Department of Mathematics
University of Wisconsin

# Van Vleck Notes 2008

## From the Editor...

First of all I need to apologize for how late I am in getting this newsletter out. I won't go into all the things that have gone wrong or that I should have pushed harder on. But I do know that many people who have a connection to this department look forward each year to hearing what has happened and what is planned, and I am very sorry that you have had so long to wait!

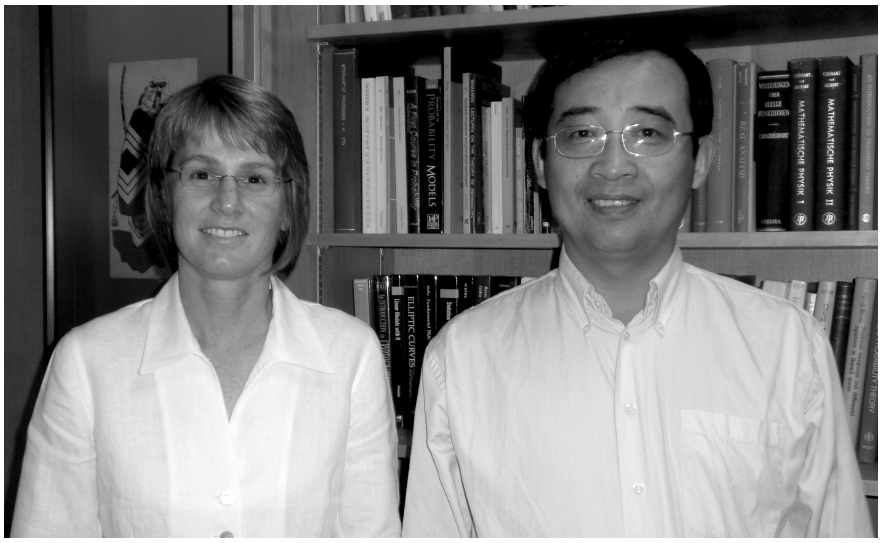
Around a university and a department like this, change is the only constant. But even more has been changing than usual. At the department level, we have a tradition in recent years that the chairs serve terms of three years, and Leslie Smith's third year was 2007-2008 so it was time to elect a new chair. At the campus level, John Wiley who had been chancellor for the Madison campus for almost a decade announced that he would leave that position in September 2008, so there was a search for a new chancellor. Within the department there were new arrivals, a retirement, promotions, honors, etc.

Our new chair, as of summer 2008, is Shi Jin. Shi has been a professor in this department since 2000: He came here from Georgia Tech, and before that had been at Courant. Shi works in computational fluid dynamics including numerical methods for conservation laws and front propogation, and numerical computation of multiscale physical problems. Since he has his own "From the Chair" page I won't say more here, but we welcome Shi as Leslie Smith completes three years as chair. Those three years were very successful for the department, with excellent additions to the faculty (see the new hires section for this year's new people), and an extensive revision and enhancement of our program preparing K-8 teachers, among many other accomplishments. Just keeping us moving along would be a significant achievment in today's financial climate, Leslie has led us in growing strength as well.

This spring we had a marvelous lecture by Jean-Pierre Bourguignon from CNRS on geometry, from the ancient Greeks through Perelman's latest results on the Poincaré Conjecture. You might think it impossible to cover that range and at the same time have depth and give insight, but he did it! Slides from his lecture are online at http://www.math.wisc.edu/~wilson/Bourguignon.pdf and convey some, but far from all, of the excitement of his presentation.

Again, I apologize for how late this is. Work is already underway to get the next newsletter back on schedule! **Bob Wilson**

# From the Chairs:...



This is the year of "change" – as you might have known, we have a new chancellor, a new associate dean for mathematical and natural sciences, and a new department chair. What remains unchanged, however, is the Department's continued success in hiring and retention and our rich academic life, as will be partly reflected by the news in this issue of the Van Vleck Notes. As the outgoing chair Leslie Smith and the newly appointed chair Shi Jin, together we highlight some of the exciting events from 2007-2008.

We successfully hired three excellent faculty members who started in the fall of 2007. Associate professor Fedor Nazarov was hired from Michigan State University. Fedor won a Salem Prize in 1999 and was an invited speaker at the 2002 International Congress of Mathematicians. Assistant Professor Jean-Luc Thiffeault joined us from the Imperial College, London, and Assistant Professor Hsian-Hua Tseng was previously a postdoc at the University of British Columbia in Canada. We also hired two Van Vleck Visiting Assistant Professors: Amanda Folsom who received her Ph.D. from UCLA, and Mustafa Kalafat whose Ph.D. is from Stony Brook University. Two more tenure-track Assistant Professors and five more Van Vleck Visiting Assistant Professors, whose stories will be featured in next year's newsletter, were hired in Spring 2008. At a time when many distinguished senior faculty retired, these excellent new hires injected fresh blood into the academic life of the department and are vital for us to remain as a leading mathematical institution in the world.

This past year our faculty continued to earn prestigious academic distinctions. These include the highly competitive Romnes Faculty Fellowship received by Alexandru Ionescu, and two major teaching awards given to Bob Wilson. These awards are reflections of our strength in both research and education. In addition, for the first time, the department awarded its Van Vleck Distinguished Research Prizes to four faculty members using the Chair's Van Vleck Professorship fund. The four awardees will use the funds not only to enhance their successful research programs but also to enrich the vibrant intellectual life of the department by sponsoring international visitors, graduate students and postdocs.

As the economy and the financial market are going through a turbulent period, as Asia is rising, and Europe is increasing its investment in higher education and scientific research, we are facing increasingly fierce competition at a global level for recruiting and retaining the best mathematical talent. Generous support and donations from our alumni have contributed in an important way to maintain the great mathematical tradition in the department. They will be even more crucial for our sustainable development into the future. Any contribution will make a difference to the Department. We would be especially grateful for contributions that directly support faculty and students in the form of endowed professorships or scholarships.

We will be very happy to meet and talk to you when you visit Madison the next time. Wherever you are, we hope Wisconsin is always in your mind.

Sincerely,
Shi Jin and Leslie Smith
Department of Mathematics

# New Faculty

Three new faculty members joined the Department of Mathematics. They are **Fedor Nazarov**, **Jean-Luc Thiffeault** and **Hsian-Hua Tseng**. They bring to us not only their depth but also their extremely wide ranging mathematical interests and activities.

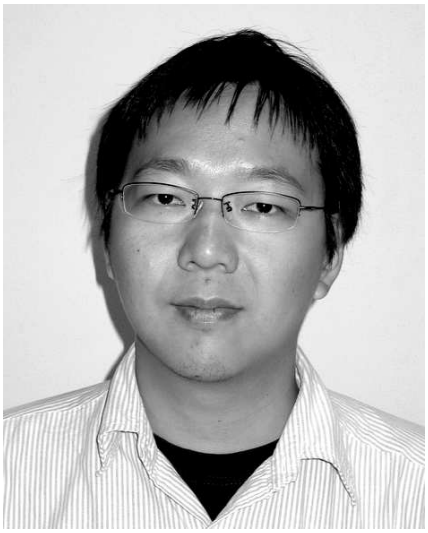
**Fedor Nazarov** joined us as an Associate Professor, coming from Michigan State where he had been for several years. He had previously been at the Institute for Advanced Study. He works in harmonic analysis, Fourier series, combinatorial geometry, partial differential equations, and probability.

In addition to invited presentations all around the North America and Europe, and many published papers, Fedor was invited to speak at the 2002 International Congress. He also won the Salem Prize in 1999, an award given every year to a young mathematician judged to have done outstanding work in Salem's field of interest, primarily the theory of Fourier series. He has an interesting collection of unsolved problems that he invites others to work on, at http://www.math.wisc.edu/~nazarov/unsolved.html.

**Jean-Luc Thiffeault** came to us as an Assistant Professor, coming from Imperial College, London. Previously he has been a visitor at Unversite' de Marseille and a scientist at Columbia, in addition to leading the Summer Program in Geophysical Fluid Dynamics at Woods Hole Oceanographic Institution. Jean-Luc is a physicist by training, with degrees from the University of Texas at Austin, and not surprisingly does applied mathematics. His research interests include fluid mixing, topological chaos, multiphase flows, and plasma physics.

