard Brandt, U. S. Army Research Laboratory

An introduction is given to some recent developments in the differential geometry of quantum computation for which the quantum evolution is described by the special unitary unimodular group in 2 dimensions, $SU(2)$. Using the Lie algebra $su(2)$, detailed derivations are given of a useful Riemannian geometry of $SU(2)$, including the connection and the geodesic equation for minimal complexity quantum computations. Examples of some solutions to the geodesic equation are elaborated.

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Quantum Knots and Mosaics

Samuel Lomonaco, University of Maryland Baltimore County

In this talk, we give a precise and workable definition of a quantum knot system, the states of which are called quantum knots. This definition can be viewed as a blueprint for the construction of an actual physical quantum system.

Moreover, this definition of a quantum knot system is intended to represent the "quantum embodiment" of a

closed knotted physical piece of rope. A quantum knot, as a state of this system, represents the state of such a knotted closed piece of rope, i.e., the particular spatial configuration of the knot tied in the rope. Associated with a quantum knot system is a group of unitary transformations, called the ambient group, which represents all possible ways of moving the rope around (without cutting the rope, and without letting the rope pass through itself.)

Of course, unlike a classical closed piece of rope, a quantum knot can exhibit non-classical behavior, such as quantum superposition and quantum entanglement. This raises some interesting and puzzling questions about the relation between topological and quantum entanglement. The knot type of a quantum knot is simply the orbit of the quantum knot under the action of the ambient group. We investigate quantum observables which are invariants of quantum knot type. We also study the Hamiltonians associated with the generators of the ambient group, and briefly look at the quantum tunneling of overcrossings into undercrossings.

A basic building block in this paper is a mosaic system which is a formal (rewriting) system for symbol strings. We conjecture that this formal system fully captures in an axiomatic way all of the properties of tame knot theory.

The PowerPoint slides for this talk will be posted at the URL: <http://www.csee.umbc.edu/~lomonaco/Lectures.html>.

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Topology and Quantum Computing

Louis H. Kauffman, University of Illinois at Chicago

This short course lecture will discuss relationships between the theory of knots and quantum computing. We will begin by describing a topological approach to the theory of teleportation. In this approach we use diagrammatic matrix algebra whose manipulations can be understood topologically. This serves as an introduction to the interactions of topology and quantum information theory. The lecture will then describe how diagrammatic matrix algebra is related to the construction of link invariants, solutions to the Yang-Baxter equation and representations of the braid group. We will introduce the bracket polynomial state model of the Jones polynomial in this context. We then discuss how the bracket model lies at the basis for the construction of unitary representations of the Artin braid group that are universal for quantum computation. The simplest example is the so-called Fibonacci model. We show how these representations can be used to construct quantum algorithms to compute colored Jones polynomials and the Witten-Reshetikhin-Turaev invariant. If there is time, we shall discuss relations among topological and quantum entanglement and concepts of quantum knots.

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Panel Discussion: The Grand Mathematical Challenges for Quantum Computation and Quantum Information

Panelists: H. Brandt, D. Gottesman, P. Hayden, L. Kauffman, S. Lomonaco, P. Shor.

AMERICAN MATHEMATICAL SOCIETY



2008 Fall AMS Sectional Meetings

October 4–5, 2008 (Saturday–Sunday)
University of British Columbia and PIMS,
 Vancouver, Canada
 (2008 Fall Western Section Meeting)
 Fourth Annual Einstein Lecture

October 11–12, 2008 (Saturday–Sunday)
Wesleyan University, Middletown, CT
 (2008 Fall Eastern Section Meeting)

October 17–19, 2008 (Friday–Sunday)
Western Michigan University, Kalamazoo, MI
 (2008 Fall Central Section Meeting)

October 24–26, 2008 (Friday–Sunday)
University of Alabama, Huntsville,
 Huntsville, AL
 (2008 Fall Southeastern Meeting)

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.

Vancouver, Canada

*University of British Columbia and the
Pacific Institute of Mathematical Sciences
(PIMS)*

October 4–5, 2008

Saturday – Sunday

Meeting #1041

Western Section

Associate secretary: Michel L. Lapidus

Announcement issue of *Notices*: August 2008

Program first available on AMS website: August 21, 2008

Program issue of electronic *Notices*: October 2008

Issue of *Abstracts*: Volume 29, Issue 4

Deadlines

For organizers: Expired

For consideration of contributed papers in Special Sessions: Expired

For abstracts: Expired

*The scientific information listed below may be dated.
For the latest information, see www.ams.org/amsmtgs/sectional.html.*

Invited Addresses

Freeman Dyson, Institute for Advanced Study, *Birds and Frogs* (Einstein Public Lecture in Mathematics).

Richard Kenyon, Brown University, *Branched polymers in two and three dimensions*.

Alexander S. Kleshchev, University of Oregon, *Representation theory of symmetric groups*.

Mark Lewis, University of Alberta, *Population spread and the dynamics of biological invasions*.

Audrey A. Terras, University of California San Diego, *Ihara zeta functions and quantum chaos*.

Special Sessions

Algebraic Topology and Related Topics, **Alejandro Adem**, University of British Columbia, and **Stephen Ames Mitchell**, University of Washington.

Algorithmic Probability and Combinatorics, **Manuel Lladser**, University of Colorado, **Robert S. Maier**, University of Arizona, **Marni Mishna**, Simon Fraser University, and **Andrew Rechnitzer**, University of British Columbia.

Applications of Algebraic Geometry, **Elizabeth S. Allman**, University of Alaska Fairbanks, and **Rekha R. Thomas**, University of Washington.

Combinatorial Representation Theory, **Sara C. Billey**, University of Washington, **Alexander S. Kleshchev**, University of Oregon, and **Stephanie Jane Van Willigenburg**, University of British Columbia.

Convex and Discrete Geometry and Asymptotic Analysis, **Karoly Bezdek**, University of Calgary, and **A. E. Litvak**, University of Alberta.

Harmonic Analysis and Related Topics, **Malabika Pramanik**, University of British Columbia, and **Burak Erdogan**, University of Illinois at Urbana-Champaign.

Hilbert Functions and Free Resolutions, **Susan Cooper**, California Polytechnic State University, **Christopher A. Francisco**, Oklahoma State University, and **Benjamin P. Richert**, California Polytechnic State University.

History and Philosophy of Mathematics, **Shawnee L. McMurrin**, California State University San Bernardino, and **James J. Tattersall**, Providence College.

Knotting and Linking of Macromolecules, **Eric J. Rawdon**, University of Saint Thomas, and **Kenneth C. Millett**, University of California Santa Barbara.

Moduli Spaces and Singularity Theory, **James B. Carrell**, **Patrick Brosnan**, and **Kalle Karu**, University of British Columbia.

Noncommutative Algebra and Geometry, **Jason Bell**, Simon Fraser University, and **James Zhang**, University of Washington.

Noncommutative Geometry, **Raphael Ponge**, University of Toronto, **Bahram Rangipour**, University of New Brunswick, and **Heath Emerson**, University of Victoria.

Nonlinear Waves and Coherent Structures, **Bernard Deconinck**, University of Washington, and **Jeffrey DiFranco**, Seattle University.

Probability and Statistical Mechanics, **David Brydges**, University of British Columbia, and **Richard Kenyon**, Brown University.

Special Functions and Orthogonal Polynomials, **Mizanur Rahman**, Carleton University, and **Diego Dominici**, State University of New York New Paltz.

Wavelets, Fractals, Tilings and Spectral Measures, **Dorin Ervin Dutkay**, University of Central Florida, **Palle E. T. Jorgensen**, University of Iowa, and **Ozgur Yilmaz**, University of British Columbia.

West End Number Theory, **Nils Bruin**, Simon Fraser University, **Matilde N. Lalin**, University of Alberta, and **Greg Martin**, University of British Columbia.

p-adic Groups and Automorphic Forms, **Clifton L. R. Cunningham**, University of Calgary, and **Julia Gordon**, University of British Columbia.

Middletown, Connecticut

Wesleyan University

October 11–12, 2008

Saturday – Sunday

Meeting #1042

Eastern Section

Associate secretary: Lesley M. Sibner

Announcement issue of *Notices*: August 2008

Program first available on AMS website: August 28, 2008

Program issue of electronic *Notices*: October 2008

Issue of *Abstracts*: Volume 29, Issue 4

Deadlines

For organizers: Expired

For consideration of contributed papers in Special Sessions: Expired

For abstracts: Expired

The scientific information listed below may be dated. For the latest information, see www.ams.org/amsmtgsectional.html.

Invited Addresses

Pekka Koskela, University of Jyväskylä, *Definitions of quasiconformality*.

Monika Ludwig, Polytechnic Institute of NYU, *SL(n)-invariant notions of surface area*.

Duong Hong Phong, Columbia University, *Flows and canonical metrics in Kaehler geometry*.

Thomas W. Scanlon, University of California, Berkeley, *Polynomial dynamics*.

Special Sessions

Algebraic Geometry, **Eyal Markman** and **Jenia Tevelev**, University of Massachusetts, Amherst.

Algebraic Topology, **Mark A. Hovey**, Wesleyan University, and **Kathryn Lesh**, Union College.

Analysis on Metric Measure Spaces and on Fractals, **Piotr Hajlasz**, University of Pittsburgh, **Luke Rogers**, University of Connecticut, **Robert S. Strichartz**, Cornell University, and **Alexander Teplyaev**, University of Connecticut.

Complex Geometry and Partial Differential Equations, **Jacob Sturm** and **Jian Song**, Rutgers University.

Computability Theory and Effective Algebra, **Joseph S. Miller**, **David Reed Solomon**, and **Asher Kach**, University of Connecticut.

Convex and Integral Geometry, **Monika Ludwig**, Polytechnic University of New York, **Daniel Klain**, University of Massachusetts, Lowell, and **Franz Schuster**, Vienna University of Technology.

Geometric Function Theory and Geometry, **Petra Bonfert-Taylor**, Wesleyan University, **Katsuhiko Matsuzaki**, Okayama University, and **Edward C. Taylor**, Wesleyan University.

Geometric Group Theory and Topology, **Matthew Horak**, University of Wisconsin-Stout, **Melanie Stein**, Trinity College, and **Jennifer Taback**, Bowdoin College.

History of Mathematics, **Robert E. Bradley**, Adelphi University, **Lawrence A. D'Antonio**, Ramapo College of New Jersey, and **Lee J. Stemkoski**, Adelphi University.

Low-Dimensional Topology, **Constance Leidy**, Wesleyan University, and **Shelly Harvey**, Rice University.

Model Theory and Its Applications, **Thomas Scanlon**, University of California, Berkeley, and **Philip H. Scowcroft** and **Carol S. Wood**, Wesleyan University.

Number Theory, **Wai Kiu Chan** and **David Pollack**, Wesleyan University.

Real and Complex Dynamics of Rational Difference Equations with Applications, **Mustafa Kulenovic** and **Gerasimos Ladas**, University of Rhode Island.

Riemannian and Lorentzian Geometries, **Ramesh Sharma**, University of New Haven, and **Philippe Rukimbira**, Florida International University.

Kalamazoo, Michigan

Western Michigan University

October 17–19, 2008

Friday – Sunday

Meeting #1043

Central Section

Associate secretary: Susan J. Friedlander

Announcement issue of *Notices*: August 2008

Program first available on AMS website: September 4, 2008

Program issue of electronic *Notices*: October 2008

Issue of *Abstracts*: Volume 29, Issue 4

Deadlines

For organizers: Expired

For consideration of contributed papers in Special Sessions: Expired

For abstracts: Expired

The scientific information listed below may be dated. For the latest information, see www.ams.org/amsmtgsectional.html.

Invited Addresses

M. Carme Calderer, University of Minnesota, *Title to be announced.*

Alexandru Ionescu, University of Wisconsin, *Title to be announced.*

Boris S. Mordukhovich, Wayne State University, *Variational analysis: New trends and applications.*

David Nadler, Northwestern University, *Title to be announced.*

Special Sessions

Affine Algebraic Geometry, **Shreeram Abhyankar**, Purdue University, **Anthony J. Crachiola**, Saginaw Valley State University, and **Leonid G. Makar-Limanov**, Wayne State University.

Computation in Modular Representation Theory and Cohomology, **Christopher P. Bendel**, University of Wisconsin-Stout, **Terrell L. Hodge**, Western Michigan University, **Brian J. Parshall**, University of Virginia, and **Cornelius Pillen**, University of South Alabama.

Computational Group Theory, **Luise-Charlotte Kappe**, State University of New York Binghamton, **Arturo Magidin**, University of Louisiana-Lafayette, and **Robert F. Morse**, University of Evansville.

Graph Labeling, Graph Coloring, and Topological Graph Theory, **Arthur T. White**, Western Michigan University, and **David L. Craft**, Muskingum College.

Homotopy Theory, **Michele Intermont**, Kalamazoo College, and **John R. Martino** and **Jeffrey A. Strom**, Western Michigan University.

Linear Codes Over Rings and Modules, **Steven T. Dougherty**, University of Scranton, and **Jay A. Wood**, Western Michigan University.

Mathematical Finance, **Qiji J. Zhu**, Western Michigan University, and **George Yin**, Wayne State University.

Mathematical Knowledge for Teaching, **Kate Kline** and **Christine Browning**, Western Michigan University.

Nonlinear Analysis and Applications, **S. P. Singh**, University of Western Ontario, **Bruce B. Watson**, Memorial University, and **Mahi Singh**, University of Western Ontario.

Optimization/Midwest Optimization Seminar, **Jay S. Treiman** and **Yuri Ledyev**, Western Michigan University, and **Ilya Shvartsman**, Penn State Harrisburg.

Quasigroups, Loops, and Nonassociative Division Algebras, **Clifton E. Ealy Jr.** and **David Richter**, Western Michigan University, and **Petr Vojtechovsky**, University of Denver.

Representations of Real and P-adic Lie Groups, **Alessandra Pantano**, University of California Irvine, **Annegret**

Paul, Western Michigan University, and **Susana Alicia Salamanca-Riba**, New Mexico State University.

Topological Field Theory, **David Nadler**, Northwestern University.

Variational Analysis and its Applications, **Yuri Ledyev** and **Jay S. Treiman**, Western Michigan University, **Ilya Shvartsman**, Penn State Harrisburg, and **Qiji J. Zhu**, Western Michigan University.

Huntsville, Alabama

University of Alabama, Huntsville

October 24–26, 2008

Friday – Sunday

Meeting #1044

Southeastern Section

Associate secretary: Matthew Miller

Announcement issue of *Notices*: August 2008

Program first available on AMS website: September 11, 2008

Program issue of electronic *Notices*: October 2008

Issue of *Abstracts*: Volume 29, Issue 4

Deadlines

For organizers: Expired

For consideration of contributed papers in Special Sessions: Expired

For abstracts: Expired

The scientific information listed below may be dated. For the latest information, see www.ams.org/amsmtgsectional.html.

Invited Addresses

Mark Behrens, Massachusetts Institute of Technology, *Congruences amongst modular forms and the stable homotopy groups of spheres.*

Anthony M. Bloch, University of Michigan, Ann Arbor, *Variational principles and nonholonomic dynamics.*

Roberto Camassa, University of North Carolina, Chapel Hill, *Spinning rods, microfluidics, and propulsion by cilia in biological systems.*

Mark V. Sapir, Vanderbilt University, *Geometry of groups, random walks, and polynomial maps over finite fields.*

Special Sessions

Applications of PDEs and ODEs (in honor of Karen Ames), **Suzanne M. Lenhart** and **Philip W. Schaefer**, University of Tennessee, Knoxville.

Applications of Topology to Dynamical Systems, **John C. Mayer** and **Lex G. Oversteegen**, University of Alabama at Birmingham.

Applied Probability, **Moonyu Park** and **Boris Kunin**, University of Alabama in Huntsville.

Dynamics and Applications of Differential Equations, **Wenzhang Huang** and **Shangbing Ai**, University of

Alabama in Huntsville, and **Weishi Liu**, University of Kansas.

Gaussian Analysis and Stochastic Partial Differential Equations, **Davar Khoshnevisan**, University of Utah, and **Dongsheng Wu**, University of Alabama in Huntsville.

Geometric Mechanics, Control, and Integrability, **Anthony M. Bloch**, University of Michigan, Ann Arbor, and **Dmitry Zenkov**, North Carolina State University.

Graph Decompositions, **Robert A. Beeler** and **Robert B. Gardner**, East Tennessee State University.

Graph Theory, **Peter J. Slater** and **Grant Zhang**, University of Alabama in Huntsville.

Homotopy Theory and Algebraic Topology, **Mark Behrens**, Massachusetts Institute of Technology, and **Michael Hill**, University of Virginia.

Inverse Limits and Their Applications, **Judy A. Kennedy**, Lamar University.

Mathematical Biology: Modeling, Analysis, and Simulations, **Jia Li**, University of Alabama in Huntsville, **Azmy S. Ackleh**, University of Louisiana at Lafayette, and **Maia Martcheva**, University of Florida.

Nonlinear Operator Theory and Partial Differential Equations, **Claudio H. Morales**, University of Alabama in Huntsville, and **Pei-Kee Lin**, University of Memphis.

Probability on Discrete and Algebraic Structures, **Kyle T. Siegrist**, University of Alabama in Huntsville.

Random Matrices, **Leonard N. Choup**, University of Alabama in Huntsville.

Set-Theoretic Topology, **Gary Gruenhagen**, Auburn University, and **Peter J. Nyikos** and **Robert M. Stephenson Jr.**, University of South Carolina.

Shanghai, People's Republic of China

Fudan University

December 17–21, 2008

Wednesday – Sunday

Meeting #1045

First Joint International Meeting Between the AMS and the Shanghai Mathematical Society

Associate secretary: Susan J. Friedlander

Announcement issue of *Notices*: June 2008

Program first available on AMS website: Not applicable

Program issue of electronic *Notices*: Not applicable

Issue of *Abstracts*: Not applicable

Deadlines

For organizers: Expired

For consideration of contributed papers in Special Sessions: To be announced

For abstracts: October 31, 2008

The scientific information listed below may be dated. For the latest information, see www.ams.org/amsmtgs/internmtgs.html.

Invited Addresses

Robert J. Bryant, University of California Berkeley, *Title to be announced.*

L. Craig Evans, University of California Berkeley, *Title to be announced.*

Zhi-Ming Ma, Chinese Academy of Sciences, *Title to be announced.*

Richard Schoen, Stanford University, *Title to be announced.*

Xiaoping Yuan, Fudan University, *Title to be announced.*

Weiping Zhang, Chern Institute, *Title to be announced.*

Special Sessions

Biomathematics: Newly Developed Applied Mathematics and New Mathematics Arising from Biosciences, **Banghe Li**, Chinese Academy of Sciences, **Reinhard C. Laubenbacher**, Virginia Bioinformatics Institute, and **Jianjun Paul Tian**, College of William and Mary.

Combinatorics and Discrete Dynamical Systems, **Reinhard C. Laubenbacher**, Virginia Bioinformatics Institute, **Klaus Sutner**, Carnegie Mellon University, and **Yaokun Wu**, Shanghai Jiao Tong University.

Differential Geometry and Its Applications, **Jianguo Cao**, University of Notre Dame, and **Yu Xin Dong**, Fudan University.

Dynamical Systems Arising in Ecology and Biology, **Qishao Lu**, Beijing University of Aeronautics & Astronautics, and **Zhaosheng Feng**, University of Texas-Pan American.

Elliptic and Parabolic Nonlinear Partial Differential Equations, **Changfeng Gui**, University of Connecticut, and **Feng Zhou**, East China Normal University.

Harmonic Analysis and Partial Differential Equations with Applications, **Yong Ding**, Beijing Normal University, **Guo-Zhen Lu**, Wayne State University, and **Shanzhen Lu**, Beijing Normal University.

Integrable System and Its Applications, **En-Gui Fan**, Fudan University, **Sen-Yue Lou**, Shanghai Jiao Tong University and Ningbo University, and **Zhi-Jun Qiao**, University of Texas-Pan American.

Integral and Convex Geometric Analysis, **Deane Yang**, Polytechnic University, and **Jiazu Zhou**, Southwest University.

Lie Algebras, Vertex Operator Algebras and Related Topics, **Hu Nai Hong**, East China Normal University, and **Yi-Zhi Huang**, Rutgers University.

Nonlinear Systems of Conservation Laws and Related Topics, **Gui-Qiang Chen**, Northwestern University, and **Shuxing Chen** and **Yi Zhou**, Fudan University.

Optimization and Its Application, **Shu-Cherng Fang**, North Carolina State University, and **Xuexiang Huang**, Fudan University.

Quantum Algebras and Related Topics, **Naihuan N. Jing**, North Carolina State University, **Quanshui Wu**, Fudan University, and **James J. Zhang**, University of Washington.

Recent Developments in Nonlinear Dispersive Wave Theory, **Jerry Bona**, University of Illinois at Chicago, **Bo Ling Guo**, Institute of Applied Physics and Computational Mathematics, **Shu Ming Sun**, Virginia Polytech Institute and State University, and **Bingyu Zhang**, University of Cincinnati.

Representation of Algebras and Groups, **Birge K. Huisgen-Zimmermann**, University of California Santa Barbara, **Jie Xiao**, Tsinghua University, **Jiping Zhang**, Beijing University, and **Pu Zhang**, Shanghai Jiao Tong University.

Several Complex Variables and Applications, **Siqi Fu**, Rutgers University, **Min Ru**, University of Houston, and **Zhihua Chen**, Tongji University.

Several Topics in Banach Space Theory, **Gerard J. Buskes** and **Qingying Bu**, University of Mississippi, and **Lixin Cheng**, Xiamen University.

Stochastic Analysis and Its Application, **Jiangang Ying**, Fudan University, and **Zhenqing Chen**, University of Washington.

Topics in Partial Differential Equations and Mathematical Control Theory, **Xiaojun Huang**, Rutgers University, **Gengsheng Wang**, Wuhan University of China, and **Stephen S.-T. Yau**, University of Illinois at Chicago.

Washington, District of Columbia

Marriott Wardman Park Hotel and Omni Shoreham Hotel

January 5–8, 2009

Monday – Thursday

Meeting #1046

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: Bernard Russo

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: Expired

For consideration of contributed papers in Special Sessions: Expired

For abstracts: September 16, 2008

The scientific information listed below may be dated. For the latest information, see www.ams.org/amsmtgs/national.html.

Joint Invited Addresses

Douglas N. Arnold, University of Minnesota, Minneapolis, *Title to be announced*, 11:10 a.m. on Monday. (AMS-MAA)

Maryam Mirzakhani, Princeton University, *Title to be announced*, 11:10 a.m. on Wednesday. (AMS-MAA)

AMS Committee on Science Policy-MAA Science Policy Committee Government Speaker, speaker and title to be announced, 4:20 p.m. on Wednesday.

Steven H. Strogatz, Cornell University, *The story of a mathematical friendship*, 6:00 p.m. on Thursday. (AMS-MAA-SIAM Gerald and Judith Porter Public Lecture) Please note that the AMS-MAA-SIAM Joint Reception immediately follows this lecture; see the details in the “Social Events” section of this announcement.

Joint Prize Session

Prize Session and Reception: In order to showcase the achievements of the recipients of various prizes, the AMS and MAA are cosponsoring this event at 4:25 p.m. on Tuesday. A cash bar reception will immediately follow. All participants are invited to attend. The AMS, MAA, and SIAM will award the Frank and Brennie Morgan Prize for Outstanding Research in Mathematics by an Undergraduate Student. The AMS will announce the winners of the George David Birkhoff Prize in Applied Mathematics, Frank Nelson Cole Prize in Algebra, Levi L. Conant Prize, Ruth Lyttle Satter Prize in Mathematics, Leroy P. Steele Prizes, and the Albert Leon Whiteman Memorial Prize. The MAA will award the Beckenbach Book Prize, Chauvenet Prize, Euler Book Prize, Yueh-Gin Gung and Dr. Charles Y. Hu Award for Distinguished Service to Mathematics, Deborah and Franklin Tepper Haimo Awards for Distinguished College or University Teaching of Mathematics, and Certificates of Meritorious Service. The AWM will present the Alice T. Schafer Prize for Excellence in Mathematics by an Undergraduate Woman and the Louise Hay Award for Contributions to Mathematics Education.

This session will also be the venue for the announcement of the Joint Policy Board for Mathematics Communication Award and the Leonard M. and Eleanor B. Blumenthal Award for the Advancement of Research in Pure Mathematics.

115th Meeting of the AMS

AMS Invited Addresses

Luis A. Caffarelli, University of Texas at Austin, *Nonlinear problems involving integral diffusions.*

Mikhail Khovanov, Institute for Advanced Study, *Categorification of quantum groups and link invariants.*

Grigori A. Margulis, Yale University, *Homogeneous dynamics and number theory* (AMS Colloquium Lectures).

Ken Ono, University of Wisconsin-Madison, *Unearthing the visions of a master: The web of Ramanujan's mock theta functions in number theory*.

Christos Papadimitriou, University of California Berkeley, *On Nash, Brouwer, and other nonconstructive proofs*.

Oded Schramm, Microsoft, *Conformally invariant random systems in the plane* (AMS Josiah Willard Gibbs Lecture).

James A. Sethian, University of California Berkeley, *Advances in advancing interfaces*.

AMS Special Sessions

Some sessions are cosponsored with other organizations. These are noted within the parenthesis at the end of each listing, where applicable.

Algebraic Cryptography and Generic Complexity (Code: SS 41A), **Vladimir Shpilrain**, The City College of New York, and **Yesem Kurt**, Randolph College.

Algebraic Structures in Knot Theory (Code: SS 33A), **Sam Nelson**, Claremont McKenna College, and **Alissa S. Crans**, Loyola Marymount University.

Asymptotic Geometric Analysis (Code: SS 45A), **Alexander E. Litvak**, University of Alberta, and **Dmitry Ryabogin** and **Artem Zvavitch**, Kent State University.

Asymptotic Methods in Analysis with Applications (Code: SS 19A), **Diego Dominici**, SUNY New Paltz, and **Peter A. McCoy**, U.S. Naval Academy (AMS-SIAM).

Automorphic and Modular Forms in Number Theory (Code: SS 55A), **Ken Ono** and **Amanda Folsom**, University of Wisconsin-Madison, and **Sharon A. Garthwaite**, Bucknell University.

Categorification and Link Homology (Code: SS 58A), **Aaron Lauda** and **Mikhail Khovanov**, Columbia University.

Commutative Rings (Code: SS 1A), **Jay A. Shapiro**, George Mason University, **David E. Dobbs**, University of Tennessee, Knoxville, **Shane P. Redmond**, Eastern Kentucky University, and **Joe A. Stickles**, Millikin University.

Complex Dynamics and Complex Function Theory (Code: SS 16A), **Stephanie Edwards**, Hope College, and **Rich L. Stankewitz**, Ball State University.

Computational Algebra and Convexity (Code: SS 9A), **Dan Bates**, Colorado State University, **Tsung-Lin Lee**, Michigan State University, **Sonja Petrovic**, University of Illinois at Chicago, and **Zach Teitler**, Texas A&M University.

Computational Algebraic and Analytic Geometry for Low-dimensional Varieties (Code: SS 48A), **Mika K. Seppälä**, Florida State University, **Tanush Shaska**, Oakland University, and **Emil J. Volcheck**, Association for Computing Machinery.

Conformal Geometry, Twistor Theory, and Integrable Systems (Code: SS 36A), **Dana Mihai**, Carnegie Mellon University, and **George Sparling**, University of Pittsburgh.

Continued Fractions (Code: SS 50A), **James G. McLaughlin**, West Chester University, and **Nancy J. Wyshinski**, Trinity College.

Convex and Discrete Geometry (Code: SS 10A), **Włodzimierz Kuperberg**, Auburn University, and **Valeriu Soltan**, George Mason University.

Difference Equations (Code: SS 4A), **Michael Radin**, Rochester Institute of Technology.

Discrete Dynamical Systems in Periodic Environments (Code: SS 38A), **M. R. S. Kulenović** and **Orlando Merino**, University of Rhode Island, and **Abdul-Aziz Yakubu**, Howard University.

Dynamical Systems and Differential Equations: Theory and Applications (Code: SS 44A), **Annalisa Crannell**, Franklin & Marshall College, and **Suzanne Sindi**, Brown University.

Experimental Mathematics (Code: SS 27A), **Tewodros Amdeberhan**, **Luis A. Medina**, and **Victor H. Moll**, Tulane University.

Financial Mathematics (Code: SS 42A), **Erhan Bayraktar**, University of Michigan, and **Tim Siu-Tang Leung**, Princeton University.

