



Department of Mathematics  
University of Wisconsin

# Van Vleck Notes 2004

## From the Editor...

We have all seen problems like: Determine the next number in the sequence  $1, 2, 3, \dots, 986, 987, 988, 989, 990, \dots$ . Of course, the answer could be anything we want it to be. Maybe it's  $\pi$  or  $e$  or  $\sqrt{3^4 + 5}$ . But the "obvious answer" is 991, and then the tenth number after 990 is **1000**. It's the significance of this sequence that is important. The UW-Madison PhD count is now at 990 and growing. There seems to be no doubt that we will reach the number 1000, if not at the May graduation, then at the summer graduation. It's a milestone in which we take great satisfaction. It is interesting to note that the 250th PhD was granted in 1966, the 500th in 1975, and the 750th in 1991. So there were 69 years between the first and 250th PhD, but only 9 years from the 250th to the 500th. The latter interval contains 1970 and 1971, in each of which years there were 39 PhDs awarded, the highest ever.

We hope that all of you who received PhDs from UW-Madison are also proud to be in the *UW-Madison's first 1000 Math PhD class*. We plan to recognize this event in the fall with a small local celebration. We will continue the celebration with you, we hope, at the next UW-Madison Mathematics Reunion at the joint meetings in Atlanta in January 2005.

Not only is the the UW-Madison Mathematics Department a major grantor of Mathematics PhDs, but UW-Madison in general is near the "top of the doctoral class" according to a recent survey compiled on behalf of a consortium of six federal agencies. UW-Madison is ranked second (to U.C.-Berkeley) among 413 U.S. universities, by granting 649 doctoral degrees in all fields in 2002.

Among the stories you can read about inside are those of six retirements of faculty and academic staff. Those of you who were in Madison in the last

40 years or so will certainly recognize their names and will know the important contributions each of them has made in the Department. There are a number of other retirements to take note of as well.

Our Dean of the College of Letters and Science, **Phillip R. Certain**, has announced his retirement in the summer of this year. Phil was a Chemistry Professor and Associate Vice-Chancellor for Academic Affairs before becoming Dean in 1993. He is highly respected on Campus for his collegiality, fairness, and problem-solving ability. As our Chancellor, John Wiley, said: "As our senior dean, there are few who possess Phil's institutional knowledge and historical perspective on the past, present, and future of this university." He will be greatly missed.

**Diane Reppert**, who has been our technical typist (and I might say, versatile contributing member of our support staff) since 1977 will be retired by the time you receive this newsletter. As you know Diane has been the technical editor of this newsletter. Her ability to produce mathematical papers and this newsletter using  $\text{\TeX}$  is extraordinary.

**Gen Novara** who has been with the Mathematics Department since 1985 has also announced her retirement for this spring. Gen was the Chair's Secretary for five years before becoming Departmental Administrator in 1990. She has worked with six chairs in these two roles: M. Osborn, S. Hellerstein, A. Nagel, R. Brualdi, A. Adem, and D. Griffeth. Each of these chairs relied greatly on Gen for the smooth running of the department. Because of her, the transition between chairs always went extremely well. She has made extraordinary contributions to the department.

Those of you who have been citizens of Van Vleck Hall will surely recognize the names of these individuals and the important contributions each of them has made. We are going to miss their skill and their cheerful presence in Van Vleck Hall.

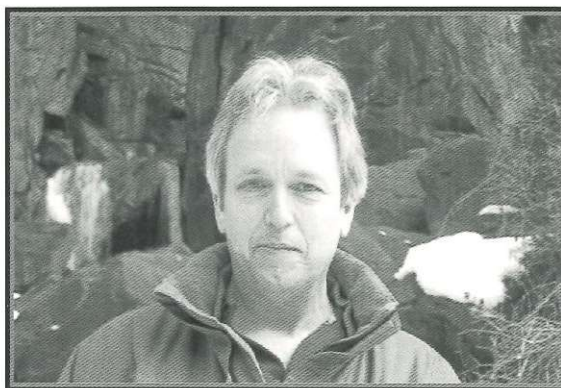
We have lots of interesting news inside. Hope you enjoy reading about us!

RAB

## From the Chair...

Greetings. I've now been Chair of the UW-Madison Math Department for a challenging but very rewarding year and a half. Let me take this opportunity to thank Richard Brualdi for producing another stellar edition of Van Vleck Notes, and for giving me this page to mention some recent highlights in the department, many of which are described in more detail elsewhere in the newsletter.

As you know, the nation's struggling economy and our state's budget crisis have posed serious challenges for UW, the College of Letters and Science, and our department. I am happy to report that we are weathering the storm remarkably well. In the crucial area of hiring, despite a freeze from the college last year, we were able to take advantage of the Chancellor's Strategic Hiring Initiative to recruit two outstanding interdisciplinary researchers: Julie Mitchell and Albrecht Klemm. I invite you to read about Julie and Albrecht in the New Faculty section immediately following. This year we will be filling two tenure-track assistant professor positions and three Van Vleck postdocs. By all indications, future prospects for hiring are even brighter. So despite the recent retirement of six distinguished members of our department (pp.11-15), there is no doubt that the vitality and excellence of our faculty will continue to grow.