Jean-Luc is active in a great many ways: For example, he is a referee/reviewer for over twenty journals and publishers. He has given invited presentations here and abroad and has edited several collected proceedings, in addition to his own research publications.

**Hsian-Hua Tseng** came to us as an Assistant Professor from a post-doc at the University of Britsh Columbia, after he got his PhD at UC-Berkeley. His research areas include algebraic and symplectic geometry Gromov-Witten theory, moduli problems, derived categories, birational geometry, and mathematical aspects of strong theory. Hsian-Hua already has many publications and invited addresses, and he is also teaching and modifying the beginning graduate topology course.



# Three Associate Professors Promoted to Professor

## Mikhail Feldman, Xianghong Gong, and Tonghai Yang have all been promoted to (full) professor in the Department of Mathematics

**Mikhail Feldman** came to us in 1999, having previously been a Ralph Boas Assistant Professor at Northwestern, and was promoted to Associate Professor in 2003. In 2007 Mikhail was promoted to (full) Professor. He received the PhD from UC-Berkeley, after undergraduate work in the Ukraine. Mikhail is an applied analyst working in non-linear PDE, in particular in shock-wave theory. He has (working with G. Q. Chen) recently solved a century-old problem in aerodynamics. He has organized sessions such as "Nonlinear Conservation Laws and Related Problems" and has been invited to present his work at many, and highly varied, venues around the world.

**Xianghong Gong** came to UW as an assistant professor in 2000, became an associate professor in 2003, and was promoted to (full) professor in the spring of 2007. He had previously been at the University of Chicago, the Institute for Advanced Study, MSRI, the University of Michigan, and Oklahoma State University. Xianghong works in several complex variables and dynamical systems. His work has interacted fruitfully with that of colleagues Jean-Pierre Rosay and Pat Ahern. His dozens of research papers and approximately seventy invited addresses attest both to his creativity and his exposition.

In addition to his mathematics, Xianghong has agreed to take on supervision of the Teaching Assistants in our department as of fall, 2008. That very time-consuming but essential job is critical to operation of the department.

**Tonghai Yang** came to Madison in 2000, was promoted to associate professor in 2003, and to (full) professor in 2007. Tonghai came to us from SUNY at Stony Brook, and he had also been at the Institute for Advanced Study, the University of Michigan, and Harvard. He works in number theory and representation theory. He has served as journal editor and advisory board member as well as producing dozens of papers and an enormous number of invited addresses. He has recently published the book **Modular Forms and Special Cycles on Shimura Curves**, with Kudla and Rapaport, in the series Annals of Mathematics.

Tonghai is much appreciated by students: In large calculus lectures they enjoy his energy and his sense of humor. In addition Tonghai has established a foundation to help poor children in his native China keep going in school. (More details at his website, `http://www.math.wisc.edu/~thyang/`) (Before going into mathematics professionally, Tonghai taught middle school. His foundation and his interests in teaching here continue from that.)

# Assistant Professor Promoted to Associate Professor

**Jordan Ellenberg** joined us in 2005, coming from Princeton. In the spring of 2007 Jordan was promoted to Associate Professor. Jordan has rapidly become a significant figure in number theory both in our own very strong group and on the national and international stage.

Jordan was off to an early start when he was in the top six Putnam finishers for two years, took first place in the US Mathematical Olympiad, and was on the US team to the International Olympiad for three years. (He received gold medals two of those three years and the silver medal the other time!) Jordan has extremely wide interests. In addition to many research papers and invited addresses, he has had expository articles in **The Washington Post** and **Slate**. He has organized the "Math And . . . " talks crossing departmental boundaries, e.g. talks by Adam Elga (from Princeton) held jointly with the philosophy department and by Dmitri Tymoczko (also Princeton) with the school of music. Jordan has also played a major role in our summer research programs for undergraduates in number theory. He helps run the annual Wisconsin Math-Science Talent Search, and he has gotten involved with the MegaMath contest we run for $5^{th}$ and $6^{th}$ graders from this area. Many of the readers of this newsletter remember fondly from Van Vleck friendly interactions between graduate students and faculty, e.g. lunches together on the $9^{th}$ floor: Jordan carries that tradition forward today!

# Van Vleck Visiting Assistant Professors

Two new PhDs began postdoctoral appointments this year as Van Vleck Visiting Assistant Professors. They are **Amanda Folsom,** and **Mustafa Kalafat**.

**Amanda Folsom** received her PhD from UCLA in 2006, working with William Duke, with a thesis titled Modular Units. Her research interests include Analytic and Algebraic Number Theory, Modular Forms, Modular units, $q$-series, Class Field Theory, Modular Curves, Complex Multiplication, and Maass forms. She is a National Science Foundation Postdoctoral Fellow as well as a UW-Madison Van Vleck Assistant Professor.

**Mustafa Kalafat** worked with Claude LeBrun at Stony Brook University, receiving his PhD in 2007 with a thesis entitled Self-Dual Metrics on 4-Manifolds. Mustafa's pre-graduate schooling was in Turkey. He works on Differential Geometry of 4-Manifolds, Complex Algebraic Geometry, Self-dual metrics on 4-manifolds, Kähler Manifolds, Geometric Invariant Theory for Toric Varieties, and Twistor Theory.

## Sabbaticals in 2007-08

**Martin Isaacs** was on sabbatical leave for the full 2007-08 academic year. He took advantage of a year-long sabbatical to complete his new book **Finite Group Theory**, which is being published by the AMS. This is based on the notes he uses when teaching our Group Theory course, becoming a text that can be used for the course. Marty was at MSRI for much of the year, taking part in the program in group representation theory.

**Ken Ono**, on sabbatical leave during the fall of 2007, continued research on hypergeometric series and Maass forms. He spent time at the Institute for Advanced Study and at the Max Planck Institute.

**Paul Terwilliger** took a year-long sabbatical for the 2007-08 academic year, at Kanazawa University in Japan. He continued his collaboration with Tatsuro Ito and Kazumasa Nomura working on association schemes. Their work during the year has resulted in eight papers.

# Honors and Awards

Department faculty continue to win notable awards for their activities in service to the profession, in teaching, and of course in research.

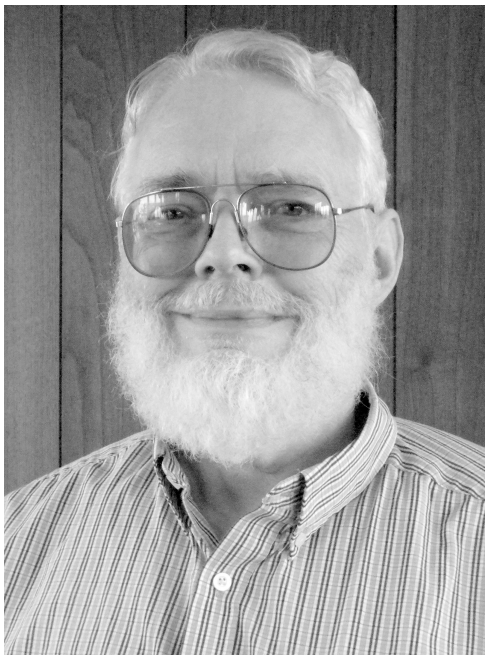
## Alexandru Ionescu Receives a Romnes Faculty Fellowship

**Alexandru Ionescu** received a Romnes Faculty Fellowship, chosen by the graduate school and supported by the Wisconsin Alumni Research Foundation. These awards recognize great potential in faculty who have earned tenure within the last four years. Alexandru joined the faculty in 2002 after earning his Ph.D. from Princeton and holding postdoctoral positions at the Massachusetts Institute for Technology and the Institute for Advanced Study. He works on a variety of deep mathematical problems, particularly in nonlinear partial differential equations, harmonic analysis and ergodic theory.