Function Theoretic Operator Theory (Code: SS 13A), **John B. Conway**, George Washington University, **Sherwin Kouckekian**, University of South Florida, and **William T. Ross**, University of Richmond.

Geometry, Algebra, and Topology of Character Varieties (Code: SS 29A), **Sean Lawton**, Instituto Superior Tecnico, and **Elisha Peterson**, United States Military Academy.

Group Actions on Curves (Code: SS 31A), **Darren Glass**, Gettysburg College, and **Amy E. Ksir**, United States Naval Academy.

Group Actions on Homogeneous Spaces and Applications (Code: SS 57A), **Dmitry Y. Kleinbock**, Brandeis University, **Gregory A. Margulis**, Yale University, and **Hee Oh**, Brown University.

Harmonic Analysis (Code: SS 49A), **Paul A. Hagelstein**, Baylor University, and **Alexander M. Stokolos**, DePaul University.

Heavy-Tailed Behavior: Theory and Applications (Code: SS 28A), **Thomas B. Fowler**, **Marty Fischer**, and **Denise Masi**, Noblis Incorporated, and **John F. Shortle**, George Mason University.

History of Mathematics (Code: SS 17A), **Joseph W. Dauben**, Lehman College, **Karen H. Parshall**, University of Virginia, **Patti Hunter**, Westmont College, and **Deborah Kent**, Hillsdale College (AMS-MAA).

Homotopy Theory and Higher Categories (Code: SS 3A), **Thomas M. Fiore**, University of Chicago, **Mark W. Johnson**, Penn State Altoona, **James M. Turner**, Calvin College, **W. Stephen Wilson**, Johns Hopkins University, and **Donald Yau**, Ohio State University at Newark.

Infinite Dimensional Analysis, Path Integrals and Related Fields (Code: SS 46A), **Tepper L. Gill**, Howard University, **Lance W. Nielsen**, Creighton University, and **Woodford W. Zachary**, Howard University.

Inquiry-Based Learning (Code: SS 35A), **William B. Jacob**, University of California Santa Barbara, **Paul J. Sally**, University of Chicago, **Ralf J. Spatzier**, University of Michigan, and **Michael Starbird**, University of Texas at Austin (AMS-MAA).

Logic and Dynamical Systems (Code: SS 12A), **Stephen G. Simpson**, Pennsylvania State University (AMS-ASL).

Mathematical Models of Biological Structures and Function (Code: SS 32A), **Chandrajit Bajaj** and **Andrew K. Gillette**, University of Texas at Austin.

Mathematics and Education Reform (Code: SS 52A), **William H. Barker**, Bowdoin College, **William G. McCallum**, University of Arizona, and **Bonnie S. Saunders**, University of Illinois at Chicago (AMS-MAA-MER).

Mathematics and Mathematics Education in Fiber Arts (Code: SS 30A), **Sarah-Marie Belcastro**, The Hampshire College Summer Studies in Mathematics, and **Carolyn A. Yackel**, Mercer University.

Mathematics of Computation (Code: SS 43A), **Susanne C. Brenner**, Louisiana State University, and **Chi-Wang Shu**, Brown University.

Model Theoretic Methods in Finite Combinatorics (Code: SS 18A), **Martin Grohe**, Humboldt University, and **Johann A. Makowsky**, Technion Israel Institute of Technology (AMS-ASL).

New Connections Between Topology, Combinatorics, and Physics (Code: SS 23A), **Paul Fendley** and **Slava Krushkal**, University of Virginia.

Noncommutative Algebra (Code: SS 39A), **Greg Marks** and **Ashish K. Srivastava**, St. Louis University.

Nonlinear Evolution Equations and Their Applications (Code: SS 34A), **Gaston N'Guerekata**, **Alexander A. Pankov**, **Guoping Zhang**, and **Xuming Xie**, Morgan State University, and **Zhijun Qiao**, University of Texas Pan American.

Nonlinear Partial Differential Equations and Applications (Code: SS 20A), **Gui-Qiang G. Chen**, Northwestern University, and **Cleopatra C. Christoforou**, University of Houston.

Nonsmooth Analysis in Inverse and Variational Problems (Code: SS 47A), **M. Zuhair Nashed**, University of Central Florida, and **Otmar Scherzer**, University of Innsbruck.

Orderings in Logic and Topology (Code: SS 54A), **Valentina S. Harizanov** and **Jozef H. Przytycki**, George Washington University.

Recent Advances in Mathematical Modeling in Medicine (Code: SS 21A), **David Chan**, **John W. Cain**, and **Rebecca A. Segal**, Virginia Commonwealth University.

Recent Trends in Coding Theory (Code: SS 14A), **Gretchen L. Matthews**, Clemson University, and **Judy L. Walker**, University of Nebraska.

Representation Theory of Lie Algebras and Algebraic Groups (Code: SS 15A), **David G. Taylor**, Roanoke College, **Terrell L. Hodge**, Western Michigan University, and **Daniel K. Nakano**, University of Georgia.

Research in Mathematics by Undergraduates (Code: SS 22A), **Darren A. Narayan**, Rochester Institute of Technology, **Jacqueline A. Jensen**, Sam Houston State University, **Carl V. Lutzer**, Rochester Institute of Technology, **Vadim Ponomarenko**, San Diego State University, and **Tamas Wiandt**, Rochester Institute of Technology (AMS-MAA-SIAM).

SAGE and Mathematical Research Using Open Source Software (Code: SS 2A), **William A. Stein**, University of Washington, Seattle, **David Saunders**, University of Delaware, **David Harvey**, Harvard University, and **David Joyner**, U.S. Naval Academy.

Scientific Computing and Advanced Computation (Code: SS 8A), **Edward Castillo Jr.**, University of California Irvine,

James M. Rath, University of Texas at Austin, and **Sarah A. Williams**, University of California Davis.

Spectra of Matrix Patterns and Applications to Dynamical Systems (Code: SS 40A), **Bryan L. Shader**, University of Wyoming, **Luz M. DeAlba**, Drake University, **Leslie Hogben**, Iowa State University, and **In-Jae Kim**, Minnesota State University.

Stochastic, Large-Scale, and Hybrid Systems with Applications (Code: SS 26A), **Aghalaya S. Vatsala**, University of Louisiana at Lafayette, and **G. S. Ladde** and **K. Ramachandran**, University of South Florida.

Teichmüller Theory and Low-Dimensional Topology (Code: SS 7A), **Richard P. Kent**, Brown University, and **Madlena Tomova**, Rice University.

The Mathematics of Information and Knowledge (Code: SS 53A), **Ronald R. Coifman**, Yale University, **James G. Glimm**, SUNY at Stony Brook, **Peter W. Jones**, Yale University, and **Stephen Smale**, Toyota Institute.

The Redistricting Problem (Code: SS 51A), **Daniel Goroff**, Harvey Mudd College, and **Daniel Ullman**, George Washington University.

The Scholarship of Teaching and Learning (Code: SS 24A), **Curtis D. Bennett** and **Jacqueline M. Dewar**, Loyola Marymount University (AMS-MAA).

Topological Methods in Applied Mathematics (Code: SS 56A), **Yongwu Rong**, George Washington University.

Tracking Moving Interfaces in Complex Phenomena (Code: SS 59A), **James A. Sethian**, University of California Berkeley.

Von Neumann Algebras (Code: SS 37A), **Pinhas Grossman**, Vanderbilt University, and **Remus Nicoara**, University of Tennessee.

The Role of Generalized Maximal Monotonicity Frameworks in Optimization and Control Theory with Applications (Code: SS 6A), **Ram U. Verma**, International Publications.

Other AMS Sessions

Committee on the Profession Presentation, Tuesday, 2:30 p.m.-4:00 p.m.

Grad School Fair, Wednesday, 8:30 a.m.-10:00 a.m. Here is the opportunity for undergrads to meet representatives from mathematical sciences graduate programs from universities all over the country. January is a great time for juniors to learn more, and college seniors may still be able to refine their search. This is your chance for one-stop shopping in the graduate school market. At last year's meeting about 300 students met with representatives from 45 graduate programs. If your school has a graduate program and you are interested in participating, a table will be provided for your posters and printed materials for US\$50 (registration for this event must be made by a person already registered for the JMM), and you are welcome to personally speak to interested students. Complimentary coffee will be served. Cosponsored by the AMS and MAA.

Who Wants to Be a Mathematician, Wednesday, 10:00 a.m.-10:55 a.m., organized by **Michael A. Breen**, AMS, and **William T. Butterworth**, DePaul University. Come watch eight of the area's top high school students compete for cash and prizes by answering questions about mathematics.

You are invited to come and take part in this educational and fun presentation.

Current Events Bulletin, Wednesday, 1:00 p.m.–6:00 p.m., organized by **David Eisenbud**, University of California Berkeley. This session follows the model of the Bourbaki Seminars in that mathematicians with strong expository skills speak on work not their own. Written versions of the talks will be distributed at the meeting and also be available on line at www.ams.org/ams/current-events-bulletin.html after the conclusion of the meeting.

Committee on Science Policy Panel Discussion, Wednesday, 2:30 p.m.–4:00 p.m.

Wolfgang Doeblin—A Mathematician Rediscovered, Wednesday, 7:00 p.m.–8:30 p.m. This documentary film by Agnes Handwerk and Harrie Willems tells the moving story of a young Jewish mathematician who is tragically caught in the difficult times of World War II. During the winter of 1939–40, while serving in the French army, he wrote a mathematics manuscript entitled “On Kolmogorov’s equation”. He sealed and sent this to the Academy of Sciences in Paris. Later that winter, when trapped by German soldiers, he committed suicide. The sealed letter was not opened until May 2000; when deciphered, the manuscript showed that Doeblin developed a formula to calculate the role of chance in continuous random processes comparable to the formula that Kiyoshi Itô developed some years later. The film explores the biography of Wolfgang Doeblin, the intriguing history of his sealed letter with the manuscript, and the mathematics in the manuscript.

Committee on Education Panel Discussion, Thursday, 8:30 a.m.–10:00 a.m.

Other AMS Events

Council: Sunday, 1:30 p.m.

Business Meeting: Thursday, 11:45 a.m. The secretary notes the following resolution of the Council: Each person who attends a business meeting of the Society shall be willing and able to identify himself as a member of the Society. In further explanation, it is noted that each person who is to vote at a meeting is thereby identifying himself as and claiming to be a member of the American Mathematical Society. The Society has a Committee on the Agenda for Business Meetings. The purpose is to make business meetings orderly and effective. The committee does not have legal or administrative power. It is intended that the committee consider what may be called “quasipolitical” motions. The committee has several possible courses of action on a proposed motion, including but not restricted to:

- (a) doing nothing,
- (b) conferring with supporters and opponents to arrive at a mutually accepted amended version to be circulated in advance of the meeting,
- (c) recommending and planning a format for debate to suggest to a business meeting,
- (d) recommending referral to a committee, and
- (e) recommending debate followed by referral to a committee.

There is no mechanism that requires automatic submission of a motion to the committee. However, if a motion has not been submitted through the committee, it may be thought reasonable by a business meeting to refer it rather than to act on it without benefit of the advice of the committee.

In order that a motion for this business meeting receive the service offered by the committee in the most effective manner, it should be in the hands of the AMS Secretary by December 5, 2008.

AMS Short Course

This two-day course on *Quantum Computation and Quantum Information* is organized by **Samuel J. Lomonaco**, University of Maryland Baltimore County, and takes place on Saturday and Sunday, January 3 and 4. See the complete article beginning on PAGE ???

There are separate registration fees to participate.

Department Chairs Workshop

This annual one-day workshop for chairs and leaders of departments of mathematical sciences will be held a day before the start of the Joint Meetings on Sunday, 8:00 a.m.–6:30 p.m. The workshop format is intended to stimulate discussion among attending chairs and workshop leaders. Sharing ideas and experiences with peers provides a form of department chair therapy, creating an environment that enables attending chairs to address departmental matters from new perspectives.

Past workshop sessions have focused on a range of issues facing departments today, including personnel issues (staff and faculty), long-range planning, hiring, promotion and tenure, budget management, assessments, outreach, stewardship, junior faculty development, communication, and departmental leadership.

There is a separate registration fee to participate. For more information and to register, visit <http://www.ams.org/government/ChairsWorkshop2008.RSVPForm.pdf>. For further information please contact the AMS Washington Office at 202-588-1100 or amsdc@ams.org.

92nd Meeting of the MAA

MAA Invited Addresses

Maria Chudnovsky, Columbia University, *Perfect graphs—Structure and recognition*, 3:20 p.m. on Monday.

Ivars Peterson, MAA, *Geometreks*, 10:05 a.m. on Thursday.

Daniel C. Rockmore, Dartmouth College, *Title to be announced*, 9:00 a.m. on Wednesday.

Peter Sarnak, Princeton University, *Integral Apollonian packings and thin orbits*, 9:00 a.m. on Tuesday.

Peter M. Winkler, Dartmouth College, *Stacking bricks and stoning crows*, 2:15 p.m. on Monday.

Presentations by Teaching Award Recipients

Wednesday, 2:30 p.m.–4:00 p.m., organized by MAA Secretary **Martha J. Seigel**, Towson University, and moderated by MAA President, **Joseph A. Gallian**, University of Minnesota-Duluth. Winners of the Deborah and Franklin Tepper Haimo Awards for Distinguished College or University Teaching will give presentations on the secrets of their success.

MAA Minicourses

Minicourses are open only to persons who register for the Joint Meetings and pay the Joint Meetings registration fee in addition to the appropriate minicourse fee. The MAA reserves the right to cancel any minicourse that is undersubscribed. Participants in minicourses #1–4 are required to come with a laptop computer equipped with appropriate software. Instructions to download any data files needed for those courses will be provided by the organizers. The enrollment limit for each course is limited to 50 participants; the cost is \$60.

Minicourse #1: *Discrete models in biology and simulations*, organized by **Saber N. Elaydi**, Trinity University; **Huseyin Kocak**, University of Miami; and **David Ribble**, Trinity University. Part 1: Monday, 9:00 a.m.–11:00 a.m.; Part 2: Wednesday, 9:00 a.m.–11:00 a.m. This minicourse will present and analyze discrete models from population biology. Participants will use the software PHASER to simulate model behavior. There will be four modules. Each module will be discussed for 30 minutes followed by 30 minutes of computer experimentation. Each participant will be expected to bring a laptop computer equipped with Windows 2000/XP/Vista, Mac OS X (10.4.5 or later, with Java 5 or greater installed) or Linux. The participants will be provided electronic copies of the notes, simulations, and the software PHASER. Basic knowledge of calculus and linear algebra will be helpful.

Minicourse #2: *Using GeoGebra to create activities and applets for visualization and exploration*, organized by **Michael K. May**, Saint Louis University. Part 1: Monday, 2:15 p.m.–4:15 p.m.; Part 2: Wednesday, 2:15 p.m.–4:15 p.m. GeoGebra is an easy to use, free, open-source, cross-platform program that allows the user to visualize and experiment with both algebraic and geometric representations of mathematical concepts. Constructions can optionally be saved as applets that can be used in any java enabled browser. Sample applets can be found at www.slu.edu/classes/maymk/GeoGebra/. The minicourse assumes only novice computer skills and covers an introduction to GeoGebra up through deploying applets in web pages. We will work through creating several activities to illustrate features of the program and to get participants to create their own activities. Participants will need a computer loaded with GeoGebra, SeaMonkey, and a collection of examples created by the presenter. Links for downloading the needed software will be sent to participants who register in advance. Participants will be able to do a fast install on site if needed.

Minicourse #3: *Educating about the state of the planet and sustainability while enhancing calculus*, organized by **Thomas J. Pfaff**, Ithaca College. Part 1: Tuesday, 8:00

a.m.–10:00 a.m.; Part 2: Thursday, 9:00 a.m.–11:00 a.m. Society faces major challenges in climate change and energy security. This minicourse will illustrate how the use of data (climate, energy, etc.) and Excel can provide richer context and relevance (a sustainability theme) for calculus. When students use Excel to fit curves to real data, fundamentally important questions about sustainability become calculus questions about those curves. Overall the goal is to provide the necessary background information, ideas, and tools to successfully incorporate sustainability themes (or other areas of interest) into a calculus course, without having to change the typical content covered in calculus. Participants will need a laptop equipped with Microsoft Excel.

Minicourse #4: *An introduction to the mathematics of modern cryptography*, organized by **Jeffrey Ehme** and **Colm A. Mulcahy**, Spelman College. Part 1: Tuesday, 10:30 a.m.–12:30 p.m.; Part 2: Thursday, 1:00 p.m.–3:00 p.m. The mathematics of modern cryptography is for anyone with an interest in mathematics today, especially if that person also registers for classes (or submits grades) online, or pays bills or shops on the Internet. Since that includes most of our students and most of us, it is a perfect subject for adding to the standard undergraduate curriculum, either in a regular or special topics course, or as a subject for directed research. There can be no better way of illustrating the application to everyday life of abstract mathematics and clever modern ideas. This minicourse will focus on the basics, assuming only a rudimentary knowledge of number theory and abstract algebra (e.g., Fermat's Little Theorem and the concept of an abelian group), and cover topics ranging from 1970s breakthroughs such as Diffie Hellman key exchange and the RSA cryptography, to the more recent methods of ElGamal, Elliptic Curves, and Groebner Bases. Participants are expected to bring laptops equipped with Maple, Adobe Acrobat Reader, and a CD drive.

Minicourse #5: *Developing department self-studies*, organized by **Donna L. Beers**, Simmons College, and **Richard A. Gillman**, Valparaiso University. Part 1: Tuesday, 1:00 p.m.–3:00 p.m.; Part 2: Thursday, 3:30 p.m.–5:30 p.m. Self-study is a critical component of departmental program review. It is retrospective, engaging department members and other interested parties (e.g., other departments and the administration) in examining all aspects of departmental programs. It is also forward looking, anticipating new areas for growth and contribution. Self-study entails discussion of issues confronting a department; as such, it is both a process of reflection and a report. This minicourse enables participants to determine how a self-study, which is an administrative mandate, can be a positive opportunity for departmental renewal.

Minicourse #6: *Teaching with clickers and classroom voting*, organized by **Derek Bruff**, Vanderbilt University; and **Kelly Cline**, **Mark Parker**, and **Holly Zullo**, Carroll College. Part 1: Monday, 9:00 a.m.–11:00 a.m.; Part 2: Wednesday, 9:00 a.m.–11:00 a.m. Classroom response systems, or “clickers”, are instructional technologies that enable teachers to rapidly collect and analyze students' responses to multiple-choice questions. In this minicourse

participants will learn how to use clickers to transform the way they use class time—promoting active participation, engagement, and discussion among students; assessing student learning in real-time during class; and adapting lessons to respond to the particular learning needs of one’s students. This minicourse will also feature a question-writing “workshop” and a mock clicker class as ways to explore the kinds of questions and activities that make the most of teaching with clickers.

Minicourse #7: *A game theory path to quantitative literacy*, organized by **David L. Housman**, Goshen College, and **Richard A. Gillman**, Valparaiso University. Part 1: Monday, 2:15 p.m.–4:15 p.m.; Part 2: Wednesday, 2:15 p.m.–4:15 p.m. Game theory, defined in the broadest sense, can be used to model many real world scenarios of decision making in situations involving conflict and cooperation. Further, mastering the basic concepts and tools of game theory require only an understanding of basic algebra, probability, and formal reasoning. These two features of game theory make it an ideal path to developing habits of quantitative literacy among our students. This audience participation minicourse develops some of the material used by the presenters in their general education courses on game theory and encourages participants to develop their own, similar, courses.

Minicourse #8: *Taking symbols seriously: Teaching form and function in college algebra*, organized by **Deborah Hughes Hallett**, University of Arizona and Harvard University; **Patti Frazer Lock**, St. Lawrence University; **William G. McCallum**, University of Arizona; and **Patricia D. Shure**, University of Michigan. Part 1: Tuesday, 8:00 a.m.–10:00 a.m.; Part 2: Thursday, 9:00 a.m.–11:00 a.m. College algebra courses often emphasize the idea of a function from multiple viewpoints. In this minicourse we will focus on the symbolic aspect, discussing what it means for students to acquire symbolic literacy. We will highlight the algebraic concepts that are essential for procedural fluency and for success in college. Common misconceptions about functions, expressions, equations, and equivalence will give us a window into student thinking. The workshop will give participants the opportunity to construct questions that probe student understanding and to develop examples that demonstrate the importance of college algebra for later coursework in the physical and social sciences.

Minicourse #9: *Beyond formulas and algorithms: Teaching a conceptual/thematics single variable calculus course*, organized by **Shahriar Shahriari**, Pomona College. Part 1: Tuesday, 10:30 a.m.–12:30 p.m.; Part 2: Thursday, 1:00 p.m.–3:00 p.m. Many students enter college having seen the main ideas of calculus and knowing how to do routine calculus problems but without a firm grasp of the concepts underlying calculus. In this hands-on course, the participants will be introduced to and have a chance to explore an honors calculus II class where the theme is approximations and one of the test cases is approximating the number of primes up to x . In this alternative calculus class the students take an active role in formulating questions and in developing the material. A thematic/conceptual approach using open-ended problems that incorporates

some unusual mathematics (in this case, analytic number theory) allows us to take advantage of the students’ prior experience with calculus to get a deeper understanding of the subject.

Minicourse #10: *The ubiquitous Catalan numbers and their applications*, organized by **Thomas Koshy**, Framingham State College. Part 1: Tuesday, 1:00 p.m.–3:00 p.m.; Part 2: Thursday, 3:30 p.m.–5:30 p.m. Catalan numbers are both fascinating and ubiquitous. They pop up in quite unexpected places, such as triangulations of convex polygons, correctly parenthesized expressions, rooted trees, binary trees, full binary trees, trivalent binary trees, lattice walks, Bertrand’s ballot problem, abstract algebra, linear algebra, chess, and the World Series, to name a few. Beginning with a brief history of Catalan numbers, this minicourse presents numerous examples from different areas. We will develop a number of combinatorial formulas for computing them, investigate their parity and their primality-link to Mersenne numbers, and present the various ways they can be extracted from Pascal’s triangle and several Pascal-like triangles. As a bonus we will investigate tribinomial coefficients and extract Catalan numbers from them.

Minicourse #11: *Planning and teaching mathematics capstone courses for preservice, secondary school teachers*, organized by **Edward F. Aboufadel**, Grand Valley State University; **Richard Hill**, **Bruce Sagan**, **Sharon Senk**, and **Natasha Speer**, Michigan State University; and **Rebecca Walker**, Grand Valley State University. Part 1: Monday, 9:00 a.m.–11:00 a.m.; Part 2: Wednesday, 9:00 a.m.–11:00 a.m. Many mathematics departments now offer “capstone” courses for majors. This minicourse will explore the rationales for offering such courses specifically designed for preservice secondary school teachers, the different ways such courses have been designed, and the challenges instructors faced in planning and teaching such courses. In addition, materials developed by the instructors (as part of a NSF-funded project about these courses) will be shared and discussed. The presenters are teams of mathematicians and mathematics educators from two different institutions who collaborated to create and implement these courses and have many years of experience with this course.

Minicourse #12: *SNAP Math Fairs in elementary education*, organized by **Andrew C.-F. Liu**, University of Alberta, and **Tanya Thompson**, ThinkFun, Inc. Part 1: Monday, 2:15 p.m.–4:15 p.m.; Part 2: Wednesday, 2:15 p.m.–4:15 p.m. The focus of this minicourse is to examine what should be taught at a one-semester mathematics course in the faculty of science for students in elementary education, and how to teach this material. We will distribute a complete set of classroom notes, discuss the philosophy behind its construction, and offer techniques for its delivery. We will also distribute an extensive list of problems suitable for the course or for a special component of our course called the SNAP Math Fair. Participants will have opportunities to work on these problems, and solutions to some will be presented.

Minicourse #13: *Directing undergraduate research*, organized by **Aparna W. Higgins**, University of Dayton.

Part 1: Tuesday, 9:00 a.m.–11:00 a.m.; Part 2: Thursday, 9:00 a.m.–11:00 a.m. This course will cover many aspects of facilitating research by undergraduates, such as getting students involved in research, finding appropriate problems, deciding how much help to provide, and presenting and publishing the results. Similarities and differences between research conducted during summer programs and research that can be conducted during the academic year will be discussed. Although the examples used will be primarily in the area of discrete mathematics, the strategies discussed can be applied to any area of mathematics.

Minicourse #14: *Teaching a course in the history of mathematics*, organized by **V. Frederick Rickey**, U.S. Military Academy, and **Victor J. Katz**, University of the District of Columbia. Part 1: Tuesday, 1:00 p.m.–3:00 p.m.; Part 2: Thursday, 1:00 p.m.–3:00 p.m. Many schools are introducing courses in the history of mathematics and asking faculty who may never have taken such a course to teach them. This minicourse will assist those teaching history by introducing participants to numerous resources, discussing differing approaches and sample syllabi, providing suggestions for student projects and assessments, and giving those teaching such courses for the first time the confidence to master the subject themselves and to present the material to their students.

MAA Contributed Paper Sessions

The MAA Committee on Contributed Paper Sessions solicits contributed papers pertinent to the sessions listed below. Contributed paper session organizers generally limit presentations to fifteen minutes with a five-minute break between talks; in the general session talks are limited to 10 minutes with a five-minute break. Each session room contains a computer projector, an overhead projector, and one screen. Please note that the dates and times scheduled for these sessions remain tentative. Full descriptions of these sessions may be found in the August issue of the *Notices*, p. 900, or see www.maa.org/amsmtgs/2109_maacontrib.html.

Assessment of Student Learning in Undergraduate Mathematics, Wednesday afternoon, **William O. Martin**, North Dakota State University, and **Bernard L. Madison**, University of Arkansas.

Building Diversity in Advanced Mathematics: Models that Work, Monday afternoon, **Patricia L. Hale**, California State Polytechnic University Pomona, and **Abbe Herzig**, University at Albany.

College Algebra: Focusing on Conceptual Understanding, Real-World Data, and Mathematical Modeling, Thursday morning, **Florence S. Gordon**, New York Institute of Technology; **Laurette B. Foster**, Prairie View A&M University; **Yajun Yang**, Farmingdale State College; and **Ray E. Collings**, Georgia Perimeter College. The session is cosponsored by CRAFTY and the Committee on Two-Year Colleges.

Cryptography for Undergraduates, Monday afternoon, **Chris Christensen**, Northern Kentucky University, and **Robert E. Lewand**, Goucher College.

Demos and Strategies with Technology that Enhance Teaching and Learning Mathematics, Tuesday morning

and afternoon. **David R. Hill**, Temple University; **Scott Greenleaf**, University of New England; **Mary L. Platt**, Salem State College; and **Lila F. Roberts**, Georgia College & State University. The session is endorsed by CTiME (Committee on Technology in Mathematics Education).

Developmental Mathematics Education: Helping Under-Prepared Students Transition to College-Level Mathematics, Thursday morning, **J. Winston Crawley** and **Kimberly Presser**, Shippensburg University.

Environmental Mathematics, Monday afternoon, **Karen Bolinger**, Clarion University, and **Ben A. Fusaro**, Florida State University. This session is sponsored by the SIGMAA Environmental Mathematics.

Guided Discovery in Mathematics Education, Thursday afternoon, **Jerome S. Epstein**, Polytechnic University. The session is sponsored by SIGMAA on Research in Undergraduate Mathematics Education (SIGMAA on RUME).

Innovative and Effective Ways to Teach Linear Algebra, Tuesday morning and afternoon, **David M. Strong**, Pepperdine University; **Gil Strang**, Massachusetts Institute of Technology; and **David C. Lay**, University of Maryland.

Mathematics and the Arts, Thursday morning and afternoon, **Douglas E. Norton**, Villanova University. The session is sponsored by the SIGMAA on Mathematics and the Arts.

Mathematics of Chemistry, Monday afternoon, **George T. Rublein**, College of William and Mary, and **Thomas R. Hagedorn**, The College of New Jersey.

Mathematics Experiences in Business, Industry, and Government, Wednesday morning, **Philip Gustafson**, Mesa State College, and **Michael Monticino**, University of North Texas. This session is sponsored by the MAA Business, Industry and Government Special Interest Group (BIG SIGMAA).

Mathematics of Games and Puzzles, Tuesday morning, **Laura A. Taalman**, James Madison University.

Mathematics and Sports, Tuesday morning, **Howard L. Penn**, U.S. Naval Academy.