During this time of austerity, one way I have been able to enhance the quality of life in our department has been through a series of remodeling projects. The first and most ambitious reclaimed a little-used computer lab above our library and converted it into new, attractive, and much-needed office space for about two dozen of our TAs. Another project has created an inviting undergraduate lounge for members of the Math Club, undergrad researchers, and other students (see p.23). Most recently we have begun the conversion of our copy center into a more efficient space which will let us provide a long overdue lounge for our support staff. These renovations are being funded jointly by Letters & Science, and by a generous gift of the Van Vleck family for improvements to our building and grounds. Such donations are especially crucial when state funding is restricted, so let me encourage all who are able to make a contribution to our annual fund drive through one of the many worthy UW Foundation accounts described on the inside back of this newsletter (p.31).

These pages are filled with evidence of the steady stream of conferences, workshops and seminars we host in Madison. Of special note this past year were the highly successful Great Lakes Geometry Conference last May (p.17) and, over the summer, Ken Ono's Research Experience for Undergraduates (p.10) and the annual Probability Intern Program hosted by Jim Kuelbs and Tom Kurtz. This coming April, Shi Jin and Athanasios Tzavaras are organizing an International Conference on Mechanics and Partial Differential Equations here, in honor of Marshall Slemrod's 60th birthday.

Of the many recent honors and awards described in the newsletter, two stand out: Marty Isaacs' selection as Pólya Lecturer for this year and next (p.9), and the naming of Ken Ono to a chaired professorship: the Solle P. and Margaret Manasse Professor of Letters and Science (p.10). I extend hearty congratulations to Marty and Ken on behalf of our entire community.

In closing, let me remind all friends of UW Math that you are always welcome to stop by Van Vleck Hall for a visit whenever you're in town. Otherwise, I hope to see many of you at the next Wisconsin Reunion of Alumni and Friends - in January 2005 at the Joint Mathematics Meetings in Atlanta. Meanwhile, I wish you the very best for 2004.

Cheers,  
David Griffeth, Chair  
Department of Mathematics

## New Faculty

Two faculty members were hired this past year as part of the strategic hiring initiatives of the university to maintain our research preeminence and to develop world-class programs in emerging areas of knowledge. Julie Mitchell is part of the cluster on Molecular Biometry (joint with Mathematics and Biochemistry). Albrecht Klemm is part of the cluster on String Theory (joint with Mathematics and Physics). The hiring for this cluster is now complete; besides Dr. Klemm, it consists of Gary Shiu (100% Physics) and Akikazu Hashimoto (100% Physics).

Dr. **Julie C. Mitchell** was appointed as an Assistant Professor with a 50% time appointment in Mathematics (College of Letters & Sciences) and a 50% time appointment in Biochemistry (College of Agriculture & Life Sciences). Julie did her undergraduate work in Mathematics at San Jose State University and received the PhD in Mathematics from the University of California, Berkeley in 1998. Her PhD thesis was titled "Hodge Decomposition and Expanding Maps on Flat Tori" and was written under the direction of Morris Hirsch. Leaving Berkeley, she changed fields and spent three years as a postdoctoral fellow at the San Diego Supercomputer Center and two more years as Assistant Principal Scientist at that Center.

Dr. Mitchell's research centers on one of the major problems in Molecular Biology: the identification of protein-protein interaction based on the structures of the individual proteins. Two highlights of her work and accomplishments are:

Fast Atomic Density Evaluator (FADE) - a program to calculate molecular shape and shape complementarity. The program uses Fast Fourier Transforms to compute local atomic density, and is widely used. In fact, since June 2001, FADE has been downloaded by almost 500 users from 30 different countries.

Docking Mesh Evaluator (DoME) - a program for molecular docking of proteins and other macromolecules. This method uses adaptive mesh solutions to the Poisson-Boltzmann equation to calculate interaction energies.

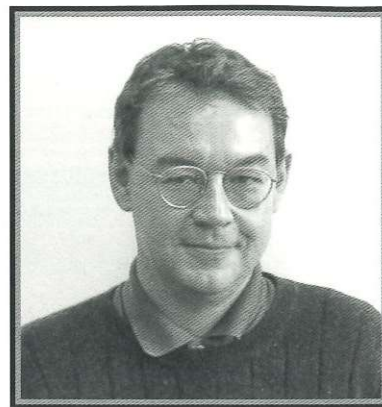
Julie's current research goals are to continue to develop FADE and DoME and to come full circle toward an integration of her research in computational biology and her prior work in mathematics. She plans to participate in the 2004-05 program of the Institute for Mathematics and Applications (IMA) on "Mathematics of Materials and Macromolecules: Multiple Scales, Disorder, and Singularities."

Dr. Mitchell brings new opportunities for cross-disciplinary training to our university. Plans include the development of a course that will be cross-listed with Mathematics and Biochemistry, thereby strengthening the ties between the two departments. While a graduate student at UC-Berkeley, Julie won the "Outstanding Graduate Student Instructor Award."