## Shi Jin receives 2007 Morningside Silver Medal

Our new chair **Shi Jin** is the recipient of the Morningside Silver Medal of Mathematics awarded at the fourth International Congress of Chinese Mathematicians (ICCM) in December 2007. The Morningside medals, given to outstanding mathematicians of Chinese descent under 45 years of age, are the highest honor awarded at ICCM, held every three years. According to the award citation, Shi Jin was given the medal "for his significant research on the development of computational methods for high frequency and quantum waves in heterogeneous media and for multiscale methods for kinetic and hyperbolic equations."

# Bob Wilson Receives Two Teaching Awards



**Bob Wilson** received two teaching awards recently. The Wisconsin section of the MAA awarded him the 2007 Wisconsin Section MAA Distinguished Teaching Award. This spring he received the Chancellors Award from outgoing UW-Madison chancellor John Wiley. At that ceremony chair Leslie Smith quoted one student "Who thought calculus could be taught with such enthusiasm. I didn't think it was possible until now." and another "I thought Prof. Wilson is a master at the teaching trade. He has presented everything in an intelligent and informative way. His greatness has influenced my life and possibly persuaded me into being a math major. I thank him greatly."

# The 2007 Van Vleck Distinguished Research Prizes Awarded

**Sigurd Angenent, Andreas Seeger, Shi Jin and Yong-Geun Oh**

In September 2007, the Mathematics Department Awards Committee awarded the "Van Vleck Distinguished Research Prizes" to **Sigurd Angenent, Shi Jin, Yong-Geun Oh** and **Andreas Seeger**. The four awardees will each receive $20,000 per year for four years from the department chair's Van Vleck Professorship.

The awardees were selected based on their past distinguished contributions to research, their record of service to the Department of Mathematics, and the award committee's high expectations for their future success in mathematics. The awardees will use this flexible funding to promote their own research and to benefit the intellectual life of the department.

# Retirements

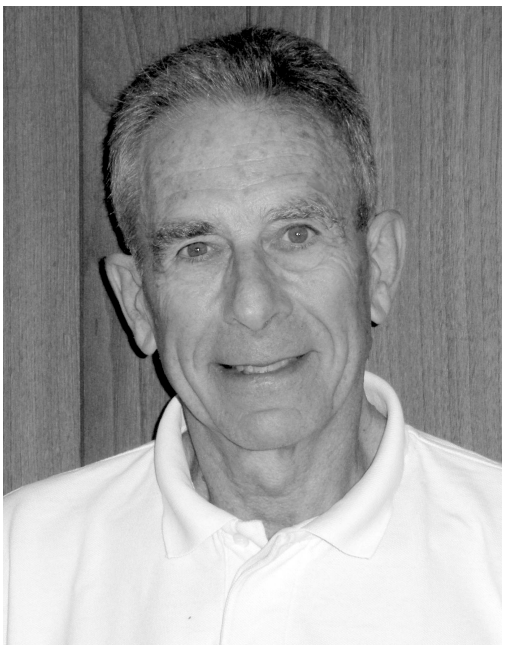
Retirees were Arnold Johnson and Peter Orlik. Arnold Johnson who retired earlier was named in last year's newsletter but with the comment that more information about him would appear this year.

**Arnold Johnson** retired in the spring of 2006. Arnie got his PhD at Notre Dame in 1965, after getting his BS in electrical engineering from Purdue. He worked at Notre Dame with Timothy O'Meara, and stayed there for a year as an instructor before coming to Madison in 1966. He was a visitor and an invited participant at conferences around the world. His 1978 paper in Crelle's Journal solved a problem others found daunting, using new techniques. Arnie loves to tell stories about his family, baseball, the stories of Jean Shepherd (one of Arnie's own favorite story tellers), etc. As Pat Ahern said at the retirement dinner, his stories always improve from one telling to the next, just the way they should. He is also a big fan of jazz violinist Stephane Grappelli.

**Peter Orlik** retired from the UW-Madison Math Department in the spring of 2007. He came to us in 1970. On receiving his PhD from the University of Michigan, Peter went to the Institute for Advanced Study before joining us. He also has had visiting positions virtually all over Europe, at MSRI, and in Kyoto. His truly international career also includes invited addresses around the world. Peter's work is very broad, producing over seventy papers and at least five books, with an important part along with Lou Solomon and Hiroaki Terao, also a colleague here for quite a while, creating and developing the theory of arrangements. His book with Terao **Arrangements of Hyperplanes** is a defining document for the field.

Peter continues to collect honors as an emeritus professor. The Fields Institute held a special conference in his honor this August. Part of their description of the conference (see http://www.fields.utoronto.ca/programs/scientific/08-09/orlik-conf/) reads

> . . . his focus has included Seifert manifolds, singularities, reflection groups and invariant theory, braids, hyperplane arrangements, and hypergeometric integrals. The theory of hyperplane arrangements should receive special mention since, together with Hiroaki Terao and Louis Solomon, Peter Orlik pioneered the area and established many of the foundational results. In doing so, they constructed a fertile meeting point for algebra, topology, and combinatorics.



Peter continues to be seen in Van Vleck. We have to hope also that his famous homemade bread continues to make it to potluck suppers!

# Special Lectures

## 12th Wolfgang Wasow Memorial Lecture

**Professor Barry Simon** of the California Institute of Technology, a prominent mathematician and physicist, gave the 12th Wolfgang Wasow Memorial Lecture on October 17, 2007. The title of his lecture was: Gems of spectral theory. According to Professor Simon, spectral theory is the study of the relation between the data defining a problem (typically the coefficients in a differential or difference equation) and the spectrum associated to that problem. By gems he meant necessary and sufficient conditions that set up a bijection between a class of equation data and a class of spectral data. In his lecture, Professor Simon focussed on a collection of results in the simplest of spectral problems - those defined by orthogonal polynomials. He also discussed a class of nonlinear analogs of the Plancherel theorem that go back to 1920 with results as recent as 2006.

## 12th LAA Lecture

**Professor Carl Meyer** of the North Carolina State University gave the 12th LAA Lecture on May 4, 2007. The title of his talk was Google's PageRank And Beyond. Professor Meyer put it this way:

Why is Google so good at what it does? There are a variety of reasons, but the fundamental thing that distinguishes Google and has put them so far ahead of other search engines is their patented PageRank concept. PageRank has revolutionized Web search to the extent that it has been charged in Federal Court with driving the direction of commerce on the Internet. Many mathematicians are therefore surprised when they learn that a technology of such consequence is predicated on the same mathematics that is available to undergraduate students.

In his talk these concepts were surveyed. Professor Meyer is coauthor with Amy N. Langville of the book: Google's PageRank and Beyond: The Science of Search Engine Rankings.

# Distinguished Lectures

**Professor Greg Lawler** visited our Mathematics Department from March 7 to 9, 2007, as the distinguished lecturer for spring 2007. Greg works in probability theory. He is especially known for his contributions to various kinds of random walks, which are among the most fundamental objects of probability. Greg is among the handful of people behind the recent remarkable development that identified a family of conformally invariant processes on the plane that serve as scaling limits for a number of lattice models from statistical physics. These processes, collectively known as Schramm-Loewner evolution, link probability theory with complex analysis in an entirely new way. The two other main protagonists were Oded Schramm from Microsoft Research (recently deceased in a hiking accident) and Wendelin Werner from Paris who received the Fields medal for this work in 2006.

Greg gave three talks, titled: (1) Random walks: simple and self-avoiding, (2) Partition function view of the Schramm-Loewner evolution, and (3) Conformal invariance and two-dimensional statistical physics.

Greg Lawler is Professor of Mathematics at University of Chicago. Previously he held appointments at Cornell University and Duke University. He was an invited speaker at the 2002 International Congress of Mathematicians in Beijing and received the 2006 George Plya Prize from SIAM jointly with Oded Schramm and Wendelin Werner. Greg is a Fellow of the American Academy of Arts and Sciences.

**Professor Jeff Cheeger** is professor at the Courant Institute of Mathematical Sciences at New York University in New York City. His main interests are differential geometry and its applications to topology and analysis. He visited us in the fall of 2007, and and delivered two distinguished lectures on Sept 26 and Sept 28.

The titles of his two lectures were: “First order calculus on non-smooth spaces”, and “Infinite dimensional Banach space targets.”

