Department of Mathematics
University of Wisconsin - Madison

2007 Van Vleck Notes

From the Editor

Shortly before this newsletter went to press, we were treated to a lecture by Professor Gang Tian of Princeton University on the biggest recent news in mathematics, *The Proof of the Poincaré Conjecture*. The lecture, part of the University Lecture Series, was co-sponsored by the Departments of Mathematics and Physics and drew a large audience which almost filled the large lecture room in Van Vleck Hall. Professor Tian was introduced by Paul Rabinowitz who briefly described his career: born in China, Masters degree from Peking University (at which time he published his first paper on the Mountain Pass Theorem — for which Paul is very well known), PhD from Harvard University in 1988, NSF Waterman Prize in 1994, AMS Veblen Prize for his outstanding work in geometric analysis, ...

The lecture started out with the quote "Solving good problems has played a significant role in mathematical research." Tian then went on to say that Hilbert's 23 problems posed at the ICM in Paris in 1900 played a crucial role in 20th century mathematics. He described how problems become more famous as they resist more and more difficult attempts at solution and how they are used as standards for testing new ideas. In the tradition of Hilbert, in 2000 the Clay Mathematics Institute identified 7 important and central problems of mathematics and offered $1 million for the solution of each of them; one of these problems is the Poincaré conjecture.

The conjecture known as the Poincaré conjecture was proposed by Poincaré in 1904 and concerned a characterization of the simplest of all 3-dimensional shapes, the 3-dimensional sphere. It asserts (informally) that a 3-dimensional space with the property that every closed curve in it can be shrunk to a point is topologically equivalent to a 3-dimensional sphere. Just as the 2-dimensional sphere (the boundary of a ball) is obtained by taking the union of two disks and gluing them together at their boundaries (1-dimensional spheres), the 3-dimensional sphere is obtained by taking the union of two balls and gluing them together at their boundaries (2-dimensional spheres). This can't be done in 3 dimensions and the 3-dimensional sphere lives in 4-dimensional space. The Poincaré conjecture was attacked by direct topological means for 100 years without much success. According to Tian, in the final analysis all topological attacks on the Poincaré conjecture involve trying to show that the 3-dimensional shape in question is obtained by gluing together two 3-dimensional balls in this way.

Attempts to solve the **Poincaré** conjecture led to many advances in the study of other 3-dimensional spaces but not the sphere. It was generalized by Stephen Smale in 1960 to all dimensions and solved by him in dimensions at least 5. Tian then went on to describe a remarkable sequence of events all of which led to a Fields Medal. First Smale got a Fields Medal for his work. John Milnor in 1956 provided a counterexample of a closely related problem in dimension at least 7 (Fields medal); Michael Freedman solved the analogue of the **Poincaré** conjecture in 1982 (Fields Medal); in 1982 Simon Donaldson solved a related problem in dimension 4 (Fields Medal); around 1980 Bill Thurston generalized the Poincaré conjecture to a conjecture about all 3-dimensional spaces — the geometrization conjecture (Fields Medal); in 2003 G.Perelman solved the **Poincaré** conjecture (Fields Medal but he declined to accept it).

The methods used by Perelman were those not of topology but of differential geometry and differential equations, more precisely the Ricci flow for Riemannian metrics. According to Professor Tian, Perelman's insight

Gang Tian with Jeff Viaclovsky and Sean Paul

Marshall Slemrod and Gang Tian

was how to deal with singularities arising in the Ricci flow and then continuing the flow for all time. In 2002-03 Perelman posted 3 preprints which sketched a proof of Thurston's geometrization conjecture. In April of 2003 he visited MIT (where Tian was at the time) and gave 20 one-hour lectures explaining his proof. Now, as a service to the mathematical community, John Morgan, also of Princeton University, and Gang Tian have written a book whose goal was to make the proof of the **Poincaré** conjecture more accessible. ... **RAB**

From the Chair

Dear Friends,

As you will read in this newsletter, there is rarely a dull moment in Van Vleck Hall. I must confess that I am having a hard time keeping up with my colleagues of boundless energy and enthusiasm for mathematics of all kinds and at all levels.

You have heard from our editor about the exciting visit by Professor Gang Tian to present the history and solution of the Poincaré conjecture. We were also recently visited by Elias Stein, the Albert Baldwin Dod Professor of Mathematics at Princeton and 11th Wolfgang Wasow Lecturer. In the same whirlwind week we hosted Andrew Majda, the Morse Professor of Arts and Sciences at Courant and one of two 2006-2007 UW Math Department Distinguished Lecturers. No, there is never a shortage of seminars and colloquia within these walls. I also want to mention a very special event for all of us - a celebration to honor acceptance by Professor Emeritus Walter Rudin of an Honorary Doctorate from the University of Vienna and presented by Professor and Vice Dean Friedrich Haslinger. Walter and Mary Ellen Rudin have had tremendous influence on generations of students and faculty, both within the UW Department of Mathematics and in the broader mathematics community, and we are grateful to have them as colleagues.

In December, the College of Letters and Science appointed an ad-hoc committee to review the Department (this is done roughly once every ten years). The committee noted that, despite the "turmoil into which budget constraints have thrown the Department..., members of the Department remain vibrant, congenial and determined." We are grateful for your gifts to help alleviate the continuing financial strain experienced by the budget cuts. Your donations are used to to recruit outstanding new faculty and students, and to bring in distinguished visitors such as mentioned above. Gift money supports undergraduate research, innovation in classroom teaching, and provides funds for undergraduate and graduate students to present their work at conferences. Members of the Department are working hard to update and strengthen our pre-service courses for future elementary and middle-school teachers of mathematics, a pressing national need which has been broadly recognized by educators, scientific leaders, parents, and politicians alike.

There are a variety of gift-giving opportunities at the end of this Newsletter, and we appreciate all your contributions.

This year we welcome three new faculty and four new Van Vleck Visiting Assistant Professors. Gloria Mari Beffa has been appointed to Associate Professor with tenure. Gloria is an expert on the geometry of Hamiltonian structures associated with curve flows in homogeneous spaces and integrable equations. Gloria also continues to update our undergraduate program in her role as Undergraduate Coordinator.

Assistant Professor Sean Paul comes to us from Columbia University. Working in complex differential geometry, Sean has made important contributions to geometric stability of algebraic manifolds. Jeff Viaclovsky joins the faculty as Associate Professor with tenure, previously an Assistant Professor at MIT. Jeff has made influential contributions to conformal geometry and to the study of canonical metrics on 4-manifolds.

The new Van Vleck Assistant Professors are David Anderson (PhD 2005, Duke University), Bart Kastermans (PhD 2006, University of Michigan), Adriana Nenciu (PhD 2006, University of Florida) and Yannan Qiu (PhD 2005, Columbia University). Their research areas are, respectively, stochastic differential equations, set theory, group theory and number theory/algebraic geometry. The Department is also pleased to introduce two new Staff members Hieu Nguyen and Mary Rice. Hieu joins the computer support staff as a Microsoft Windows expert, with a degree in Management Information Systems from the University of Nebraska. Mary is the new Graduate Program Assistant, with a BA in Portuguese from UW-Madison and a Ed.M. in College Student Services Administration from Oregon State University.

Read on and I guarantee that you will be intrigued and impressed by the people you meet and their varied activities. But the best way to experience all the excitement is to visit us in person - you won't be disappointed!

Wishing you all the best,
Leslie Smith, Chair

Van Vleck Visiting Assistant Professors

David Anderson

received the PhD in 2005 from Duke University. His area of research is stochastic differential equations related to biochemical reaction systems. The title of his thesis is *Stochastic Perturbations of Biochemical Reaction Systems*. After receiving the PhD he spent 1 1/2 years as a Research Assistant at Duke and then joined us in January of 2007. His appointment is partially funded by an NSF Focused Research Grant on Stochastic Models for Intracellular Reaction Networks, and he will be collaborating with George Craciun, Thomas Kurtz, and John Yin.

Bart Kastermans

received the PhD in 2006 from the University of Michigan working with Andreas Blass. His research area is set theory, specifically cofinitary groups, their actions and isomorphism types. His thesis at Michigan is titled *Cofinitary groups and other almost disjoint families of reals*. Bart was born in The Netherlands and holds an M.Sc. from the Free University of Amsterdam. In 2005 he was a Visiting Scholar at Sun Yat-Sen University in Guangzhou, China where he worked with Yi Zhang.

Adriana Nenciu

received the PhD in 2006 from the University of Florida where her thesis advisor was Alexandre Turull. Her research is in group theory, especially character tables of groups. The title of her thesis is *Characters of Finite Groups*. Adriana was born in Romania and received B.S. and M.Sc. degrees from the University of Bucharest. From 1997 to 2000, she was an Adjunct Instructor at the University of Bucharest. There she did research on Hopf algebras.
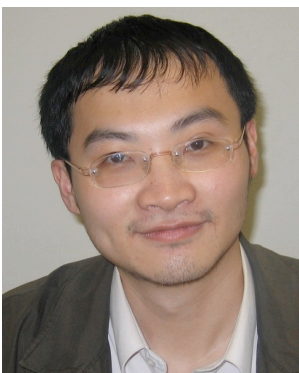
Yannan Qiu

received the PhD in 2005 from Columbia University with Shou-Wu Zhang as thesis advisor. His research areas are number theory, arithmetic algebraic geometry, automorphic forms, and Shimura varieties. His thesis is entitled *Work on Siegel 3-folds*. Yannan was born in China and received a B.S. degree in 2000 from the University of Science and Technology of China in Hefei. In 2005-06 he worked at the Max-Planck Institute in Bonn, Germany. During his time in Madison, Yannan is partially supported by an NSF Focused Research Grant administered by Ken Ono and Tonghai Yang.

New Faculty

Four new faculty members joined the Department of Mathematics in the 2006-07 academic year. They are **Sean Paul**, hired as an Assistant Professor, **Gloria Marí Beffa** and **Jeff Viaclovsky** hired as Associate Professors with tenure.

Gloria Marí Beffa

Gloria Marí Beffa who has been Faculty Associate in the Department of Mathematics, has been appointed Associate Professor of Mathematics with tenure. Gloria has a varied history at UW-Madison. She was Van Vleck Visiting Assistant Professor of Mathematics from 1993 to 1997, Lecturer from 1997 to 1998, Assistant Faculty Associate from 1998 to 2002, Associate Faculty Associate from 2002 to 2006, and now Associate Professor. Professor Marí Beffa has held several visiting positions, including most recently, Visiting Fellow at the Vrij University in Amsterdam.

While a faculty associate, Gloria was Honors Coordinator and Undergraduate Advisor. She played an important and leading role toward improvement of mathematics advising. She was a member of a campus-wide group to increase student retention and developed for the Mathematics Department an "early warning" system. In this system, she worked with our faculty and TAs to review student placements, identify through early diagnostic quizzes students who are experiencing difficulty, provide this information to students and their advisors early in the semester for strategic advising, referral to the Mathematics Tutorial Program or other academic support services, or change in course enrollment. Dr. Marí Beffa continues to serve as undergraduate advisor.

Gloria is an expert on the geometry of Hamiltonian structures associated with curve flows in homogeneous spaces and integrable (soliton) equations. Some of her recent work includes Poisson structures associates with conformal geometry of curves, time arc-length preserving evolution of curves in Riemannian manifolds as Hamiltonian flows, and completely integrable evolution of curves in Lagrangian planes. Her work on Poisson geometry of loops in homogeneous spaces leads to interesting structures on the associated loop groups. This past year Gloria gave invited talks at the University of Kent, the Vrije University, and the IMA (Minneapolis) summer meeting on Symmetries and Overdetermined Systems of PDEs.