Mathlets for Teaching and Learning Mathematics, Wednesday morning and afternoon, **Thomas E. Leathrum**, Jacksonville State University, **David M. Strong**, Pepperdine University, and **Joe Yanik**, Emporia University. This session is sponsored by the MAA Committee on Technology in Mathematics Education (CTiME).

Operations Research in the Undergraduate Classroom, Monday afternoon, **Gerald Kobylski** and **Josh Helms**, U.S. Military Academy, and **William Fox**, Naval Post Graduate School.

Performing Mathematics, Monday afternoon, **Timothy P. Chartier**, Davidson College, and **Karl Schaffer**, De Anza College.

Productive Roles for Math Faculty in the Professional Development of K-12 Teachers, Wednesday morning, **Dale R. Oliver**, Humboldt State University, and **Elizabeth Burroughs**, Montana State University. This session is sponsored by the MAA Committee on the Mathematical Education of Teachers (COMET).

Promoting Deep Learning for Mathematics Majors through Experiential Learning, Writing, and Reflection,

Thursday morning and afternoon, **Murphy Waggoner**, Simpson College, and **Chuck Straley**, Wheaton College.

Quantitative Literacy Across the Curriculum, Wednesday morning, **Kimberly M. Vincent**, Washington State University, and **Cinnamon Hillyard**, University of Washington, Bothell. The session is sponsored by SIGMAA-QL.

Research on the Teaching and Learning of Undergraduate Mathematics, Tuesday afternoon, **Keith H. Weber**, Rutgers University; **Michelle J. Zandieh**, Arizona State University; and **Karen A. Marrongelle**, Portland State University.

Statistics in K-12 Education: How Will It Affect Statistics at the College Level?, Wednesday morning, **Patricia B. Humphrey**, Georgia Southern University, and **Robin H. Lock**, St. Lawrence University. Presenters in the session will be considered for the SIGMAA on Statistics Education's Best Contributed Presentation Award.

Statistics Resources on the Web, Wednesday afternoon, **Dorothy W. Anway**, University of Wisconsin, Superior; **Patricia B. Humphrey**, Georgia Southern University; **Christopher J. Lacke**, Rowan University. The session is sponsored by the SIGMAA on Statistics Education. In order to be considered for this session, applicants should submit a one-page summary of the presentation to Dorothy Anway at danway@uwsuper.edu in addition to the abstract submitted through the JMM website. Presenters in the session will be considered for the SIGMAA on Statistics Education's Best Contributed Presentation Award.

Teaching Calculus in High School: Ideas that Work, Tuesday morning, **Dan Teague**, North Carolina School of Science and Mathematics, and **John F. Mahoney**, Benjamin Banneker Academic High School.

Undergraduate Mathematical Biology, Tuesday, morning and afternoon, **Timothy D. Comar**, Benedictine University, **Raina Robeva**, Sweet Briar College, and **Eric S. Marland**, Appalachian State University. This session is sponsored by the BIO SIGMAA.

General Session, Monday, Tuesday, Wednesday, and Thursday mornings and afternoons; **Sarah L. Mabrouk**, Framingham State University. Papers may be presented on any mathematical topic. Papers that fit into one of the other sessions should be sent to that organizer, not to this session. Note the restriction below that you may give only one talk in this session.

Submission Procedures for MAA Contributed Papers

Send your abstract directly to the meeting website (abstracts should not be sent to the organizer(s) who will automatically receive a copy). Please read the session descriptions thoroughly as some organizers require an additional summary of your proposal be sent to them directly. Participants may speak in at most two MAA contributed paper sessions. If your paper cannot be accommodated in the session for which it was submitted, it will be automatically considered for the general session. Speakers in the general session will be limited to one talk because of time constraints. Abstracts must be submitted by Tuesday, **September 16, 2008**.

All accepted abstracts will be published in a book available at the meeting to all registered participants. Abstracts must be submitted electronically. While no knowledge of L^AT_EX is necessary for submission, L^AT_EX and $\mathcal{A}\mathcal{M}\mathcal{S}$ -L^AT_EX are the only typesetting systems that can be used if mathematics or any text markup (e.g., accent marks) is included. The abstracts submissions page is at www.ams.org/cgi-bin/abstracts/abstract.pl. Simply select the Washington meeting, fill in the number of authors, and proceed with the step-by-step instructions. Submitters will be able to view their abstracts before final submission. Upon completion of your submission, your unique abstract number will immediately be sent to you. All questions concerning the submission of abstracts should be addressed to abs-coord@ams.org.

MAA Panels, Posters, and Other Sessions

National Science Foundation Programs Supporting Learning and Teaching in the Mathematical Sciences, Monday, 9:00 a.m.-10:20 a.m., organized by **Henry Warchall** (NSF/DMS); **Karen A. Marrongelle** (NSF/DRL); and **Daniel P. Maki**, **Ginger H. Rowell**, **Elizabeth J. Teles**, and **Lee L. Zia** (NSF/DUE). A number of NSF divisions offer a variety of grant programs that support innovations in learning and teaching in the mathematical sciences. These programs will be discussed along with examples of successful projects. Anticipated budget highlights and other new initiatives for the next fiscal year will also be presented.

Finding Your nth Job (for n Greater than or Equal to 2), Monday, 9:00 a.m.-10:20 a.m., organized by **Joshua D. Laison**, Willamette University; **Aaron Luttmann**, Clarkson University; and **Raluca M. Gera**, Naval Postgraduate School. Your first job in academia is often not your last. Visiting positions, postdocs, and bad matches mean in many cases that the next step after finding a job in academia is to find another one. Many new issues arise when searching for your second, or third, or nth position. This panel will focus on what makes later job searches different from your first and how best to prepare to re-enter the job market. Sponsored by the Young Mathematicians' Network.

ICME-11 in Retrospect, Monday 9:30 a.m.-10:30 a.m., organized by **Martha J. Siegel**, Towson University, and **William G. McCallum**, University of Arizona. Panelists will present the newest research in mathematics education K-20 from an international perspective.

Mathematical Sociology, Monday, 2:15 p.m.-4:15 p.m., organized by **Barbara F. Meeker** and **Joseph Auslander**, University of Maryland, College Park. Mathematical sociology is a branch of applied mathematics, in which sociologists use mathematical models (including graph theory, stochastic models, game theory, computer simulation, and differential equations) to describe sociological phenomena such as population growth and decline, income inequality, decision-making in small groups and social networks. This panel consists of presentations of examples of their own work by four members of the mathematical sociology section of the American Sociological Association. Speakers in this invited paper session include **Phillip Bonacich**,

University of California at Los Angeles, *Network implications of social exchange: An overview*; **John C. Angle**, Inequality Process Institute, *A particle system that mimics empirical income dynamics*; **Guillermina Jasso**, New York University, *Exploring polarization: The effects of general inequality and subgroup relative size on distance between subgroups and dispersion within subgroups*; and **Barbara F. Meeker**, *Mathematical models of talking in discussion groups*.

Project NExT/Young Mathematicians' Network Poster Session, Monday, 9:00 a.m.–11:00 a.m., organized by **Michael C. Axtell**, Wabash College, and **Kevin E. Charlwood**, Washburn University. This session is intended to highlight the research activities, both mathematical and pedagogical, of recent or future Ph.D.'s in mathematics and related fields. The organizers seek to provide an open venue for people who are near completion, or have finished their graduate studies in the last five years to present their work and make connections with other same-stage professionals, in much the same spirit as the YMN and Project NExT. The posterboard size will be 48" by 36"; it is best to have the posters 36" high. Posterboards and materials for posting pages on the posters will be provided on site. If you are interested in participating, submit copies of your abstract to axtellm@wabash.edu and kevin.charlwood@washburn.edu.

Starting and Maintaining an Academic Year Undergraduate Research Program, Monday, 3:50 p.m.–5:10 p.m., organized by **Michael J. Dorff**, Brigham Young University, and **Zsuzsanna Szaniszló**, Valparaiso University. There is a growing trend to have undergraduate students participate in research during the academic year. In this session several experienced professors will share their insight and ideas on the following topics: 1) Purposes for doing undergraduate research; (2) Finding students to do undergraduate research; (3) Finding research problems for undergraduates; (4) Characteristics of good undergraduate research problems; (5) Logistics of an academic year undergraduate research program; and (6) Student presentations and written report/paper. A question and answer period will conclude the session. Panelists are **Sarah Spence Adams**, Franklin W. Olin College of Engineering; **Rebecca Garcia**, Sam Houston State University; **Richard A. Gillman**, Valparaiso University; **Darren A. Narayan**, Rochester Institute of Technology; and **Daniel J. Schaal**, South Dakota State University. Sponsored by the MAA CUPM Subcommittee on Research by Undergraduates.

How to Apply for Jobs, Monday 4:30 p.m.–5:40 p.m., organized by **David C. Manderscheid**, University of Nebraska. This session is aimed at Ph.D. students and recent Ph.D.'s. An overview of the employment process will be given with ample opportunity for participants to ask questions. Questions that will be addressed include: How do you find which jobs are available? How do you choose which jobs you want to apply for? What are academic and other employers looking for in the materials that you send? What should you be doing now? How do schools conduct interviews? How can you best prepare for these interviews? How do employers choose to whom they will make offers? How do you negotiate once you

have an offer? Panelists are **Sharon M. Clarke**, Pepperdine University; **James H. Freeman**, Cornell College; **David C. Manderscheid**, plus someone from industry and possibly someone from a community college. Cosponsored by the MAA Committee on Graduate Students and the Young Mathematicians' Network.

The CNN United States of Mathematics Presidential Debate, Monday, 6:00 p.m.–7:00 p.m., coordinated by **Colin C. Adams** and **Thomas Garrity**, Williams College. In perhaps the most critical election in the history of the United States of Mathematics, two diametrically opposed candidates are vying for the presidency. Should it be the figure-eight knot, the first knot to run for the presidency and a strong supporter of the jobs program for unemployed mathematical symbols, or should it be the Euclidean algorithm, the first algorithm to run and a firm believer in cutting the equality sign tax? Don't miss the fireworks in this historic debate.

Mathematical Outreach Programs for Underrepresented Populations, Tuesday, 9:00 a.m.–11:00 a.m., organized by **Elizabeth (Betsy) G. Yanik**, Emporia State University. This poster session is designed to highlight special programs which have been developed to encourage students from underrepresented populations to maintain an interest in and commitment to succeeding in mathematics. These programs might include such activities as after school clubs, weekend activities, one-day conferences, mentoring opportunities with women professionals, summer camps, etc. In particular, recipients of Tensor and SUMMA grants will find this an ideal venue in which to share the progress of their funded projects. We encourage everyone involved with offering outreach activities to consider submitting an abstract to the session organizer, Betsy Yanik, yanikeli@emporia.edu. The deadline for submissions is **December 1, 2008**. Sponsored by the Women and Mathematics Network, a subcommittee of the MAA Committee on the Participation of Women.

Session for Chairs, Tuesday, 9:00 a.m.–10:20 a.m., organized by **Daniel P. Maki**, Indiana University, and **Catherine M. Murphy**, Purdue University Calumet. This session will focus on the suggestions contained in the MAA's Guidelines for Programs and Departments in Undergraduate Mathematical Sciences, www.maa.org/guidelines/guidelines.html. **Susan C. Geller**, Texas A&M University, chair of the MAA's Committee on the Profession, will present a summary of the Guidelines and, with the organizers of this session, will lead a discussion of areas of most interest to the attendees. Attendees are encouraged to read the Guidelines which are available at the above URL and come to the session with questions and suggestions.

Multidisciplinary Projects that Hook Those Not Usually Interested in Mathematics, Tuesday, 9:00 a.m.–10:20 a.m., organized by **Alex J. Heidenberg** and **Gerald C. Kobylski**, U.S. Military Academy at West Point. A majority of college students study mathematics courses to fulfill their degree requirements. These students, many of whom dislike or fear mathematics, generally do not see mathematics as a tool for their discipline. How do we as mathematics educators excite these students about learning mathematics? Panelists from

four different universities, **Laurie J. Heyer**, Davidson College; **Shawnee L. McMurrin**, California State University, San Bernardino; **Michael Huber**, Muhlenberg College; and **Barbra S. Melendez**, U.S. Military Academy, will discuss examples of multi-disciplinary projects that they have used that require students to discover connections between mathematical concepts and disciplines in which they are interested. The panelists will specifically discuss their multi-disciplinary project, the logistics of its implementation, and an assessment regarding the effectiveness of the learning experience. Panelists will also discuss the barriers they had to overcome and provide suggestions for others who are interested in implementing these ideas at their institution.

Proposal Writing Workshop for Grant Applications to the NSF Division of Undergraduate Education, Tuesday, 10:45 a.m.–12:05 p.m., organized by **Daniel P. Maki**, **Ginger H. Rowell**, **Elizabeth J. Teles**, and **Lee L. Zia**, Division of Undergraduate Education, National Science Foundation. Presenters will describe the general NSF grant proposal process and consider particular details relevant to programs in the Division of Undergraduate Education. This interactive session will feature a series of “read/think/share/report” exercises built around a series of short excerpts from sample proposals.

Picture This! Geometry Software, Tuesday, 10:45 a.m.–12:05 p.m., organized by **Mary L. Platt**, Salem State College; **Marina Vulis**, University of New Haven; and **Lawrence Moore**, Duke University. Interested in using geometry software in the classroom? This panel will showcase four options for freeware, Geometry Explorer, GeoGebra, Google SketchUp, and Spherical Easel. Each panelist will give a brief history of the software, describe what the software is designed to do, discuss any extensions of the software beyond geometry topics, and demonstrate of the software. Time will be reserved for questions and comments from the audience. Panelists include **Michael D. Hvidsten**, Gustavus Adolphus College, *Geometry Explorer*; **David Fowler**, University of Nebraska-Lincoln, *Geogebra*; **Jon Choate**, Groton School, *Google SketchUp*; and **David Austin**, Grand Valley State University, *Spherical Easel*. The panel will be moderated by **Mary L. Platt** and **Marina Vulis**. Sponsored by the Committee on Technology in Mathematics Education.

The Intersection of the History and Philosophy of Mathematics, Tuesday, 10:45 a.m.–12:05 p.m., organized by **Bonnie Gold**, Monmouth University, and **Amy Shell-Gellasch**, Pacific Lutheran University. The best work in the philosophy of mathematics is accurately descriptive of mathematics as it is actually done. This often requires careful examination of the history of mathematics. On the other hand, the best work in the history of mathematics must include philosophical concerns related to that mathematics. This panel will discuss several cases of the history of mathematics and the philosophy of mathematics influencing each other. Panelists are **Thomas L. Drucker**, University of Wisconsin-Whitewater; **Kenneth L. Manders**, University of Pittsburgh; and **Daniel C. Slough**, Furman University. Cosponsored by the SIGMAA on the History

of Mathematics and the SIGMAA on the Philosophy of Mathematics.

Using Open Source Software for Undergraduate Courses, Tuesday 1:00 p.m.–2:20 p.m., organized by **Karl-Dieter Crisman**, Gordon College; **Marshall E. Hampton**, University of Minnesota, Duluth; and **David Joyner**, U.S. Naval Academy. The open source software paradigm provides freely available and freely modifiable software to anyone with an Internet connection, including much mathematics software. Some of the most familiar to the math community are L^AT_EX and the Firefox web browser, but there are many other high-quality projects as well. Two reasons this software is appropriate for use in the undergraduate curriculum are its affordability for institutions where this is a limiting factor, and the ability for advanced students with programming experience to see the inner workings of, contribute to, and improve upon software they constantly use. This panel will describe and demonstrate a variety of successful uses of open source software in contexts ranging from the introductory classroom to senior projects. Panelists are **John A. Verzani**, CUNY, *Introductory Statistics with R*; **Michael E. Gage**, University of Rochester, *WebWork*; and **David Joyner**, *Differential Equations with Sage*.

Teaching Postdocs: A Journey from Graduate School to a Position in the World of Mathematics, Tuesday, 1:00 p.m.–2:20 p.m., organized by **Stephen M. Gagola III**, University of Arizona, and **Feryal Alayont**, Grand Valley State University. Teaching postdoc programs can play an important role in helping people gain different types of experience that are relevant to their future careers. These positions are similar to postdoctoral positions in research except that the postdoctoral fellow is introduced to new teaching techniques and scholarly activities pertaining to teaching. Such programs offer postdocs an opportunity to gain experience in broad instructional and scholarly activities in an environment committed to excellence in teaching and learning. Examples of such activities are teaching across the undergraduate curriculum, participating in independent study and research projects, training teaching assistants, designing courses, grant writing, outreach activities, along with participating in research groups. The session will serve to inform the audience of the ways a teaching postdoc program can be beneficial to potential employees, math departments interested in starting such a program, and current teaching postdocs interested in how such programs have helped others in the past. Panelists are **Taliesin Sutton**, University of Arizona; **Andrew G. Bennett**, Kansas State University; **Nathan A. Carlson**, University of Arizona; **Steven J. Schlicker**, Grand Valley State University; and **Matt Salomone**, Bates College. Sponsored by the MAA Committee on Graduate Students.

Preparing Students to Communicate Mathematics, Tuesday, 1:00 p.m.–2:20 p.m., organized by **Lewis D. Ludwig**, Denison University. As research in mathematics by undergraduates becomes more and more prevalent, it is important that students effectively communicate and disseminate their ideas and findings. The participants in this panel will share their experiences and suggestions for successfully preparing students to communicate mathematics

through oral presentations, posters sessions, and articles, ranging from the classroom to organized conferences. This panel is intended for a general audience. Panelists are **Joseph A. Gallian**, University of Minnesota-Duluth; **Darren A. Narayan**, Rochester Institute of Technology; and **Michael E. Orrison**, Harvey Mudd College. Cosponsored by the CUPM Subcommittee on Research by Undergraduates and Project NEXt.

Projects Supported by the NSF Division of Undergraduate Education, Tuesday, 2:00 p.m.–4:00 p.m., organized by **Jon W. Scott**, Montgomery Community College. This poster session will feature principal investigators (PIs) presenting progress and outcomes from various NSF funded projects in the Division of Undergraduate Education. The poster session format will permit ample opportunity for attendees to engage in small group discussions with the PIs and to network with each other. Information about presenters and their projects will appear in the program.

Online Homework Systems: A Pedagogical Perspective, Tuesday, 2:30 p.m.–3:50 p.m., organized by **Ellen E. Kirkman**, Wake Forest University, and **Cheryl Miner**, Nebraska Wesleyan University. This panel will consider online homework systems in courses at the calculus level and above from a pedagogical perspective. Panelists will include faculty who have experience using online homework systems and/or have done research on their effectiveness as a teaching tool. The panelists will consider questions such as: How can online systems be used to facilitate student learning? For what sorts of topics are they useful, or not useful? What are problems that one encounters in using online systems? What are the best practices in using online systems effectively? Our focus is not on the particular products and how to use them, but rather the pedagogical strengths and weaknesses that they bring to the classroom. Panelists include **Andrew G. Bennett**, Kansas State University; **Ellen E. Kirkman**; and **P. Gavin LaRose**, University of Michigan. Sponsored by the Committee on the Teaching of Undergraduate Mathematics.

Hiring, Tenuring, and Promoting Statisticians in a Mathematics or Mathematical Sciences Department, Tuesday, 2:30 p.m.–3:50 p.m., organized by **Patricia B. Humphrey**, Georgia Southern University; **Chris J. Lacke**, Rowan University; **Michael A. Posner**, Villanova University; and **Robin H. Lock**, St. Lawrence University. At many small and medium-size institutions, statistics courses are offered by departments of mathematics, mathematics and statistics, or mathematical sciences. Our hope and intention is to help educate chairs and members of mathematics departments who incorporate statisticians to the fact that these individuals may need to be treated somewhat differently than the typical mathematician. Specifically, we will address (1) Any differences in the search/hiring process. (For example, there are typically many times fewer statisticians than mathematicians in any given year. Salary surveys indicate statisticians command higher salaries. Is this a problem?) (2) What role, if any, does consulting work play in the promotion and tenure processes? (3) The assessment of the quality and value of statistical research as opposed to mathematical research. (4) Any other ways in which statisticians might be

“different” from the typical mathematician. Panelists include **Carolyn K. Cuff**, Westminster College (moderator); **Patti Frazer Lock**, St. Lawrence University; **Douglas E. Norton**, Villanova University; and **Lila F. Roberts**, Georgia College & State University and Clayton State University. Cosponsored by the SIGMAA on Statistics Education and the ASA-MAA Joint Committee on Statistics.

The Story of Maths I, Tuesday, 3:00 p.m.–4:00 p.m. This film will be introduced by **Robin Wilson**, The Open University, and covers Egyptian, Mesopotamian, and Greek mathematics. It is the first of a series of four one-hour television programs by the BBC and The Open University, filmed around the world by Marcus du Sautoy. See Wednesday at 3:00 p.m. for Part II.

Lewis Carroll in Numberland, Tuesday, 6:00 p.m.–7:30 p.m., performed by **Robin Wilson**, The Open University. This illustrated one-hour informal dramatic performance presents the mathematical life of Charles Dodgson (Lewis Carroll)—as a student, a mathematics lecturer, a champion of Euclid and a logician—in a light-hearted and informative way. What mathematics did he do? What was he interested in? How good a mathematician was he? Sponsored by the SIGMAA on the History of Mathematics.

Environmental Mathematics—Getting It in the Curriculum, Wednesday, 9:00 a.m.–10:20 a.m., organized by **Karen D. Bolinger**, Clarion State University, and **Ben A. Fusaro**, Florida State University. Introducing an unconventional subject into a mathematics program, even as a relatively harmless general education course, raises some interesting challenges. How can a course in applications offer any depth if it has no college mathematics pre-requisites? How can there be time for other than toy applications in a subject with the broad sweep of the environment? How can a faculty member be expected to cope with a subject that often requires a background in biology, chemistry, or geology? These, as well as audience-generated questions, will be addressed by the panelists **Charles R. Hadlock**, Bentley College; **Martin E. Walter**, University of Colorado at Boulder; and **Ben A. Fusaro**. The panel will be moderated by **Lee Seitelman**, United Technologies. Sponsored by the SIGMAA on Environmental Mathematics.

Placement Testing: Is It Working?, Wednesday, 9:00 a.m.–10:20 a.m., organized by **Jerry F. Dwyer**, Texas Tech University, and **Susan L. Forman**, Bronx Community College, CUNY. Panelists will describe the processes used by colleges and universities to evaluate the reliability, validity and effectiveness of their testing procedures for placing students into mathematics courses. Several perspectives will be presented including that of **Bernard L. Madison**, University of Arkansas, who is leading the development of the new MAA placement instrument. **Dan Miller** and **Kent Pearce** have developed placement tests at Milliken (private college) and Texas Tech (large public university), respectively. **Judy E. Ackerman**, Montgomery College, will present the view from a two-year college standpoint. Cosponsored by the MAA/NCTM Committee on Mutual Concerns and the MAA Committee on Articulation and Placement.

Refocusing the Courses below Calculus: The View from the Dean’s Office, Wednesday, 1:00 p.m.–2:20 p.m.,

organized by **Sheldon P. Gordon**, Farmingdale State College. Each year over a million students take college algebra and related courses that typically aim to prepare students for calculus. However, these courses do not adequately serve the needs of the overwhelming majority of students; do not adequately prepare most students who go on to subsequent mathematics courses; do not serve the needs of most quantitative disciplines or today's workplace; and are not an appropriate terminal mathematics experience for most students. The MAA is addressing the challenge of changing the focus in these courses to better serve the majority of students who take them. This session will give the dean's perspective on the college algebra issues: Information about enrollment and success rates; what the dean hears about these courses from students, parents, and faculty in other disciplines; how to approach the dean to request support to change the focus in these courses; and the kinds of support a dean can provide to facilitate change. Panelists include **Bruce C. Crauder**, Oklahoma State University; **Judi H. Morrel**, Butler University; **Rhonda Mandel**, SUNY Oswego; and **Reggie K. U. Luke**, Middlesex County College.

Power of Three: How the Public, Private, and Academic Sector Need to Work Together to Restore Education in America, Wednesday, 1:00 p.m.–2:20 p.m., organized by **Jim Whaley**, president, Siemens Foundation. Education in America is on a slippery slope. According to the World Economic Forum's "Global Competitiveness Report 2006-07", the U.S. dropped from first place to sixth place in global rankings. Today, countries such as Switzerland, Finland, and Sweden have moved up significantly on the list, due in part to their top-notch education systems that focus on technology and innovation. The Power of Three panel will discuss how the public, private and academic sectors must work together to restore America's competitiveness, particularly in the field of math. Without an emphasis on math-oriented education, American youth will not have the tools and abilities to solve complex problems such as developing ground-breaking technologies to improve homeland security, modernize our infrastructures, and further usher in the digital world. Representatives from some of the country's most prestigious institutions, along with pioneering private-sector companies and government officials, will discuss innovation and what is needed from all three sectors to restore America's educational system leadership at all levels.

From the Trenches: Middle School Teachers Look at Their Training, Wednesday, 2:30 p.m.–3:50 p.m., organized by **Florence D. Fasanelli**, AAAS, and **George M. Rosenstein**, Franklin & Marshall College. Four middle school teachers representing a variety of backgrounds and school settings (for example, public, private, and charter schools; diverse educational backgrounds; diverse ethnic groups) will discuss, under the guidance of a moderator, their training as mathematics teachers and their reactions to that training. Following their discussion a person active in the training of middle school teachers will respond. Panelists are **Beth Cole**, St. Patrick Episcopal School, Georgetown; **Michelle Johncock**, Edmund Burke School, Washington DC; **Brieta Dougherty-Brill**, Maya Angelou

Public Charter School, Washington DC; and **Marcia Cole**, Clark Elementary School, Washington DC. **Hyman Bass**, University of Michigan, will moderate this panel.

The Story of Maths II, Wednesday, 3:00 p.m.–4:00 p.m. This film will be introduced by **Robin Wilson**, The Open University, and is the last of a series of four one-hour television programs by the BBC and the Open University, filmed around the world by Marcus du Sautoy. This film covers twentieth-century European and American mathematics and contains some interesting archive material.

Actuarial Education Session, Wednesday, 5:00–7:00 p.m., organized by **Robert E. Buck**, Slippery Rock University; **Bettye Anne Case**, Florida State University; **Kevin E. Charlwood**, Washburn University; and **Steve P. Paris**, Florida State University. Panelists will be local practicing actuaries, and discuss topics of import to the profession currently, with an emphasis on ties to programs in actuarial science in academia. The session is sponsored by Actuarial Educators.

Mathematics and Love: A Poetry Reading, Wednesday, 7:00 p.m.–9:00 p.m., organized by **JoAnne S. Growney**, Silver Spring, MD. Mathematicians and friends of mathematicians are invited to this reading of "mathematical" love poems. An opening portion of the poetry program features guest readers whose poems are collected in a recent anthology of poems of love and mathematics edited by Sarah Glaz and JoAnne Growney. A second portion of the program is open for all math-poets to submit work on the same theme and to read. Mathematician poets who wish to participate should submit one to three poems (not more than three pages) via email to JoAnne Growney, japoet@msn.com, by **November 14, 2008**. Each poem should involve mathematics in its structure or imagery—it might have, for example, a triangular shape or mention love's division or love's geometry. The theme, "Mathematics and Love," includes love's various categories: not only romantic love but also love of family, love of nature, spiritual love and—not to be forgotten—love of mathematics. Participating poets include **Sarah Glaz**, University of Connecticut (moderator); **JoAnne S. Growney**; **Karren LaLonde Alenier**, Bethesda, MD; **Marion Deutsche Cohen**, Arcadia University; **Emily Grosholz**, Pennsylvania State University; **Bob Grumman**, Port Charlotte, FL; **Israel Lewis**, Silver Spring, MD; **Kaz Maslanka**, D3 Industries; **Wilmer Mills**, University of North Carolina; **Wendy Mnookin**, Newton, MA; **Deanna Nikaido**, Baltimore, MD; **Elizabeth Anne Socolow**, Evergreen Forum; and **Ellen Wehle**, West Chester University. Sponsored by SIGMAA on Mathematics and the Arts.