In addition, Professor Cheeger gave a special talk for graduate students about his career and experiences as a mathematician. He gave advice to our students on how to work hard to be successful in their own careers. This informal lecture was very well received by our graduate students.

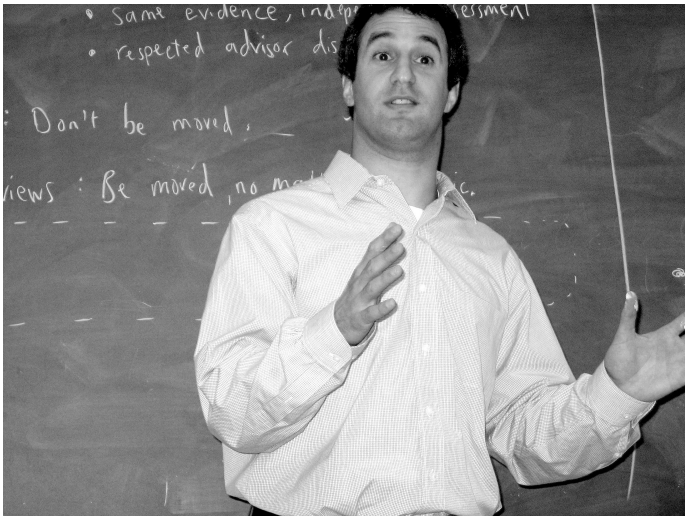
Jeff Cheeger delivered an Invited Address at the International Congress of Mathematicians in 1974 and in 1986. He received the Guggenheim Fellowship in 1984. In 1998, he was elected a foreign member of the Finnish Academy of Science and Letters. He was elected a member of the United States National Academy of Sciences in 1997. He received the Fourteenth Oswald Veblen Prize in Geometry from the American Mathematical Society in 2001.

# Women in Math at Wisconsin

Yvonne Nagel, who among other things makes the department's computing systems run, has produced a DVD on the history of Women in Math here at Wisconsin. Did you know that two of the first four math PhD's from here were earned by women? The DVD includes interviews with faculty members Georgia Benkart, Mary Ellen Rudin, Sean Paul, Tom Kurtz, and Richard Brualdi, and present graduate student Christine Lien. Plans are under way to make this DVD available.

The DVD is one part of our plans to document the history of the department. A webpage for Women in Mathematics at Wisconsin is history available at http://www.math.wisc.edu/people/UWomen.html (as well as a web page for the Women in Math group active in the department.) We are still working on the Photo Project and welcome submission of pictures (printed or electronic) of people or events related to mathematics at Wisconsin!

# Math and ...




Last year Jordan Ellenberg started a series of two talks a year under the heading "Math and ...", bringing in speakers in areas related to math but not the sort of thing frequently found in our seminars and colloquia. In October, 2007, **Adam Elga** from Princeton spoke in a session held jointly with the philosophy department, with the title "How to disagree about how to disagree." Adam is a philosopher of decision-making and of science with a long and interesting record of applying mathematical techniques to problems in philosophy. A question giving rise to the talk: "When one encounters disagreement about the truth of a factual claim from a trusted advisor who has access to all of one's evidence, should that move one in the direction of the advisor's view?"

# Certificate Program in Mathematics

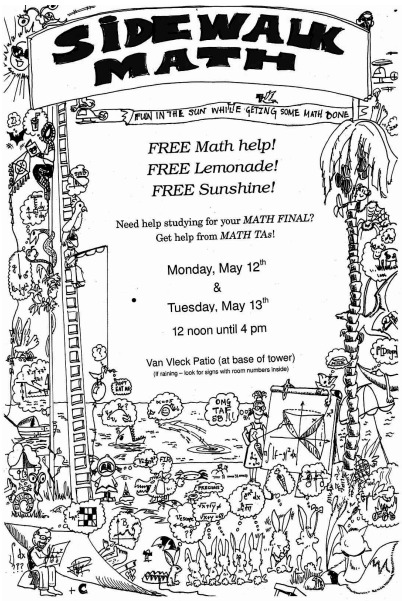
The department has designed and proposed and now had accepted a new program for an *Undergraduate Certificate Program in Mathematics*. The new program is designed for students majoring in subjects that use a lot of mathematics, whose major does not allow time for them to get a second major in mathematics but who want to go beyond the mathematics required by their major. These might be students in engineering or economics or many areas, and students who started out to major in mathematics but switched to another area and want formal recognition of their accomplishments in math. Students working for the certificate have to take quite a bit of advanced mathematics, but not as much as is required for the math major. Students with a math major are not eligible to get the certificate in addition.

# Special Teaching Activities

A major part of the department's responsibility as viewed by the campus continues to be teaching a great number of students in service courses, primarily calculus for students going on in the sciences or engineering or business or . . .. In addition to our ongoing special programs like WES (Wisconsin Emerging Scholars, see http://www.math.wisc.edu/∼wes/) this year we tried as an experiment a section of second semester calculus that met in a dormitory, with enrollment from that and nearby dorms. Although the group was too small for lots of statistical testing, those students seem to have done significantly better than others in conventional classes. This was despite the fact that (it turned out, they were not pre-selected) the students in the special section had lower scores on admission tests! For next fall we will be expanding this program. WES itself continues to show significant gains for its students. They are invited into the program as students who show promise (this is distinctly not a remedial program!) as individuals but come from pre- college situations that could be disabling: Students from chaotic inner-city schools, or very small rural schools that lack resources, etc. In both WES and the new experimental program, although they serve different groups of students, the students register for a standard lecture section in calculus but have a special discussion section. The discussion section places an emphasis on working in groups to solve challenging problems, and meets more hours per week than a standard discussion section: The students get pass/fail credit for the extra hours.

## Sidewalk Math

At the end of the semester for several years now the graduate students have organized "Sidewalk Math" just before the biggest groups of math final exams. Students are invited to come to help sessions outside on the Van Vleck patio (indoors if it rains) staffed by grad students and faculty. Here are some students working with award-winning TA Nicos Georgiou this spring, and the poster students saw advertising it:

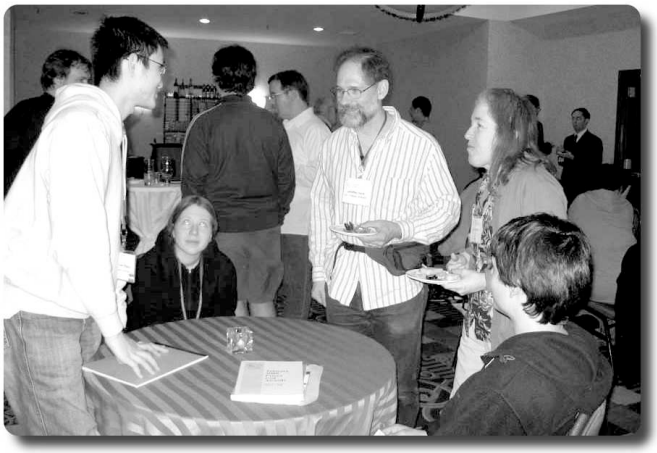



Our TAs and faculty continue to win awards for outstanding teaching. See elsewhere in this newsletter details on department, campus, and state awards won this last year!

# UW Reunion at JMM

As we do every year, we had a reunion at the Joint Mathematics Meetings for anyone with a UW-Madison math connection. JMM in January, 2008, was in San Diego, and plans are already under way for the reunion in Washington, DC, in 2009, which will be on Tuesday, January 6, 2009 6-8PM in the Nathan Hale room of the Marriott Wardman Park hotel. At the department website, under "Alumni", there is a link to the webpage http://www.math.wisc.edu/~wilson/Reunions/ about the reunions, where last minute news will be posted. (There are some pictures from San Diego below, and many more online at the website mentioned above.)

(The summer Mathfest national meeting of MAA was here in Madison, at the Frank Lloyd Wright designed Monona Terrace convention center. So we had a reunion right here in Van Vleck. More about that in next year's newsletter!)