Sean Paul

Sean Paul received the PhD from Princeton University in 2000 with a thesis *Geometric Analysis of Chow Mumford Stability* written under the direction of Gang Tian and Peter Sarnak. Before coming to Madison, Sean was Ritt Assistant Professor at Columbia University. His primary field of research is complex differential geometry. This is a relatively new area of investigation that brings together several areas of mathematics: nonlinear partial differential equations and the calculus of variations, algebraic geometry, classical invariant theory and commutative algebra, several complex variables, and symplectic geometry. Sean's work concerns fundamental problems in complex geometry, and he has made very significant contributions to geometric stability of algebraic manifolds. He comes highly recommended to us as a researcher and a teacher. In the fall he taught our graduate complex differential geometry course, and in the spring he is running the seminar in topology on advanced topics in complex differential geometry.

Jeff Viaclovsky

Jeff Viaclovsky received the PhD from Princeton University in 1999 where his thesis *Conformal Geometry, Contact Geometry, and the Calculus of Variations* was written under the direction of Phillip A. Griffiths. He was R.H. Bing Instructor of Mathematics at the University of Texas at Austin in 1999-2000 and C.L.E. Moore Instructor of Mathematics, then Assistant Professor of Mathematics at MIT from 2000 to 2006. During 1999-2002 he was also an NSF postdoctoral research fellow. Jeff s research interests are in partial differential equations, differential geometry, and conformal geometry, with a study of the relationship between the geometry and topology of manifolds. He has made very original and influential contributions to conformal geometry and to the study of canonical metrics on 4-manifolds. He comes highly recommended as a researcher and teacher, In the fall, Jeff taught our graduate course on differentiable manifolds. Currently he is teaching our differential geometry course focusing on the metric properties of Riemannian manifolds.

Jeff Viaclovsky

New Affiliate Faculty Member

Michael Ferris

Professor **Michael C. Ferris** of the Department of Computer Science has received a zero-time appointment in the Department of Mathematics. Such an appointment enables Michael to supervise dissertations of graduate mathematics students. He received the PhD in 1989 from Churchill College of the University of Cambridge, and joined the Department of Computer Science in 1994. He has been (full) Professor since 1998. Michael's research interests are in mathematical programming, modeling and applications of operations research, optimization in medicine, complementary problems, grid computation, and numerical algorithms. He holds a U.S. patent for a method for caching of media files to receive delivery cost. Michael has been a Guggenheim Fellow, and in 2002 won the William Pierskalla Best Paper Award for Research Excellence in Health Care Management Science, given by the Institute for Operations Research and the Management Sciences.

Promotion

Albrecht Klemm promoted to Professor

Albrecht Klemm who holds a 25% time appointment in the Department of Mathematics and a 75% time appointment in the Department of Physics, has been promoted to (full) Professor. Before joining our university in 2003, Albrecht was a Professor at the Humboldt University in Berlin. Professor Klemm's research is in mathematical physics and includes such mathematical topics as Calabi-Yau manifolds, mirror symmetry, and algebraic geometry. He is one of several authors of the book Mirror Symmetry published by the American Mathematical Society in 2002. He was a co-organizer of the special program New Topological Structures in Physics held at MSRI from January to June in 2004 where he was Simons Professor of Mathematics.

In the last two years, Albrecht has given many invited lectures at universities including the Albert Einstein Institute in Golm, CERN, and ETH-Zurich. He is also in great demand for lecture series. In 2005 and 2006, he gave a 3 hour series on *Topological String Theory and Integrable Structures* at the RTN Winter School; *Strings, Supergravity and Gauge Theories* in Trieste; a 2 hour mini-course on *The Topological Vertex* at the Workshop on Random Partitions and Calabi-Yau Crystals in Amsterdam, a 3 hour lecture series on *Mathematical Aspects of the Topological B-model* in the program Algebraic Geometry & Topological Strings at the Instituto Superior Téchnico in Lisbon, and a 4 hour lecture series on *Introduction into Topological String Theory on Calabi-Yau Manifolds* as part of the Andrejewski-Leectures in Berlin/Potsdam.

New Interdisciplinary Seminar: Math and ...

Last fall semester **Jordan Ellenberg** originated a new semiannual seminar called *Math and ....* in which connections between mathematics and other disciplines are to be explored. The first seminar, cosponsored by the Department of Mathematics and the Department of Art History, was given by **Daniel Biss** of the University of Chicago on *Grothendieck, Braque, and the formality of relativism*. In his talk, Professor Biss discussed some common ground shared by mathematics and the art of the first two-thirds of the 20th century. Professor Biss started his fascinating lecture with the following quote of the painter George Braque from 1961 (as translated by Professor Biss): *You see, I have made a great discovery---I no longer believe in objects except insofar as a rapport exists between them*. He then talked about what he understood this quote to mean and discussed the mathematics of Grothendieck through it. He mentioned that during the period 1909 to 1913, Braque and Picasso worked together on a daily basis — painting and discussing,

Jordan Ellenberg and Daniel Biss

each influencing the work of the other, similar to the kind of collaboration that often takes place in mathematical research (except, as far as we know, there is no painting signed by both Braque and Picasso). In connection with the quote of Braque, Professor Biss said that some forms of art are about discovering and teasing out relationships between different kinds of objects in one's field of vision---more about relationships than objects.

In the spring semester, Professor Adam Elga of Princeton University will be the seminar speaker, and his talk will be cosponsored by the Department of Mathematics and the Department of Philosphy. Judging by the very large attendance at the first seminar, we think this seminar series is going to be very popular.

Two Faculty Win Vilas Associates Awards

The Graduate School has named **Paul Milewski** and **Julie Mitchell** as **Vilas Associates** for the years 2007-09. This award provides summer research support for two years and a flexible research fund for scholarly activities.

Paul Milewski

received the PhD in Applied Mathematics from MIT in 1993 and has been on the UW faculty since 1995, becoming (full) Professor in 2003. His research concerns mathematical fluid mechanics. Currently his research focuses on stratified flow as is found in the earth's atmosphere and oceans. He plans to use his award to understand basic problems in shear instabilility and mixing that occur in these two fundamental aspects of earth science, bringing the tools of modern applied mathematics to bear in these investigations. Paul is the coordinator of the AMEP program and a member of the Bacter Institute in Computational Biology on campus. He is also the co-principal investigator of our VIGRE program and serves as its undergraduate coordinator.

Julie Mitchell

is Assistant Professor in the Departments of Mathematics and Biochemistry. She received the PhD in Mathematics from UC-Berkeley in 1998. Before coming to Madison, she was a scientist at the San Diego Supercomputer Center. Julie was nominated for this award by the Department of Biochemistry. Her research focuses on mathematical models for protein interactions. Using differential equations, optimization and computational learning algorithms, tools for predicting and engineering protein binding geometry will be developed with the Vilas award. One problem of current interest is engineering a stronger interface within a system that inhibits the expression of a cancer gene. Julie is the Director of the Bacter (Bringing Advanced Computational Techniques to Environmental Research) Institute.

Special Lectures

11ᵗʰ Wolfgang Wasow Lecture

The 11ᵗʰ Wolfgang Wasow Memorial Lecture was given on November 1, 2006 by **Elias Stein**, the Albert

Elias M. Stein

Baldwin Dod Professor of Mathematics at Princeton University. The title of this special lecture was Discrete Analogues in Harmonic Analysis. Professor Stein has pioneered the development of tools of harmonic analysis for tackling problems in many areas of mathematics, such as several complex variables, PDEs, representation theory, and probablity theory, and he fascinated a large audience by describing how these discrete analogues spawned important applications in applied physics and engineering. His many honors include: National Academy of Sciences (1974), Wolf Prize (1999), President's Award for Distinguished Teaching (Princeton University) (2001), Steele Prize for Lifetime Achievement (2002), National Medal of Science (2002), and Bergman Prize (2005). A reception was held in our ninth floor lounge following the lecture.

The 12ᵗʰ Wolfgang Wasow Memorial Lecture will be given on October 17, 2007 by **Barry Simon** of the California Institute of Technology.

11ᵗʰ LAA Lecture

The 11ᵗʰ LAA Lecture was given by **Ronald DeVore**, the Robert L. Sumwalt Professor of Mathematics at the University of South Carolina, on April 28, 2006. The title of his lecture was *Analog to Digital Conversion: A Mathematician's view*. According to Ron: "The digital world is preferred for signal processing since one can take advantage of the fact that the signal only takes values in a finite set of possibilities when doing computation. On the other hand, most signals are inherently analog. This make the operations of Analog to Digital conversion (A/D) and the reverse Digital to Analog conversion (D/A) cornerstones of signal processing. The story of how one should perform this conversion is an interesting one from the viewpoints of both mathematicians and engineers. The mathematical solution does not match the preferred engineering solution (Sigma-Delta modulation)." Ron went on to explain some possible mathematical reasons why Engineers choose Sigma-Delta Modulation over more obvious and seemingly better choices. Professor DeVore holds an Honorary Doctorate from RWTH-Aachen and is a member of the Academy of Arts and Sciences (2001). At the ICM in Madrid in the summer of 2006, he gave a plenary lecture.
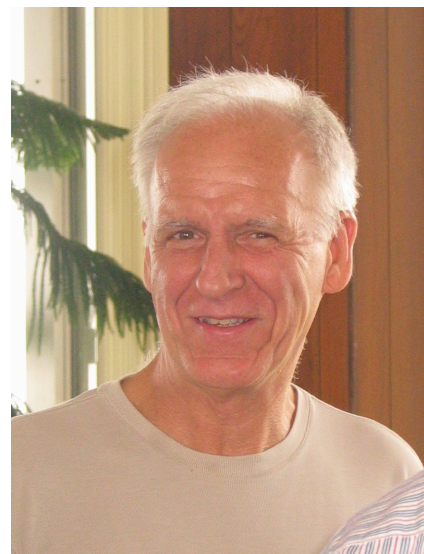

Ronald DeVore

The 12ᵗʰ LAA Lecture will be given by **Carl D. Meyer** of North Carolina State University on May 4, 2007.

Distinguished Lectures

Andrew Majda,

Morse Professor of Arts and Sciences at the Courant Institute of NYU visited the Department of Mathematics from October 30 to November 2, 2006 and delivered a series of lectures to faculty and graduate students. The titles of his lectures were:
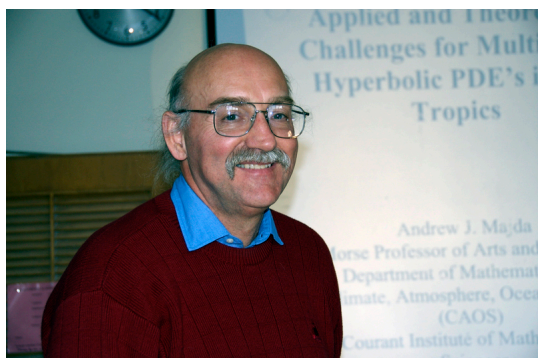
Andrew Majda

•*Multi-scale models for the tropics (given in the Department of Atmospheric and Oceanic Sciences),*

• *Applied and theoretical challenges for multi-scale hyperbolic PDEs in the tropics, and*

• *Information theory, statistical mechanics, and predicting Jupiter's red spot.*

In addition, Professor Majda had a Brown Bag lunch with graduate students during one day of his visit.

Professor Majda is a member of the National Academy of Sciences and has received numerous honors and awards including the John von Neumann Prize of SIAM, the Gibbs Prize of the AMS, and the Medal of the College de France. In 2000 he was awarded an honorary doctorate by Purdue University, from which he earned the PhD in 1973. At the Courant Institute, he created the Center for Atmosphere Ocean Science consisting of a multi-disciplinary faculty to promote cross-disciplinary research with modern applied mathematics in climate modelling and prediction.