Technology in Statistics Education, Thursday, 9:00 a.m.–10:20 a.m., organized by **Patricia B. Humphrey**, Georgia Southern University; **Chris J. Lacke**, Rowan University; and **Michael A. Posner**, Villanova University. Since the late 1980s the birth and enhancement of technological tools for teaching and performing statistical analyses has substantially changed the way introductory data analysis courses are taught. Instead of concentrating on formulas, making graphs by hand, and using tables to obtain results, many teachers of statistics let the technology do the number crunching and spend more time on analyzing

the results. A “not-so-random” survey of statisticians and teachers of statistics makes it clear that different people use different forms of technology, whether by choice or institutional mandate. In this panel session, the members seek to discuss the strengths and weaknesses of different types of technology. The various technologies will be grouped as follows: (1) graphing calculators, (2) spreadsheets, (3) Fathom, and (4) packages with user-friendly GUI’s (e.g., JMP, Minitab, SPSS). Panelists include **Patricia B. Humphrey**; **John D. McKenzie**, Babson College; **Paul L. Myers**, Woodward Academy; **Chris J. Lacke**; and **Michael A. Posner** (moderator). Sponsored by SIGMAA on Statistics Education.

Beyond T.A. Training: Calculus Curriculum Development by Graduate Teaching Assistants, Thursday, 1:00 p.m.-2:20 p.m., organized by **Timothy Lucas**, Pepperdine University, and **Joseph A. Spivey**, Wofford College. Although graduate students teach the majority of calculus sections at Duke, there is no formal framework for graduate student input in the calculus program. To that end, in the spring of 2007 a group of graduate students formed a committee to review the calculus curriculum. In response to placement issues the committee created a Calculus II course for undergraduates with AP credit, designed to encourage students to pursue mathematics. It is currently taught and maintained by graduate students. In addition two committee members created a dynamic, indexed electronic database to assist in the sharing of handouts and exams among teachers. **Jack Bookman** will discuss the teacher training program that he leads and his interactions with the graduate student projects. Three committee members will talk about the organization process, the curriculum review, developing a calculus course that emphasizes both theory and applications, and the politics involved in lobbying for a new course. Panelists include **Jack Bookman**, Duke University; **Paul L. Bendich**, Pennsylvania State University; **Abraham D. Smith**, Duke University; **Rann Bar-On**, Duke University; and **Timothy Lucas**. The session will be moderated by **Joseph A. Spivey**.

Mathematicians and Public Policy, Thursday, 2:30 p.m.-3:50 p.m., organized by **Philippe M. Tondeur**, University of Illinois at Urbana-Champaign. Panelists will include members of Congress and/or their staff and mathematicians who have worked in the public policy arena. The panel will discuss how mathematicians can serve to influence public policy on issues affecting the funding for research and education and other policy matters and how to learn about these issues.

Project NExT Sessions

Project NExT (New Experiences in Teaching) is the MAA’s professional development program for new and recent Ph.D.’s in the mathematical sciences. Each year, about sixty new faculty are selected as Project NExT Fellows; application materials for 2009-2010 are available at the Project NExT booth in the exhibit area.

Project NExT has organized several sessions to which it invites all meeting participants. The following sessions were organized by the “middle dots” Project NExT Fellows

to address the concerns of faculty who have four to ten years of teaching experience.

The Art of Test-Making and Alternative Assessments, Monday, 2:00 p.m.-3:15 p.m., organized by **Suzanne Caulk**, Regis University; **Gertrud L. Kraut**, Southern Virginia University; **Laurie Lenz**, Marymount University; and **Beth Schaubroeck**, United States Air Force Academy. The panelists will discuss test design including how to address different learning styles and how to make tests a learning experience. They will discuss examples of good tests and of tests that could be improved. The panelists will also explore alternative forms of assessment. Audience participation will be encouraged and all are invited to bring their own samples of tests to share. This session was organized by the 1994-2004 Project NExT Fellows to address issues of concern to faculty who have four to ten years of teaching experience. Panelists include **David M. Bressoud**, Macalester College; **Richard J. Cleary**, Bentley College; **Gary Hagerly**, Black Hills State University; and **Barbara E. Reynolds**, SDS, Cardinal Stritch University. All Meetings participants are invited to attend.

Establishing Your Identity as a Post-Tenure Professor, Tuesday, 1:00 p.m.-2:15 p.m., organized by **Linda Braddy**, East Central University; **Sharon M. Frechette**, College of the Holy Cross, and **Jennifer McLoud-Mann**, University of Texas at Tyler. The panelists will discuss the academic endeavors in which they have been engaged since receiving tenure. Topics will include administrative duties, undergraduate research, educational outreach, grant-funded projects (conferences, workshops, REUs), writing and publishing, and more. The panelists’ remarks will be followed by questions from the audience. This session was organized by the 1994-2004 Project NExT Fellows to address issues of concern to faculty who have four to ten years of teaching experience. The panelists are **Colin L. Adams**, Williams College; **Jaimie Hebert**, Sam Houston State University; **Catherine A. Roberts**, College of the Holy Cross; **Charlotte K. Simmons**, University of Central Oklahoma; and **Judy L. Walker**, University of Nebraska-Lincoln.

Designing and Teaching a Geometry Course for Pre-service Secondary Mathematics Teachers, Thursday, 9:30 a.m.-10:45 a.m., organized by **James E. Hamblin**, Shippensburg University; **William O. Martin**, North Dakota State University; and **Todd D. Oberg**, Illinois College. Preservice secondary mathematics teachers are expected to help their future students comprehend how geometry provides a way to represent and understand the world. How can undergraduate geometry courses prepare these students for this task? What geometric topics help our students develop a deep understanding of the material in order to promote geometric learning in the classroom? What techniques used in undergraduate geometry courses will help students in their future teaching careers? Panelists are **William E. Fenton**, Bellarmine University; **Angela M. Hodge**, North Dakota State University; **Barbara E. Reynolds**, Cardinal Stritch University; and **Thomas Q. Sibley**, St. John’s University.

Special Interest Groups of the MAA (SIGMAAs)

SIGMAAs will be hosting a number of interesting activities, sessions, and guest lecturers. There are currently nine such focus groups offering members opportunities to interact not only at meetings but throughout the year via newsletters and email-based communications. For more information visit www.maa.org/SIGMAA/SIGMAA.html.

SIGMAA Officers Meeting, Tuesday 10:00 a.m.–11:30 a.m., chaired by **Amy Shell-Gellasch**, Pacific Lutheran University.

SIGMAA on Mathematical and Computational Biology

Undergraduate Mathematical Biology, Tuesday, morning and afternoon (see the “MAA Contributed Paper Sessions” section).

SIGMAA on Business, Industry, and Government

Mathematics Experiences in Business, Industry, and Government, Wednesday morning (see the “MAA Contributed Paper Sessions” section).

Guest Lecture, Wednesday, 5:00 p.m.–6:00 p.m., by **Dan Kalman**, American University, who will speak on *Calculus in Orbit*.

SIGMAA on Environmental Mathematics

Environmental Mathematics, Monday afternoon (see the “MAA Contributed Paper Sessions” section).

Guest Lecture and Business Meeting, Monday, 5:30 p.m.–7:30 p.m., speaker and title to be announced.

Environmental Mathematics—Getting It in the Curriculum, Wednesday, 9:00 a.m.–10:20 a.m. (see the “MAA Panels, Posters, and Other Sessions” section).

Bus trip to the Conservatory of the U.S. Botanical Gardens, Thursday, 1:30 p.m.–4:30 p.m.

SIGMAA on the History of Mathematics

Business Meeting and Reception, Monday, 5:30 p.m.–6:30 p.m.

Guest Lecture, Monday, 6:30 p.m.–7:30 p.m., by **Chandler Davis**, University of Toronto, *Title to be announced*. Cosponsored by the SIGMAA on the Philosophy of Mathematics.

The Intersection of the History and Philosophy of Mathematics, Tuesday, 10:45 a.m. (see the “MAA Panels, Posters and Other Sessions” section).

Lewis Carroll in Numberland, Tuesday, 6:00 p.m. (see the “MAA Panels and Poster Sessions” section).

SIGMAA on Mathematics and the Arts

Art Exhibition in the Exhibit Hall, Monday–Thursday

Business Meeting, Tuesday, 7:00 p.m.–8:00 p.m.

Mathematics and Love: A Poetry Reading, Wednesday, 7:00 p.m. (see the “MAA Panels and Poster Sessions” section).

Mathematics and the Arts, Thursday morning and afternoon (see the “MAA Contributed Paper Sessions” section).

SIGMAA on the Philosophy of Mathematics

The Intersection of the History and Philosophy of Mathematics, Tuesday, 10:45 a.m.–12:05 p.m. (See the “MAA Panels, Posters and Other Sessions” section).

Guest Lecture, Monday, 6:30 p.m.–7:30 p.m., by **Chandler Davis**, University of Toronto, *Title to be announced*. Cosponsored by the SIGMAA on the History of Mathematics.

Business Meeting and Reception, Tuesday, 5:45 p.m.–6:45 p.m.

SIGMAA on Quantitative Literacy

Business Meeting, Tuesday, 5:45 p.m.–7:15 p.m.

Quantitative Literacy Across the Curriculum, Wednesday morning (see the “MAA Contributed Paper Sessions” section).

SIGMAA on Research in Undergraduate Mathematics

Guided Discovery in Mathematics Education, Thursday (see the “MAA Contributed Paper Sessions” section).

SIGMAA on Statistics Education

Hiring, Tenuring, and Promoting Statisticians in a Mathematics or Mathematical Sciences Department, Tuesday, 2:30 p.m.–3:50 p.m., and

Technology in Statistics Education, Thursday, 9:00 a.m.–10:20 a.m. (see the “MAA Panels, Posters and Other Sessions” section).

Statistics in K–12 Education: How Will it Affect Statistics at the College Level?, Wednesday morning, and

Statistics Resources on the Web, Wednesday afternoon (see the “MAA Contributed Paper Sessions” section).

SIGMAA on the Teaching of Advanced High School Mathematics

Teaching Calculus in High School: Ideas that Work, Tuesday morning (See the “MAA Contributed Paper Sessions” section).

MAA Sessions for Students

Graduate School: Choosing One, Getting In, Staying In, Monday, 2:15 p.m.–3:35 p.m., organized by **Kristi Meyer**, Wisconsin Lutheran College; **Vanessa Garcia**, Texas State University–San Marcos; and **Alan Alewine**, McKendree University. With so much information about graduate schools available how do you narrow down your list of schools to apply to? How do you get into a program? How do you successfully complete a program? Our panelists will discuss these and other important issues for those choosing a graduate school or considering switching graduate programs. Cosponsored by the Young Mathematicians’ Network.

Career Options for Undergraduate Mathematics Majors, Tuesday, 9:00 a.m.–10:20 a.m., organized by **Vanessa Garcia**, Texas State University–San Marcos, and **Dov N. Chelst**, ICMA. There is a vast amount of options available for students in today’s global market. A degree in mathematics continues to be a desirable asset, yet a common question for students to ask is “what options are available for someone with a math degree?” This panel showcases

several options for career paths for students with an undergraduate degree in mathematics. A variety of panelists will speak on their own experiences of finding a job and answer questions from the audience. Cosponsored by the Young Mathematicians' Network.

Grad School Fair, Wednesday, 8:30 a.m.–10:00 a.m. Here is the opportunity for undergrads to meet representatives from mathematical sciences graduate programs from universities all over the country. January is a great time for juniors to learn more, and college seniors may still be able to refine their search. This is your chance for one-stop shopping in the graduate school market. At last year's meeting about 300 students met with representatives from 45 graduate programs. If your school has a graduate program and you are interested in participating, a table will be provided for your posters and printed materials for US\$50 (registration for this event must be made by a person already registered for the JMM), and you are welcome to personally speak to interested students. Complimentary coffee will be served. Cosponsored by the AMS and MAA.

MAA Lecture for Students, Wednesday, 1:00 p.m.–1:50 p.m., will be given by **Nathaniel Dean**, Texas State University, San Marcos, on *Some elementary problems that remain unsolved*.

Undergraduate Student Poster Session, Wednesday, 4:00 p.m.–5:30 p.m., organized by **Diana M. Thomas**, Montclair State University. The session is reserved to undergraduates and first-year graduate students submitting posters on work done while undergraduates. Abstracts are accepted on a first come basis. Space is limited and students are encouraged to apply early. Beginning August 1, 2008, students can submit abstracts online at www.maa.org/students/undergrad/poster09.htm. Examples of poster topics include a new result, a different proof of a known theorem, an innovative solution of a Putnam problem, a new mathematical model, or method of solution of an applied problem. Purely expository posters cannot be accepted. Prizes will be awarded to the top rated posters with money provided by the AMS, MAA, AWM, CUR, PME and by the Moore Foundation. Trifold, self-standing 48" by 36" tabletop posterboards will be provided. Additional material or equipment is the responsibility of the presenters. Questions regarding this session should be directed to Diana Thomas at thomasdia@mail.montclair.edu. The deadline for proposals is **November 7, 2008**. Cosponsored by the MAA-CUPM Subcommittee on Undergraduate Research and the MAA Committee on Undergraduate Student Activities and Chapters (CUSAC).

Also see the "Social Events" section for the open hours of the **Student Hospitality Center** and the **Reception for Undergraduates**. There are several sessions of general interest

MAA Short Course

This two-day Short Course on *Data Mining and New Trends in Teaching Statistics* organized by **Richard D. De Veaux**, Williams College, and will take place on Saturday and Sunday, January 3 and 4.

There are two main themes. It will serve as a practical introduction to and an overview of data mining. It will also highlight some of the ways that technology has changed the way we practice and teach statistics.

Forty years ago the emphasis in introductory statistics was on formulas and their calculation. For example students were taught the formula for standard deviation and learned alternatives for avoiding rounding errors and short cuts for grouped data. Technology has made much of that subject matter irrelevant and obsolete. Today, we have been freed by technology to focus on the concepts of data analysis and inference. Where is this trend taking us? Computational methods in statistics are rendering some of our methods obsolete as well. How much should be introduced in the introductory statistics course?

Data mining is the exploration and analysis of large data sets by automatic or semiautomatic means with the purpose of discovering meaningful patterns. The knowledge learned from these patterns can then be used for decision making via a process known as "knowledge discovery". Much of exploratory data analysis and inferential statistics concern the same type of problems, so what is different about data mining? What is similar? In the course I will attempt to answer these questions by providing a broad survey of the problems that motivate data mining and the approaches that are used to solve them.

The course will start with an overview of how the introductory statistics course is taught today and what the main concepts are. Examples of how technology enables us to get to the heart of the subject early will be given. Some elementary modeling concepts will be reviewed before we embark on an introduction to data mining. Then, we will use case studies and real data sets to illustrate many of the algorithms used in data mining. The applications will come from a wide variety of industries and include applications from my personal experiences as a consultant for companies that deal with such topics as financial services, chemical processing, pharmaceuticals, and insurance.

There are separate registration fees to participate. See the fee schedule on the registration form at the back of this issue or visit www.ams.org/amsmtgs/2110_reg.html.

Other MAA Events

Board of Governors, Sunday, 9:00 a.m.–5:00 p.m.

Section Officers, Monday, 2:30 p.m.–5:00 p.m.

Joint PME and MAA Student Chapter Advisors' Meeting, Monday, 3:00 p.m.–3:50 p.m.

Business Meeting, Thursday, 11:10 a.m.–11:40 a.m., organized by MAA Secretary, **Martha J. Siegel**, Towson University, and moderated by MAA President **Joseph A. Gallian**, University of Minnesota-Duluth.

Department Liaisons Meeting, day and time to be determined.

Minority Chairs Meeting, day and time to be determined.

See the listings for various receptions in the "Social Events" section.

Activities of Other Organizations

This section includes scientific sessions. Several organizations or special groups are having receptions or other social events. Please see the “Social Events” section of this announcement for details.

Association for Symbolic Logic (ASL)

This **two-day program on Tuesday and Wednesday** will include sessions of contributed papers as well as Invited Addresses by **Barbara Csima**, University of Waterloo; **Inessa Epstein**, California Institute of Technology; **Rahim Moosa**, University of Waterloo; **Christian Rosendal**, University of Illinois at Urbana-Champaign; **Albert Visser**, Utrecht University; and **Jouko Väänänen**, University of Amsterdam.

See also the Special Sessions cosponsored by the ASL on *Logic and Dynamical Systems* on Monday and Tuesday, and *Model Theoretic Methods in Finite Combinatorics* on Tuesday and Wednesday in the “AMS Special Sessions” listings.

Association for Women in Mathematics (AWM)

Thirtieth Annual Emmy Noether Lecture, Tuesday, 10:05 a.m., will be given by **Fan Chung Graham**, University of California San Diego, *The geometry of graphs*. A luncheon will be given in her honor; see the “Social Events” section for details.

What and Where will the Jobs Be? Trends in Mathematics and in Employment, Monday, 2:15 p.m.–3:40 p.m., organized by **Cathy B. Kessel**, Mathematics Education Consultant. Panelists are **Ellen E. Kirkman**, Wake Forest University, and **Mary E. Morley**, Ocean County College. Just before the panel discussion, AWM will recognize the honorees for the Alice T. Schafer Prize for Excellence in Mathematics by an Undergraduate Woman and the Louise Hay Award for Contributions to Mathematics Education. Note that formal prizewinner announcements are made at the Joint Prize Session on Tuesday afternoon.

Business Meeting, Monday, 3:45 p.m.–4:15 p.m.

Workshop, Thursday, 8:20 a.m.–4:20 p.m. With funding from the Office of Naval Research and the National Security Agency, AWM will conduct its workshop for women graduate students and women who have received the Ph.D. within the last five years. Twenty women mathematicians are selected in advance of this workshop to present their research; graduate students will present posters, and the recent Ph.D.’s will give 20-minute talks. The workshop includes a panel discussion at 1:00 p.m. on *What is the right job for me?*, moderated by **Gail D. L. Ratcliff**, East Carolina University, with panelists **Deanna Haunsperger**, Carleton College; **Magnhild Lien**, California State University Northridge; **David L. Manderscheid**, University of Nebraska-Lincoln; and **Carol S. Wood**, Wesleyan University. All mathematicians (female and male) are invited to attend the entire program. Departments are urged to help graduate students and recent Ph.D.’s who do not receive funding to obtain some institutional support to attend the workshop and other meeting sessions. The deadline for applications for presenting and funding has expired.

Updated information about the Workshop is available at www.awm-math.org/workshops.html. AWM seeks volunteers to lead discussion groups and to act as mentors for workshop participants. If you are interested, please contact the AWM office; inquiries regarding future workshops may be made to the office at awm@awm-math.edu.

Reception, Monday, 9:30 p.m.–11:00 p.m. See the listing in the “Social Events” section of this announcement.

National Association of Mathematicians (NAM) Granville-Brown-Haynes Session of Presentations by Recent Doctoral Recipients in the Mathematical Sciences, Wednesday, 2:15 p.m.–4:00 p.m.

Cox-Talbot Address, to be given Wednesday after the banquet; speaker and title to be announced.

Panel Discussion, Thursday, 9:00 a.m.–9:50 a.m.

Business Meeting, Thursday, 10:00 a.m.–10:50 a.m.

Claytor-Woodard Lecture: Thursday, 1:00 p.m., speaker and title to be announced.

See details about the banquet on Tuesday in the “Social Events” section.

National Science Foundation (NSF)

The NSF will be represented at a booth in the exhibit area. NSF staff members will be available to provide counsel and information on NSF programs of interest to mathematicians. The booth is open the same days and hours as the exhibits. Times that staff will be available will be posted at the booth.

Pi Mu Epsilon (PME)

Council Meeting, Wednesday, 8:00 a.m.–11:00 a.m.

Rocky Mountain Mathematics Consortium (RMCC)

Board of Directors Meeting, Wednesday, 2:15 p.m.–4:10 p.m.

Society for Industrial and Applied Mathematics (SIAM)

This program consists of an Invited Address at 11:10 a.m. on Tuesday by **Kenneth M. Golden**, University of Utah, *Mathematics of sea ice to help predict climate change*, and a series of Minisymposia scheduled Monday through Thursday.

Young Mathematicians Network (YMN)

Concerns of Young Mathematicians: A Town Meeting, Tuesday, 7:30 p.m.–8:30 p.m., organized by **Sarah Ann Stewart**, Belmont University, and **Joshua D. Laison**, Willamette University. This panel discussion will focus on the current primary concerns of young mathematicians, from undergraduates to newly-tenured professors, with emphasis on audience participation.

Also see details about other sessions cosponsored by the YMN under these headings: *MAA Panels, Posters, and Other Sessions (Finding Your nth Job...*, Monday at 9:00 a.m.; **Project NEX-T-YMN Poster Session**, Monday at 2:15 p.m.; **How to Apply for Jobs**, Monday at 4:30 p.m.;) and *MAA Sessions for Students (Graduate School: Choosing One...*, Monday at 2:15 p.m.; **Career Options**

for Undergraduate Mathematics Majors, Tuesday at 9:00 a.m.).

Others

Mathematical Art Exhibition, organized by **Robert Fathauer**, Tessellations Company, **Nathaniel A. Friedman**, ISAMA and SUNY Albany, and **Anne Burns**, Long Island University, C. W. Post University. A popular feature at the last Joint Mathematics Meetings this exhibition provides a break in your day. On display are works in various media by artists who are inspired by mathematics and by mathematicians who use visual art to express their findings. Fractals, symmetry, and tiling are some of the ideas at play here. Don't miss this unique opportunity for a different perspective on mathematics. The exhibition will be open during the regular exhibit hours.

Summer Program for Women in Mathematics (SPWM) Reunion, Tuesday 1:00 p.m.–4:00 p.m., organized by **Murli M. Gupta**, George Washington University. SPWM participants will describe their experiences from past programs.

Social Events

All events listed are open to all registered participants. It is strongly recommended that for any event requiring a ticket, tickets should be purchased through advance registration. Only a very limited number of tickets, if any, will be available for sale on site. If you must cancel your participation in a ticketed event, you may request a 50% refund by returning your ticket(s) to the Mathematics Meetings Service Bureau (MMSB) **by December 22**. After that date no refunds can be made. Special meals are available at banquets upon advance request, but this must be indicated on the Advance Registration/Housing Form.

AMS-MAA-SIAM Joint Reception, Thursday, 7:00 p.m.–7:45 p.m. All are cordially invited to this reception immediately following the AMS-MAA-SIAM Gerald and Judith Porter Public Lecture and immediately preceding the AMS Banquet.

AMS Banquet: As a fitting culmination to the meetings, the AMS banquet provides an excellent opportunity to socialize with fellow participants in a relaxed atmosphere. The participant who has been a member of the Society for the greatest number of years will be recognized and will receive a special award. The banquet will be held on Thursday, with dinner served at 7:45 p.m. Tickets are US\$52.50 including tax and gratuity. Please note there is a Joint AMS-MAA-SIAM Reception held immediately preceding the banquet beginning at 7:00 p.m.

Association of Christians in the Mathematical Sciences (ACMS) Reception and Banquet, Tuesday, 6:00 p.m.–10:00 p.m. This annual dinner at 6:30 p.m. is preceded by a reception and will be followed by an after-dinner talk. Tickets must be ordered by **November 30**; see www.acmsonline.org for details.

Association of Lesbian, Gay, Bisexual, and Transgendered Mathematicians Reception, Monday, 5:45 p.m.–7:00 p.m. Everyone is welcome to attend this open reception

cosponsored by NOGLSTP. Come and meet some old friends and allies and make new friends, too.

AWM Reception: There is an open reception on Monday at 9:30 p.m. after the AMS Gibbs Lecture. This has been a popular, well-attended event in the past.

AWM Luncheon to honor Noether Lecturer, Fan Chung Graham, Tuesday. Those interested may email awm@awm-math.org; a sign-up sheet for those interested will also be located at the AWM table in the exhibit area and also at the AWM panel discussion and Business Meeting on Monday afternoon.

Budapest Semesters in Mathematics Reunion, Wednesday, 6:30 p.m.–8:30 p.m. All alumni, family, and spouses are invited.

University of Chicago Mathematics Alumni Reception, Tuesday, 6:00 p.m.–7:00 p.m.

Reception for Graduate Students and First-Time Participants, Monday, 5:30 p.m.–6:30 p.m. The AMS and the MAA cosponsor this social hour. Graduate students and first-timers are especially encouraged to come and meet some old-timers to pick up a few tips on how to survive the environment of a large meeting. Refreshments will be served.

Hawkes Learning Systems Courseware Presentation, Wednesday, 6:00 p.m.–7:00 p.m. All participants are invited to a presentation on *Improving Student Performance with Mastery-Based Software*. The demonstration of this interactive math software system will illustrate how it motivates students to succeed and promotes grade improvement. Students learn more efficiently and effectively through tutorials, unlimited practice, mastery-based homework, and error-specific feedback.

University of Kansas Alumni and Friends Reception, Wednesday, 5:45 p.m.–7:00 p.m. All friends and graduates of the University of Kansas Mathematics Department are invited to attend.

University of Illinois at Urbana-Champaign Department of Mathematics Alumni Reception, Wednesday, 5:30 p.m.–7:30 p.m. Everyone ever connected with the department is encouraged to get together for conversation and to hear about mathematics at the University of Illinois. Please see www.math.uiuc.edu/jmm-reception.html.

University of Iowa Mathematics Department Reception, Tuesday, 5:45 p.m.–7:00 p.m.

Knitting Circle, Tuesday, 8:15 p.m.–9:45 p.m. Bring a project (knitting/crochet/tatting/beading/etc.) and chat with other mathematical crafters!

University of Maryland Mathematics Department Reception, Tuesday, 6:00 p.m.–8:00 p.m. All alumni, faculty, students, and friends of the department are welcome.

MAA-Project NExT Reception, Wednesday, 8:30 p.m.–10:30 p.m., organized by **T. Christine Stevens**, St. Louis University, **Joseph A. Gallian**, University of Minnesota-Duluth, and **Aparna W. Higgins**, University of Dayton. All Project NExT Fellows, consultants, and other friends of Project NExT are invited.

MAA Two-Year College Reception, Tuesday, 5:45 p.m.–7:00 p.m., is open to all meeting participants, particularly two-year faculty members. This is a great opportunity to meet old friends and make some new ones. There will be

hot and cold refreshments and a cash bar. Sponsored by Pearson Education.

Mathematical Reviews Reception, Wednesday, 6:00 p.m.–7:00 p.m. All friends of *Mathematical Reviews* (MR) are invited to join reviewers and MR editors and staff (past and present) for a reception in honor of all the efforts that go into the creation and publication of the *Mathematical Reviews* database. Refreshments will be served.

Mathematical Institutes Open House, Monday, 5:30 p.m.–8:00 p.m. Participants are warmly invited to attend this open house cosponsored by several North American mathematical institutes. Come find out about the latest activities and programs at each of the institutes that may be suited to your own research interests.

MER Banquet: The Mathematicians and Education Reform (MER) Forum welcomes all mathematicians who are interested in precollege, undergraduate, and/or graduate educational reform to attend the MER banquet on Wednesday evening. This is an opportunity to make or renew contacts with other mathematicians who are involved in education projects and to engage in lively conversation about educational issues. The after-dinner discussion is an open forum for participants to voice their impressions, observations, and analyses of the current education scene. There will be a cash bar beginning at 6:30 p.m. Dinner will be served at 7:30 p.m. Tickets are US\$53 each, including tax and gratuity.

Millersville University Alumni Association, Wednesday, 7:00 p.m.–9:00 p.m. All alumni and friends are invited to attend; light refreshments will be provided.

NAM Banquet, Wednesday, 6:00 p.m.–8:40 p.m. The National Association of Mathematicians will host a banquet on Tuesday evening. A cash bar reception will be held at 6:00 p.m., and dinner will be served at 6:30 p.m. Tickets are US\$52 each, including tax and gratuity.

National Association of Math Circles Reception and Meeting, Wednesday, 7:00 p.m.–9:00 p.m. All current and potential Math Circles (and similar programs) organizers are invited to the second annual NAMC Reception. The newly appointed NAMC Board will present the NAMC mission and program structure and information about upcoming Math Circle projects including the mathcircles.org Circle-in-A-Box wiki.

New Mexico State University Mathematics Association Reception, Tuesday, 5:45 p.m.–7:15 p.m. Current and former students and faculty as well as other friends of the New Mexico State University Department of Mathematical Sciences are cordially invited to this reception.

The Ohio State University Friends and Alumni Reception, Tuesday, 6:00 p.m.–8:00 p.m.

Luncheon in Honor of Retiring MAA Associate Secretary James Tattersall, Thursday, 12:05 a.m.–1:30 p.m. For ten years Jim has served the MAA community with flair and aplomb (and that bow tie!) as associate secretary, overseeing its extensive JMM and Mathfest programs. Join your colleagues in wishing Jim well in the next chapter of his life. Tickets are US\$36.00 each, including tax and gratuity.

University of Oregon Mathematics Department Reception, Monday, 6:00 p.m.–7:30 p.m. All alumni and friends are welcome.