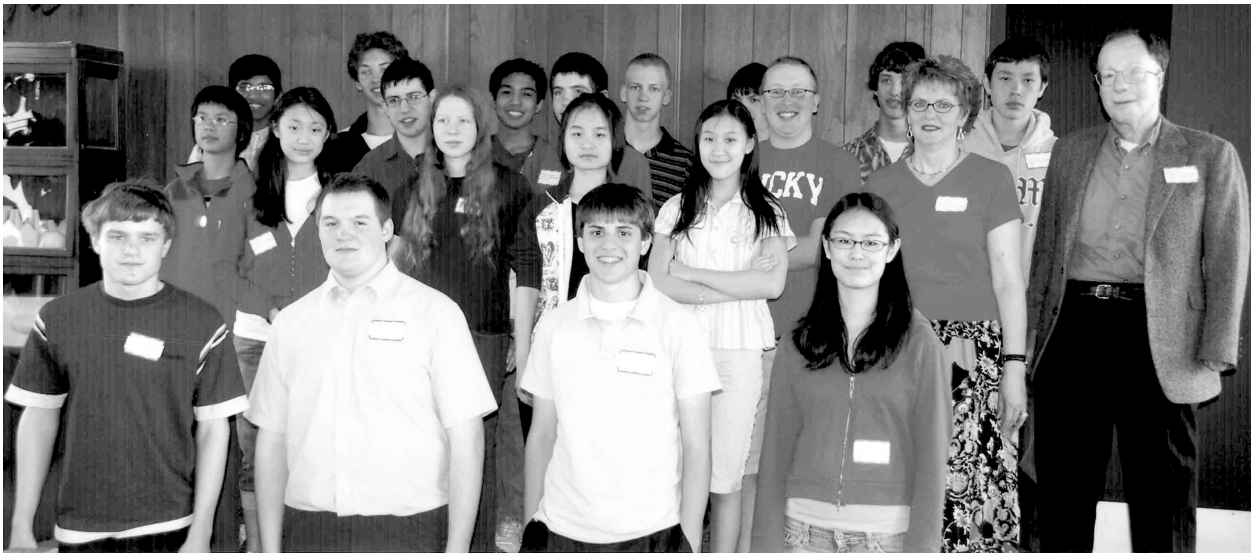


(The DVD Darren is so avidly watching was produced by Yvonne Nagel, about the history of women in mathematics at UW-Madison.)

# Student and Instructional News

## Mathematics Talent Search Honors Day

## May 2007



**back: Suhas Kodali, David Walker, Nathan Fox, Sam Balinghasay, Thomas Morgan, Anthony Kirckof, Tim Black, Zef RosnBrick, Peter Wear, Walter Cai, Prof. Martin Isaacs**
**second row: Kou-Kai Chin, Iris Xu, Sally Wolfe, Ye Wang, Willa Cai, Sharon Paulson**
**front: Christopher Pieper, Matthew Madsen, Matthew Wage, Valerie Shen**

The UW Mathematics, Engineering, and Science talent search continues to flourish after 45 years. In 2007 Marty Isaacs led the program recognizing winners, having run the contest together with Don Passman, Lev Borisov, and Jordan Ellenberg. Twenty two winners from the statewide contest came to Van Vleck for the Honors Day on March 4, 2007. We awarded the $24,000 Van Vleck Scholarship to two outstanding students this year, Zef RosnBrick from Madison West High School and Matthew Wage (son of Mike Wage, UW PhD 1976 with Mary Ellen Rudin) from Appleton East High School. The Honors Day program included talks by Nicola Ferrier from the department of Mechanical Engineering, on Vision Based Control of Robot Manipulators, and our own David Griffeath, on Snowflakes: Real and Imagined. (You may have seen national coverage of David's work producing mathemetical models for snowflake growth that have revolutionized the field.)

Here are a few sample problems the high-schoolers had to solve:

(1) Given an integer $n > 2$, let $S$ be the set of all integers $m$ such that $m+n$ is a divisor of $m^2+n^2$. Show that the set $S$ is finite, and that the number of negative numbers in $S$ exceeds the number of positive numbers in $S$ by at least five.

(2) Suppose that for each integer $k \geq 1$, we have an unlimited supply of rectangular $2 \times k$ tiles. Given an integer $n \geq 1$, write $a(n)$ to denote the number of ways that a $2 \times n$ rectangle can be covered using our tiles. It is clear, for example, that $a(1) = 1$, and a little experimentation shows that $a(2) = 3$ and $a(3) = 6$. Compute $a(7)$.

(3) Find all solutions in positive integers $a < b < c$ to the equation $(a+b+c)^2 = a^3 + b^3 + c^3$.

# 2007 Undergraduate Prize Winners

**Zacariah Labby and Li Jiang** won the **Leadership Prize of the AMEP** (Applied Mathematics Engineering and Physics) program.

**Tarel Elgindi and Laura Legault** won the **Irma L. Newman Scholarship** for an outstanding mathematics major.

**Jason Malinowski** was awarded the **David Lawrence Young Memorial Scholarship** for a student showing promise early in his/her career.

**Damon Alexander and Jon Sperling** were awarded the **Prof. Linnaeus Wayland Dowling Scholarships** for students majoring in mathematics.

**Thomas Watson and Aaron Veith** won the Violet Higgitt Frank Scholarships for students majoring in mathematics.

**Daniel Chavas, Joel Hestness and Adam Beardsley** won the **Frank Cady Scholarships** for outstanding and financially needy juniors and seniors with plans to continue their study of mathematics beyond college.

**Charlie Brummitt and Daniel Lecoanet** were awarded the **R. Creighton Buck Scholarship** for students demonstrating outstanding creativity in mathematics.

**Judith Wacker, Grant Teply, Yuek-Yu Kwai and Keaton Miller** won the **Mark H. Ingraham Scholarships** for outstanding mathematics majors.

Undergraduates elsewhere with UW-Madison connections also did well: (All of these students have participated in our VIGRE REUs.)

**Po-Ru Loh** (CalTech) **and Daniel Kane** (MIT) were both named Putnam Fellows.

**Alison Miller** (Harvard) **and Aaron Pixton** (Princeton), who were in our Number Theory REU last summer, won honorable mention in the Putnam competition. (Alison was the top female performer.)

# Undergraduate Research

The department has been running an REU (Research Experiences for Undergraduates) in Number Theory as part of its NSF VIGRE grant. There were 10 participants (including 2 high school students!) in the summer of 2007. They worked very hard, and collectively published 8 papers. Participants and their work:

**Doris Dobi** (MIT), [**Nick Wage**] (Harvard) and [**Irena Wang**] (Harvard), *Supersingular Rank Two Drinfeld Modules and Drinfeld Modular forms.*

**Elena Udovina** (Harvard University) , *Counting solutions to Diophantine equations over function fields.*

**Adam Merberg** (Brown University) , *Divisibility of class numbers of imaginary quadratic function fields.*

**Noam Tanner** (Princeton University) (extending work of grad student Frank Thorne) , *Strings of consecutive primes in function fields.*

**Sally Wolfe** (Memorial High School in Madison) , *Parity of the partition function and the modular discriminant.*

**Shanshan Ding** (Columbia University) , *Splitting Primes and Irreducibles of the Form* $x^2 - dy^2$.

**Matt Wage** (Appleton High School, son of UW grad Michael Wage) , *On Lehmer-Type Questions for Special Classes of Arithmetic Functions.*

**Sam Lichtenstein** (Harvard University), *Effective Chebotarev and Galois representations.*

# Twenty PhDs Awarded in 2007

Twenty PhDs were awarded in mathematics in calendar year 2007.
The recipients, with their advisors and their thesis titles (and their next move if known) are:

**Alfeld, Christopher P. Alfeld** (Advisor: Steffen Lempp), *To Branch or Not to Branch: Branching and Non-branching in the Medvedev Lattice of $\pi^1_0$ Classes* (Nemean Networks) .

**Bowman, John D.** (Advisor: Arun Ram), *Finite-Dimensional Modules for the Quantum Affine Algebra $U_q(y)$ and its Borel Subalgebra.*

**Christodoulopoulou, Konstantina** (Advisor: Georgia Benkart), *Whittaker Modules for Heisenberg and Affine Lie Algebras* (University of Windsor (Canada)).