Helmut Hofer

 Helmut Hofer, a leading world expert in the area of symplectic geometry, Hamiltonian dynamical systems and related global analysis, was Distinguished Lecturer in the spring semester of 2006. He delivered three lectures on symplectic geometry and global analysis during the week of May 1--5. The titles of his lectures were: *Symplectic rigidity and quantitative symplectic geometry, Analytic and geometric foundations of symplectic field theory, and Symplectic geometry and Hamiltonian dynamics*. According to Professor Hofer, quantitative symplectic geometry is concerned with the ``size" of a symplectic space and the study of rigidity questions. On the other hand, symplectic field theory may be viewed as a theory of invariants for symplectic cobordisms. In his final lecture, he explained how the techniques of symplectic geometry give new insight to classical questions in the theory of Hamiltonian dynamics and how certain dynamical phenomenon can be used in symplectic rigidity theory.

Helmut Hofer

Professor Hofer is Professor of Mathematics at the Courant Institute of Mathematical Sciences at NYU. He was a plenary speaker at the International Congress of Mathematicians held in Berlin in 1998.

Graduate Student Combinatorics Conference (GSCC2)

A combinatorics conference organized by and for graduate students was held in Madison on April 22-23, 2006. The conference GCSS2 was the second in what is hoped will be an annual conference; GSCC1 was held at the University of Minnesota in the spring of 2005. Sixty graduate students working in combinatorics from throughout the U.S. and Canada attended GSCC2. Participating were students from more than 20 different universities. The conference was organized by graduate students **Adam Berliner** and **Louis Deaett** of UW-Madison and **Dimitrije Kostic** of Texas A&M University. The faculty advisor for the conference was Richard Brualdi. There were 34 talks given by graduate students on topics including graph theory, generating functions, matroids, random simplicial complexes, lattice paths, partitions, and symmetric functions. Funding for the conference came from the UW-Madison Mathematics Department and the Institute for Mathematics and its Applications (IMA) through its Participating Institution Program.

The keynote speaker was Professor **Doron Zeilberger** of Rutgers University. As he remarked, the average age of the conference participants was the lowest of any conference he has ever attended. Professor Zeilberger gave two lectures in his usual dynamic and incomparable style. His first lecture was titled $\geq$ and it was a "sequel" to an invited AMS hour talk he gave in 1994 titled =. His theme was that it is much harder to prove an inequality $A \geq B$ than to prove an equality $A=B$, and the way to do it is to define C by $A-B=C^2$ and then find the real number C (or use a sum of squares). A familiar example is the arithmetic-geometric mean inequality **(AM/GM)** where

one uses

$$\frac{a+b}{2} - \sqrt{ab} = \frac{(\sqrt{a}-\sqrt{b})^2}{2}.$$

Another example is given by the Cauchy-Schwarz inequality. He also gave an example due to Motzkin for which this method fails. We cannot use a sum of squares to show that

$$x^4 y^2 + x^2 y^4 - 3x^2 y^2 + 1 \geq 0$$

but it follows from the **AM/GM** by

$$\frac{x^4 y^2 + x^2 y^4 + 1}{3} \geq \sqrt[3]{x^4 y^2 \cdot x^2 y^4 \cdot 1}.$$

For his second lecture My Ph.D. defense (Thirty years later), Professor Zeilberger said that he never got to defend his Ph.D. thesis (nor did he have a proper qualifying exam) because by the time the outside reviewers' reports were received, he was faraway as a postdoc. He then proceeded to give a talk on the problem he got from his advisor (Harry Dym) and how he put Dym's approach aside to solve it and became a "discretean." Doron fascinated the audience with his discrete analytic functions and discrete Cauchy contour integral identity over a fundamental region. He then showed how his new approach led to generating functions and his love-affair with combinatorics.

GSCC3 will be held at the University of Washington in Seattle in April, 2007.
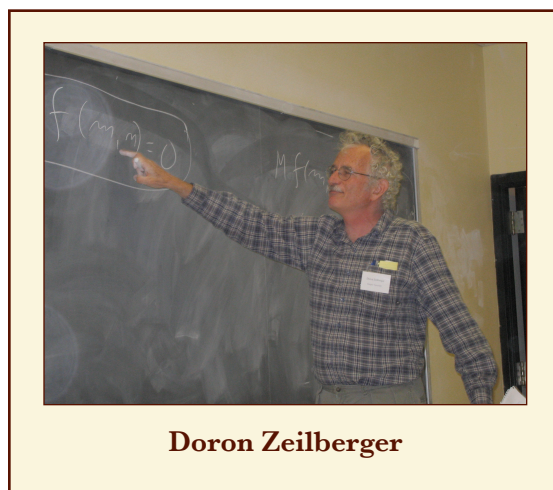

Doron Zeilberger

Graduate Student Conference in Logic in Madison

A logic conference organized by and for graduate students was held in Madison on April 29-30, 2006; this was the seventh in a series of such conferences. There were 43 registered graduate students in logic attending, coming from 15 different institutions throughout the country. The organizers of the conference were **Ascher Kach** and other graduate students of UW-Madison; Steffen Lempp served as faculty advisor. There were 16 talks given by graduate students on topics including automatic and computable structures, *o-minimality*, shuffle sums, degree spectra of homogeneous models. temporal logic, perturbations of metric spaces, and neighborhood semantics for modal logic.

The keynote speaker was **Itay Ben-Yaacov** of UW-Madison. The title of his talk was ***From discrete to continuous logic***. According to his abstract: First order logic has been, is, and will probably remain the form logic of (p)reference in most branches of mathematical logic, and in particular in model theory. At the same time, extending the study of formal logic beyond first order logic is common practice: in model theory, this means the study of many non-elementary classes of various kinds. In most of these cases this comes at some cost (more complicated or weaker theory), and the further we stray from first order logic, the higher the cost. Continuous first order logic is obtained by replacing the classical set of truth values

{0,1} with the whole **[0,1]**, while keeping syntax (and semantics) as close as possible to first order logic. Thus many properties of classical first order logic (e.g. compactness) are preserved, while at the same time "continuous elementary classes" encompass many new and interesting classes of complete metric structures.

This conference was partially funded by the UW-Madison Department of Mathematics.
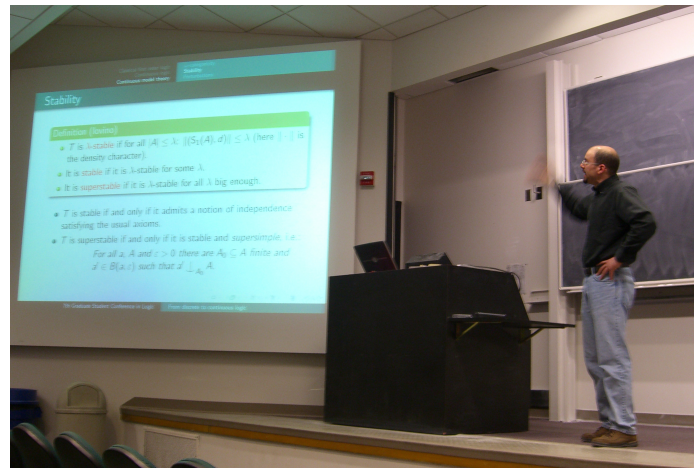
Walter Rudin Receives Honorary Doctorate

The University of Vienna recently voted to confer an honorary doctorate on Walter Rudin. A reception in honor of this event was held on Wednesday, September 27, 2006 in the 9th floor lounge of Van Vleck Hall. Professor Friedrich Haslinger, who is a mathematician and a vice-dean at the University of Vienna, presented the honorary degree to Walter. Chancellor John Wiley also attended the reception. This is the first time that the University of Vienna has awarded an honorary degree to a mathematician since 1956 when Carl Ludwig Siegel was so honored. With our chair, Leslie Smith, as emcee, the festivities began with a UW Music School Quartet playing the second movement from Schubert's Rosamunde Quartet.

John Wiley, introduced as the 27th chancellor of UW, said that he speaks to alumni groups from all over the world frequently and that many think of the Union Terrace or Camp Randall when they think of UW but when mathematicians think of UW they think of the name Rudin. That name has become synonymous with Wisconsin for mathematicians. John asked what does it mean to have a great faculty: stellar contributions to research and to teaching, including writing seminal books like Walter has.

Leslie said that she feels very honored to be in the same department as Walter and Mary Ellen Rudin. The Rudins, who have shaped the mathematical research of many faculty members, still go to seminars, colloquia, and special activities.

Jean-Pierre Rosay spoke on Walter's career. Some highlights of his speech are: The Rudins came to Madison in 1959 (same year that Vince Lombardi was hired as Packers coach). He read an excerpt from Walter's book "The way I remember it." Walter has opened fields to us: he proved great theorems, so we had to study them, and posed great problems and conjectures. The analysis group owes a lot to Walter. He mentioned that there were two former students of Walter's here representing the two main areas of Walter's research: Dan Rider [PhD 1964, W. Rudin] (representing the harmonic analysis side of Walter) and Lee Stout [PhD 1964, W. Rudin], who came all the way from Seattle (representing the complex analysis side). Walter and Mary Ellen have done so much to make our department a wonderfully welcoming place.

Walter Rudin and John Wiley

Walter Rudin's Acceptance Speech

Most of my friends know that Austria has not been one of my favorite countries and some were surprised by my acceptance of this award. I accept it in the spirit in which I hope it is offered, by a group of mathematicians as an acknowledgment of my contributions to mathematics. I left Austria when I was 17 and have therefore had no actual contact with the University of Vienna, while I have spent 47 happy years in this department, which has been a wonderful environment for research. Some of my best work was joint work with Pat Ahern, Alex Nagel and Jean-Pierre Rosay. Thus having the award delivered here seems especially appropriate.

I wish to thank the Mathematics Department of the University of Vienna for making me an honorary doctor and especially Professor Haslinger for coming here to deliver the document in person.

Walter closed with: *What do the following 4 universities have in common: University of North Carolina, Kenyon College (OH), Cedar Crest College (PA), and University of the South (TN).* The answer, which several people knew, was that they are all institutions which have given Mary Ellen Rudin an honorary degree!

The ceremony concluded with the quartet playing the European anthem from Beethoven's 9th symphony.

Presentation of the Honorary Degree

Below is the text of the speech given by Professor Haslinger in presenting the honorary degree to Walter:

Dear Professor Mary Ellen Rudin,

Dear Professor Walter Rudin,

Chancellor John Wiley,

Dear Colleagues,

It is a great honor and pleasure for me to be here in order to present a high academic honor to Walter Rudin.

Last year the school in Vienna that Walter Rudin had attended celebrated its 150th anniversary. One main point in the program of the celebration was dedicated to the memory of a very black year, namely the year 1938 when all Jewish pupils were excluded from school. Exactly the same number of pupils of the present school went down the staircase leaving the building through the hall where all guests were seated. It was very impressive especially as some of the former pupils who had been excluded were among the guests of honor of the celebration.

Also Walter Rudin was contacted by representatives of his former school and was invited to participate in this event, but due to his health condition he was not able to come to Vienna. Nevertheless a commemorative plaque was unveiled in memory of the famous former pupil, a plaque with a nice mathematical formula (we chose the Poisson integral formula from one of Walter Rudin's books) and with a warning to all present and future pupils and teachers not to forget the terrible years.

This May, Walter Rudin celebrated his 85th birthday and on this occasion the University of Vienna decided to pay tribute to Walter Rudin's scientific work. So we asked him whether he would accept the honorary doctorate of Vienna university. And we were very glad to hear that he has agreed to this.