Student Hospitality Center, Monday–Wednesday, 9:00 a.m.–5:00 p.m., and Thursday, 9:00 a.m.–3:00 p.m., organized by **Richard** and **Araceli Neal**, American Society for the Communication of Mathematics.

Reception for Undergraduates, Monday, 4:00 p.m.–5:00 p.m.

Other Events of Interest

AMS Information Booth: All meetings participants are invited to visit the AMS Information Booth during the meetings. A special gift will be available for participants, compliments of the AMS. AMS staff will be at the booth to answer questions about AMS programs and membership.

Book Sales and Exhibits: All participants are encouraged to visit the book, education media, and software exhibits from 12:15 p.m.–5:30 p.m. on Monday, 9:30 a.m.–5:30 p.m. on Tuesday and Wednesday, and 9:00 a.m.–noon on Thursday. Books published by the AMS and MAA will be sold at discounted prices somewhat below the cost for the same books purchased by mail. These discounts will be available only to registered participants wearing the official meetings badge. Participants visiting the exhibits are required to display their meetings badge in order to enter the exhibit area.

The AMS and the MAA cordially invite all registered participants to enjoy complimentary tea and coffee while perusing the associations' booths.

Mathematical Sciences Employment Center: Those wishing to participate in the Mathematical Sciences Employment Center should read carefully the important article about the center beginning on page ??? in this issue of *Notices* or at www.ams.org/emp-reg/.

Networking Opportunities: There are many opportunities to meet new friends and greet old acquaintances in addition to the vast array of scientific sessions offered at these meetings. These opportunities are listed on the newcomers page at www.ams.org/amsmtgs/2110_newcomers.html. Newcomers may want to investigate the many receptions listed in the “Social Events” section, the Student Hospitality Center, and the Employment Center. On site a Networking Center featuring casual seating and lists of registered participants sorted by school and math subject classification will be available for your perusal. This is a great place to relax between sessions and forge new friendships.

Registering in Advance and Obtaining Hotel Accommodations

The AMS and MAA make every effort to keep participant expenses at meetings and registration fees for meetings as low as possible. We work hard to negotiate the best hotel rates and to make the best use of your registration dollars to keep the meetings affordable for you. The AMS and the MAA encourage all participants to register for

the meeting. When you pay the registration fee, you are helping to support a wide range of activities associated with planning, organizing, and running a major meeting of this size.

How to Register in Advance: The importance of advance registration cannot be overemphasized. Advance registration fees are considerably lower than the fees that will be charged for registration at the meetings. Participants registering by November 14 may receive their badges, programs, and tickets (where applicable) in advance by mail approximately three weeks before the meetings. Those who do not want their materials mailed should check the box on the form. Because of delays that occur in U.S. mail to Canada, advance registrants from Canada must pick up their materials at the meetings. Because of delays that occur in U.S. mail to overseas, materials are never mailed overseas. There will be a special Registration Assistance Desk at the Joint Meetings to assist individuals who either did not receive this mailing or who have a problem with their registration. Please note that a US\$5 replacement fee will be charged for programs and badges that are mailed but not taken to Washington DC. Acknowledgments of registrations will be sent by email to the email addresses given on the Advance Registration/Housing Form. If you do not wish your registration acknowledged by email, please mark the appropriate box on the form.

Internet Advance Registration: This service is available for advance registration and hotel reservations at www.ams.org/amsmtgs/2110_reg.html. VISA, MasterCard, Discover, and American Express are the only methods of payment which are accepted for Internet advance registration, and charges to credit cards will be made in U.S. funds. All Internet advance registrants will receive acknowledgment of payment upon submission of this form.

Cancellation Policy: Those who cancel their advance registration for the meetings, MAA Minicourses, or Short Courses by December 30 (the deadline for refunds for banquet tickets is December 22) will receive a 50% refund of fees paid. No refunds will be issued after this date.

Joint Mathematics Meetings Registration Fees

	by Dec. 15 at meeting	
Member of AMS, ASL, Canadian Mathematical Society, MAA, SIAM	US\$216	US\$282
Emeritus Member of AMS, MAA; Unemployed; Librarian; High School Teacher; Developing Countries Special Rate	43	53
Graduate Student	44	54
Undergraduate Student	30	40
Temporarily Employed	174	202
Nonmember	335	435
High School Student	5	10
One-Day Member of AMS, ASL, CMS, MAA, SIAM	N/A	154
One-Day Nonmember	N/A	240
Nonmathematician Guest	15	15
MAA Minicourses	60	60*

*if space is available

Grad Student Fair (table/posterboard/electricity)	US\$50	N/A
Employment Center (please note that earlier deadlines apply for inclusion in the <i>Winter Lists</i> ; see the full article)		
Employer—Quiet area table (up to two interviewers)	US\$250	US\$330
Employer—Additional quiet area table	100	N/A
Employer—Committee table (three–six interviewers)	350	425
Employer—Curtained booth (one–three interviewers)	425	N/A
Applicant	25	40
AMS Short Course		
Member of AMS or MAA	US\$96	US\$130
Nonmember	130	160
Student/Unemployed/Emeritus	44	65
MAA Short Course		
MAA or AMS Member	\$125	\$140
Nonmember	175	190
Student/Unemployed/Emeritus	50	60

Full-Time Students: Those currently working toward a degree or diploma. Students are asked to determine whether their status can be described as graduate (working toward a degree beyond the bachelor's), undergraduate (working toward a bachelor's degree), or high school (working toward a high school diploma) and to mark the Advance Registration/Housing Form accordingly.

Emeritus: Any person who has been a member of the AMS or MAA for twenty years or more and who retired because of age or long-term disability from his or her latest position.

Librarian: Any librarian who is not a professional mathematician.

Unemployed: Any person currently unemployed, actively seeking employment, and not a student. It is not intended to include any person who has voluntarily resigned or retired from his or her latest position.

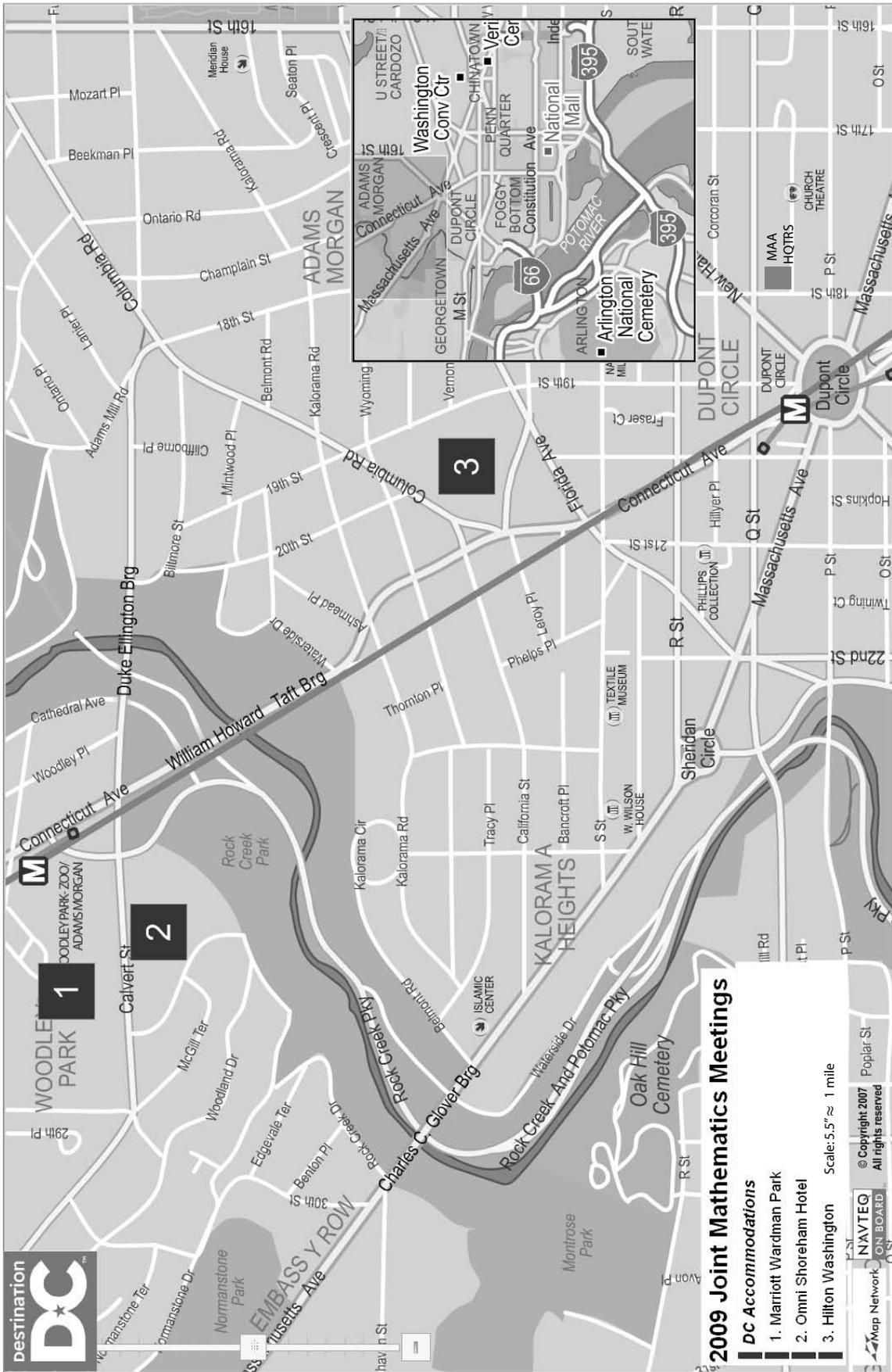
Developing Country Participant: Any person employed in developing countries where salary levels are radically noncommensurate with those in the U.S.

Temporarily Employed: Any person currently employed but who will become unemployed by June 1, 2009, and who is actively seeking employment.

Nonmathematician Guest: Any family member or friend who is not a mathematician and who is accompanied by a participant in the meetings. These official guests will receive a badge and may attend all sessions and the exhibits.

Participants Who Are Not Members of the AMS and register for the meetings as a nonmember will receive mailings after the meetings are over with a special membership offer.

Advance registration and on-site registration fees only partially cover the expenses of holding meetings. All mathematicians who wish to attend sessions are expected to register and should be prepared to show their badges if so requested. Badges are required to enter the exhibit



How to Obtain Hotel Accommodations – 2009 JMM

Complimentary Room Drawing:

Anyone who reserves a room at the Marriott, Omni or Hilton through the MMSB by **October 31** is eligible for a drawing to have their room reservation made complimentary. See *How to Register in Advance* for details.

Deadlines:

- Complimentary Room Drawing: **October 31**
- Reservations through MMSB: **November 14**
- Changes/Cancellations through MMSB: **December 5**

Rates:

- Subject to a 14.5% state and local tax
- Only certified students or unemployed mathematicians qualify for student rates.
- See Advanced Registration/Housing (ARH) Form for detailed breakdown of rates for each hotel.

Guarantee Requirements:

- One night deposit by check, or
- Credit cards: Visa, MC, AMEX, Diners, and Discover.
- Hilton charges credit cards one night's deposit immediately.

Cancellation Policies:

- **Marriott:** 7 days before arrival
- **Omni:** 48 hours before arrival
- **Hilton:** 72 hours before arrival; **US \$50 early departure fee**

General Instructions:

Participants must register in advance in order to obtain hotel accommodations through the Mathematics Meetings Service Bureau (MMSB). Special rates have been negotiated exclusively for this meeting at the following hotels. Reservations must be made through the MMSB to receive these rates. These hotels should **ONLY** start accepting reservations directly after **December 14**, at which time rooms and rates will be based on availability. Higher rates will be applied to any rooms reserved directly with these hotels at the JMM rates before **December 12**.

To make a **reservation**, please submit a completed housing section of the Advance Registration/Housing Form (ARH) Form (paper or internet) with a guarantee by **November 14**. **Sorry, reservations cannot be taken by phone.** The internet form can be found at www.ams.org/meetreg?meetnum=2110. The paper form can be found at the back of this announcement. Participants interested in suites should contact the MMSB directly at mmsb@ams.org or 1-800-321-4267 ext. 4143 or 4144 for further information.

General Information:

- Check-in at all hotels is 3:00 p.m. Check-out is 12:00 p.m. at the Marriott & Omni and 11:00 a.m. at the Hilton.
- Windows open in the Omni and Hilton and a little in the Marriott.
- Children under 18 years old free in all hotels if they are in a room with an adult.
- Cribs are free of charge (limited availability). The Omni does not permit cribs in rooms that have two beds.
- The Omni and the Hilton have environmental policies regarding linen, and the Marriott is all "green".
- Internet Access/Wireless: Marriott: Complimentary wired internet in guest rooms, complimentary wireless in public areas. Omni: Complimentary Wi-Fi service in guest rooms for members of Omni's Select Guest Program (otherwise US \$10 per day), complimentary high speed wireless in the lobby. Hilton: Internet access (wired) US \$12.95/day. Go to https://ssl.omnihotels.com/sg?pagedst=SG5&lang_code=en-us to become a member of Omni's Select Guest Program. This service is free of charge.
- All hotels are in acceptable compliance with ADA and have TDD phones on premises. Marriott also has a TTY text phone.
- The Omni will not send separate hotel confirmations. You may contact the MMSB after December 15 if you would like your confirmation number.

Marriott Wardman Park Hotel
(co-headquarters)

2660 Woodley Road NW
Washington, DC 20008
202-328-2000
Single/Double: US \$150
Student Single/Double: US \$120

All nonsmoking hotel; Restaurants; Lounge; Starbucks; Gourmet Deli. Fitness center; Business center; Full amenities in guest rooms; Complimentary wired internet access in guest rooms; Complimentary wireless in public areas; Pets allowed with US \$50 non-refundable fee; Valet parking US \$37 per day; Self parking US \$32 per day. Credit cards will not be charged in advance. **Confirmations sent by email only.**

Omni Shoreham Hotel
(co-headquarters)

2500 Calvert St. NW (at Connecticut Avenue)
Washington, DC 20008
202-234-0700
Single/Double: US \$150
Student Single/Double: US \$120

Restaurants; Lounge; Fitness center (US \$10 per day or US \$18 per person per stay); Business center; Full amenities in guest rooms; Complimentary Wi-Fi service in guest rooms for members of Omni's Select Guest Program (otherwise US \$10 per day); Complimentary high speed wireless internet access in lobby; Pets allowed with US \$50 non-refundable fee; Valet parking including in/out privileges US \$28 per day. Credit cards will not be charged until check-out. **Confirmations not sent.**

Hilton Washington Hotel
(3/4 mile from the Marriott Wardman Park
4 blocks from Dupont Circle Metro Station)

1919 Connecticut Avenue NW
Washington, DC 20009
202-483-3000
Hilton Rate 1 Single/Double: US \$109
Hilton Rate 2 Single/Double: US \$119

Restaurants; Lounge; Deli; Fitness center; Business center; Full amenities in guest rooms; Wired internet access in guest rooms for US \$12.95 per day; Complimentary wireless in the lobby lounge; Self-parking US \$23 per day. **Credit cards are charged one night's deposit as soon as reservation is sent to hotel.** Changes to departure dates must be made no later than check-in or a US \$50 fee will be charged. **Confirmations sent by email only.**

area, to obtain discounts at the AMS and MAA Book Sales, and to cash a check with the Joint Meetings cashier.

Advance registration forms accompanied by insufficient payment will be returned, thereby delaying the processing of any housing request, or a US\$5 charge will be assessed if an invoice must be prepared to collect the delinquent amount. Overpayments of less than US\$5 will not be refunded.

For each invalid check or credit card transaction that results in an insufficient payment for registration or housing, a US\$5 charge will be assessed. Participants should check with their tax preparers for applicable deductions for education expenses as they pertain to these meetings.

If you wish to be included in a **list of individuals sorted by mathematical interest**, please provide the one mathematics subject classification number of your major area of interest on the Advance Registration/Housing Form. (A list of these numbers is available by sending an empty email message to abs-submit@ams.org; include the number 1035 as the subject of the message.) Copies of this list will be available for your perusal in the Networking Center.

If you do not wish to be included in any mailing list used for promotional purposes, please indicate this in the appropriate box on the Advance Registration/Housing Form.

Advance Registration Deadlines

There are four separate advance registration deadlines, each with its own advantages and benefits.

EMPLOYMENT CENTER advance registration
(inclusion in the *Winter Lists*) **October 22**

EARLY meetings advance registration
(room drawing) **October 31**

ORDINARY meetings advance registration
(hotel reservations, materials
mailed) **November 14**

FINAL meetings advance registration
(advance registration, Short Courses,
Employment Center, MAA Minicourses,
banquets) **December 15**

Employment Center Advance Registration: Applicant and employer forms must be received by **October 22** in order to appear in the publications distributed to all participants. For detailed information on the Employment Center, see the separate article on page 1157.

Early Advance Registration: Those who register by the **early** deadline of **October 31** will be included in a random drawing to select winners of complimentary hotel rooms in Washington DC. Multiple occupancy is permissible. The location of rooms to be used in this drawing will be based on the number of complimentary rooms available in the various hotels. Therefore, the free room may not necessarily be in the winner's first-choice hotel. The winners will be notified by mail prior to **December 20**. So register early!

Applicant and employer forms must be received by

October 22 in order to be reproduced in the *Winter Lists* for the Employment Center.

Ordinary Advance Registration: Those who register **after October 31** and by the **ordinary** deadline of **November 14** may use the housing services offered by the MMSB but are not eligible for the room drawing. You may also elect to receive your badge and program by mail in advance of the meetings.

Final Advance Registration: Those who register after November 14 and by the **final** deadline of **December 15** must pick up their badges, programs, and any tickets for social events at the meetings. Unfortunately, it is sometimes not possible to provide **final** advance registrants with housing, so registrants are strongly urged to make their hotel reservations by **November 14**. Please note that the **December 15 deadline is firm**; any forms received after that date will be returned and full refunds issued. Please come to the Meetings Registration Desk in the Marriott Wardman Park Hotel located near the Marriott Ballroom.

Hotel Reservations

Participants should be aware that the AMS and MAA contract only with facilities who are working toward being in compliance with the public accommodations requirements of the ADA.

Participants requiring hotel reservations should read the instructions on the following hotel pages. Participants who did not reserve a room during advance registration and would like to obtain a room at one of the hotels listed on the following pages should call the hotels directly after **December 14**. However, after that date the MMSB can no longer guarantee availability of rooms or special convention rates. Participants should be aware that most hotels are starting to charge a penalty fee to guests for departure changes made before or after guests have checked into their rooms. These hotels are indicated on the hotel page at www.ams.org/amsmtgs/2110_hotelpage.html. Participants should also inquire about this at check-in and make their final plans accordingly.

Participants should also be aware that it is general hotel practice in most cities to hold a nonguaranteed reservation until 6:00 p.m. only. When one guarantees a reservation by paying a deposit or submitting a credit card number as a guarantee in advance, however, the hotel usually will honor this reservation up until checkout time the following day. If the individual holding the reservation has not checked in by that time, the room is then released for sale, and the hotel retains the deposit or applies one night's room charge to the credit card number submitted. Please note that the Hilton will be immediately charging your credit card for your first night's deposit when your reservation is booked.

If you hold a guaranteed reservation at a hotel but are informed upon arrival that there is no room for you, there are certain things you can request the hotel do. First, they should provide for a room at another hotel in town for that evening at no charge. (You already paid for the first night when you made your deposit.) They should pay for taxi fares to the other hotel that evening and back to the meetings the following morning. They should also pay for

one telephone toll call so that you can let people know you are not at the hotel you expected. They should make every effort to find a room for you in their hotel the following day and, if successful, pay your taxi fares to and from the second hotel so that you can pick up your baggage and bring it to the first hotel. Not all hotels in all cities follow this practice, so your request for these services may bring mixed results or none at all.

Importance of Staying in the Official Meetings Hotels: Your patronage of the official headquarters hotels enables the JMM to secure the meeting space at a greatly reduced cost which helps to keep the cost of the meeting and your registration fees down.

Room Drawing: Win FREE room nights at our official hotels as listed on the hotel pages. Multiple winners! Participants who register and reserve a room at any of the listed meetings hotels by October 31, 2008, will automatically be included in a random drawing to select a winner of free room nights in that hotel. The number of drawings to be made will be based on the number of complimentary room nights available in the various hotels. Multiple occupancy is permissible. The winners will be drawn at random from the hotel reservation lists and notified by email or phone prior to December 20, 2008.

Miscellaneous Information

Audio-Visual Equipment: Standard equipment in all session rooms is one overhead projector and screen. (Invited 50-minute speakers are automatically provided with two overhead projectors and a laptop projector; AMS Special Sessions and MAA Contributed Paper Sessions are provided with the standard equipment and a laptop projector. Blackboards are not available. Organizers of sessions that by their nature demand additional equipment and where the majority of speakers in the session require this equipment should contact the audio-visual coordinator for the meetings at the AMS office in Providence at 401-455-4140 or by email at wsd@ams.org to obtain the necessary approvals. Individual speakers must consult with the session organizer(s) if additional equipment or services are needed. If your session has no organizer, please contact the audio-visual coordinator directly. All requests should be received by November 1.

Equipment requests made at the meetings most likely will not be granted because of budgetary restrictions. Unfortunately no audio-visual equipment can be provided for committee meetings or other meetings or gatherings not on the scientific program.

Childcare: The American Mathematical Society and the Mathematical Association of America will again offer childcare services for the Joint Mathematics Meetings to registered participants.

The child care will be offered through KiddieCorp Children's Program. KiddieCorp is an organization that has been providing high quality programs for children of all ages at meetings throughout the United States and Canada since 1986. Read all about them at www.kiddiecorp.com/.

The childcare services provided at the JMM are for children ages 6 months through 12 years old. Space per day will be limited and is on a space available basis. The dates and times for the program are January 5-8, 2009, 8:00 a.m.-5:00 p.m. each day. It will be located at the Marriott Wardman Park. Parents are encouraged to bring snacks and beverages for their children but items such as juice boxes, Cheerios, and crackers will be provided. KiddieCorp can arrange meals for children at cost plus 15% or parents can be responsible for meals for their children.

Registration starts on September 1. The registration fee is US\$30 per family (nonrefundable). Additional cost will be US\$10 per hour per child or US\$8 per hour per child for graduate students. These reduced child care rates are made possible to the meetings participant by the American Mathematical Society and the Mathematical Association of America, who heavily subsidize the cost of this service thus keeping this program affordable for families. Parents must be registered for the JMM to participate. Full payment is due at the time of registration with KiddieCorp. Deadline for registering is December 8, 2008.

If parents do not pick up their children at the time scheduled or by the end of the day (no later than 5:00 p.m.), they will be charged a late fee of US\$5 per child for every 15 minutes thereafter.

Cancellations must be made to KiddieCorp prior to December 8, 2008, for a full refund. Cancellations made after that date will be subject to a 50% cancellation fee. Once the program has begun, no refunds will be issued.

To register, go to <https://www.kiddiecorp.com/jmmkids.htm> or call KiddieCorp at (858) 455-1718 to request a form.

Email Services: Limited email access for all Joint Meetings participants will be available in an email center located near the JMM Registration Desk. The hours of operation will be published in the program. Participants should be aware that **complimentary Internet access** will be available in all sleeping rooms at the Marriott and Omni, and **free wireless Internet** is available in all public areas of these hotels. Be sure to bring your laptop to take advantage of this special consideration for JMM participants.

Information Distribution: Tables are set up in the exhibit area for dissemination of general information of possible interest to the members and for the dissemination of information of a mathematical nature not promoting a product or program for sale. Information must be approved by the Director of Meetings prior to being placed on these tables.

If a person or group wishes to display information of a mathematical nature promoting a product or program for sale, they may do so in the exhibit area at the Joint Books, Journals, and Promotional Materials exhibit for a fee of US\$50 (posters are slightly higher) per item. Please contact the exhibits manager, MMSB, P.O. Box 6887, Providence, RI 02940, for further details.

The administration of these tables is in the hands of the AMS-MAA Joint Meetings Committee, as are all arrangements for Joint Mathematics Meetings.

Local Information: For information about the city see www.washington.org.

Petition Table: At the request of the AMS Committee on Human Rights of Mathematicians, a table will be made available in the exhibit area at which petitions on behalf of named individual mathematicians suffering from human rights violations may be displayed and signed by meetings participants acting in their individual capacities. For details contact the director of meetings in the Providence office at 401-455-4145 or by email at pop@ams.org.

Signs of moderate size may be displayed at the table but must not represent that the case of the individual in question is backed by the Committee on Human Rights unless it has, in fact, so voted. Volunteers may be present at the table to provide information on individual cases, but notice must be sent at least seven days in advance of the meetings to the director of meetings in the Providence office. Since space is limited, it may also be necessary to limit the number of volunteers present at the table at any one time. The Committee on Human Rights may delegate a person to be present at the table at any or all times, taking precedence over other volunteers.

Any material that is not a petition (e.g., advertisements, résumés) will be removed by the staff. At the end of the exhibits on Monday, any material on the table will be discarded, so individuals placing petitions on the table should be sure to remove them prior to the close of exhibits.

Telephone Messages: The most convenient method for leaving a message is to do so with the participant's hotel. Another method would be to leave a message at the meetings registration desk from January 5 through 8 during the hours that the desk is open. These messages will be posted on the Mathematics Meetings Message Board; however, staff at the desk will try to locate a participant in the event of a bona fide emergency. The telephone number will be published in the program and daily newsletter.

Discounted Air Travel

The official airline for the meetings is **Delta**. The AMS and MAA have made an agreement with Delta that will enable meetings' participants to enjoy exclusive discounts! Discounts vary depending on the cabin and available airfare level. We cannot guarantee that these will be the lowest fares when you make your arrangements but they will be Delta's best online fares. We strongly urge participants to make use of this special deal if at all possible, since the AMS and MAA can earn complimentary tickets. These tickets are used to send meetings' staff (not officers or other staff) to the Joint Mathematics Meetings, thereby keeping the costs of the meetings (and registration fees) down.

To make reservations, visit www.ams.org/amsmtgs/2110_travel.html#delta and click on the Delta Air Lines logo. This will bring you to the Delta Air Lines website where you can make your reservations and have your tickets issued. The applicable discount will automatically apply and the total airfare noted included all taxes and fees—convenient, fast and no special meeting code is needed. Reservations must be made through this link to be recognized as a Joint Mathematics Meetings participant. If you go to the www.delta.com website directly you will **not** get a discount. Your benefits include no airline or agency

booking fees and the opportunity to skip the airport lines! Check in online and print your boarding pass within 24 hours of your flight time.

You may also make reservations by calling Delta's Association Desk at 1-800-455-2720, Monday-Friday, 9:00 a.m.-5:00 p.m. Please cite reference #DP29. A booking fee will be applied to reservations made by telephone. This option is available for those who prefer not to book online.

Traveling from the airport: Washington DC is on Eastern Standard Time and is conveniently served by three large airports: Ronald Reagan/Washington National (DCA), Dulles International Airport (IAD), and Baltimore/Washington International Thurgood Marshall Airport (BWI). Terminal maps of each airport can be found online: Ronald Reagan/Washington National: www.metwashairports.com/reagan/about_reagan_national/directions_maps_reagan/terminal_map_2; Dulles International: www.metwashairports.com/dulles/flight_information_3/terminal_map; Baltimore/Washington International: www.bwiairport.com/customer_assistance/lower_level_terminal_map/.

Driving Directions (to the Marriott/Omni):

From Ronald Reagan Washington National (DCA): The Marriott and the Omni are approximately nine miles northwest of DCA. Leaving the airport, follow the signs to Washington DC northbound along the George Washington Parkway. Take I-395 North to Route 1 (Route 1 is the 14th Street Bridge). Merge to the far left lane on the bridge and follow the signs for 14th Street. Take 14th Street for one mile. Turn left onto K Street. Continue on K for five blocks. Turn right onto Connecticut Ave. and drive about one mile. Cross over the William Taft Bridge. Turn left onto Calvert St. to the Omni, or continue on and make a left turn at the third light after the bridge onto Woodley Rd. for the Marriott.

From Dulles Airport (IAD): The Marriott and the Omni are approximately 25 miles northeast of IAD. Upon leaving the airport, follow the signs to Interstate 66 east to Washington. Follow I-66 to the Theodore Roosevelt Bridge (U.S. Route 50). Take the Constitution Ave. exit off of the bridge. Continue on Constitution for six blocks and make a left turn onto 17th Street. This will change to Connecticut Ave. Continue on Connecticut Ave. for one mile. Cross over the William Taft Bridge. Turn left onto Calvert St. to the Omni, or continue on and make a left turn at the third light after the bridge onto Woodley Rd. for the Marriott.