**Deng, Geng** (Advisor: Michael Ferris), *Simulated - Based Optimization.*

**Fang, Ye** (Advisor: Sigurd Angenent), *Precise Asymptotics of Blow-up in the 4D Yang-Mills Head Flow.*

**Funk-Neubauer, Darren R.** (Advisor: Paul Terwilliger), *Tridiagonal Pairs and Their Use in Representation Theory.*

**Garthwaite, Sharon A.** (Advisor: Ken Ono), *On Questions of Congruence and Size for Modular Forms and Maass-Poincare Series.*

**Getz, Jayce R.** (Advisor: Ken Ono), *Intersection Homology of Hilbert Modular Varietics and Quadratic Base Change.*

**Hangelbroek, Thomas C.** (Advisor: Amos Ron), *Thin Plate Spline Approximation* (Texas A&M).

**He, Weiyong** (Advisor: Xiuxiong Chen), *On the Calabi Flow* (University of British-Columbia, Canada).

**Kach, Asher M.** (Advisor: Steffen Lempp), *Characterizing the Computable Structures Boolean Algebras and Linear Orders* (University of Connecticut-Storrs).

**Kane, Benjamin** (Advisor: Tonghai Yang), *Computationally Feasible Bounds for Representations of Integers by Ternary Quadratic Forms and CM Lifts of Supersingular Elliptic Curves.*

**Kim, Ahyoung** (Advisor: Alexander Kiselev), *Locating Absolutely Continuous Spectra of Jacobi Operators.*

**Liao, Xiaomei** (Advisor: Shi Jin), *Computational High Frequency Waves in Heterogeneous Media* (Department of Biostatistics, Harvard University).

**Oberlin, Richard** (Advisor: Andreas Seeger), *The $(d, k)$ Kakeya problem and estimates for the X-ray transform* (UCLA),

**Rose, Michael** (Advisor: Lev Borisov), *On Gromov-Witten Invariants of Stacks.*

**Rouse, Jeremy A.** (Advisor: Ken Ono), *Arithmetic Analytic and Geometric Aspects of the Theory of Modular Forms.*

**Shallue, Andrew R.** (Advisor: Eric Bach), *Two Number Theoretic Algorithms that illustrate the Power and Limitations of Randomness.*

**Wang, Jue** (Advisor: Fabian Waleffe), *On Lower Branch Exact Coherent Structures* (Union College).

**Weber, Brian** (Advisor: Xiuxiong Chen), *Moduli Spaces of Extremal Kohler Manifolds.*

In addition the following students finished with a Masters Degree in mathematics in 2007:

**Ulysses Andrews**

**Jonathan R. Godshall**

**Blythe Hazellief**

**Stephen Hruska**

**Anne Jorstad**

# Graduate Student Professional Activities

For those of us who were grad students here in long past years, many things seem to have changed. One is that grad students these days get involved earlier in activities as mathematics professionals. We have several seminars these days whose names include "GPS" and that does not refer to a location finder. (OK, it does, but in a different sense!) The Graduate Pre-Seminars are organized and run largely by the grad students. Modern typographical methods (TeX, LaTeX primarily) have our grad students routinely publishing several papers before finishing, quite a difference from the old typewriter and carbon paper days. Grad students are organizing research conferences attracting participants on at least a national scale.

Each of the last two years has seen a Grad Student Conference in Probability organized by our students. The conferences were organized by Hye won Kang, Sabrina Guettes, Rohini Kumar, and Mathew Joseph and included also Madison grad students Arnab Ganguly, Nicos Georgiou, Ankit Gupta, and Hao Lin. The April, 2007, conference included keynote talks by Tom Kurtz and Timo Seppalainen as well as presentations by grad student participants from all over. That conference was a great success and there was a second grad student conference this May with keynote speakers Amir Dembo and Davar Khoshnevisan.

The Graduate Student Conference in Combinatorics was held here two years ago. But it was such a success that the series of these conferences is continuing, last year at Univ. of Washington, 2008 at UC-Davis, and already planned for 2009 at the University of Kentucky. The 2006 conference here was organized by grad students Adam Berliner, Louis Deaett, and Dimitrije Kostic.

Two present grad students, Brian Weber and Rob Rhoades, have papers appearing soon in the Journal of the AMS. Brian's paper is with Xiuxiong Chen, and Rob's paper is with Ken Ono and Kathrin Bringmann. Both Brian and Rob have been part of our VIGRE (Vertical Integration of Research and Integration) program supported by NSF.

# 2007 Awards to Graduate Students

Our graduate students won many awards for research, teaching, and university service at our annual student awards ceremony held May 2, 2007.

This year The **Excellence in Mathematical Research Awards** went to **Jayce Getz** and **Xu Yang**.

- The **John Nohel Prize** in Applied Mathematics recognizes a graduate student who writes an outstanding Ph.D. thesis in applied mathematics. This year it was awarded to **Thomas Hangelbroeck**.
- The department gave awards to teaching assistants for **Math TA Teaching Awards** to **Anakewit Boonkasame, Weidong Yin, Matthew Davis, Myoungjean Bae, Stephen Hruska, Jernej Tonejc, Adam Berliner, Michael Woodbury** and **Michael Schroeder**.
- The **Elizabeth Hirschfelder Awards** were given to **Yeon Hyang Kim** and **Rohini Kumar**. This award commemorates Elizabeth Stafford Hirschfelder who got her PhD from our department in 1930 working with Mark Ingraham, and is awarded to outstanding women graduate students.

# New Graduate Students in the Fall of 2007

We had 22 new graduate students in the fall of 2007. Here they are, with the universities they came from:

| | |
|---|---|
| BAO, Erkao | Jilin University (China) |
| BLACKHURST, Jonathan | Brigham Young University |
| BOCKTING, Sarah | University of Evansville |
| CANDIOTO, Anne | Marquette University |
| DABKOWSKI, Michael | Michigan State University |
| DAVIS, Rachel | Le Moyne College |
| ECKELS, Samuel | Northwestern University-Evanston |
| GARTON, Derek | Portland State University |
| JAMESON, Marie | Harvey Mudd College |
| KOYAMA, Masanori | Harvey Mudd College |
| LOSAW, Jennifer | Wellesley College |
| MAGNESS, Elizabeth | Baylor University |
| MASON, Jonathan | University of South Carolina-Columbia |
| NELSON, Joanna | University of Illinois Urbana/Champaign |
| QI, Peng | Tsinghua University (China) |
| WANG, Dongning | Nanjing University (China) |
| WANG, Li | Huazhong Univ of Science Tech (China) |
| WANG, Yuanqi | Peking University (China) |
| YENIARAS, Esra | Gazi University (Turkey) |
| YUAN, Fang | Peking University (China) |
| ZHENG, Fan | China University of Science and Tech |

# Other News

**Julie Mitchell**, jointly in mathematics and biochemistry, was featured in a UW news story this last year about her work connecting these disciplines. The full article is available online at http://www.news.wisc.edu/14453. For those used to working in mathematics, one piece of advice she gives is "Most of all: Don't let biology's unpredictability drive you insane." Going further,

> "In many ways, mathematics and biology are almost logical opposites," she says. "Mathematics is more of an art: You create rules for some geometric or algebraic space and then see what you can prove about it. In biology, we can't even figure out what some of the basic rules are. There are no theorems. Everything has a little asterisk next to it that says, 'Except in the following cases.'"

Julie has developed software that analyzes how proteins fit together when held tightly and predicts how changes in molecular composition might break the fit apart. That analysis led to development of a new cancer drug. As she says,

> "I never would have imagined in a million years as a mathematics graduate student that I would end up on a patent for a new cancer drug," she says. "It seems unfathomable: What, as a mathematician, can one do that's going to have that kind of impact? It's exactly the type of thing that I went into this field to do."

Now Julie and others working with her have turned the problem around, working on where amino acid changes might tighten bonds rather than weaken them.