Before I want to pay tribute to Walter Rudin's scientific work, I would like to express my warmest thanks to Mary Ellen Rudin who was always of great help when I wanted to contact Walter.

Professor Rudin, we regret very much that you could not come to Vienna to receive your honorary degree. I am glad we have some pieces of music here in order to give you and the audience some impressions of the usual academic ceremony at Vienna university. We started with the second movement Andante of Franz Schubert's famous Rosamunde quartett. At the end we will still hear the music of the European anthem from Beethoven's 9th symphony. The document I will present to you is written in Latin, which is the traditional academic language of our university. Vienna university was founded in 1365, it was the second German university after Prague. It is a big school with almost 80,000 students. The mathematics department of Vienna university had some famous members for instance Hans Hahn, Kurt Gödel and Johann Radon.

The last honorary doctorate in mathematics was awarded to Carl Ludwig Siegel in the 1960's, it is a very rare honor reserved for exceptional scientists.

The document says that the University of Vienna pays tribute to your exceptional scientific work especially to your contributions in modern analysis and to your important expository books in analysis which were and are still landmarks for the development of modern analysis. These books, which were also honored by the distinguished Steele Prize for Mathematical Exposition of the AMS, are often used for lecture courses and seminars in our university.

In the MathSciNet of the AMS one can find over 210 entries of high quality papers by Walter Rudin in several fields of modern analysis. The honorary doctorate of the University of Vienna pays tribute to the exceptional scientific work of Walter Rudin, but it also stands for a sign of good will and admiration for Walter Rudin. This admiration comes from a new regretful generation of a country from which he had to suffer so much.

Congratulations and good health! Ad multos annos, as we usually express it in Latin.
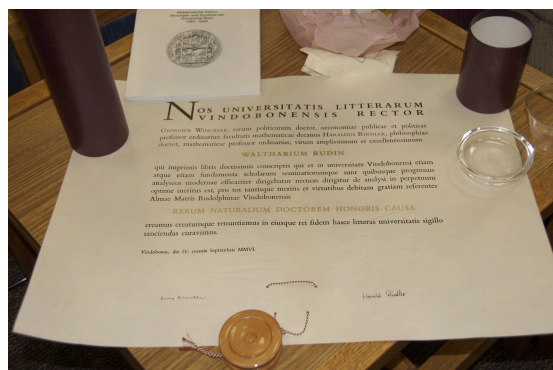
Conference in Honor of Tom Kurtz

A four-day conference, "Markov Processes and Related Topics," was held in Madison July 10-13, 2006, in celebration of Tom Kurtz's 65th birthday and his many contributions to mathematics. It attracted more than 75 participants. There

were 14 45-minute invited talks given by prominent probabilists, including colleagues Jim Kuelbs and Peter Ney. In addition, there were 33 15-minute talks, nine of which were given by Tom's former PhD students, and there was a poster session. A substantial number of speakers were UW-Madison "alumni," having participated in the NSF-sponsored Summer Probability Intern Programs often organized by Tom. A banquet was held at the Alumni Room of the Pyle Center on the final evening at which Tom was given a plaque listing each of his 23 former PhD students (with room for 13 more!) and the inscription was a quote from Tom: *The students I have had over the years have really been the joy of my career. Even the ones who have driven me a little crazy.* Tom's current and former PhD students, after learning that he is a Green Bay Packers fan, presented him with two tickets for each of five games in Green Bay during the 2006 season (unfortunately, a mediocre 8--8 season). The conference was organized by Stew Ethier [PhD 1975, T. Kurtz], Jin Feng [PhD 1996, T. Kurtz], and Dick Stockbridge [PhD 1987, T. Kurtz] and was sponsored by the National Science Foundation, the National Security Agency, the U.S. Army Research Office, the Office of Naval Research, the Departments of Mathematics and Statistics, UWM Mathematical Sciences, and the Institute of Mathematical Statistics. A contributed volume titled *Markov Processes and Related Topics: A Festschrift for Thomas G. Kurtz* is currently in preparation and will be published by the Institute of Mathematical Statistics. Contributed by Stewart Ethier [PhD, T. Kurtz 1975].

Sabbaticals

Three faculty members were awarded sabbaticals for the 2006-07 academic year.

Xianghong Gong

was on sabbatical leave for the fall semester. During that time he had extended visits at the University of Chicago and Nanjing University doing collaborative research in complex analysis and dynamical systems. He also planned to compare their undergraduate programs, especially in the teaching of calculus, with ours.

Shi Jin

is on sabbatical leave this academic year. In Fall, 2006 he organized a special semester on Quantum Kinetic Theory at the Beijing International Center for Mathematical Research in Beijing Univerity, China. In Spring 2007 he will be a CNRS Invited Professor at Université Paul Sabatier, Toulouse, France, a Pauli Fellow at the Wolfgang Pauli Institute in University of Vienna, Austria, and a Visiting Chair Professor at China's Tsinghua University. In Vienna he will be organizing a mini-course series and a Workshop on Computational High Frequency Waves. He will also have short visits to give lectures or attend conferences in Germany, Singapore, Korea and Japan in spring and summer of 2007.

Robert Wilson

was on sabbatical leave for the fall semester. He was conducting research on the role of "culture" in how people learn mathematics, perhaps a factor in how US kids do compared to other countries. It is reported, for example, that the question "What is required to do well in mathematics?" in the US frequently gets the answer "a special gift" while in Japan the answer is "hard work". That makes it a lot easier for US parents to say "Oh, I was never any good at math either..."

Tonghai Yang

is on leave for the full academic year pursuing research on modular forms, working actively with research groups at Columbia University and the University of Maryland. In addition, he will be developing innovative course materials for advanced undergraduate research projects in number theory. He will also will be preparing a text on the Arakelov theory of modular forms.

Next Year's Sabbaticals

The following people have been awarded sabbaticals for the 2007-08 academic year.

Marty Isaacs	2007-08 academic year
Ken Ono	Fall 2007 semester
Paul Terwilliger	2007-08 academic year

Patrick Ahern Retires

The Math department celebrated the 40-year career of Pat Ahern at UW-Madison on Saturday, May 6, 2006 at its annual end-of-semester dinner. Pat, who retired at the end of the fall semester of the 2005-06 academic year, came to Madison as an assistant professor in 1966, after two years as a postdoc at the Institute for Advanced Study and one year at UCLA. After chair Leslie Smith briefly reviewed the highlights of Pat's career at UW, several people reminisced about their relationships with Pat. Hans Schneider, who had just become chair when Pat arrived in 1966, said that Pat was the first person he greeted as chair and that Pat was the first person to greet him. When the department secretary, who overheard the conversation with Hans and Pat, asked Hans why he was so deferential to Pat, Hans remarked that one day Pat may be sitting in his chair and Pat would be his boss. Well, that was not to be, as Pat preferred to concentrate on his research and students.

Xianghong Gong related how his ongoing collaboration with Pat has been a wonderful experience and, as many other speakers, remarked on Pat's modesty, not only in his mathematical achievements, but also in other ways. Not many people know that Pat once won a state bicycle championship and that he has tutored high school students in mathematics. Walter Rudin talking about Pat's mathematical accomplishments said that he had written 9 papers with Pat and that Pat was one of his favorite collaborators. Andreas Seeger also remarked on his friendship with Pat and read a letter from Jean-Pierre Rosay. Jean-Pierre said that he has been grateful for Pat's efficient help over many years and that it was a pleasure to learn from him. Steve Wainger said that he considers himself very fortunate to have had Pat as a friend and colleague for 40 years. Steve also read a letter from Joachim Bruno of Barcelona with whom Pat has collaborated on several papers. This friendship began in 1985 when Joachim first visited Madison and evolved into a strong Madison-Barcelona connection.

Alex Nagel said he had mixed feelings of congratulations and sadness on this occasion. He mentioned that Pat has been an invaluable resource in answering all kinds of mathematical questions. He also remarked on how Pat and his wife Kay have been important friends and that they have befriended a lot of Spanish visitors over the years, making them feel very welcome in Madison. (Pat speaks fluent Spanish now.) Finally, Pat expressed words of thanks to all the speakers and all those present at the dinner. He said how being a member of our department made it possible for him to do mathematics and how the summers and sabbaticals gave him opportunities to travel and collaborate. He related how he and Kay first met at the University of Minnesota when they were both undergraduates working in the cafeteria. Now they have three children and five grandchildren. Pat concluded by saying to Kay how lucky he feels to have had Kay in his life. Pat is now Professor Emeritus of Mathematics.

Arnold Johnson also retired at the end of the 2005-06 academic year and will be an honoree at the annual Faculty Dinner on the 9th floor of Van Vleck near the end of the current semester. An article on his career at UW-Madison will appear in next year's newsletter.

Georgia Benkart Retires

After 32 years at UW-Madison Georgia Benkart retired from the university in the summer of 2006 and is now Professor Emerita of Mathematics. The algebra group in the department honored Georgia with a dinner at Otto's restaurant in Madison with over 30 colleagues and spouses attending. After a delicious meal, several people, including Don Passman, Mary Ellen Rudin, and Marty Isaacs, spoke about Georgia's career and the great influence she has had on the mathematical programs and graduate students at Wisconsin. Lou Solomon read a limerick that he had written for the occasion that went like this

> There was a young lady named Georgia
> Who proved a few theorems that floored ya
> When it came to Cartan
> You were really right on
> And your students and colleagues adored ya.

In responding, Georgia thanked the older people in the department, singling out Mary Ellen Rudin (the only other woman in the department when Georgia first became a faculty member) for the guidance she gave her in early years. She also praised the younger members of the algebra group saying that with them, algebra was in good hands at UW.

Georgia received the PhD in 1974 from Yale University and then came to Madison as the first C.C. MacDuffee Instructor, becoming Assistant Professor in 1976 and (full) Professor in 1983. In 2005 she was named E.B. Van Vleck Professor of Mathematics. Her mathematical research has been very broad, very distinguished and voluminous, focussing on Lie Algebras, their representation theory and combinatorial connections. Georgia has held many visiting positions at prestigious institutions, including the Institute for Advanced Study in Princeton and the Mathematical Sciences Research Institute in Berkeley.

In addition to outstanding research, Georgia is well known nationally and internationally for her remarkable lecturing and expository skills. In 1987 her teaching accomplishments were recognized by our university with a Distinguished Teaching Award. The Mathematical Association of America appointed her as Pólya Lecturer for 2000-02. Twenty students received PhD's under Georgia's supervision and have gone on to have productive careers at many universities throughout the world.

Fortunately for us, Georgia remains in Madison continuing with her research, attending seminars, lecturing, and finishing the supervision of PhD students. She will also be an honoree at the annual Faculty Dinner on the 9th floor of Van Vleck near the end of the current semester.

Jim Kuelbs Retires

After 41 1/2 year of service at UW-Madison, Jim Kuelbs retired from the university at the end of the fall semester of 2006-07. Jim received an undergraduate degree at St. John's University in 1960 and a PhD from the University of Minnesota in 1965, and then joined the University of Wisconsin-Madison.

Jim's research has focused primarily on the development of probability in infinite dimensional spaces, a field in which he was a leading pioneer. He has made significant contributions to almost all aspects of limit theorems and inequalities on separable Banach spaces, including: representations of the characteristic functional of symmetric stable measures, Gaussian chaos, the strong law of large numbers, the central limit theorem, the law of the iterated logarithm (LIL), exponential inequalities, rates of convergence, small ball probabilities, and the theory of large and moderate deviations.

 Jim was the first to develop and use exponential inequalities in infinite dimensions in order to obtain laws of the iterated logarithm in the same setting. In particular, he formulated and proved a basic theorem concerning a Strassen version of the LIL in Banach spaces. This result had a major impact on all further research on the subject.