From Baltimore/Washington International Thurgood Marshall Airport (BWI): The Marriott and the Omni are approximately 33 miles northeast of BWI. Upon leaving the airport, follow the signs to I-95 South. From I-95 S take I-495 West towards Silver Spring to Exit 33, Connecticut Ave. Southbound. Continue south on Connecticut Avenue for about 6.5 miles. Turn right onto Woodley Rd. for the Marriott or continue on and take a right onto Calvert S. for the Omni.

Taxi: One-way taxi fare to the Marriott Wardman Park or to the Omni Shoreham is approximately US\$18-20

from DCA, approximately US\$55 from IAD, and around US\$79 from BWI.

SuperShuttle: www.supershuttle.com or 1-800-BLUE VAN (258-3826). Trips can be booked in shared vans, up to seven people. The fares below (current at press time) are from the airport to the Marriott Wardman Park, the Omni Shoreham, or the Hilton.

From DCA: US\$12 for the first person and US\$10 for each additional person in the party. Upon leaving the Baggage Claim area, proceed to the outside curb and contact the SuperShuttle representative. After hours, call 1-800-258-3826 and press 1 for dispatch or 2 for reservations.

From IAD: US\$27 for the first person and US\$10 for each additional person in the party. Proceed to parking and ground transportation curb outside the Baggage Claim area to the SuperShuttle stop. A map showing the shuttle stop can be seen at www.washfly.com/pdfs/ss-map.pdf.

From BWI: US\$36 for the first person, and US\$13 for each additional person in the party. Proceed to the lower level near luggage carousels 1-5 (Southwest Airlines in Pier A/B).

Public Transportation:

Metro (Washington Metropolitan Area Transit Authority, www.wmata.com): The Marriott Wardman Park and the Omni Shoreham are right next to the Woodley Park-Zoo/Adams Morgan Metro Stop on the Red Line. The Hilton is closer to the Dupont Circle stop, also on the Red Line. The Metrorail (subway) system map can be accessed at www.wmata.com/metrorail/systemmap.cfm. To phone for information on the Metrorail system, call (202) 637-7000; TDD (202) 638-3780.

From DCA: The airport is on the Yellow Line. The metro station is on Concourse Level 2, accessible from Terminals B and C by enclosed pedestrian bridges. If you arrive at Terminal A, exit the terminal to the street-side curb, and board any Airport Shuttle bus. At the stops for Parking Garages B and C (bus shelter #3 and bus shelter #5) you may access an enclosed bridge which connects to the Metrorail station. Travel on the Yellow Line to Gallery Pl/Chinatown. Change to the Red Line in the direction of Shady Grove to the Woodley Park/Zoo/Adams Morgan stop. Regular fare is around US\$2.55 (discounted fares are available).

From IAD: Purchase a ticket (one-way or round-trip) at the Washington Flyer Coach ticket counter located at Arrivals Door #4 in the Main Terminal and board the Coach from this location. The buses depart approximately every 30 minutes, but please listen for announcements for exact bus departure times. The schedule is at www.washfly.com/flyer_bus_schedule.htm. Ticket prices are US\$10 one way and US\$18 round trip. The Washington Flyer will bring you to the West Falls Church Metro stop on the Orange Line. Trains bound for New Carrollton will take you toward downtown Washington DC. Change at Metro Center to the Red Line. Take the Red Line to Woodley Park or Dupont Circle.

From BWI: It is possible to take the BWI Express Metro Bus Service into Washington DC. (Please refer to www.bwiairport.com/ground_transportation/

[washington_dc_wmata/](http://www.washington_dc_wmata/)) Metro Bus Service provides a direct connection between BWI and the Greenbelt Metro Station on the Green Line in Washington DC. The fare is approximately US\$7. The BWI Express/B30 service runs every 40 minutes, seven days a week to the Greenbelt Metro Station. Buses run 25 times each weekday and 21 times on Saturdays and Sunday, every 40 minutes. There are two WMATA Bus Stops. One is located on the lower level of the International Concourse and the other stop is located on the lower level of Concourse A/B. The B30 will pick you up outside at the bus shelter. Follow the signs that say "Public Transit".

When you arrive at the Greenbelt Station, take the Green line south and transfer to the Red Line at Gallery Pl-Chinatown to proceed to the Marriott, Omni, or Hilton. For more information call 202-637-7000 or go to www.wmata.com/timetables/md/b30.pdf.

Train from BWI: Rail transportation is available from the BWI Train Station; for details and a map of its location relative to the airport terminal, see www.visitingdc.com/airport/bwi-train-station.htm. MARC trains provide service (Monday to Friday only) to Union Station in Washington DC for US\$6 one way. The MARC route to from BWI to Union Station is the Penn Line. The schedule is at www.mtmaryland.com/services/marc/schedules-SystemMaps/penn.cfm.

Amtrak has daily train service to Union Station in Washington DC starting at US\$12 one way. Four routes connect BWI to Union Station (WAS), so Amtrak trains are fairly frequent. To check possible trains and prices, see www.amtrak.com or call 1-800-USA-RAIL.

From Union Station, transfer to the Metro (subway). The Marriott, Omni, and Hilton are all on the Red line. It is also possible to take a taxi from Union Station.

Discounted Car Rental

Avis Rent A Car is the official car rental company for the meetings. All car rentals include unlimited free mileage. Renters must meet Avis's age, driver, and credit requirements. Return to the same rental location or additional surcharges may apply. Rates do not include any state or local surcharges, tax, optional coverages, or gas refueling charges. Watch the JMM website at www.ams.org/amsmtgs/2110_travel.html for contact and rate information.

Travel Information for International Participants

International participants should view the important information about traveling to the United States at www7.nationalacademies.org/visas/Traveling_to_US.html.

Because of increased scrutiny of visa applicants, many potential attendees of scientific meetings in the United States have experienced unusual delays in obtaining travel visas. If you need a letter of invitation from the AMS and have not yet requested it, please send email to meet@ams.org and an invitation will be forwarded as soon as possible. In order to compose and send your letter, we will need your document number, email address, and your complete mailing address. Also see this very informative

document from the U.S. Department of State which lists answers to frequently asked questions about the processing of visas (www.ams.org/amsmtg/FAQ-Bus-1-Visa.pdf). You should also be aware that this meeting has been registered with the U.S. Department of State.

Machine Readable Passports Required by June 26, 2005: The Department of Homeland Security reminds travelers from the 27 Visa Waiver Program (VWP) countries (see the website cited above for a list) that as of June 26, 2005, they must have a machine-readable passport to enter the United States without a visa. Beginning June 26, 2005, transportation carriers will be fined US\$3,300, per violation, for transporting any VWP traveler to the United States without a machine-readable passport. Similarly, VWP travelers arriving in the United States on that date without a machine-readable passport should not anticipate being granted one-time entry into the country. As an alternative for persons with immediate travel plans who are unable to obtain a machine-readable passport in time, the individual may apply for a U.S. visa at a U.S. Consulate or Embassy abroad.

Weather

January weather in Washington DC can be quite variable. While average daily high and low temperatures are between 42 °F and 27 °F, it can reach the low 60s during the day when the “January thaw” is evident. However, snowstorms are also possible. Please plan accordingly. Visit your favorite weather site for up-to-the-minute forecasts, or see www.usatoday.com/weather/default.htm.

Urbana, Illinois

University of Illinois at Urbana-Champaign

March 27–29, 2009

Friday – Sunday

Meeting #1047

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: Expired

For consideration of contributed papers in Special Sessions: December 9, 2008

For abstracts: February 3, 2009

The scientific information listed below may be dated. For the latest information, see www.ams.org/amsmtg/section1.html.

Invited Addresses

Jeffrey C. Lagarias, University of Michigan, *Title to be announced* (Erdős’s Memorial Lecture).

Jacob Lurie, Massachusetts Institute of Technology, *Title to be announced*.

Gilles Pisier, Texas A&M University, *Title to be announced*.

Akshay Venkatesh, New York University-Courant Institute, *Title to be announced*.

Special Sessions

Algebra, Geometry and Combinatorics (Code: SS 10A), **Rinat Kedem**, University of Illinois at Urbana-Champaign, and **Alexander T. Yong**, University of Minnesota.

Algebraic Methods in Statistics and Probability (Code: SS 3A), **Marlos A. G. Viana**, University of Illinois at Chicago.

Complex Dynamics and Value Distribution (Code: SS 11A), **Aimo Hinkkanen** and **Joseph B. Miles**, University of Illinois at Urbana-Champaign.

Differential Geometry and Its Applications (Code: SS 16A), **Stephanie B. Alexander**, University of Illinois at Urbana-Champaign, and **Jianguo Cao**, University of Notre Dame.

Geometric Function Theory and Analysis on Metric Spaces (Code: SS 6A), **Sergiy Merenkov**, **Jeremy Taylor Tyson**, and **Jang-Mei Wu**, University of Illinois at Urbana-Champaign.

Geometric Group Theory (Code: SS 2A), **Sergei V. Ivanov**, **Ilya Kapovich**, **Igor Mineyev**, and **Paul E. Schupp**, University of Illinois at Urbana-Champaign.

Graph Theory (Code: SS 4A), **Alexander V. Kostochka** and **Douglas B. West**, University of Illinois at Urbana-Champaign.

Holomorphic and CR Mappings (Code: SS 9A), **John P. D’Angelo**, **Jiri Lebl**, and **Alex Tumanov**, University of Illinois at Urbana-Champaign.

Local and Homological Methods in Commutative Algebra (Code: SS 13A), **Florian Enescu**, Georgia State University, and **Sandra Spiroff**, University of Mississippi.

Mathematical Visualization (Code: SS 7A), **George K. Francis**, University of Illinois at Urbana-Champaign, **Louis H. Kauffman**, University of Illinois at Chicago, **Dennis Martin Roseman**, University of Iowa, and **Andrew J. Hanson**, Indiana University.

Number Theory in the Spirit of Erdős (Code: SS 14A), **Kevin Ford** and **A. J. Hildebrand**, University of Illinois at Urbana-Champaign.

Operator Algebras and Operator Spaces (Code: SS 8A), **Zhong-Jin Ruan**, **Florin P. Boca**, and **Marius Junge**, University of Illinois at Urbana-Champaign.

Probabilistic and Extremal Combinatorics (Code: SS 5A), **Jozsef Balogh** and **Zoltan Furedi**, University of Illinois at Urbana-Champaign.

The Interface Between Number Theory and Dynamical Systems (Code: SS 17A), **Florin Boca**, University of Illinois at Urbana-Champaign, **Jeffrey Lagarias**, University of Michigan, and **Kenneth Stolarsky**, University of Illinois at Urbana-Champaign.

Time, Scale and Frequency Methods in Harmonic Analysis (Code: SS 15A), **Richard S. Laugesen**, University of Illinois at Urbana-Champaign, and **Darrin M. Speegle**, St. Louis University.

Topological Field Theories, Representation Theory, and Algebraic Geometry (Code: SS 12A), **Thomas Nevins**, University of Illinois at Urbana-Champaign, and **David Ben-Zvi**, University of Texas at Austin.

q-Series and Partitions (Code: SS 1A), **Bruce Berndt**, University of Illinois at Urbana-Champaign, and **Ae Ja Yee**, Pennsylvania State University.

Raleigh, North Carolina

North Carolina State University

April 4–5, 2009

Saturday – Sunday

Meeting #1048

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: Expired

For consideration of contributed papers in Special Sessions: December 16, 2008

For abstracts: February 10, 2009

The scientific information listed below may be dated. For the latest information, see www.ams.org/amsmtgsectional.html.

Invited Addresses

Nathan Dunfield, University of Illinois at Urbana-Champaign, *Title to be announced.*

Reinhard C. Laubenbacher, Virginia Biomathematics Institute at Virginia Tech, *Title to be announced.*

Jonathan C. Mattingly, Duke University, *Stochastically forced fluid equations: Transfer between scales and ergodicity.*

Raman Parimala, Emory University, *Title to be announced.*

Special Sessions

Advancements in Turbulent Flow Modeling and Computation (Code: SS 8A), **Leo G. Rebholz**, Clemson University, and **Traian Iliescu**, Virginia Polytechnic Institute and State University.

Applications of Algebraic and Geometric Combinatorics (Code: SS 2A), **Seth M. Sullivant**, Harvard University, and **Carla D. Savage**, North Carolina State University.

Brauer Groups, Quadratic Forms, Algebraic Groups, and Lie Algebras (Code: SS 12A), **Eric S. Brussel** and **Skip Garibaldi**, Emory University.

Computational Methods in Lie Theory (Code: SS 10A), **Eric Sommers**, University of Massachusetts, Amherst, and **Molly Fenn**, North Carolina State University.

Enumerative Geometry and Related Topics (Code: SS 7A), **Richard L. Rimanyi**, University of North Carolina, Chapel Hill, and **Leonardo C. Mihalcea**, Duke University.

Geometry of Differential Equations (Code: SS 9A), **Thomas A. Ivey**, College of Charleston, and **Irina A. Kogan**, North Carolina State University.

Homotopical Algebra with Applications to Mathematical Physics (Code: SS 3A), **Thomas J. Lada**, North Carolina State University, and **Jim Stasheff**, University of North Carolina, Chapel Hill.

Kac-Moody Algebras, Vertex Algebras, Quantum Groups, and Applications (Code: SS 1A), **Bojko N. Bakalov**, **Kailash C. Misra**, and **Naihuan N. Jing**, North Carolina State University.

Low Dimensional Topology and Geometry (Code: SS 4A), **Nathan M. Dunfield**, University of Illinois at Urbana-Champaign, **John B. Etnyre**, Georgia Institute of Technology, and **Lenhard Ng**, Duke University.

Nonlinear Dynamics and Control (Code: SS 11A), **Anthony M. Bloch**, University of Michigan, Ann Arbor, and **Dmitry Zenkov**, North Carolina State University.

Recent Advances in Symbolic Algebra and Analysis (Code: SS 5A), **Michael F. Singer** and **Agnes Szanto**, North Carolina State University.

Rings, Algebras, and Varieties in Combinatorics (Code: SS 6A), **Patricia Hersh**, North Carolina State University, **Christian Lenart**, SUNY Albany, and **Nathan Reading**, North Carolina State University.

Worcester, Massachusetts

Worcester Polytechnic Institute

April 25–26, 2009

Saturday – Sunday

Meeting #1050

Eastern Section

Associate secretary: Steven H. Weintraub

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 25, 2008

For consideration of contributed papers in Special Sessions: January 6, 2009
For abstracts: March 3, 2009

The scientific information listed below may be dated. For the latest information, see www.ams.org/amsmtgs/sectional.html.

Invited Addresses

Octav Cornea, Université de Montréal, *Title to be announced*.

Fengbo Hang, Courant Institute of New York University, *Title to be announced*.

Umberto Mosco, Worcester Polytechnic Institute, *Title to be announced*.

Kevin Whyte, University of Illinois at Chicago, *Title to be announced*.

Special Sessions

Number Theory (Code: SS 4A), **John T. Cullinan**, Bard College, and **Siman Wong**, University of Massachusetts, Amherst.

Symplectic and Contact Topology (Code: SS 1A), **Peter Albers**, Courant Institute of Mathematical Sciences, and **Basak Gurel**, Université de Montréal.

The Mathematics of Climate Change (Code: SS 3A), **Catherine A. Roberts**, College of the Holy Cross, **Mary Lou Zeeman**, Bowdoin College, and **Gareth E. Roberts**, College of the Holy Cross.

Topological Robotics (Code: SS 2A), **Li Han** and **Lee N. Rudolph**, Clark University.

San Francisco, California

San Francisco State University

April 25–26, 2009

Saturday – Sunday

Meeting #1049

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: September 25, 2008

For consideration of contributed papers in Special Sessions: January 6, 2009

For abstracts: March 3, 2009

The scientific information listed below may be dated. For the latest information, see www.ams.org/amsmtgs/sectional.html.

Invited Addresses

Yehuda Shalom, University of California Los Angeles, *Title to be announced*.

Roman Vershynin, University of California Davis, *Title to be announced*.

Karen Vogtmann, Cornell University, *Title to be announced*.

Efim Zelmanov, University of California Los Angeles, *Title to be announced*.

Special Sessions

Banach Algebras, Topological Algebras and Abstract Harmonic Analysis (Code: SS 1A), **Thomas V. Tonev**, University of Montana-Missoula, and **Fereidoun Ghahramani**, University of Manitoba.

Concentration Inequalities (Code: SS 3A), **Sourav Chatterjee**, University of California Berkeley, and **Roman Vershynin**, University of California Davis.

Nonlinear Dispersive Equations (Code: SS 4A), **Sebastian Herr**, University of California Berkeley, and **Jeremy L. Marzuola**, Columbia University.

Recent Progress in Geometric Group Theory (Code: SS 2A), **Seonhee Lim** and **Anne Thomas**, Cornell University.

Waco, Texas

Baylor University

October 16–18, 2009

Friday – Sunday

Meeting #1051

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: March 17, 2009

For consideration of contributed papers in Special Sessions: June 30, 2009

For abstracts: August 25, 2009

The scientific information listed below may be dated. For the latest information, see www.ams.org/amsmtgs/sectional.html.

Invited Addresses

David Ben-Zvi, University of Texas at Austin, *Title to be announced*.

Alexander A. Kiselev, University of Wisconsin, *Title to be announced.*

Michael C. Reed, Duke University, *Title to be announced.*

Igor Rodnianski, Princeton University, *Title to be announced.*

Special Sessions

Commutative Algebra: Module and Ideal Theory (Code: SS 4A), **Lars W. Christensen**, Texas Tech University, **Louiza Fouli**, University of Texas at Austin, and **David Jorgensen**, University of Texas at Arlington.

Dynamic Equations on Time Scales: Analysis and Applications (Code: SS 1A), **John M. Davis**, **Ian A. Gravagne**, and **Robert J. Marks**, Baylor University.

Mathematical Models of Neuronal and Metabolic Mechanisms (Code: SS 3A), **Janet Best**, Ohio State University, and **Michael Reed**, Duke University.

Numerical Solutions of Singular or Perturbed Partial Differential Equation Problems with Applications (Code: SS 2A), **Peter Moore**, Southern Methodist University, and **Qin Sheng**, Baylor University.

Topological Methods for Boundary Value Problems for Ordinary Differential Equations (Code: SS 5A), **Richard Avery**, Dakota State University, **Paul W. Elloe**, University of Dayton, and **Johnny Henderson**, Baylor University.

University Park, Pennsylvania

Pennsylvania State University

October 24–25, 2009

Saturday – Sunday

Meeting #1052

Eastern Section

Associate secretary: Steven H. Weintraub

Announcement issue of *Notices*: August 2009

Program first available on AMS website: September 24, 2009

Program issue of electronic *Notices*: October 2009

Issue of *Abstracts*: To be announced

Deadlines

For organizers: March 24, 2009

For consideration of contributed papers in Special Sessions: July 7, 2009

For abstracts: September 1, 2009

Boca Raton, Florida

Florida Atlantic University

October 30 – November 1, 2009

Friday – Sunday

Meeting #1053

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 30, 2009

For consideration of contributed papers in Special Sessions: July 14, 2009

For abstracts: September 8, 2009

The scientific information listed below may be dated. For the latest information, see www.ams.org/amsmtgs/sectional.html.

Invited Addresses

Spyros Alexakis, Princeton University, *Title to be announced.*

Kai-Uwe Bux, University of Virginia, *Title to be announced.*

Dino J. Lorenzini, University of Georgia, *Title to be announced.*

Eduardo D. Sontag, Rutgers University, *Title to be announced.*

Special Sessions

Concentration, Functional Inequalities, and Isoperimetry (Code: SS 2A), **Mario Milman**, Florida Atlantic University, **Christian Houdre**, Georgia Institute of Technology, and **Emanuel Milman**, Institute for Advanced Study.

Constructive Mathematics (Code: SS 1A), **Robert Lubar-sky**, **Fred Richman**, and **Martin Solomon**, Florida Atlantic University.

Riverside, California

University of California

November 7–8, 2009

Saturday – Sunday

Meeting #1054

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: April 6, 2009
For consideration of contributed papers in Special Sessions: July 21, 2009
For abstracts: September 15, 2009

The scientific information listed below may be dated. For the latest information, see www.ams.org/amsmtg/sectional.html.

Special Sessions

Algebraic Geometry (Code: SS 1A), **Christopher Hacon**, University of Utah, and **Ziv Ran**, University of California Riverside.

Noncommutative Geometry (Code: SS 2A), **Vasilii Dolgushev** and **Wee Liang Gan**, University of California Riverside.

Representation Theory (Code: SS 3A), **Vyjayanthi Chari**, **Wee Liang Gan**, and **Jacob Greenstein**, University of California Riverside.

San Francisco, California

Moscone Center West and the San Francisco Marriott

January 13–16, 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

Lexington, Kentucky

University of Kentucky

March 27–28, 2010

Saturday – Sunday

Southeastern Section

Associate secretary: Matthew Miller

Announcement issue of *Notices*: To be announced

Program first available on AMS website: To be announced

Program issue of electronic *Notices*: To be announced

Issue of *Abstracts*: To be announced

Deadlines

For organizers: August 28, 2009

For consideration of contributed papers in Special Sessions: To be announced

For abstracts: To be announced

St. Paul, Minnesota

Macalester College

April 10–11, 2010

Saturday – 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 10, 2009

For consideration of contributed papers in Special Sessions: To be announced

For abstracts: To be announced

Albuquerque, New Mexico

University of New Mexico

April 17–18, 2010

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: September 17, 2009

For consideration of contributed papers in Special Sessions: To be announced

For abstracts: To be announced

Berkeley, California

University of California Berkeley

June 2–5, 2010

Wednesday – Saturday

Eighth Joint International Meeting of the AMS and the Sociedad Matematica Mexicana.

Associate secretary: Susan J. Friedlander

Announcement issue of *Notices*: February 2010

Program first available on AMS website: To be announced

Program issue of electronic *Notices*: To be announced

Issue of *Abstracts*: To be announced

Deadlines

For organizers: To be announced

For consideration of contributed papers in Special Sessions: To be announced

For abstracts: To be announced

Notre Dame, Indiana

Notre Dame University

September 18–19, 2010

Saturday – 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: February 19, 2010

For consideration of contributed papers in Special Sessions: To be announced

For abstracts: To be announced

Los Angeles, California

University of California Los Angeles

October 9–10, 2010

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 10, 2010

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: Steven H. Weintraub

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: 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: April 1, 2012

For consideration of contributed papers in Special Sessions: To be announced

For abstracts: To be announced

Baltimore, Maryland

Baltimore Convention Center

January 15–18, 2014

Wednesday – Saturday

Joint Mathematics Meetings, including the 120th Annual Meeting of the AMS, 97th 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, with sessions contributed by the Society for Industrial and Applied Mathematics (SIAM).

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: April 1, 2013

For consideration of contributed papers in Special Sessions: To be announced

For abstracts: To be announced

San Antonio, Texas

Henry B. Gonzalez Convention Center and Grand Hyatt San Antonio

January 10–13, 2015

Saturday – Tuesday

Joint Mathematics Meetings, including the 121st Annual Meeting of the AMS, 98th 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, with sessions contributed by the Society for Industrial and Applied Mathematics (SIAM).

Associate secretary: Steven H. Weintraub

Announcement issue of *Notices*: October 2014

Program first available on AMS website: To be announced

Program issue of electronic *Notices*: January 2015

Issue of *Abstracts*: To be announced

Deadlines

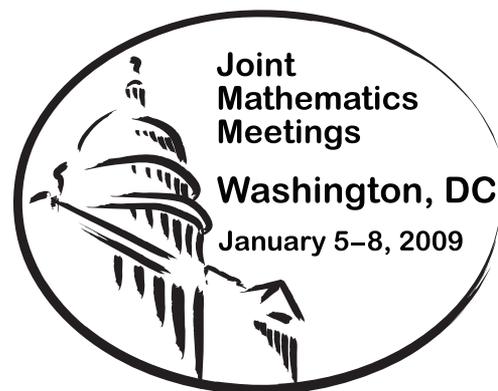
For organizers: April 1, 2014

For consideration of contributed papers in Special Sessions: To be announced

For abstracts: To be announced

Program at a Glance

This document provides a thumbnail sketch of all scientific and social events so you can easily see which events may overlap and better plan your time.