**Ken Ono** and **Kathrin Bringmann** made the news last year by settling long-standing questions about mock theta functions. Their work appeared in a sequence of papers in the Inventiones Mathematicae, Annals of Mathematics, Proceedings of the National Academy of Sciences, and the Journal of the American Mathematical Society and was featured in the year-end top stories issue of Science News. Ramanujan first referred to these functions in a letter written as he was dying. Ken and Kathrin have pulled together a theoretical framework explaining what these functions really say and how to work with them. As Ken said, "It's extremely gratifying to be able to say we solved the 'final problem' of Ramanujan". The new theory is already proving very useful in number theory and also has applications in other branches of mathematics and in sciences such as physics and chemistry.

"This is something I really didn't expect anybody to do," said George Andrews, a leading number theorist at Pennsylvania State University who in 2000 called mock theta functions one of the most difficult math puzzles of the new millennium. "It is an outstanding piece of work, a breathtakingly wonderful achievement."

What made mock theta functions all the more inscrutable was the fact that the first few pages of Ramanujan's letter were lost. Those pages may have contained more clues, but in their absence, the letter merely presented 17 examples of the functions. What's missing is any definition of what the functions are, any hints on how to derive them, and any indication of why they are even important. All those secrets died with Ramanujan just two months after he wrote the letter, when he succumbed to tuberculosis at the age of 32.

The Seminar Bourbaki lectures have famous mathematicians giving lectures on recent results of others for a general audience. Last year, Don Zagier, a Professor at the College de France, gave his lecture "Les "mock theta functions" de Ramanujan d'aprs Zwegers et Ono-Bringmann" on this work.

**Ken Ono** has been invited to give an AMS-MAA Invited Address at the Joint Mathematics Meetings next January in Washington, DC.

**Fabian Waleffe**, also professor of engineering physics, together with mathematics graduate student Jue Wang and Georgia Tech University postdoctoral researcher John Gibson have published clear computational evidence that a newly discovered class of 3-D unstable traveling wave solutions of the Navier-Stokes equations scale like the inverse of the Reynolds number for large Reynolds numbers. That scaling is consistent with recent experiments by a British group, which showed that the smallest amplitude perturbation necessary to trigger turbulence in a fluid flowing down a pipe also scaled like the inverse of the Reynolds number. Waleffe and colleagues show that the 3-D unstable states have only one mode of instability, and demonstrate that these states are the "backbone" of a boundary separating turbulent and laminar flows. Their results imply that those 3-D unstable states control the transition to turbulence; the discovery may lead to new ways to control transition to turbulence for various engineering applications. The group's paper, "Lower branch coherent states in shear flows: Transition and control," appeared in the journal Physical Review Letters.

**David Griffeath's** work with former student Janko Gravner on mathematical modeling of snowflakes has produced snowflakes that are more like "real" snowflakes (and we had plenty of those in Madison this year to compare to!) than any previous constructions. They got covered in such non-traditional journals as the Chicago Tribune, with a gallery of pictures. In addition to snowflakes that one does see in the real world, the model can create varieties such as a flake that resembles three butterflies stuck together along their bodies: While never seen outside the computer, they can exist but would be very fragile. You can see examples including movies showing snowflake growth at David's website, http://psoup.math.wisc.edu/Snowfakes.htm.

**Jin-Yi Cai**, in the computer science department as well as mathematics, was elected a fellow of the American Association for the Advancement of Science, for exceptional contributions to computational complexity theory.

# News from Our Alumni

**Emre Alkan:** (PhD 2003, Ken Ono) and **Ergun Yalcin** (Alejandro Adem and Amir Assadi, 1998) have won CAREER Award from the Science Council of Turkey, an award inspired by the NSF CAREER program. Those are the two winners for the year!

**Charlie Slavin:** (PhD 1984, Steve Wainger), now Dean of the Honors College at the University of Maine, wrote to tell us how many of the faculty as well as guest speakers mentioned in last years newsletter were of great importance to him. We hope that the newsletter lets you keep in touch to some extent with both what has happened here in the past and also how the department grows and develops.

**Carlos Castillo Chavez:** (PhD 1984, Fred Brauer), now at Arizona State University, received the 2007 AAAS Mentor Award from the American Association for the Advancement of Science, for his efforts to help underrepresented students earn doctoral degrees in the sciences. A Hispanic American woman wrote that his summer program for undergraduates had changed her life. "I am the first one in my family to get an education beyond high school." She said Carlos "gave me the confidence needed not only to dream big but also to achieve those big dreams through hard work and dedication."

**Mike Benedikt:** (PhD 1993, Jerry Kiesler) is a professor in the Computer Science department at Oxford University in England.

**Yiming Long:** (PhD 1987, Paul Rabinowitz) has been elected to membership in the Chinese Academy of Sciences. Two mathematicians are elected every second year.

**Christopher Hoffman:** (BS 1992, PhD Stanford 1996) has been awarded the 2008-2009 AMS Centennial Fellowship.

**Stephen Turner:** (BS 1991) has received the 2008 Distinguished Young Alumni Award from UW. Steven is founder and chief technology officer of Pacific Biosciences, a company based in Menlo Park, Calif., that is developing groundbreaking DNA sequencing technology. Turner, who earned his UW-Madison bachelor's degree in applied math, engineering and physics, is the inventor on nine issued U.S. patents and more than 20 published applications.

# Outreach Activities

The department continues to be vitally involved in connections to schools, and other off-campus events. But the editor is so late getting this issue out that we have two years of some events to mention.

The MegaMath contest for 5th and 6th grade students from our area each year brought in teams from about 20 schools. There are individual "mental math" events as well as team events, with trophies and ribbons for the top finishers and tee-shirts for all participants. The students particularly enjoyed the "Charades" event where teams of their teachers had to guess mathematical (in some cases not so mathematical, e.g. "The dog ate my homework") phrases acted out by a team member. Competition was fierce: Even that example phrase was solved in less than 15 seconds! Many of the mental math problems have a "neat" solution when you have time to think about them, but students only had 15 seconds for problems like $\frac{5\times12\times7\times16\times9}{10\times6\times14\times8\times18}$.

Ken Ono and a team of graduate students created and graded the questions for the 2007 contest, and Jordan Ellenberg replaced Ken this year. Graduate student Meghan Dewitt pulled everything together and really made it run. Bob Wilson was emcee both years. (The Wisconsin Math Talent Search also involves mathematics competition for students, but it has its own separate section in this newsletter.)

A committee involving this department, the School of Education, and the Madison Metropolitan School District, has revised existing courses for preparing elementary teachers and created new ones to be part of a program for middle school teachers. Wisconsin, and many other states, has no higher certification requirement for a teacher who will teach math at the 8th grade level than for 1st grade. The new program will let a teacher be certified to teach all those grades but also have a math specialization showing additional preparation in mathematics.

The department has also been actively working with the Wisconsin Department of Public Instruction as the DPI reviews and revises the Wisconsin state standards for mathematics in K-12. Leslie Smith has participated in sessions both at the state and the federal level (she needed some more work besides being chair?). The department was invited to comment on proposed changes (conveyed by Gloria Mari Beffa) and a letter to the DPI was signed by many department members. A member of the department (possibly Steffen Lempp) will probably serve on the DPI committee to revise the standards.

A new program this last year called Expanding Mathematical Knowledge had Bob Wilson together with engineering professor Vicki Bier working with teachers in grades 3-5. The teachers came from Madison Metropolitan as well as some other districts in the area. Classes met intensively for one week in summer of 2007 and continued monthly during the school year. This very successful program is being continued in the coming year: Bob Wilson will take part again, and this year Shirin Malekpour from our department will be the other UW participant. This program combines mathematical content knowledge for the teachers with pedagogical knowledge, led by Carrie Valentine who is a mathematics resource teacher with Madison Metropolitan. This combination produced some very interesting results. E.g. each of the teachers was asked to select three students at varying mathematics ability levels and track their progress in specific mathematics content, choosing pedagogical approaches that seemed best for each. As the year went along there was clear development showing what the students knew and what worked for helping them learn.

Connecting for Academic Success (David Camacho and Gloria Mari Beffa) continues to work on improving retention of students. Many students come from high school ill-prepared to be college students, regardless of course content, and UW is working to help make that transition work better. Another component of this effort is the Summer Bridge Program (David Camacho) bringing in about 70 minority freshmen before their fall classes start for a seven week course to get them off to a good start mathematically.