Originally, it was thought that the strong law of large numbers for independent, but not necessarily identically distributed, random variables in the separable Banach space setting was related to the geometry of the space. However, Jim's inspiration in the LIL carried over to the strong law, and with Joel Zinn [PhD 1972, J. Kuelbs], he showed that the relationship with the geometry was through the weak limit theorems and not the strong limit theorems. This insight influenced much of the later work and culminated in a complete solution of the iid LIL problem (by Ledoux and Talagrand) after Talagrand was able to improve upon Jim's exponential inequalities. Together with Wenbo Li [PhD 1992, J. Kuelbs], Jim developed a beautiful relationship between estimates on the probability a random variable is in a small ball

and the geometric notion of metric entropy. This completely unanticipated relationship has provided a fundamental tool for studying both small ball probabilities and metric entropy. Jim has give many lectures throughout the world. His St. Flour lectures on the law of the iterated logarithm are a standard reference. He was one of the original organizers of the now annual Midwest Probability Colloquium. Jim has provided editorial and organizational leadership for a long series of conferences on probability on Banach spaces and, in addition, has provided extensive editorial support for many journals.

Jim was a popular teacher at both the undergraduate and graduate level, and had ten PhD students. His service to the Department and the University has been extensive with lasting positive effect. In particular, his leadership of the Graduate Admissions Committee resulted in a striking change in the quality of the graduate program.

Jim, now as Professor Emeritus of Mathematics, continues to be engaged in the activities of our Department, and we hope he will be so for many years to come.

New Staff

Hieu Nguyen

Hieu Nguyen is our newest Information Support Technician hired on June 12, 2006. He has a degree in Management Information Systems from the University of Nebraska. Previously, he worked for the Omaha Public Schools as a computer support technician. Hieu has extensive experience with Windows computers and Windows networking. His computer expertise complements the unix skills of the other computing staff. He provides computer support for the support staff, the Math department's computer classroom and Windows users.

Additionally, Hieu speaks Vietnamese fluently and can educate you about Vietnamese culture.

Mary Rice

Mary Rice is the new permanent Graduate Program Assistant in the Department of Mathematics (the position held by Sherry Lange for many years before she retired in 2004). Mary has a BA in Portuguese from UW-Madison (she speaks Portuguese fluently) and a Ed.M. in College Student Services Administration from Oregon State University. She has an interesting and varied background. In Oregon, she was an Americorps VISTA volunteer in public health for two years. She also held several positions at Linn Benton Community College. Most recently, Mary lived in Lafayette, Indiana for a few years where she worked at an adult literacy organization teaching English as a Second Language classes in American Culture. She also was a Lab Assistant in the GED/ABE classroom labs. Besides doing administrative work, Mary also tutored students for their GED. In one of the classes she spent about 9 months teaching basic math up to beginning algebra. Mary has also worked with people on work release, in drug rehabilation centers, on house arrest, and with dislocated workers, especially factory workers whose jobs were sent out of the country. Most recently Mary worked in ECE as the Assistant to the Chair and Secretary of the Department.

Wisconsin Math Talent Search Honors Day

The UW Mathematics, Engineering and Science Talent Search has distributed challenging problem sets to middle schools and high schools since 1963. Participants now include students throughout Wisconsin, from other states as distant as California, and from foreign countries such as Bulgaria. The top prize in the annual competition is a $24,000 scholarship to attend UW-Madison.

Last year, out of more than one hundred contestants, 25 were selected to attend Talent Search Honors Day on April 27. The day-long program included a talk by Professor Audrey Gasch of the UW Genetics Department entitled "Understanding The Genome," and a talk by our own Professor Georgia Benkart entitled "Name A Well-Known Mathematician," as well as a tour of the Ice Cube Project labs of the UW Physics Department.
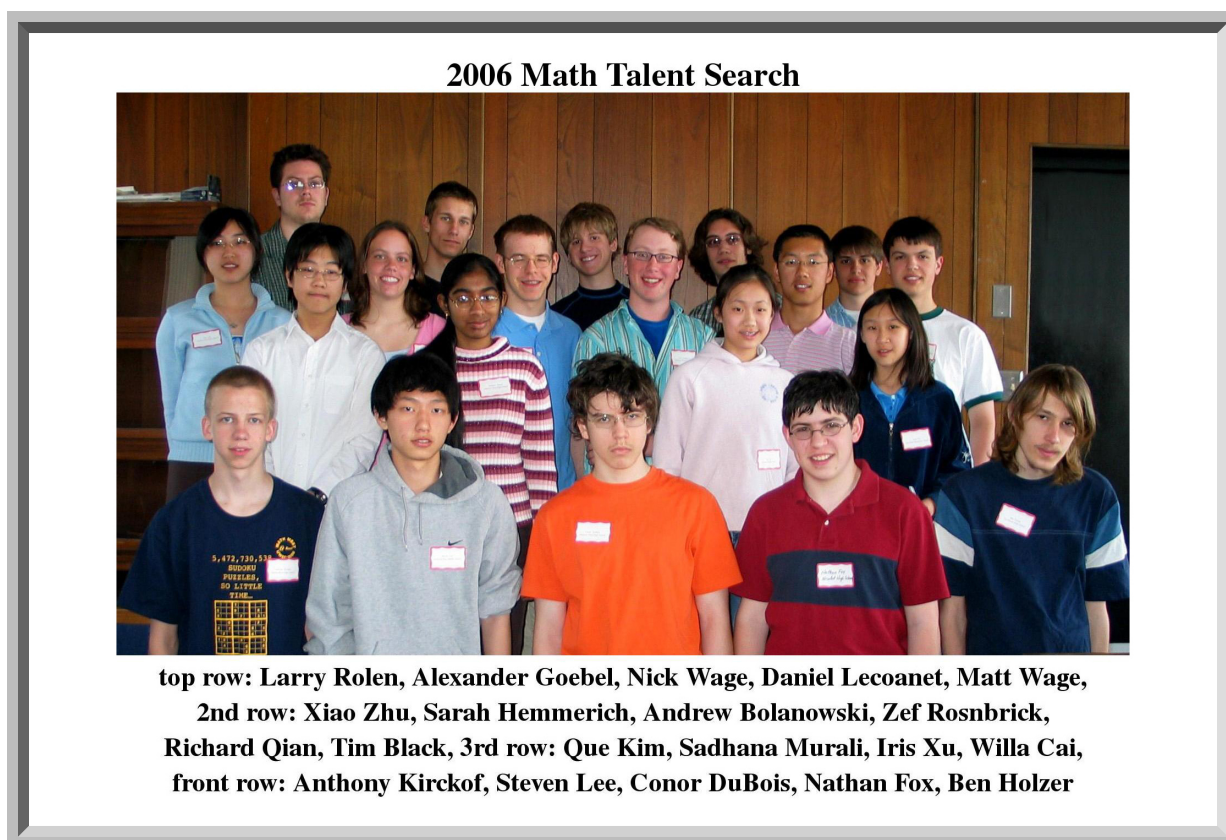
Professors Lev Borisov, Jordan Ellenberg, Martin Isaacs, and Don Passman now produce the Talent Search problem sets and administer the program together with Sharon Paulson. Here are two problems from this year's collection:

(1) It is a fact that 2^{38}=**274877906944**, which is a number having its two rightmost digits equal. Does there exist some power of **2** whose three rightmost digits are equal? Does there exist some power of **2** whose four rightmost digits are equal?

(2) What is the largest number of points that can be placed in (or on the boundary of) a **2x2** square so that the distance between each pair of points is at least **1**?

For the solutions, and additional information about the Talent Search, see:

http://www.math.wisc.edu/talent/honors.html

2006 Math Talent Search

top row: Larry Rolen, Alexander Goebel, Nick Wage, Daniel Lecoanet, Matt Wage,
2nd row: Xiao Zhu, Sarah Hemmerich, Andrew Bolanowski, Zef Rosnbrick,
Richard Qian, Tim Black, 3rd row: Que Kim, Sadhana Murali, Iris Xu, Willa Cai,
front row: Anthony Kirckof, Steven Lee, Conor DuBois, Nathan Fox, Ben Holzer

Graduate Student Awards

Excellence in Mathematical Research Award

                  Paul Jenkins
                  Richard Oberlin

John A. Nohel Prize in Applied Mathematics

recognizes a graduate student who writes an outstanding Ph.D. thesis in applied mathematics at the University of Wisconsin - Madison. The award carries a cash prize of $500.

                  Youngmi Hur
                  Kyle Novak

Special Recognition

Karl Mahlburg [PhD 2006, Ono] received the first PNAS

(Proceedings of the National Academy of Sciences) Paper of the Year award

for his paper entitled "Partition Congruences and the Andrews-Garvan-Dyson Crank."

He also won a Clay Mathematics Institute Liftoff Fellowship. These are prestigious awards

for new Ph.D.s which are awarded based on the quality and significance of mathematical

research already achieved by the candidate. They are intended to support those exhibiting

the potential of becoming a leader in mathematical research.

Math Department TA teaching Awards

                  Ben Akers
                  Tyler Bray
                  Sharon Garthwaite
                  Susan Hollingsworth
                  Asher Kach
                  Ahyoung Kim
                  Jue Wang

Elizabeth Hirschfelder Awards

annual award of $2000 to three women graduate students who are making excellent progress toward the PhD.

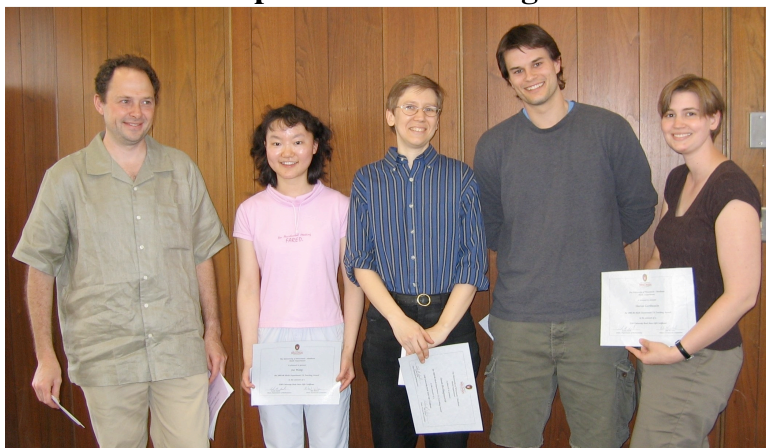   Konstantina (Dina) Christodoulopoulou
                  Sharon Garthwaite
                  Xiaomei Liao

Mary Ellen Rudin Fellowship

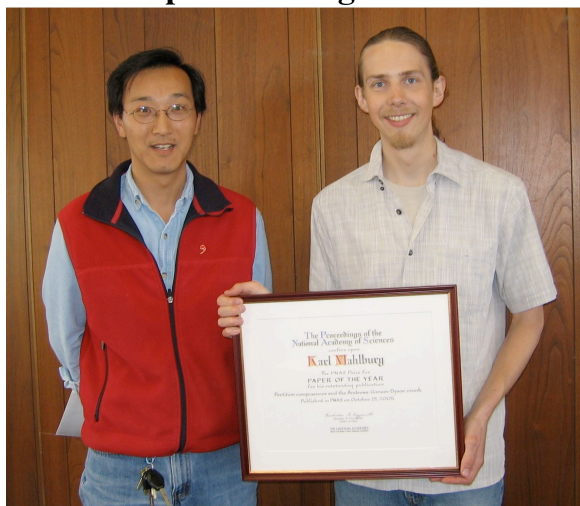Scholarship to support a female graduate student.