Saturday, January 3

- 8:00 a.m.–12:00 p.m. **AMS SHORT COURSE ON QUANTUM COMPUTATION AND QUANTUM INFORMATION (PART I)**
- 8:00 a.m.–12:00 p.m. **MAA SHORT COURSE ON DATA MINING AND NEW TRENDS IN TEACHING STATISTICS (PART I)**

Sunday, January 4

- 8:00 a.m.–6:30 p.m. **AMS DEPARTMENT CHAIRS WORKSHOP**
- 9:00 a.m.–5:00 p.m. **AMS SHORT COURSE ON QUANTUM COMPUTATION AND QUANTUM INFORMATION (PART II)**
- 9:00 a.m.–4:00 p.m. **MAA SHORT COURSE ON DATA MINING AND NEW TRENDS IN TEACHING STATISTICS (PART II)**
- 9:00 a.m.–5:00 p.m. **MAA BOARD OF GOVERNORS**
- 1:30 p.m.–10:00 p.m. **AMS COUNCIL**
- 3:00 p.m.–7:00 p.m. **JOINT MEETINGS REGISTRATION**, Marriot Ballroom Lobby, Lobby Level, Marriott Wardman Park Hotel

Monday, January 5

- 7:30 a.m.–4:00 p.m. **JOINT MEETINGS REGISTRATION**, Marriot Ballroom Lobby, Lobby Level, Marriott Wardman Park Hotel
- 8:00 a.m.–10:50 a.m. **AMS-MAA-SIAM SPECIAL SESSION ON RESEARCH IN MATHEMATICS BY UNDERGRADUATES, I**
- AMS SPECIAL SESSIONS**
- 8:00 a.m.–10:50 a.m. *Recent Trends in Coding Theory, I*
- 8:00 a.m.–10:50 a.m. *Representation Theory of Lie Algebras and Algebraic Groups, I*
- 8:00 a.m.–10:50 a.m. *Nonlinear Partial Differential Equations and Applications, I*
- 8:00 a.m.–10:50 a.m. *Stochastic, Large-Scale, and Hybrid Systems with Applications, I*
- 8:00 a.m.–10:50 a.m. *Experimental Mathematics, I*
- 8:00 a.m.–10:50 a.m. *Heavy-Tailed Behavior: Theory and Applications*
- 8:00 a.m.–10:50 a.m. *Von Neumann Algebras, I*
- 8:00 a.m.–10:50 a.m. *Mathematics of Computation, I*
- 8:00 a.m.–10:50 a.m. *Difference Equations, I*
- 8:00 a.m.–10:50 a.m. *The Mathematics of Information and Knowledge, I*
- 8:00 a.m.–10:50 a.m. *Automorphic and Modular Forms in Number Theory, I*
- 8:00 a.m.–10:50 a.m. *Topological Methods in Applied Mathematics, I*

- 8:00 a.m.–10:50 a.m. *Group Actions on Homogeneous Spaces and Applications, I*
- 8:00 a.m.–10:50 a.m. *Role of Generalized Maximal Monotonicity Frameworks in Optimization and Control Theory with Applications, I*
- 8:00 a.m.–10:55 a.m. *General Contributed Paper Session, I*
- 8:00 a.m.–10:55 a.m. **SIAM MINISYMPOSIUM**
- 8:00 a.m.–10:55 a.m. **AMS SESSIONS FOR CONTRIBUTED PAPERS**
- 8:00 a.m.–7:00 p.m. **EMPLOYMENT CENTER**
- 9:00 a.m.–11:00 a.m. **MAA MINICOURSE #11: PART A** *Planning and teaching mathematics capstone courses for preservice secondary school teachers.*
- 9:00 a.m.–11:00 a.m. **MAA MINICOURSE #1: PART A** *Discrete models in biology and simulations.*
- 9:00 a.m.–11:00 a.m. **MAA MINICOURSE #6: PART A** *Teaching with clickers and classroom voting.*
- 9:00 a.m.–10:20 a.m. **MAA-YOUNG MATHEMATICIANS NETWORK PANEL DISCUSSION** *Finding your n^{th} job (for n greater than or equal to 2).*
- 9:00 a.m.–10:20 a.m. **MAA SPECIAL PRESENTATION** *National Science Foundation programs supporting learning and teaching in the mathematical sciences.*
- 9:00 a.m.–5:00 p.m. **STUDENT HOSPITALITY CENTER**
- 9:30 a.m.–10:30 a.m. **MAA SPECIAL PRESENTATION** *ICME-11 in retrospect.*
- 10:05 a.m.–10:55 a.m. **AMS INVITED ADDRESS** *Advances in advancing interfaces.* **James A. Sethian**
- 11:10 a.m.–12:00 p.m. **AMS-MAA INVITED ADDRESS** *Title to be announced.* **Douglas N. Arnold**
- 12:15 p.m.–5:30 p.m. **EXHIBITS AND BOOK SALES** *Come to the Grand Opening at 12:15!*
- 2:15 p.m.–3:15 p.m. **AMS COLLOQUIUM LECTURES: LECTURE I** *Homogeneous dynamics and number theory.* **Grigori A. Margulis**
- 2:15 p.m.–3:05 p.m. **MAA INVITED ADDRESS** *Stacking bricks and stoning crows.* **Peter M. Winkler**
- 2:15 p.m.–6:05 p.m. **AMS-MAA-SIAM SPECIAL SESSION ON RESEARCH IN MATHEMATICS BY UNDERGRADUATES, II**
- 2:15 p.m.–6:05 p.m. **AMS-ASL SPECIAL SESSION ON LOGIC AND DYNAMICAL SYSTEMS, I**
- AMS SPECIAL SESSIONS**
- 2:15 p.m.–6:05 p.m. *Convex and Discrete Geometry, I*
- 2:15 p.m.–6:05 p.m. *Recent Trends in Coding Theory, II*
- 2:15 p.m.–6:05 p.m. *Nonlinear Partial Differential Equations and Applications, II*
- 2:15 p.m.–6:05 p.m. *Recent Advances in Mathematical Modeling in Medicine*
- 2:15 p.m.–6:05 p.m. *Stochastic, Large-Scale, and Hybrid Systems with Applications, II*
- 2:15 p.m.–6:05 p.m. *Experimental Mathematics, II*
- 2:15 p.m.–6:05 p.m. *Algebraic Structures in Knot Theory*
- 2:15 p.m.–6:05 p.m. *Nonsmooth Analysis in Inverse and Variational Problems, I*
- 2:15 p.m.–6:05 p.m. *Difference Equations, II*
- 2:15 p.m.–6:05 p.m. *The Mathematics of Information and Knowledge, II*
- 2:15 p.m.–6:05 p.m. *Tracking Moving Interfaces in Complex Phenomena, I*
- 2:15 p.m.–6:05 p.m. *Group Actions on Homogeneous Spaces and Applications, II*
- 2:15 p.m.–4:15 p.m. **MAA MINICOURSE #12: PART A** *SNAP Math Fairs in elementary education.*
- 2:15 p.m.–4:15 p.m. **MAA MINICOURSE #2: PART A** *Using GeoGebra to create activities and applets for visualization and exploration.*
- 2:15 p.m.–4:15 p.m. **MAA MINICOURSE #7: PART A** *A Game Theory path to quantitative literacy.*
- MAA CONTRIBUTED PAPER SESSIONS**
- 2:15 p.m.–5:15 p.m. *Building Diversity in Advanced Mathematics: Models that Work*
- 2:15 p.m.–5:15 p.m. *Cryptology for Undergraduates*
- 2:15 p.m.–5:15 p.m. *Environmental Mathematics*
- 2:15 p.m.–5:15 p.m. *Mathematics of Chemistry*
- 2:15 p.m.–5:15 p.m. *Operations Research in the Undergraduate Classroom*

2:15 p.m.–5:15 p.m.	<i>Performing Mathematics</i>
2:15 p.m.–5:15 p.m.	<i>General Contributed Paper Session, II</i>
2:15 p.m.–4:15 p.m.	MAA INVITED PAPER SESSION ON MATHEMATICAL SOCIOLOGY
2:15 p.m.–6:05 p.m.	SIAM MINISYMPOSIUM
2:15 p.m.–3:35 p.m.	MAA-YOUNG MATHEMATICIANS NETWORK PANEL DISCUSSION <i>Graduate school: Choosing one, getting in, staying in.</i>
2:15 p.m.–3:15 p.m.	MAA-PROJECT NEXT PANEL DISCUSSION <i>The art of test-making and alternative assessments.</i>
2:15 p.m.–4:15 p.m.	MAA PROJECT NEXT-YOUNG MATHEMATICIANS' NETWORK POSTER SESSION
2:15 p.m.–3:40 p.m.	AWM PANEL DISCUSSION <i>What and where will the jobs be? Trends in mathematics and in employment.</i>
2:15 p.m.–5:55 p.m.	AMS SESSIONS FOR CONTRIBUTED PAPERS
2:30 p.m.–5:00 p.m.	MAA SECTION OFFICERS
3:20 p.m.–4:10 p.m.	MAA INVITED ADDRESS <i>Integral Appollonian packings and thin orbits.</i> Peter Sarnak
3:45 p.m.–4:15 p.m.	AWM BUSINESS MEETING
3:50 p.m.–5:10 p.m.	MAA CUPM SUBCOMMITTEE ON RESEARCH BY UNDERGRADUATES PANEL DISCUSSION <i>Starting and maintaining an academic year undergraduate research program.</i>
4:00 p.m.–5:00 p.m.	RECEPTION FOR UNDERGRADUATE STUDENTS AND MATH CLUB ADVISORS
4:30 p.m.–5:40 p.m.	MAA COMMITTEE ON GRADUATE STUDENTS-YOUNG MATHEMATICIANS NETWORK PANEL DISCUSSION <i>How to apply for jobs.</i>
5:30 p.m.–7:30 p.m.	SIGMAA ON ENVIRONMENTAL MATHEMATICS GUEST LECTURE AND BUSINESS MEETING
5:30 p.m.–6:30 p.m.	SIGMAA ON THE HISTORY OF MATHEMATICS BUSINESS MEETING AND RECEPTION
5:30 p.m.–6:30 p.m.	RECEPTION FOR GRADUATE STUDENTS AND FIRST-TIME PARTICIPANTS
5:30 p.m.–8:00 p.m.	MATHEMATICAL INSTITUTES OPEN HOUSE
6:00 p.m.–7:00 p.m.	MAA SPECIAL DRAMATIC PRESENTATION <i>The CNN United States of Mathematics Presidential Debate.</i>
6:00 p.m.–7:30 p.m.	RECEPTION FOR ALUMNI AND FRIENDS OF THE UNIVERSITY OF OREGON MATHEMATICS DEPARTMENT
6:30 p.m.–7:30 p.m.	SIGMAA ON THE HISTORY OF MATHEMATICS AND SIGMAA ON THE PHILOSOPHY OF MATHEMATICS GUEST LECTURE
8:30 p.m.–9:30 p.m.	AMS JOSIAH WILLARD GIBBS LECTURE <i>Conformally invariant random systems in the plane.</i> Oded Schramm
9:30 p.m.–11:00 p.m.	AWM RECEPTION

Tuesday, January 6

7:30 a.m.–4:00 p.m.	JOINT MEETINGS REGISTRATION , Marriot Ballroom Lobby, Lobby Level, Marriott Wardman Park Hotel
8:00 a.m.–11:50 a.m.	AMS-MAA-MER SPECIAL SESSION ON MATHEMATICS AND EDUCATION REFORM, I
8:00 a.m.–11:50 a.m.	AMS-SIAM SPECIAL SESSION ON ASYMPTOTIC METHODS IN ANALYSIS WITH APPLICATIONS, I
8:00 a.m.–11:50 a.m.	AMS-ASL SPECIAL SESSION ON LOGIC AND DYNAMICAL SYSTEMS, II
	AMS SPECIAL SESSIONS
8:00 a.m.–11:50 a.m.	<i>Mathematical Models of Biological Structures and Function</i>
8:00 a.m.–11:50 a.m.	<i>Noncommutative Algebra, I</i>
8:00 a.m.–11:50 a.m.	<i>Mathematics of Computation, II</i>
8:00 a.m.–11:50 a.m.	<i>Infinite Dimensional Analysis, Path Integrals and Related Fields</i>
8:00 a.m.–11:50 a.m.	<i>Computational Algebraic and Analytic Geometry for Low-dimensional Varieties, I</i>
8:00 a.m.–11:50 a.m.	<i>The Mathematics of Information and Knowledge, III</i>

- 8:00 a.m.–11:50 a.m. *Automorphic and Modular Forms in Number Theory, II*
- 8:00 a.m.–11:50 a.m. *Group Actions on Homogeneous Spaces and Applications, III*
- 8:00 a.m.–11:50 a.m. *Categorification and Link Homology, I*
- 8:00 a.m.–11:50 a.m. *Tracking Moving Interfaces in Complex Phenomena, I*
- 8:00 a.m.–11:50 a.m. *Teichmüller Theory and Low-Dimensional Topology, I*
- 8:00 a.m.–10:00 a.m. **MAA MINICOURSE #3: PART A** *Educating about the state of the planet and sustainability while enhancing calculus.*
- 8:00 a.m.–10:00 a.m. **MAA MINICOURSE #8: PART A** *Taking symbols seriously: Teaching form and function in college algebra.*
- MAA CONTRIBUTED PAPER SESSIONS**
- 8:00 a.m.–12:00 p.m. *Demos and Strategies with Technology that Enhance Teaching and Learning Mathematics, I*
- 8:00 a.m.–12:00 p.m. *Innovative and Effective Ways to Teach Linear Algebra, I*
- 8:00 a.m.–12:00 p.m. *Mathematics of Games and Puzzles*
- 8:00 a.m.–12:00 p.m. *Mathematics and Sports*
- 8:00 a.m.–12:00 p.m. *Teaching Calculus in High School: Ideas that Work*
- 8:00 a.m.–12:00 p.m. *Undergraduate Mathematical Biology, I*
- 8:00 a.m.–12:00 p.m. *General Contributed Paper Session, III*
- 8:00 a.m.–10:50 a.m. **SIAM MINISYMPOSIUM**
- 8:00 a.m.–11:55 a.m. **AMS SESSIONS FOR CONTRIBUTED PAPERS**
- 8:00 a.m.–7:00 p.m. **EMPLOYMENT CENTER**
- 9:00 a.m.–9:50 a.m. **MAA INVITED ADDRESS** *Perfect graphs—Structure and recognition.* **Maria Chudnovsky**
- 9:00 a.m.–11:00 a.m. **MAA MINICOURSE #13: PART A** *Directing undergraduate research.*
- 9:00 a.m.–10:20 a.m. **MAA-YOUNG MATHEMATICIANS NETWORK PANEL DISCUSSION** *Career options for undergraduate mathematics majors.*
- 9:00 a.m.–10:20 a.m. **MAA PANEL DISCUSSION** *Multidisciplinary projects that hook those not usually interested in mathematics.*
- 9:00 a.m.–10:20 a.m. **MAA COMMITTEE ON THE PROFESSION SPECIAL PRESENTATION** *Session for chairs.*
- 9:00 a.m.–11:00 a.m. **MAA COMMITTEE ON THE PARTICIPATION OF WOMEN/WOMEN AND MATHEMATICS NETWORK POSTER SESSION** *Mathematical outreach programs for underrepresented populations.*
- 9:00 a.m.–5:00 p.m. **STUDENT HOSPITALITY CENTER**
- 9:30 a.m.–5:30 p.m. **EXHIBITS AND BOOK SALES**
- 10:00 a.m.–11:30 a.m. **SIGMAA OFFICERS MEETING**
- 10:05 a.m.–10:55 a.m. **AWM EMMY NOETHER LECTURE** *The geometry of graphs.* **Fan Chung Graham**
- 10:30 a.m.–12:30 p.m. **MAA MINICOURSE #4: PART A** *An introduction to the mathematics of modern cryptography.*
- 10:30 a.m.–12:30 p.m. **MAA MINICOURSE #9: PART A** *Beyond formulas and algorithms: Teaching a conceptual/thematic single variable calculus course.*
- 10:45 a.m.–12:05 p.m. **SIGMAA ON THE HISTORY OF MATHEMATICS AND SIGMAA ON THE PHILOSOPHY OF MATHEMATICS PANEL DISCUSSION** *The intersection of the history and philosophy of mathematics.*
- 10:45 a.m.–12:05 p.m. **MAA WORKSHOP** *Proposal writing for grant applications to the NSF Division of Undergraduate Education.*
- 10:45 a.m.–12:05 p.m. **MAA COMMITTEE ON TECHNOLOGY IN MATHEMATICS EDUCATION PANEL DISCUSSION** *Picture this! Geometry software.*
- 11:10 a.m.–12:00 p.m. **SIAM INVITED ADDRESS** *Mathematics of sea ice to help predict climate change.* **Kenneth M. Golden**
- 1:00 p.m.–2:00 p.m. **AMS COLLOQUIUM LECTURES: LECTURE II** *Homogeneous dynamics and number theory.* **Grigori A. Margulis**
- 1:00 p.m.–4:20 p.m. **AMS-MAA-SIAM SPECIAL SESSION ON RESEARCH IN MATHEMATICS BY UNDERGRADUATES, III**

- 1:00 p.m.–4:20 p.m. **AMS-MAA-MER SPECIAL SESSION ON MATHEMATICS AND EDUCATION REFORM, II**
- 1:00 p.m.–4:20 p.m. **AMS-MAA SPECIAL SESSION ON THE SCHOLARSHIP OF TEACHING AND LEARNING, I**
- 1:00 p.m.–4:20 p.m. **AMS-SIAM SPECIAL SESSION ON ASYMPTOTIC METHODS IN ANALYSIS WITH APPLICATIONS, II**
- 1:00 p.m.–4:20 p.m. **AMS-ASL SPECIAL SESSION ON MODEL THEORETIC METHODS IN FINITE COMBINATORICS, I**
- AMS SPECIAL SESSIONS**
- 1:00 p.m.–4:20 p.m. *Convex and Discrete Geometry, II*
- 1:00 p.m.–4:20 p.m. *Von Neumann Algebras, II*
- 1:00 p.m.–4:20 p.m. *Noncommutative Algebra, II*
- 1:00 p.m.–4:20 p.m. *Computational Algebraic and Analytic Geometry for Low-dimensional Varieties, II*
- 1:00 p.m.–4:20 p.m. *Harmonic Analysis, I*
- 1:00 p.m.–4:20 p.m. *The Mathematics of Information and Knowledge, IV*
- 1:00 p.m.–4:20 p.m. *Topological Methods in Applied Mathematics, II*
- 1:00 p.m.–4:20 p.m. *Group Actions on Homogeneous Spaces and Applications, IV*
- 1:00 p.m.–4:20 p.m. *Teichmüller Theory and Low-Dimensional Topology, II*
- 1:00 p.m.–3:00 p.m. **MAA MINICOURSE #10: PART A** *The ubiquitous Catalan numbers and their applications.*
- 1:00 p.m.–3:00 p.m. **MAA MINICOURSE #14: PART A** *Teaching a course in the history of mathematics.*
- 1:00 p.m.–3:00 p.m. **MAA MINICOURSE #5: PART A** *Developing departmental self-studies.*
- MAA CONTRIBUTED PAPER SESSIONS**
- 1:00 p.m.–4:10 p.m. *Demos and Strategies with Technology that Enhance Teaching and Learning Mathematics, II*
- 1:00 p.m.–4:10 p.m. *Innovative and Effective Ways to Teach Linear Algebra, II*
- 1:00 p.m.–4:10 p.m. *Research on the Teaching and Learning of Undergraduate Mathematics*
- 1:00 p.m.–4:10 p.m. *Undergraduate Mathematical Biology, II*
- 1:00 p.m.–4:10 p.m. *General Contributed Paper Session, IV*
- 1:00 p.m.–4:15 p.m. **SIAM MINISYMPOSIUM**
- 1:00 p.m.–2:20 p.m. **MAA PANEL DISCUSSION** *Using open source software for undergraduate courses.*
- 1:00 p.m.–2:20 p.m. **MAA COMMITTEE ON GRADUATE STUDENTS PANEL DISCUSSION** *Teaching postdocs: A journey from graduate school to a position in the world of mathematics.*
- 1:00 p.m.–2:20 p.m. **MAA CUPM SUBCOMMITTEE ON RESEARCH BY UNDERGRADUATES-PROJECT NEXT PANEL DISCUSSION** *Preparing students to communicate mathematics.*
- 1:00 p.m.–2:15 p.m. **MAA-PROJECT NEXT PANEL DISCUSSION** *Establishing your identity as a post-tenure professor*
- 1:00 p.m.–4:10 p.m. **AMS SESSIONS FOR CONTRIBUTED PAPERS**
- 1:00 p.m.–4:00 p.m. **SUMMER PROGRAM FOR WOMEN IN MATHEMATICS (SPWM) REUNION**
- 2:00 p.m.–4:00 p.m. **MAA POSTER SESSION ON PROJECTS SUPPORTED BY THE NSF DIVISION OF UNDERGRADUATE EDUCATION**
- 2:15 p.m.–3:05 p.m. **AMS INVITED ADDRESS** *Unearthing the visions of a master: The web of Ramanujan's mock theta functions in number theory.* Ken Ono
- 2:30 p.m.–4:00 p.m. **AMS COMMITTEE ON THE PROFESSION PRESENTATION**
- 2:30 p.m.–3:50 p.m. **SIGMAA ON STATISTICS EDUCATION AND ASA-MAA JOINT COMMITTEE ON STATISTICS PANEL DISCUSSION** *Hiring, tenuring, and promoting statisticians in a mathematics or mathematical sciences department.*
- 2:30 p.m.–3:50 p.m. **MAA COMMITTEE ON THE TEACHING OF UNDERGRADUATE MATHEMATICS PANEL DISCUSSION** *Online homework systems: A pedagogical prospective.*
- 3:00 p.m.–4:00 p.m. **MAA SPECIAL FILM PRESENTATION** *The Story of Maths (Part I).*
- 3:20 p.m.–4:10 p.m. **AMS INVITED ADDRESS** *Categorification of quantum groups and link invariants.* Mikhail Khovanov
- 4:25 p.m.–5:25 p.m. **JOINT PRIZE SESSION**
- 5:30 p.m.–6:30 p.m. **JOINT PRIZE SESSION RECEPTION**

5:45 p.m.–6:45 p.m.	SIGMAA ON THE PHILOSOPHY OF MATHEMATICS BUSINESS MEETING AND RECEPTION
5:45 p.m.–7:15 p.m.	SIGMAA ON QUANTITATIVE LITERACY BUSINESS MEETING
5:45 p.m.–7:00 p.m.	UNIVERSITY OF IOWA MATHEMATICS DEPARTMENT RECEPTION
5:45 p.m.–7:00 p.m.	ASSOCIATION OF LESBIAN, GAY, BISEXUAL, AND TRANSGENDERED MATHEMATICIANS RECEPTION
5:45 p.m.–7:00 p.m.	MAA TWO-YEAR COLLEGE RECEPTION
5:45 p.m.–7:15 p.m.	NEW MEXICO STATE UNIVERSITY MATHEMATICS ASSOCIATION RECEPTION
6:00 p.m.–7:30 p.m.	MAA SPECIAL DRAMATIC PRESENTATION <i>Lewis Carroll in Numberland.</i>
6:00 p.m.–9:00 p.m.	ASSOCIATION OF CHRISTIANS IN THE MATHEMATICAL SCIENCES BANQUET
6:00 p.m.–7:00 p.m.	UNIVERSITY OF CHICAGO MATHEMATICS ALUMNI RECEPTION
6:00 p.m.–8:00 p.m.	OHIO STATE UNIVERSITY DEPARTMENT OF MATHEMATICS RECEPTION
6:00 p.m.–8:00 p.m.	RECEPTION FOR UNIVERSITY OF MARYLAND ALUMNI AND FRIENDS
6:30 p.m.–9:00 p.m.	MER BANQUET
7:00 p.m.–8:00 p.m.	SIGMAA ON MATHEMATICS AND THE ARTS BUSINESS MEETING
7:30 p.m.–8:30 p.m.	YOUNG MATHEMATICIANS NETWORK TOWN MEETING
8:15 p.m.–9:45 p.m.	KNITTING CIRCLE

Wednesday, January 7

7:30 a.m.–4:00 p.m.	JOINT MEETINGS REGISTRATION , Marriot Ballroom Lobby, Lobby Level, Marriott Wardman Park Hotel
8:00 a.m.–10:50 a.m.	AMS-MAA-SIAM SPECIAL SESSION ON RESEARCH IN MATHEMATICS BY UNDERGRADUATES, IV
8:00 a.m.–10:50 a.m.	AMS-MAA-MER SPECIAL SESSION ON MATHEMATICS AND EDUCATION REFORM, III
	AMS-MAA SPECIAL SESSIONS
8:00 a.m.–10:50 a.m.	<i>History of Mathematics, I</i>
8:00 a.m.–10:50 a.m.	<i>The Scholarship of Teaching and Learning, II</i>
	AMS SPECIAL SESSIONS
8:00 a.m.–10:50 a.m.	<i>Representation Theory of Lie Algebras and Algebraic Groups, II</i>
8:00 a.m.–10:50 a.m.	<i>Discrete Dynamical Systems in Periodic Environments, I</i>
8:00 a.m.–10:50 a.m.	<i>Homotopy Theory and Higher Categories, I</i>
8:00 a.m.–10:50 a.m.	<i>Algebraic Cryptography and Generic Complexity, I</i>
8:00 a.m.–10:50 a.m.	<i>Financial Mathematics, I</i>
8:00 a.m.–10:50 a.m.	<i>Dynamical Systems and Differential Equations: Theory and Applications, I</i>
8:00 a.m.–10:50 a.m.	<i>Asymptotic Geometric Analysis, I</i>
8:00 a.m.–10:50 a.m.	<i>Harmonic Analysis, II</i>
8:00 a.m.–10:50 a.m.	<i>Continued Fractions, I</i>
8:00 a.m.–10:50 a.m.	<i>Automorphic and Modular Forms in Number Theory, III</i>
8:00 a.m.–10:50 a.m.	<i>Computational Algebra and Convexity, I</i>
	MAA CONTRIBUTED PAPER SESSIONS
8:00 a.m.–10:55 a.m.	<i>Mathematics Experiences in Business, Industry, and Government</i>
8:00 a.m.–10:55 a.m.	<i>Mathlets for Teaching and Learning Mathematics, I</i>
8:00 a.m.–10:55 a.m.	<i>Productive Roles for Math Faculty in the Professional Development of K–12 Teachers</i>
8:00 a.m.–10:55 a.m.	<i>Quantitative Literacy Across the Curriculum</i>
8:00 a.m.–10:55 a.m.	<i>Statistics in K–12 Education: How Will It Affect Statistics at the College Level?</i>
8:00 a.m.–10:55 a.m.	<i>General Contributed Paper Session, V</i>
8:00 a.m.–10:50 a.m.	SIAM MINISYMPOSIUM

- 8:00 a.m.–10:55 a.m. **AMS SESSIONS FOR CONTRIBUTED PAPERS**
- 8:00 a.m.–5:30 p.m. **ASL INVITED ADDRESSES AND CONTRIBUTED PAPER SESSIONS**
- 8:00 a.m.–11:00 a.m. **PME COUNCIL**
- 8:00 a.m.–7:00 p.m. **EMPLOYMENT CENTER**
- 8:30 a.m.–10:30 a.m. **AMS-MAA GRAD SCHOOL FAIR** *Undergrads! Take this opportunity to meet representatives from mathematical sciences graduate programs.*
- 9:00 a.m.–9:50 a.m. **MAA INVITED ADDRESS** *Title to be announced.* **Daniel C. Rockmore**
- 9:00 a.m.–11:00 a.m. **MAA MINICOURSE #11: PART B** *Planning and teaching mathematics capstone courses for preservice secondary school teachers.*
- 9:00 a.m.–11:00 a.m. **MAA MINICOURSE #1: PART B** *Discrete models in biology and simulations.*
- 9:00 a.m.–11:00 a.m. **MAA MINICOURSE #6: PART B** *Teaching with clickers and classroom voting.*
- 9:00 a.m.–10:20 a.m. **SIGMAA ON ENVIRONMENTAL MATHEMATICS PANEL DISCUSSION** *Environmental mathematics: Getting it in the curriculum.*
- 9:00 a.m.–10:20 a.m. **MAA-NCTM COMMITTEE ON MUTUAL CONCERNS-MAA COMMITTEE ON ARTICULATION AND PLACEMENT PANEL DISCUSSION** *Placement testing: Is it working?*
- 9:00 a.m.–5:00 p.m. **STUDENT HOSPITALITY CENTER**
- 9:30 a.m.–5:30 p.m. **EXHIBITS AND BOOK SALES**
- 10:00 a.m.–11:00 a.m. **AMS SPECIAL PRESENTATION** *Who wants to be a mathematician.*
- 10:05 a.m.–10:55 a.m. **AMS INVITED ADDRESS** *Nonlinear problems involving integral diffusions.* **Luis A. Caffarelli**
- 11:10 a.m.–12:00 p.m. **AMS-MAA INVITED ADDRESS** *Title to be announced.* **Maryam Mirzakhani**
- 1:00 p.m.–2:00 p.m. **AMS COLLOQUIUM LECTURES: LECTURE III** *Homogeneous dynamics and number theory.* **Grigorii A. Margulis**
- 1:00 p.m.–2:00 p.m. **MAA LECTURE FOR STUDENTS** *Some elementary problems that remain unsolved.* **Nathaniel Dean**
- 1:00 p.m.–6:00 p.m. **AMS CURRENT EVENTS BULLETIN**
- 1:00 p.m.–5:50 p.m. **AMS-MAA SPECIAL SESSION ON THE HISTORY OF MATHEMATICS, II**
- 1:00 p.m.–5:50 p.m. **AMS-ASL SPECIAL SESSION ON MODEL THEORETIC METHODS IN FINITE COMBINATORICS, II**
- AMS SPECIAL SESSIONS**
- 1:00 p.m.–5:50 p.m. *Commutative Rings, I*
- 1:00 p.m.–5:50 p.m. *Mathematics and Mathematics Education in Fiber Arts*
- 1:00 p.m.–5:50 p.m. *Conformal Geometry, Twistor Theory, and Integrable Systems*
- 1:00 p.m.–5:50 p.m. *Discrete Dynamical Systems in Periodic Environments, II*
- 1:00 p.m.–5:50 p.m. *Homotopy Theory and Higher Categories, II*
- 1:00 p.m.–5:50 p.m. *Algebraic Cryptography and Generic Complexity, II*
- 1:00 p.m.–5:50 p.m. *Asymptotic Geometric Analysis, II*
- 1:00 p.m.–5:50 p.m. *Nonsmooth Analysis in Inverse and Variational Problems, II*
- 1:00 p.m.–5:50 p.m. *Categorification and Link Homology, II*
- 1:00 p.m.–5:50 p.m. *The Role of Generalized Maximal Monotonicity Frameworks in Optimization and Control Theory with Applications, II*
- 1:00 p.m.–5:50 p.m. *Computational Algebra and Convexity, II*
- MAA CONTRIBUTED PAPER SESSIONS**
- 1:00 p.m.–6:00 p.m. *Mathlets for Teaching and Learning Mathematics, II*
- 1:00 p.m.–6:00 p.m. *Statistics Resources on the Web*
- 1:00 p.m.–6:00 p.m. *Assessment of Student Learning in Undergraduate Mathematics*
- 1:00 p.m.–6:00 p.m. *General Contributed Paper Session, VI*
- 1:00 p.m.–6:00 p.m. **SIAM MINISYMPOSIUM**
- 1:00 p.m.–4:00 p.m. **NAM GRANVILLE-BROWN-HAYNES SESSION OF PRESENTATIONS BY RECENT DOCTORAL RECIPIENTS IN THE MATHEMATICAL SCIENCES**