The Evening Program for High School Women brings in women from local schools for programs that include working with faculty, graduate students, and undergraduates. Monthly High School Math Nights, organized by the graduate students, were run this year by David Milovich. Speakers included grad students Daniela Banu, Rob Owen, Alec Johnson, Nic Addington, and David Seal, and Van Vleck Postdoc Bart Kastermans.

# In Memoriam

**Professor John Harvey** passed away May 5, 2007. John got his PhD from Tulane in 1961, working with Paul Conrad: His dissertation was titled Complete Holomorphs and Chains in Partially Ordered Groups. From Tulane, John went to the University of Illinois. There he worked on ordered algebraic structures, and jointly with Paul Conrad and Charles Holland (former UW math faculty also) proved the Hahn embedding theorem for lattice-ordered groups. (I can remember when I was a graduate student here taking a course from Charles Holland, going through that theorem: I did not know then that I would be referring back to it in this way so many years later!)

John came to Madison in 1966 as an Associate Professor jointly in Mathematics and in the Department of Curriculum and Instruction in the School of Education. He has continued as a member of both departments until his retirement in 2001. John was active in many professional areas. He held major positions in professional societies, he led reviews of departments. He published almost 100 papers and books. He authored or coauthored 45 different text and test curricular materials and 40 book or article reviews. He made presentations at over 100 conferences and workshops. In 1993 the Wisconsin Math Council named him as its Outstanding Mathematics Educator. He has had over 20 PhD, and in turn their students number almost 100.

On retiring, John moved to New Orleans to be with his sister and brother-in-law: They made it through hurricane Katrina with some time in Tyler, TX. John has a wide variety of outside interests. He was always actively involved with music, as a singer as well as a listener. In fact the first time I ever visited John's house was when I was a grad student and along with two other grad students I went over to consult on something (I forget what) having to do with John's stereo system, a really high-end system for the time.

Lowell Tonnesssen (a student of John's from 1980) commented on a particular strength John gave to his PhD students, through his very high standards for their written work. John would make comments all over their drafts, in an era when retyping meant just that and not just another pass with LaTeX. But he was mindful of the effect on the psyche of a page full of red marks, and used a green pen. For many of his students this requirement for careful writing was an additional part of their graduate education.

**Professor Richard Meyer and his wife Ilse** both passed away on Sunday, Jan. 6, 2008, in Madison. Richard was recognized worldwide for his groundbreaking research in mathematics and fluid dynamics. Among his many professional recognitions, he may have been most proud to be elected the first member of the Australian Academy of Science. Ilse was one of the fixtures of the fashion world in Madison, and was well known as the owner of the successful Ilse's Where Else boutiques. However, she considered her main professional passion to be her writing and subsequent career working with the president of one of the best-known publishers in London. They are survived by their children, Michele, Nicole and Peter; grandson, Max; as well as his brother, Ludwig and her sister, Eva; their son-in-law, Bruce and daughter-in-law, Eva.

Richard was born March 23, 1919 in Berlin, Germany and was educated at the College Francais (Berlin) and the Swiss Federal Institute of Technology (ETH) where he received, respectively, the degrees of Dipl.Mech.Engr. in 1942 and Dr.Sc.Technology, Aero. Eng. in 1946. His first appointment was junior scientific officer, British Ministry of Aircraft Production, 1945-46, which was followed by assistant lecturer in applied mathematics, University of Manchester, 1946-47; I.C.I. Research Fellow, University of Manchester, 1947-52; senior lecturer in aeronautical engineering, Sydney University,

1953-56; reader, University of Sydney, 1956-57; associate and full professor of applied mathematics, Brown University, 1957-1964; professor of mathematics, University of Wisconsin-Madison, 1964-1994; and professor emeritus after 1994. In addition Richard was a member of the Australian Academy of Sciences and had held visiting appointments in the U.S., Israel, U.K., and Australia.

Richard's early work was on turbine aerodynamics which began his sustained interest in supersonic aerodynamics, gas dynamics, and the theory of characteristics, to which he made many contributions. In Australia, he became responsible for a supersonic laboratory and organized an integrated, experimental and theoretical research team; conversely, he found himself involved in studies of the relation between theory and experiment in modern continuum mechanics. At Brown, he turned to mathematical problems in nonlinear hyperbolic and singular partial differential equations arising from gas dynamics. He also undertook studies on the nonlinear long-wave theory of waves on beaches, which culminated in the discovery of the mechanism that converts waves into run-up and back-wash on the foreshore.

His interest in the mathematical theory of water waves continued with studies of fundamental hydraulics and, in alliance with M.C. Shen and J.B. Keller, of wave refraction and resonance offshore, in which shortwave asymptotics has been used and extended to obtain notable advances in the three-dimensional theory of classical water waves with applications to the coastal and shelf oceanography.

At Wisconsin, he contributed to the interdepartmental research program in plasma physics with studies in collisionless plasma shock structure and an elucidation of adiabatic invariance. In turn these questions involved him in a series of mathematical researches, first on modern asymptotics and then on classical asymptotics and exponential precision. These advances led him into reforms and extensions of turning point theory and short-wave (WKB and ray) asymptotics. In his later years his interests broadened to include quantum scattering, meteorology, and ecological fluid mechanics.

Apart from his research papers he wrote a number of books, encyclopedic articles and reviews to offer access to recent advances in his specialties to a wider scientific audience.

Richard had a vigorous non-mathematical life as well. His accomplishments as a mountaineer have recently by recounted in an article by his daughter Michele in the United Airlines Hemispheres magazine, June 2007 (available online at http://www.hemispheresmagazine.com/jun07/alpine.html)

**Professor Jacob Levin** passed away on Sunday, March 16, 2008, at his home. Jake grew up liking sports, including basketball and stickball in the city streets. He soon became an excellent student, and the pursuit of knowledge launched him forward in life. He attended Stuyvesant High School in Manhattan and earned a scholarship to City College of New York City where he earned a bachelors degree in electrical engineering. After spending two years in the United States Army, he then attended the Massachusetts Institute of Technology where he received his PhD. in mathematics. While at M.I.T. he met Avis Offstrock to whom he proposed marriage on their second date! And, she accepted. They were married for 55 years and had three children. After positions at Lincoln Laboratory and Purdue university, Jake and Avis, and the kids, moved to Madison. He had an extremely productive career as a researcher and as a teacher, where his real success was appreciated. His interests included jogging, reading, going to movies, golfing and spending time with his wife, Avis and his family. Jake is survived by his wife, Avis; three children, Debra Francis, Kenneth Ellis (Deborah) and Claire Brenda; brother, Norman (Freya) and their children, Erik and Anya; and grandson, Joey.

# Department of Mathematics Annual Fund Drive

Please accept my contribution in the amount of $ _____ which is designated for:

**UW Foundation Accounts** (Department of Mathematics)

- ☐ Department of Mathematics General Fund – *serves as the department's "general" account.*
- ☐ R. Creighton Buck Prize Fund – *awards an undergraduate prize for creativity in mathematics.*
- ☐ Wallace J. Hilliard Fund – *provides support for the Wisconsin Emerging Scholars Program (WES).*
- ☐ Elizabeth Hirschfelder Fund – *for Graduate Women in Mathematics, Chemistry & Physics.*
- ☐ Mark Ingraham Math Scholarship Fund – *provides a scholarship for a mathematics major above freshman standing.*
- ☐ Mary Ellen Rudin Fellowship Fund – *scholarship to support bright and talented female mathematics students.*
- ☐ John Nohel Prize in Mathematics – *a prize for the best PhD thesis in applied mathematics.*
- ☐ Wolfgang Wasow Memorial Lecture Fund – *supports a lecture by an eminent mathematician in a distinguished lecture series.*
- ☐ Van Vleck Math Talent Search – *provides funds for our annual math talent competition.*

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# Van Vleck Notes

is published annually by the
Department of Mathematics of the University of Wisconsin–Madison
480 Lincoln Drive, Madison, WI 53706-1388

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