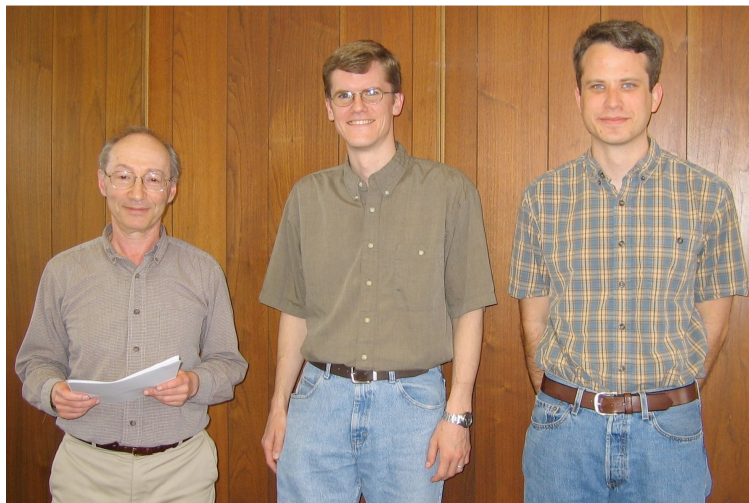   Zajj Daugherty

Math Department Teaching Awards

**Paul Milewski, Jue Wang, Susan Hollingsworth
Ben Akers and Sharon Garthwaite**

Special Recognition

Ken Ono and Karl Mahlburg
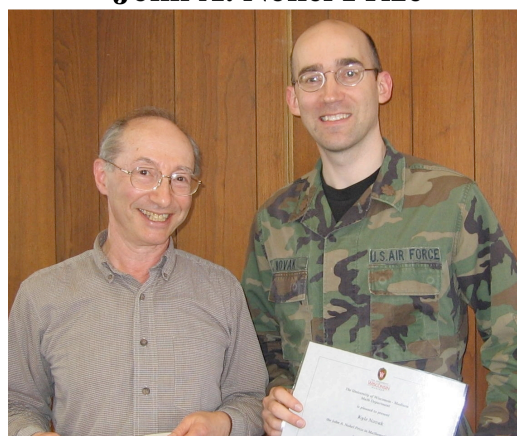
Excellence in Mathematical Research

**Paul Rabinowitz, Paul Jenkins
and Richard Oberlin**

Elizabeth Hirschfelder Awards

**Paul Rabinowitz, Konstantina Christodoulopoulou,
Sharon Garthwaite and Xiaomei Liao**

John A. Nohel Prize

Paul Rabinowitz and Kyle Novak

Undergraduate Scholarship Awards

At our annual Student Awards Ceremony held on May 2, 2006, fourteen exceptional undergraduates were recognized with scholarship awards. Those in attendance are shown in the accompanying photos.

The **Leadership Prize in AMEP** ($500), awarded to an outstanding student pursuing a degree in Applied Math, Engineering, and Physics with demonstrated leadership and superior academic record, went to **Douglas Lipinski**.

Irma L. Newman Scholarships ($600), for outstanding majors, went to **Chelsey Green** and **Lam Raga Anggara Markeley**.

The **David Lawrence Young Memorial Scholarship** ($400), for a student showing promise early in his/her career, went to **Samuel Lachterman**.

Prof. Linnaeus Wayland Dowling Scholarships ($400), for students majoring in Mathematics, went to **Jesse Beder** and **Isaac Schwacher**.

Violet Higgitt Frank Scholarships ($800), for students majoring in Mathematics, went to **Emilie Hogan**, **Fung Bark Lau**, **Liana Prescott**, and **Jeremiah Wilke**.

The **Frank Cady Scholarship** ($3000), for an outstanding and financially needy junior or senior with plans to continue study of mathematics beyond college, went to **Fung Bark Lau**.
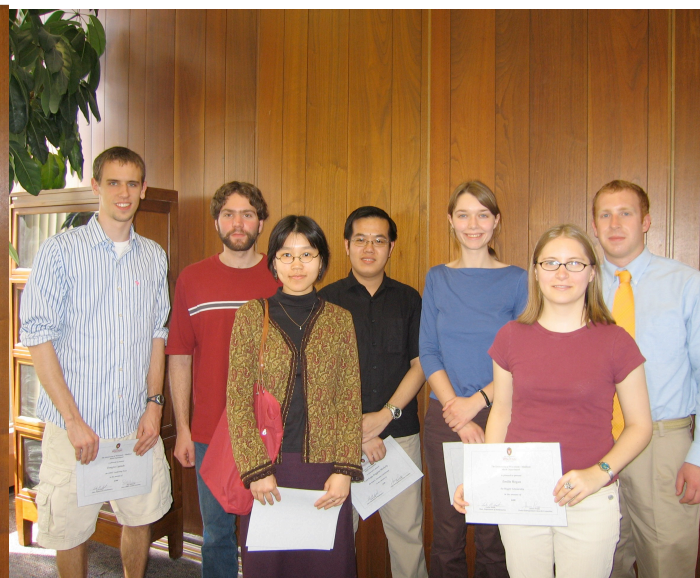
The **R. Creighton Buck Scholarship** ($350), for a student demonstrating outstanding creativity in mathematics, went to **Shane Squires**.

Mark H. Ingraham Scholarships ($1000), for the best Math majors, went to **Eric Becker**, **Mike He**, and **Joseph Richie**.

Dowling Scholarship

Buck Scholarship

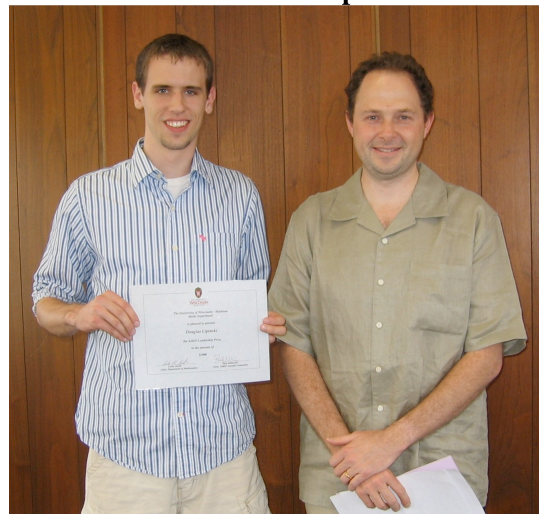Jesse Beder

Shane Squires

Frank Cady Scholarship

AMEP Leadership Prize

Ingraham Scholarship

Fung Bark Lau

Doug Lipinski and Paul Milewski

Joseph Richie

Irma Newman Scholarship

Violet Higgitt Frank Scholarships
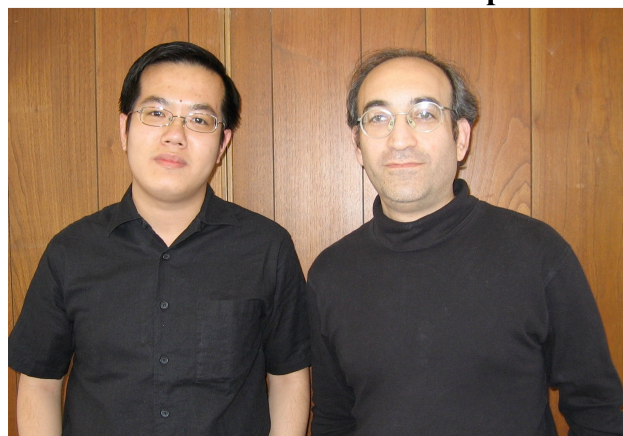
Lam Raga Markeley and Jim Propp

Liana Prescott and Emily Hogan

Undergraduate and High School News

REU in Number Theory

Last summer Ken Ono ran an REU in Number Theory with Rafe Jones (Van Vleck Assistant Professor), Sharon Garthwaite, Karl Mahlburg, and Jeremy Rouse. Thanks to NSF VIGRE funding, they were able to support ten undergraduate students and two high school students. The participants included three former IMO gold medalists, two current Putnam Fellows, and two Goldwater Scholars. The students investigated arithmetic dynamics and p-adic modular forms. These students wrote five papers that will be appearing in the Proceedings of the American Mathematical Society, The International Journal of Number Theory, The Ramanujan Journal, and Integers. Two of the participants deserve special mention. Daniel Kane (MIT), who participated for a few weeks, won the 2007 Frank and Brennie Morgan Prize. Yaim Cooper (MIT) was recently named the first runner-up in the 2007 Alice T. Schafer Prize Competition.

2006 Mega Math Meet

On May 25, 2006, the department hosted its annual Mega Math Meet. Twenty teams of eight 5th and 6th graders from throughout the state competed for prizes by solving math problems. The teams thought about the Game of Nim, formulas for angles, and the combinatorics of electric switches. The Middleton School District team won the team event. Mega Math was hosted this year by Bob Wilson and Tim Boester. The event was organized by Tim Boester, Sharon Garthwaite, Asher Kach, Derek Moffitt, Ken Ono, and Andrew Shale.

Undergraduate Research

Thanks to funding from our National Science Foundation VIGRE grant, each semester the department offers a Collaborative Undergraduate Research Lab (CURL) to a dozen or more of our most talented students. A topics seminar, taken for credit, provides exposure to an active area of contemporary mathematics accessible to undergrads. Participants in the lab are then paid for their research efforts in the area. In recent years Professors Amir Assadi, Jordan Ellenberg, Sasha Kiselev, Paul Milewski, and Julie Mitchell have supervised CURLs on topics in scientific computation, algebraic number theory, and mathematical biology.

This year Professor David Griffeath is offering a CURL organized around the dynamics of snowflakes. How snow crystals evolve from the molecular scale to their final sizes of a few millimeters across, and how they achieve their delicate mix of complex branching and faceted six-fold symmetry, has fascinated scientists since the pioneering studies of Kepler and Descartes.

Over the past few years, advances in photomicroscopy and computer modeling have helped illuminate some aspects of the riddle. Griffeath is collaborating with his former UW student, Professor Janko Gravner of UC-Davis Mathematics, and with Professor Ken Libbrecht from Cal Tech Physics, to develop two- and three- dimensional algorithms that capture the essential morphology of snowflakes observed in nature. This work was featured in a recent Science News article (Week of Dec. 23, 2006; Vol. 170, No. 26/27, p. 408) available on-line:

http://www.sciencenews.org/articles/20061223/bob9.asp

Students in the CURL have been working on rigorous results for some of the simplest discrete algorithms associated with growth of snowflakes. Introduced by Norman Packard in the early 1980s, and subsequently popularized by Stephen Wolfram in Scientific American and elsewhere, these two-dimensional cellular automata produce digital crystals that closely resemble the familiar Koch Snowflake at certain times in their evolution. It has been widely believed that such processes are too complicated to be analyzed mathematically. Last semester, however, the CURL obtained a series of new theorems for Packard's rules. This spring three of the participants -- Charlie Brumitt, Hannah Delventhal, and Mike Retzlaff -- are writing up the results for publication.