Meetings & Conferences

- 1:00 p.m.–2:20 p.m. **MAA PANEL DISCUSSION** *Refocusing the courses below calculus: The view from the Dean's office.*
- 1:00 p.m.–2:20 p.m. **MAA PANEL DISCUSSION** *Power of three: How the public, private, and academic sector need to work together to restore education in America.*
- 1:00 p.m.–5:55 p.m. **AMS SESSIONS FOR CONTRIBUTED PAPERS**
- 2:15 p.m.–4:15 p.m. **MAA MINICOURSE #12: PART B** *SNAP Math Fairs in elementary education.*
- 2:15 p.m.–4:15 p.m. **MAA MINICOURSE #2: PART B** *Using GeoGebra to create activities and applets for visualization and exploration.*
- 2:15 p.m.–4:15 p.m. **MAA MINICOURSE #7: PART B** *A Game Theory path to quantitative literacy.*
- 2:15 p.m.–4:10 p.m. **RMMC BOARD OF DIRECTORS**
- 2:30 p.m.–4:00 p.m. **MAA PRESENTATIONS BY TEACHING AWARDS RECIPIENTS**
- 2:30 p.m.–4:00 p.m. **AMS COMMITTEE ON SCIENCE POLICY PANEL DISCUSSION**
- 2:30 p.m.–3:50 p.m. **MAA PANEL DISCUSSION** *From the trenches: Middle school teachers look at their training.*
- 3:00 p.m.–4:00 p.m. **MAA SPECIAL FILM PRESENTATION** *The Story of Maths (Part II).*
- 4:00 p.m.–5:30 p.m. **MAA POSTER SESSION ON RESEARCH BY UNDERGRADUATE STUDENTS**
- 4:20 p.m.–5:10 p.m. **AMS COMMITTEE ON SCIENCE POLICY-MAA SCIENCE POLICY COMMITTEE GOVERNMENT SPEAKER** *Speaker and title to be announced.*
- 5:00 p.m.–6:00 p.m. **SIGMAA ON BUSINESS, INDUSTRY, AND GOVERNMENT GUEST LECTURE**
- 5:00 p.m.–7:00 p.m. **MAA INFORMATION SESSION** *Actuarial education.*
- 5:30 p.m.–7:30 p.m. **UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN DEPARTMENT OF MATHEMATICS ALUMNI RECEPTION**
- 5:45 p.m.–7:00 p.m. **UNIVERSITY OF KANSAS ALUMNI AND FRIENDS RECEPTION**
- 6:00 p.m.–7:00 p.m. **HAWKES LEARNING SYSTEMS PRESENTATION**
- 6:00 p.m.–7:00 p.m. **MATHEMATICAL REVIEWS RECEPTION**
- 6:00 p.m.–8:40 p.m. **NAM RECEPTION, BANQUET, AND COX-TALBOT ADDRESS**
- 6:30 p.m.–8:30 p.m. **BUDAPEST SEMESTERS IN MATHEMATICS REUNION**
- 7:00 p.m.–8:30 p.m. **AMS SPECIAL FILM PRESENTATION** *Wolfgang Doeblin—A Mathematician Rediscovered.*
- 7:00 p.m.–9:00 p.m. **SIGMAA ON MATHEMATICS AND THE ARTS SPECIAL PRESENTATION** *Mathematics and love: A poetry reading*
- 7:00 p.m.–9:00 p.m. **NATIONAL ASSOCIATION OF MATH CIRCLES (NAMC) RECEPTION AND MEETING**
- 7:00 p.m.–9:00 p.m. **RECEPTION FOR MILLERSVILLE UNIVERSITY ALUMNI ASSOCIATION**
- 8:00 p.m.–8:40 p.m. **NAM COX-TALBOT ADDRESS** *Title to be announced who??*
- 8:30 p.m.–10:30 p.m. **MAA-PROJECT NEXT RECEPTION** *All Project NExT fellows, consultants, and other friends of Project NExT are invited.*

Thursday, January 8

- 7:30 a.m.–2:00 p.m. **JOINT MEETINGS REGISTRATION**, Marriot Ballroom Lobby, Lobby Level, Marriott Wardman Park Hotel
- AMS-MAA SPECIAL SESSIONS**
- 8:00 a.m.–10:50 a.m. *History of Mathematics, III*
- 8:00 a.m.–10:50 a.m. *Inquiry-Based Learning, I*
- AMS SPECIAL SESSIONS**
- 8:00 a.m.–10:50 a.m. *Function Theoretic Operator Theory, I*
- 8:00 a.m.–10:50 a.m. *Commutative Rings, II*
- 8:00 a.m.–10:50 a.m. *New Connections Between Topology, Combinatorics, and Physics, I*
- 8:00 a.m.–10:50 a.m. *SAGE and Mathematical Research Using Open Source Software, I*

- 8:00 a.m.–10:50 a.m. *Nonlinear Evolution Equations and Their Applications, I*
- 8:00 a.m.–10:50 a.m. *Homotopy Theory and Higher Categories, II*
- 8:00 a.m.–10:50 a.m. *Spectra of Matrix Patterns and Applications to Dynamical Systems, I*
- 8:00 a.m.–10:50 a.m. *Financial Mathematics, II*
- 8:00 a.m.–10:50 a.m. *Dynamical Systems and Differential Equations: Theory and Applications, II*
- 8:00 a.m.–10:50 a.m. *Continued Fractions, II*
- 8:00 a.m.–10:50 a.m. *Orderings in Logic and Topology, I*
- 8:00 a.m.–10:50 a.m. *Scientific Computing and Advanced Computation, I*
- MAA CONTRIBUTED PAPER SESSIONS**
- 8:00 a.m.–10:55 a.m. *College Algebra: Focusing on Conceptual Understanding, Real-World Data, and Mathematical Modeling*
- 8:00 a.m.–10:55 a.m. *Developmental Mathematics Education: Helping Under-Prepared Students Transition to College-Level Mathematics*
- 8:00 a.m.–10:55 a.m. *Mathematics and the Arts, I*
- 8:00 a.m.–10:55 a.m. *Promoting Deep Learning for Mathematics Majors through Experiential Learning, Writing, and Reflection, I*
- 8:00 a.m.–10:55 a.m. *MAA General Contributed Paper Session, VII*
- 8:00 a.m.–10:50 a.m. **SIAM MINISYMPOSIUM**
- 8:00 a.m.–10:55 a.m. **AMS SESSIONS FOR CONTRIBUTED PAPERS**
- 8:00 a.m.–5:30 p.m. **ASL INVITED ADDRESSES AND CONTRIBUTED PAPER SESSIONS**
- 8:20 a.m.–4:30 p.m. **AWM WORKSHOP** *This session has several parts that will be listed separately by time in this program. All presentations are open to all JMM participants.*
- 8:30 a.m.–10:20 a.m. **AWM WORKSHOP: RESEARCH PRESENTATIONS BY RECENT PH.D.'S, I**
- 8:30 a.m.–10:00 a.m. **AMS COMMITTEE ON EDUCATION PANEL DISCUSSION**
- 9:00 a.m.–9:50 a.m. **AMS INVITED ADDRESS** *On Nash, Brouwer, and other nonconstructive proofs. Christos Papadimitriou*
- 9:00 a.m.–11:00 a.m. **MAA MINICOURSE #13: PART B** *Directing undergraduate research.*
- 9:00 a.m.–11:00 a.m. **MAA MINICOURSE #3: PART B** *Educating about the state of the planet and sustainability while enhancing calculus.*
- 9:00 a.m.–11:00 a.m. **MAA MINICOURSE #8: PART B** *Taking symbols seriously: Teaching form and function in college algebra.*
- 9:00 a.m.–10:20 a.m. **SIGMAA ON STATISTICS EDUCATION PANEL DISCUSSION** *Technology in statistics education.*
- 9:00 a.m.–10:00 a.m. **NAM PANEL DISCUSSION** *Title to be announced.*
- 9:00 a.m.–12:00 p.m. **EXHIBITS AND BOOK SALES**
- 9:00 a.m.–2:00 p.m. **STUDENT HOSPITALITY CENTER**
- 9:00 a.m.–12:00 p.m. **EMPLOYMENT CENTER**
- 9:30 a.m.–10:45 a.m. **MAA-PROJECT NEXT PANEL DISCUSSION** *Designing and teaching a geometry course for preservice secondary mathematics teachers.*
- 10:00 a.m.–10:55 a.m. **NAM BUSINESS MEETING**
- 10:05 a.m.–10:55 a.m. **MAA INVITED ADDRESS** *Geometreks. Ivars Peterson*
- 10:30 a.m.–11:00 a.m. **AMW WORKSHOP: POSTER SESSION WITH PRESENTATIONS FROM WOMEN GRADUATE STUDENTS**
- 11:10 a.m.–11:40 a.m. **MAA BUSINESS MEETING**
- 11:45 a.m.–12:15 p.m. **AMS BUSINESS MEETING**
- 12:05 p.m.–1:30 p.m. **LUNCHEON IN HONOR OF RETIRING MAA ASSOCIATE SECRETARY JAMES TATTERSALL**
- 1:00 p.m.–1:50 p.m. **NAM CLAYTOR-WOODARD LECTURE** *Speaker and title to be announced*
- AMS-MAA SPECIAL SESSIONS**
- 1:00 p.m.–5:50 p.m. *History of Mathematics, IV*

- 1:00 p.m.–5:50 p.m. *Inquiry-Based Learning, II*
- AMS SPECIAL SESSIONS**
- 1:00 p.m.–5:50 p.m. *Function Theoretic Operator Theory, II*
- 1:00 p.m.–5:50 p.m. *Complex Dynamics and Complex Function Theory, I*
- 1:00 p.m.–5:50 p.m. *Commutative Rings, III*
- 1:00 p.m.–5:50 p.m. *New Connections Between Topology, Combinatorics, and Physics, II*
- 1:00 p.m.–5:50 p.m. *Geometry, Algebra, and Topology of Character Varieties*
- 1:00 p.m.–5:50 p.m. *SAGE and Mathematical Research Using Open Source Software, II*
- 1:00 p.m.–5:50 p.m. *Group Actions on Curves*
- 1:00 p.m.–5:50 p.m. *Nonlinear Evolution Equations and Their Applications, II*
- 1:00 p.m.–5:50 p.m. *Spectra of Matrix Patterns and Applications to Dynamical Systems, II*
- 1:00 p.m.–5:50 p.m. *Financial Mathematics, III*
- 1:00 p.m.–5:50 p.m. *The Redistricting Problem*
- 1:00 p.m.–5:50 p.m. *Orderings in Logic and Topology, II*
- 1:00 p.m.–5:50 p.m. *Scientific Computing and Advanced Computation, II*
- 1:00 p.m.–3:00 p.m. **MAA MINICOURSE #14: PART B** *Teaching a course in the history of mathematics.*
- 1:00 p.m.–3:00 p.m. **MAA MINICOURSE #4: PART B** *An introduction to the mathematics of modern cryptography.*
- 1:00 p.m.–3:00 p.m. **MAA MINICOURSE #9: PART B** *Beyond formulas and algorithms: Teaching a conceptual/thematic single variable calculus course.*
- MAA CONTRIBUTED PAPER SESSIONS**
- 1:00 p.m.–5:30 p.m. *Guided Discovery in Mathematics Education*
- 1:00 p.m.–5:30 p.m. *Mathematics and the Arts, II*
- 1:00 p.m.–5:30 p.m. *Promoting Deep Learning for Mathematics Majors through Experiential Learning, Writing, and Reflection, II*
- 1:00 p.m.–5:30 p.m. *General Contributed Paper Session, VIII*
- 1:00 p.m.–6:00 p.m. **SIAM MINISYMPOSIUM**
- 1:00 p.m.–2:20 p.m. **MAA PANEL DISCUSSION** *Beyond T.A. training: Calculus curriculum development by graduate teaching assistants.*
- 1:00 p.m.–2:00 p.m. **AWM WORKSHOP PANEL DISCUSSION** *What is the right job for me?*
- 1:00 p.m.–5:55 p.m. **AMS SESSIONS FOR CONTRIBUTED PAPERS**
- 2:30 p.m.–3:50 p.m. **MAA PANEL DISCUSSION** *Mathematics and public policy.*
- 2:30 p.m.–4:20 p.m. **AWM WORKSHOP: RESEARCH PRESENTATIONS BY RECENT PH.D.'S, II**
- 3:30 p.m.–5:30 p.m. **MAA MINICOURSE #10: PART B** *The ubiquitous Catalan numbers and their applications.*
- 3:30 p.m.–5:30 p.m. **MAA MINICOURSE #5: PART B** *Developing departmental self-studies.*
- 6:00 p.m.–7:00 p.m. **AMS-MAA-SIAM GERALD AND JUDITH PORTER PUBLIC LECTURE** *The story of a mathematical friendship. Steven Strogatz*
- 7:00 p.m.–7:45 p.m. **AMS-MAA-SIAM JOINT RECEPTION**
- 7:45 p.m.–10:00 p.m. **AMS BANQUET**

Headlines & Deadlines for students

Sign up
Today!

Email notifications of news, helpful websites, special programs, book sales, and deadlines for applications for fellowships and grants, meeting registrations, and more.

Headlines & Deadlines for Students, a service from the AMS Public Awareness Office, provides email notification of mathematics news and of upcoming deadlines. These email notifications are issued about once a month, and when there's special news. Imminent deadlines are included in these emails, which link to a web page that's a centralized source for information relevant to students and faculty advisors, at: www.ams.org/news-for-students/

Sign up for the email service at: www.ams.org/news-for-students/signup

Check out the latest *Headlines & Deadlines for Students* for news and due dates for applications, registrations, proposals...

Pi Mu Epsilon Student Paper Presentation Awards

Fellowships and Grants

New Mathematical Moments

Stipends for Study and Travel

Marshall Scholarships

Trjitzinsky Awards

Math in Moscow Semester - Call for Applications

AWM Essay Contest

Special Book Sales on AMS Bookstore

Poster Session Proposals

Putnam Exam Results

Employment Center Registration

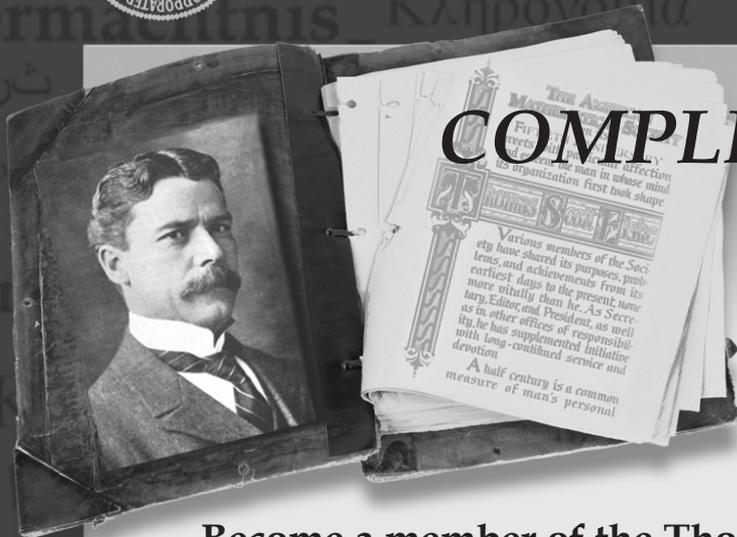
Clay Research Fellowships



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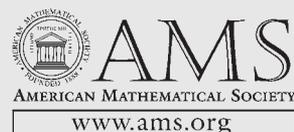
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For more information about planned giving and Thomas S. Fiske, please visit www.ams.org/giving-to-ams.

Development Office
Email: development@ams.org
Phone: (401) 455-4000
Toll free in the US and Canada (800) 321-4267
Postal mail: 201 Charles Street,
Providence, RI 02904-2294



2009 Joint Meetings Advance Registration/Housing Form



Name _____
(please write name as you would like it to appear on your badge)

Mailing Address _____

Telephone _____ Fax: _____

In case of emergency (for you) at the meeting, call: Day # _____ Evening #: _____

Email Address _____
(Acknowledgment of this registration will be sent to the email address given here, unless you check this box: **Send by U.S. Mail**)

Affiliation for badge _____

Nonmathematician guest badge name _____
(please note charge below)

I DO NOT want my program and badge to be mailed to me on 12/12/08. (Materials will be mailed unless you check this box.)

Registration Fees

Joint Meetings	by Dec 15	at mtg	Subtotal
<input type="checkbox"/> Member AMS, ASL, CMS, MAA, SIAM	US \$216	US \$282	
<input type="checkbox"/> Nonmember	US \$335	US \$435	
<input type="checkbox"/> Graduate Student	US \$ 44	US \$ 54	
<input type="checkbox"/> Undergraduate Student	US \$ 30	US \$ 40	
<input type="checkbox"/> High School Student	US \$ 5	US \$ 10	
<input type="checkbox"/> Unemployed	US \$ 43	US \$ 53	
<input type="checkbox"/> Temporarily Employed	US \$174	US \$202	
<input type="checkbox"/> Developing Countries Special Rate	US \$ 43	US \$ 53	
<input type="checkbox"/> Emeritus Member of AMS or MAA	US \$ 43	US \$ 53	
<input type="checkbox"/> High School Teacher	US \$ 43	US \$ 53	
<input type="checkbox"/> Librarian	US \$ 43	US \$ 53	
<input type="checkbox"/> Nonmathematician Guest	US \$ 15	US \$ 15	
			\$ _____

AMS Short Course: *Quantum Computation and Quantum Information (1/3-1/4)*

<input type="checkbox"/> Member of AMS or MAA	US \$ 96	US \$130	
<input type="checkbox"/> Nonmember	US \$130	US \$160	
<input type="checkbox"/> Student, Unemployed, Emeritus	US \$ 44	US \$ 65	
			\$ _____

MAA Short Course: *Data Mining & New Trends in Teaching Statistics. (1/3-1/4)*

<input type="checkbox"/> Member of MAA or AMS	US \$125	US \$140	
<input type="checkbox"/> Nonmember	US \$175	US \$190	
<input type="checkbox"/> Student, Unemployed, Emeritus	US \$ 50	US \$ 60	
			\$ _____

MAA Minicourses (see listing in text)

I would like to attend: One Minicourse Two Minicourses
Please enroll me in MAA Minicourse(s) # _____ and/or # _____
In order of preference, my alternatives are: # _____ and/or # _____
Price: US \$60 for each minicourse.
(For more than 2 minicourses call or email the MMSB.) \$ _____

Employment Center

Applicant résumé forms and employer job listing forms can be found at www.ams.org/emp-reg/.

<input type="checkbox"/> Employer—Quiet Area Table (2 interviewers)	US \$250	US \$330	
<input type="checkbox"/> Employer— Additional Quiet Area Table	US \$100	N/A	
<input type="checkbox"/> Employer— Committee Table (3-6 interviewers)	US \$350	US \$425	
<input type="checkbox"/> Employer— Curtained Booth (1-3 interviewers)	US \$425	N/A	
<input type="checkbox"/> Applicant	US \$ 25	US \$40	
			\$ _____

Graduate School Fair

<input type="checkbox"/> Graduate School Fair Table	US \$ 50	N/A	
			\$ _____

Events with Tickets

MER Banquet (1/6)	US \$53.00	# _____ Regular	# _____ Veg	# _____ Kosher
NAM Banquet (1/7)	US \$52.00	# _____ Regular	# _____ Veg	# _____ Kosher
AMS Banquet (1/8)	US \$52.50	# _____ Regular	# _____ Veg	# _____ Kosher
Luncheon for Jim Tattersall (1/8)	US \$36.00	# _____ Reg	# _____ Veg	# _____ Kosher
				\$ _____

Other Events

Graduate Student/First Time Attendee Reception (1/5) (no charge)

Total for Registrations and Events \$ _____

Registration for the Joint Meetings is not required for the Short Courses, but it is required for the Minicourses and the Employment Center.

Payment

Registration & Event Total (total from column on left) \$ _____

Hotel Deposit (only if paying by check) \$ _____

Total Amount To Be Paid \$ _____

(Note: A US \$5 processing fee will be charged for each returned check or invalid credit card. Debit cards are not accepted.)

Method of Payment

Check. Make checks payable to the AMS. Checks drawn on foreign banks must be in equivalent foreign currency at current exchange rates.

Credit Card. VISA, MasterCard, AMEX, Discover (no others accepted)

Card number: _____

Exp. date: _____ Zipcode of credit card billing address: _____

Signature: _____

Name on card: _____

Purchase order # _____ (please enclose copy)

Other Information

Mathematical Reviews field of interest # _____

How did you hear about this meeting? Check one: Colleague(s) Notices
 Focus Internet

This is my first Joint Mathematics Meetings.

I am a mathematics department chair.

For planning purposes for the MAA Two-year College Reception, please check if you are a faculty member at a two-year college.

I would like to receive promotions for future JMM meetings.

Please do not include my name on any promotional mailing list.

Please this box if you have a disability requiring special services. 

Mail to:

Mathematics Meetings Service Bureau (MMSB)

P. O. Box 6887

Providence, RI 02940-6887 Fax: 401-455-4004

Questions/changes call: 401-455-4143 or 1-800-321-4267 x4143; mmsb@ams.org

Deadlines *Please register by the following dates for:*

Résumés/job descriptions printed in the *Winter Lists* **Oct. 22, 2008**

To be eligible for the complimentary room drawing: **Oct. 31, 2008**

For housing reservations, badges/programs mailed: **Nov. 14, 2008**

For housing changes/cancellations through MMSB: **Dec. 5, 2008**

For advance registration for the Joint Meetings, Employment Center, Short Courses, MAA Minicourses, & Tickets: **Dec. 15, 2008**

For 50% refund on banquets, cancel by: **Dec. 22, 2008***

For 50% refund on advance registration, Minicourses & Short Courses, cancel by: **Dec. 30, 2008***

***no refunds after this date**

Washington DC Joint Mathematics Meetings Hotel Reservations

To ensure accurate assignments, please rank hotels in order of preference by writing 1, 2, 3, etc., in the column on the left and by circling the requested room type and rate. If the rate or the hotel requested is no longer available, you will be assigned a room at a ranked or unranked hotel at a comparable rate. Please call the MMSB for details on suite configurations, sizes, availability, etc. Suite reservations can only be made through the MMSB to receive the convention rate. Reservations at the following hotels must be made through the MMSB to receive the convention rates listed. Reservations made directly with the hotels at the JMM rate will be changed to a higher rate. All rates are subject to a 14.5% sales tax. **Guarantee requirements: First night deposit by check (add to payment on reverse of form) or a credit card guarantee. The Hilton will charge credit cards for the first night deposit immediately upon receipt of reservations.**

Deposit enclosed (see front of form) Hold with my credit card Card Number _____ Exp. Date _____ Signature _____

Date and Time of Arrival _____ Date and Time of Departure _____

Name of Other Room Occupant _____ Arrival Date _____ Departure Date _____ Child (give age(s)) _____

Name of Other Room Occupant _____ Arrival Date _____ Departure Date _____ Child (give age(s)) _____

Order of choice	Hotel	Single	Double 1 bed	Double 2 beds	Triple 2 beds	Triple 2 beds w/cot	Triple - king or queen w/cot	Quad 2 beds	Quad 2 beds w/cot	Suites Starting rates
	Marriott Wardman Park Hotel									
	Marriott Regular Rate	US \$150	US \$150	US \$150	US \$165	US \$165	US \$165	US \$180	US \$180	US \$450
	Student Rate	US \$120	US \$120	US \$120	US \$128	US \$128	US \$128	US \$136	US \$136	N/A
	Omni Shoreham Hotel									
	Omni Regular Rate	US \$150	US \$150	US \$150	US \$170	US \$195	US \$195	US \$170	US \$195	US \$325
	Student Rate	US \$120	US \$120	US \$120	US \$136	US \$161	US \$161	US \$136	US \$161	N/A
	Hilton Washington									
	Hilton Rate 1*	US \$109	US \$109	US \$109	US \$109	N/A	US \$134	US \$109	N/A	US \$359
	Hilton Rate 2*	US \$119	US \$119	US \$119	US \$119	N/A	US \$144	US \$119	N/A	US \$359

* Please note: Hilton 1 and Hilton 2 rooms are identical.

Special Housing Requests:

I have disabilities as defined by the ADA that require a sleeping room that is accessible to the physically challenged. My needs are: _____
 Other requests: _____

I am a member of a hotel frequent-travel club and would like to receive appropriate credit.

The hotel chain and card number are: _____

Email confirmations (no paper) will be sent by the Marriott and the Hilton. (The Omni will not send confirmations.)
Please provide your email address for Marriott & Hilton confirmations: _____

If you are not making a reservation, please check off one of the following:

- I plan to make a reservation at a later date.
- I will be making my own reservations at a hotel not listed. Name of hotel: _____
- I live in the area or will be staying privately with family or friends.
- I plan to share a room with _____, who is making the reservations.

Meetings and Conferences of the AMS

Associate Secretaries of the AMS

Western Section: Michel L. Lapidus, Department of Mathematics, University of California, Surge Bldg., Riverside, CA 92521-0135; e-mail: lapidus@math.ucr.edu; telephone: 951-827-5910.

Central Section: Susan J. Friedlander, Department of Mathematics, University of Illinois at Chicago, 851 S. Morgan (M/C 249), Chicago, IL 60607-7045; e-mail: susan@math.nwu.edu; telephone: 312-996-3041.

Eastern Section: Lesley M. Sibner (until January 31, 2009), Department of Mathematics, Polytechnic University, Brooklyn,

NY 11201-2990; e-mail: lsibner@duke.poly.edu; telephone: 718-260-3505. **Steven H. Weintraub** (after January 31, 2009), Department of Mathematics, Lehigh University, Bethlehem, PA 18105-3174; e-mail: steve.weintraub@lehigh.edu; telephone: 610-758-3717.

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.

2009 Washington, DC, Meeting: Bernard Russo, Department of Mathematics, University of California, Irvine, CA 92697-3875, e-mail: brusso@math.uci.edu; telephone: 949-824-5505.

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:

2008

October 4-5	Vancouver, Canada	p. 1165
October 11-12	Middletown, Connecticut	p. 1166
October 17-19	Kalamazoo, Michigan	p. 1166
October 24-26	Huntsville, Alabama	p. 1167
December 17-21	Shanghai, People's Republic of China	p. 1168

2009

January 5-8	Washington, DC Annual Meeting	p. 1169
March 27-29	Urbana, Illinois	p. 1194
April 4-5	Raleigh, North Carolina	p. 1195
April 25-26	Worcester, Massachusetts	p. 1195
April 25-26	San Francisco, California	p. 1196
Oct. 16-18	Waco, Texas	p. 1196
Oct. 24-25	University Park, Pennsylvania	p. 1197
Oct. 30-Nov. 1	Boca Raton, Florida	p. 1197
Nov. 7-8	Riverside, California	p. 1197

2010

January 13-16	San Francisco, California Annual Meeting	p. 1198
March 27-28	Lexington, Kentucky	p. 1198
April 10-11	St. Paul, Minnesota	p. 1198

April 17-18	Albuquerque, New Mexico	p. 1198
June 2-5	Berkeley, California	p. 1199
September 18-19	Notre Dame, Indiana	p. 1199
October 9-10	Los Angeles, California	p. 1199

2011

January 5-8	New Orleans, Louisiana Annual Meeting	p. 1199
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2012

January 4-7	Boston, Massachusetts Annual Meeting	p. 1200
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2013

January 9-12	San Diego, California Annual Meeting	p. 1200
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2014

January 15-18	Baltimore, Maryland Annual Meeting	p. 1200
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2015

January 10-13	San Antonio, Texas Annual Meeting	p. 1200
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Important Information Regarding AMS Meetings

Potential organizers, speakers, and hosts should refer to page 95 in the January 2008 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 L^AT_EX is necessary to submit an electronic form, although those who use L^AT_EX may submit abstracts with such coding, and all math displays and similarly coded material (such as accent marks in text) must be typeset in L^AT_EX. Visit <http://www.ams.org/cgi-bin/abstracts/abstract.pl>. Questions about abstracts may be sent to abs-info@ams.org. Close attention should be paid to specified deadlines in this issue. Unfortunately, late abstracts cannot be accommodated.

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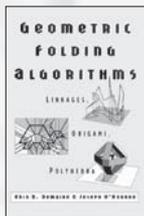
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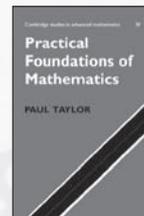


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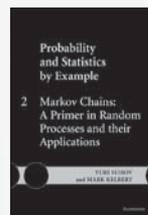


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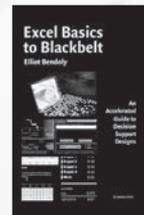
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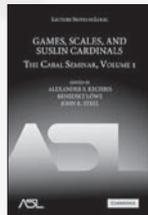
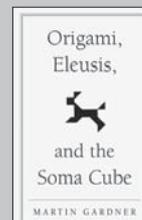
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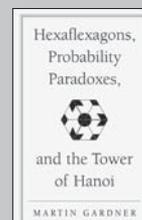
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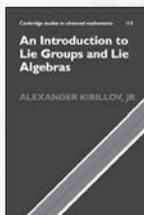


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