Here are a few of the lab's discoveries that are easiest to state. Suppose a crystal spreads over the two-dimensional integer lattice starting from a single frozen "nucleus" at the origin. Each time after that, any unfrozen cell with exactly one of its four nearest neighbors already frozen joins the crystal (i.e., freezes). Then as the crystal spreads to cover the grid, 2/3 of all the cells are frozen eventually. If unfrozen cells join when either one or three neighbors are frozen, then the limiting density is also 2/3, and in fact the total number of frozen cells is exactly the same at any time that is a power of 2, but the pattern of growth is quite different. If unfrozen cells-join when either one or four neighbors are frozen, then the crystal eventually contains every cell of the grid. Finally, and rather surprisingly, if unfrozen cells join when one or three or four neighbors are frozen, then the limiting density equals 29/36.
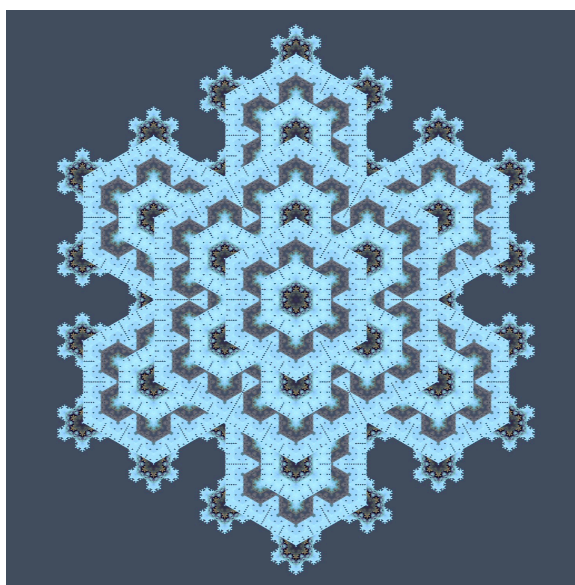
Comparison of a natural crystal (left, photo by K. Libbrecht) and Packard CA on the triangle lattice (right)

Outreach Activities

A great many department programs benefit Madison, the state of Wisconsin, and beyond. The annual UW Math and Science Talent Search, and the Mega Math Meet are highlighted elsewhere in the newsletter. Here are some additional activities.

First, two contributions to the crucial societal mission of improved teacher training:

Collaboration with the School of Education

Math 130, 131, and 132 prepare prospective elementary school teachers. These are content courses on topics such as problem solving, geometry and mathematical models, required for the degree program in Elementary Education. In collaboration with Mathematics Education faculty, and teachers and administrators from the Madison public schools, we are currently developing additional curricula that will supplement this sequence and lead to a middle school minor. This is the first step in a plan to improve preparedness of Wisconsin teachers of mathematics, especially in the critical grades 6-8. Several recent mathematics graduate students have also been part of research teams in the School of Education. At the graduate level, we partner with the Department of Curriculum and Instruction to provide a joint program of graduate work for the master of arts (M.A.) degree. This program, designed especially for teachers of mathematics, culminates in a degree that encompasses both professional education and the field of mathematics.

Math Masters

UW, the Madison Metropolitan School District, and other regional school districts have an ongoing Math Masters pilot program, developed with Title II funding and designed to provide content enrichment for practicing middle school teachers. A follow-up program is currently being developed for elementary teachers. Two-credit courses in Algebra, Probability, Geometry, and Measurement, taught by faculty from our department and others, have been particularly successful in two respects: the participating teachers' content knowledge has improved, and our faculty have become more familiar with present middle school curriculum and methodology.

The department is also active in many programs aimed at increasing diversity and supporting minority students on campus. These include:

Connecting for Academic Success

David Camacho and Gloria Marí Beffa have contributed to a campus-wide effort to develop an academic early warning system for incoming students (not necessarily minorities). The goal is to increase retention of incoming freshmen and improve the success of minority students in mathematics.

Evening Mathematics Program for High School Women

With funding from the department's NSF VIGRE grant, we offer a local program to address the pipeline for future mathematicians. High school women come to the department for evening sessions, working in groups with faculty, graduate students, and undergraduates. Plans are under way to expand the program to additional schools and more students.

Summer Bridge Program
A seven-week course is provided to incoming minority freshmen from the Summer Collegiate Experience Program and from the Engineering Pipeline Program. These students, already accepted at the University of Wisconsin-Madison, enroll in Math 198. They can earn two elective credits with satisfactory homework and examinations. Approximately 70 students participate each summer.

Wisconsin Emerging Scholars (WES)
The WES program, started in 1993, offers motivated students the opportunity to study calculus in a challenging, friendly, multicultural environment. A recent innovation, the WES Mentoring Program, provides former WES participants as math and science role models for students from Lincoln Elementary School on Madison's south side. For more about WES, see http://www.math.wisc.edu/~wes/ .

Terry Millar receives MMSD Distinguished Service Award
Terry Millar, Professor of Mathematics and Associate Dean for Physical Sciences of the Graduate School has been chosen for the 2006 Madison Metropolitan School District (MMSD) Distinguished Service Award honoring a volunteer who has made district-wide contributions. Terry has dedicated many years to the improvement of K-12 education. This award recognizes the work of volunteers who dedicate their time and energy to the MMSD. The announcement of this award said: "In addition to his current work as Principal Investigator and Project Director for SCALE, Dr. Millar has contributed to the MMSD Math Masters Program by teaching professional development classes on Algebraic Relationships and Number operations for middle school math teachers. The goal of the Math Masters project is to increase middle school students' achievement in mathematics by strengthening the quality of mathematics instruction through the provision of content-based professional development. MMSD Math Masters proposal to the Wisconsin MSP initiative (funded by The U.S. Dept. of Education) is led by Mary Ramberg, Executive Director of Teaching & Learning, with funding that started March 1, 2004."

"Past contributions to MMSD include his role in the 1999 Graduate School submission of a successful National Science Foundation (NSF) GK-12 proposal that was called the K-Through-Infinity (KTI) Professional Development Partnership. This six year project had two primary institutional partners, UW-Madison and MMSD. Dr. Millar was the KTI Principal Investigator and Project Director. The goal of KTI was the professional development of STEM (Science, Technology, Engineering, and Mathematics) graduate student KTI fellows through their direct involvement in K-12 education, and in the context of faculty advisors, teachers, and KTI fellows working in teams to help enhance mathematics and science instruction in K-12 classrooms."

In accepting congratulations, Terry said: "I feel that the work I have been involved in with many other folks has been in support of the department, college and university mission to improve math and science education. The vision/support of the Department, the College of Letters and Sciences, and the Graduate School has made this possible."

New Graduate Students in the Fall of 2006

We had an excellent entering class of mathematics graduate students, numbering 38. Their names and undergraduate institutions are:

Ache, Antonio	Universidad Simon Bolivar
Amorim, Lino	University do Porto
Banu, Daniela	Hope College
Bawdon, Orion	University of Washington-Seattle
Beros, Achilles	UC - Berkeley
Beros, Konstantinos	UC - Berkeley
Childers, Michael	University of Maryland
Collins, Nathan	University of Oregon
Conrad, Marc	Indiana University
Curran, Patrick	University of Maryland College Park
Deng, Qiang	Nanjing University
Dewitt, Meghan	Brigham Young University
Ganguly, Arnab	Indian Statistical Institute - Calcutta
Georgiou, Nicos	University of Athens
Gupta, Ankit	Indian Institute of Technology - Kanpur
Hanson, Edward	University of Massachusetts
Hu, Jingwei	Peking University
Hubler, Shane	UW-Madison
Kazalicki, Matija	University of Zagreb
Ling, Jie	China University of Science and Technology
Matz, Sarah	Pennsylvania State University
Medini, Andrea	University delgi Studi di Bologna
Meyer, Seth	Carleton College
Mihalek, Elizabeth	Loyola University
Murcko, Jason	Harvey Mudd College
Rosendorf, Dan	Charles University - Praha
Sarb, Diana	University Din Cluj-Napoca
Schattner, Kim	UW-Parkside
Seal, David	University of Utah
Spyker, Annette	Arizona State University
Sun, Song	China University of Science and Technology
Vincent, Christelle	McGill University - Montreal
Virk, Rahbar	Colorado College
Wang, Rui	Peking University
Worawannotai, Chalermpong	University of Virginia - Charlottesville
Yan, Bokai	Tsinghua University - Beijing
Yip, Martha	University of Waterloo
Zhao, Yongqiang	Shandong University

(They are also online with pictures at the department People page.)

2006 PhDs

Eighteen PhDs were awarded in mathematics at UW-Madison during 2006. Here are their names, their advisors, present employment(as best we can find out!), and their thesis titles:

Anderson, Jaclyn Ann (Advisor, Ken Ono)

Two Problems in the Theory of T-Core Partitions

Chakrabarti, Debraj (Advisor, J-P Rosay)

Postdoc at University Western Ontario
Approximation of Maps with Values in a Complex or Almost Complex Manifold

Griffeth, Stephen P. (Advisor, Arun Ram)

Postdoc at University of Minnesota
Rational Cherednik Algebras and Coinvariant Rings

Hartwig, Brian (Advisor, Paul Terwilliger)

National Security Agency
Tridiagonal Pairs, the Onsager Algebra, and the Three-Point $(s/l)_2$ Loop Algebra

Hollingsworth, Susan (Advisor, Richard Brualdi)

Visiting Professor at Edgewood College in Madison
Packing trees into complete bipartite graphs

Hur, Youngmi (Advisor, Amos Ron)

C.L.E. Moore Instructor in Pure Math at MIT.
Novel Methodologies for Effective Wavelet Constructions in High Dimensions

Jenkins, Paul (Advisor, Ken Ono)

Hedrick Assistant Professor, UCLA
Traces of Singular Moduli, Modular Forms, and Maass Forms

Leida, Johann K. (Advisor, Alejandro Adem)

Milliman Consulting, in Minneapolis
Orbifolds and Stable Homotopy Theory

Liao, Xiaomei (Advisor, Shi Jin)

Computational High Frequency Waves in Heterogeneous Media

Mahlburg, Karl E. (Advisor, Ken Ono)

C.L.E. Moore Instructor in Pure Math at MIT
The Andrews-Garvan-Dyson Crank

Newton, Benjamin W. (Advisor, Martin Isaacs)

Assistant Professor of Mathematics and Computer Science, Beloit College
Complex p-Solvable Linear Groups of Finite Order

Nguyen, Xuan Hien (Advisor, Sigurd Angenent)

Visiting Assistant Professor at the University of Cincinnati
Construction of Complete Embedded Self-Similar Surfaces Under Mean Curvature Flow

Novak, Kyle A. (Advisor, Shi Jin)

Assistant Professor, Air Force Institute of Technology
A Semiclassical Model for Thin Quantum Barriers

Raichev, Alexander (Advisor, Steffen Lempp)

Postdoctoral Research Fellow, The University of Auckland
Relative Randomness via rK-Reducibility

Spaeth, Peter (Advisor, Yong-Geun Oh)

Lecturer, Penn State University
Floer homology and engulfable Hamiltonian diffeomorphisms

Sutton, Talieson (Advisor, Tong Hai Yang)

Postdoc at University of Arizona
Automorphic forms on Quaternions and Central L-values

Vasquez, Elisa (Advisors, Steffen Lempp and Patrick Speissegger)

Assistant Professor, Augsburg College
Geometric Partitions of Definable Sets and the Cauchy-Crofton Formula

Other News

Timo Seppalainen gave one of two plenary lectures at the London Mathematical Society Meeting in Bath, September 11, 2006, titled "Limit shapes and fluctuations for some planar stochastic growth models" (the other one was given by Pierre-Louis Lions). The LMS meetings was followed by a 4-day workshop on the topic "Analysis and Stochastics of Growth Processes" where Timo also spoke.

Márton Balazs after 3 years as a Van Vleck postdoc has begun a tenure-track position at the Budapest University of Technology and Economics. While in Madison, Márton worked with Timo Seppalainen on interacting particle systems and they wrote several papers together. This work earned Márton the Géza Grünwald medal from the János Bolyai Society (Hungary), an award given to young mathematicians in Hungary with exceptional research potential.

Andrej Zlatos after 3 years as a Van Vleck postdoc, has been appointed an Assistant Professor at the University of Chicago.

Steffen Lempp has received a faculty development grant to put together a syllabus and course materials for a new course, Math 135 (temporarily called ``Algebra for Middle School Teachers'' and being developed by the Mathematics Education committee this year), to begin in the fall semester of 07-08. Steffen and **David Griffeath** are co-chairing this Math Ed committee, whose current main projects are a sequence of courses for future middle school math teachers (as part of a new split minor with science) and a revision of the elementary education math courses (our Math 130-1-2). Steffen has received many invitations to lecture including a logic meeting in Bonn in September, 2006, a workshop in Buenos Aires on randomness in January, 2007, an Association of Symbolic Logic meeting in Chicago in April, 2007, and a meeting in Dagstuhl in November, 2007. He is also co-organizing a PIMS meeting on reverse mathematics in Banff in 2008.

Jordan Ellenberg has joined the editorial board of the Journal de Theorie des Nombres de Bordeaux. Jordan gave an invited lecture at the NYU Mini-conference on ergodic theory and diophantine problems in July of 2006.

Richard Brualdi was awarded the Hans Schneider Prize in Linear Algebra by the International Linear Algebra Society (ILAS) at the ILAS meeting held in Amsterdam in July 2006. He is also author of the book Combinatorial Matrix Classes, published by Cambridge University Press in 2006 as volume 108 in their series Encyclopedia of Mathematics and its Applications.

Andrei Caldararu was an invited speaker in 2006 at conferences at the Schrodinger Institute in Vienna, and at the University of Utah. In 2007 he will be giving invited talks at the IAS in Princeton, at CIRM Montreal, and in Bucharest, Romania, He is one of the lecturers at a two week summer school on *Derived Categories in Mathematics and Physics* at the University of Utah, aimed at graduate students and young post-docs this coming summer.

Tom Kurtz has completed his term as President of the Institute of Mathematical Statistics

Alexander Kiselev was a Quantum Mechanics session speaker at the International Congress in Mathematical Physics at Rio Dejaneiro this past year.

Kathrin Bringmann who has been a Van Vleck Assistant Professor for the last three years, working with Ken Ono, will assume a tenure track assistant professorship at the University of Minnesota (Twin Cities) in the fall.

Lawrence Levy retired from teaching as Professor Emeritus in May 1999 in order to complete an AMS memoir that he had been working on for many years---jointly with his former PhD student Lee Klingler [PhD 1984, L. Levy] . It has now been published as AMS Memoir 832 (2005). (Larry is grateful to the University of Nebraska for administering the NSA grant supporting that research, when technical difficulties prevented that grant from being administered at UW.)

Geng Deng, a current graduate student was awarded the best student paper award from the INFORMS computing society at the National Meeting held in Pittsburgh for the paper: "Variable-Number Sample-Path Optimization."

Annual Wisconsin Reunion in New Orleans

The Joint Math Meetings in New Orleans this last January were the scene of our usual reunion of students, faculty, visitors, anyone who has been part of the Madison math scene over the years. Roughly a hundred (some rougher than others...) took part, snacking and drinking and talking about almost everything. We plan to have a similar get-together at the meetings in San Diego next year - Please try to join us!

The Wisconsin Reunion always gets scheduled at the same time as similar fests for other schools. It is always interesting to see how much the Wisconsin folks want to get back together: When there are other meetings just down the hall, ours always seems to be the most popular and certainly the most rambunctious!

Here are a few pictures from this year's reunion. There are more online at this URL

http://www.math.wisc.edu/~wilson/2007reunion/

ALUMNI NEWS

Kenneth B. Stolarsky
[PhD 1967, M. Knopp] of the University of Illinois and Karl Dilcher of Dalhousie University were the recipients of a Lester R. Ford Award for their article "A Pascal-type triangle characterizing twin primes" which appeared in the October 2005 issue of the American Mathematical Monthly. The award, which carries a cash prize of $500 was presented at MAA's Summerfest in Knoxville.

Wenbo Li
[PhD 1992, J. Kuelbs] of the University of Delaware, was named Fellow of the Institute of Mathematical Statistics (IMS). The induction ceremony took place August 2, 2006 at the IMS Annual Meeting in Rio de Janeiro, Brazil. Wenbo received the award for distinguished research in the theory of Gaussian processes and in using this theory to solve many important problems in diverse areas of probability.

Jack Minker
[M.Sc. 1950] Professor Emeritus at the University of Maryland, received the 2005 ACM/AAAI Allen Newell Award. This award is presented to an individual selected for career contributions that have breadth and depth within computer science, or that bridge computer science and other disciplines. The citation on the award states: "For his fundamental contributions to the fields of deductive databases, logic programming, artificial intelligence, and more generally, logic-based methods in Computer Science and for his truly unprecedented role in organizing and stimulating scientific discourse."

Olga Holtz
[PhD 2000, H. Schneider] is the recipient this year of the Sofja Kovalevskaja Award of the Alexander von Humboldt Foundation. This is a very substantial award that is given to young researchers in Germany. The award allows her to hire two post-docs (one in analysis, one in algebra). After gettting her PhD, Olga was hired as a post-doc by Amos Ron of the Computer Science Department of UW-Madison for two years. She then went to Berlin on a junior Humboldt fellowship) and after that to UC-Berkeley.

Xiantao Li [PhD 2002, Shi Jin], now an Assistant Professor of Mathematics at the Pennsylvania State University, has been awarded an Alfred P. Sloan Fellowship.

Two UW-Madison alumni **Jennifer Quinn** [PhD 1993, R. Brualdi], formerly of Occidental College and now Executive Director of the Association of Women in Mathematics, and **Michael Starbird** [PhD 1974, M. Rudin], University Distinguished Teaching Professor at UT-Austin are two of the three 2007 winners of the Deborah and Franklin Tepper Haimo Award for Distinguished College or University Teaching of Mathematics. The awards were presented at the Joint Mathematics Meetings in New Orleans, January 5-8, 2007, where each was invited to speak on ``the secrets of their success." Jenny's presentation was entitled *My practice of mathematics*; Mike's presentation was entitled *Teaching the joy of thought*. Jenny has a recent book with Arthur Benjamin called *Proofs that really count: The art of combinatorial proof*; Mike has a recent book with Edward Burger called *Coincidences, chaos, and all that math jazz: Making light of weighty ideas.*

The Frank and Brennie Morgan Prize recognizes and encourages outstanding mathematical research by undergraduate students. **Daniel Kane**, a mathematics and physics major at the Massachusetts Institute of Technology (MIT), was presented this prize at the Joint Mathematics Meetings in New Orleans, January 5-8, 2007. He has already authored or co-authored ten articles that have appeared or will soon appear in research journals including the Proceedings of the AMS, The Ramanujan Journal, the Journal of Number Theory, Foundations of Computer Science, and Integers: Electronic Journal of Combinatorial Number Theory. Daniel is also a three-time Putnam Fellow and two-time International Mathematical Olympiad (IMO) Gold Medalist. Although not officially an alumni of UW-Madison, while a high school student in Madison, Daniel took a great number of mathematics classes at UW-Madison. He also participated regularly in our Van Vleck Talent Search, and did research on modular forms under the supervision of Ken Ono.

In Memoriam

Frank Kosier

died on June 3, 2006. Frank received the PhD from Michigan State University in 1960 and was an Assistant Professor of Mathematics in our department from 1961 to 1966. He taught at the University of Iowa for over 30 years.

Robert L. Wilson, Sr.

died on August 11, 2006. He received the PhD from our department in 1947 with a thesis "A Finite Method for the Determination of the Galois Group of an Equation with an Application to the Problem of Reducibility" written under the direction of Cyrus MacDuffee.

After completing the PhD he taught at the University of Tennessee (Knoxville) until 1956. He then worked in the aircraft industry for two years, helping to design the computer used in the nation's first supersonic bomber. Professor Wilson then joined the faculty of Ohio Wesleyan University as Chair of the Mathematics Department and taught there for over 20 years. He attended our PhD Centennial Celebration in 1997, having held his Wisconsin PhD for 50 years at the time. Dr. Wilson is survived by many relatives including his son Bob Wilson of our department.

Alexander Khoury

died on August 21, 2006 in Panama City, FL. He received a M.A. in mathematics from our university and then a PhD in mathematics from Columbia University in 1981. He taught at several universities during his career, the last of which as Ferris State University in Michigan.
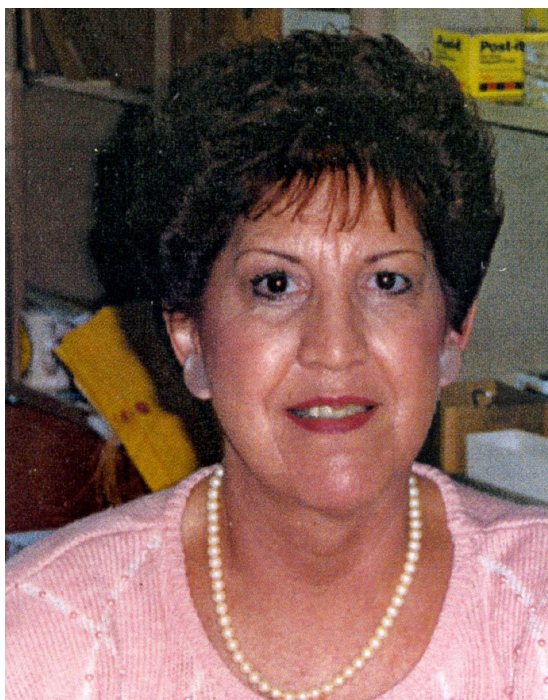
Ann Caruso

died on October 9, 2006. Ann was the receptionist of our department for 33 years beginning in 1964. During that time she was greeter and welcomer to a huge number of graduate students and faculty, the first person most of us saw in the morning when we came to Van Vleck Hall. Ann retired in 1997 and received a Certificate of Commendation from then Governor Tommy Thompson for her years of service to the State of Wisconsin.

Her day of retirement was proclaimed Ann Caruso Day and there was a surprise party in her honor in our 9th floor lounge.

Daniel A. Robinson

died on January 31, 2007. He received the PhD from our department in 1964 with a thesis on loop theory written under the direction of R.H. Bruck and J. Marshall Osborn. Professor Robinson was a member of the Department of Mathematics of Georgia Tech University for many years.

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Van Vleck Photo Project

Here are a few of the hundreds of photos we have acumulated of UW Math people and Van Vleck Hall. See how many of them you recognize. If you have photos which you would like to contribute to this project please contact us. We will have a photo identification and sharing session on Sunday, April 22, 2007 in the 9th floor lounge of Van Vleck. Join us if you can!

DECEMBER 19, 1961
NORTH HALL
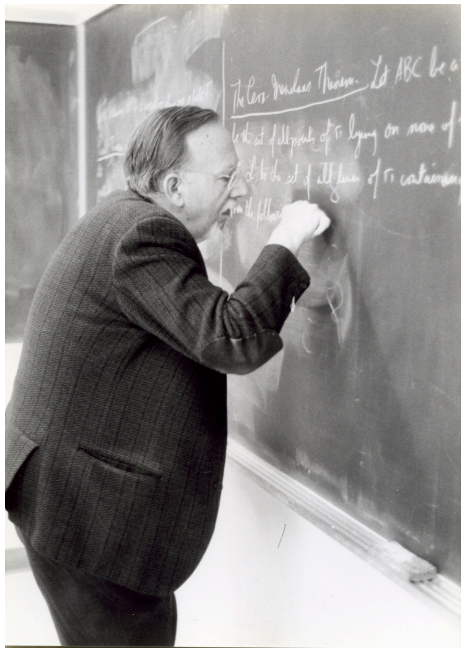
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