Last September, Julie gave a talk at a "virtual" conference that was simulcast to hundreds of locations around the world. She went to Fargo, North Dakota and was broadcast from their site. There were a number of different "nodes" where people gave their talks, and the audience from one node could ask questions in real time of speakers broadcasting from the other nodes. Julie says that there were some glitches, but overall it was really quite impressive - sort of like a video conference, but between hundreds of sites.



Dr. **Albrecht Klemm** was appointed as an Associate Professor with a 25% time appointment in Mathematics and a 75% time appointment in Physics. Albrecht was born in Germany and studied at the Ruprecht-Karls-University in Heidelberg. He completed his Habilitation from the Ludwig-Maximilians-Universität in 1997. He has been a Research Fellow at the Department of Mathematics of Harvard University and at the Enrico-Fermi-Institute of the University of Chicago. In 1998-2000 he was a Heisenberg Fellow at the Institute for Advanced Studies at Princeton University. From 2000 to 2003 Dr. Klemm was a Professor at the Humboldt University in Berlin.

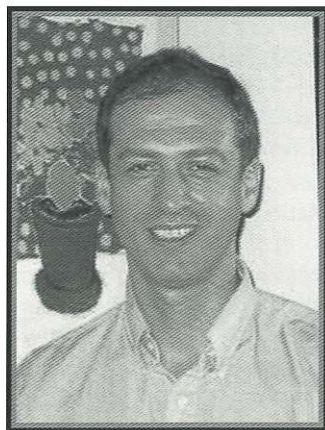


Professor Klemm is one of the leading experts in modern mathematical physics which involves such mathematical topics as Calabi-Yau manifolds, mirror symmetry and algebraic geometry. His work has had a large impact on supersymmetric field theories and string theory. The important topics on which he has made substantial contributions include mirror symmetry, dynamics of supersymmetric gauge theories and the use of “geometric engineering” to embed it into string theory, and the relations of matrix models, gauge theories, and Chern-Simons theory. At Humboldt University, Albrecht has taught a variety of courses, including those on Mathematical Aspects of String Theory, Electro Dynamics, Quantum Mechanics, and Classical Mechanics.

Dr. Klemm is one of the coauthors of the American Mathematical Society book “Mirror Symmetry” published in 2002. He has given many lecture series including “Mirror Symmetry at Higher Genus” at the School on Mirror Symmetry organized by the Clay Institute for Mathematics at Harvard University in 2000, and “Open and Closed String Mirror Symmetry” at the Workshop on Mathematical Aspects of String Theory at the Erwin Schrödinger Institute in Vienna in 2001.

## Promotions to Associate Professor

Three Assistant Professors were promoted to Associate Professor with tenure this past year. They are **Mikhail Feldman**, **Xianghong Gong**, and **Tonghai Yang**.

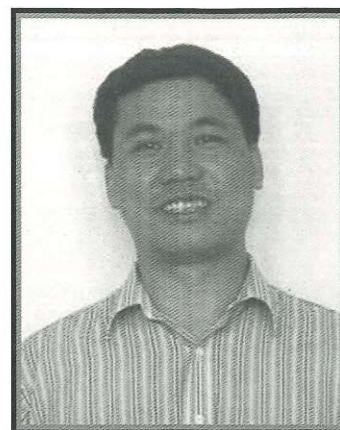


**Mikhail Feldman** received the PhD in mathematics from the University of California, Berkeley in 1994 where his thesis advisor was L. C. Evans. Before joining us as Assistant Professor in 1999, he spent two years as Lecturer at the University of Pennsylvania, one year as a Postdoctoral Fellow at the University of California, Berkeley, and two years as Ralph Boas Assistant Professor of Mathematics at Northwestern University. His research field is nonlinear partial differential equations (including elliptic and parabolic equations and free boundary problems, variational problems, and geometric and variational evolution problems). According to colleagues Sigurd Angenent and Paul Rabinowitz, who acted as his mentors, Feldman “has made broad, deep and original contributions to the analysis of nonlinear partial differential equations” and “has done excellent research on mass transport problems, sandpile dynamics, free boundary problems, and multidimensional transonic shocks.”

Mikhail’s research contributions have been recognized through grants and many invited talks. Besides an NSF individual research grant, he is a co-PI on a Focused Research Grant in mass transport problems (with L. Caffarelli, M. Cullen, L. C. Evans, W. Gangbo, and R. McCann). In the fall of 2003, Dr. Feldman was a visiting member of the Fields Institute in Toronto. Other recent invitations include talks at the PDE meeting in Oberwolfach, the Workshop on Optimal Transportation and Nonlinear Dynamics Workshop at PIMS in Vancouver, and the International Conference on Optimal Transportation Theory and Applications in Pisa. Mikhail has been organizing our joint Applied Math/PDE seminar.

**Xianghong Gong** received the PhD in mathematics from the University of Chicago in 1994, under the direction of Sidney M. Webster. He spent the 1994-1995 academic year visiting the Institute for Advanced Study (Princeton). During 1995-1996 he had a post-doctoral position at the Mathematical Sciences Research Institute in Berkeley, California. He then spent three years as an Assistant Professor at the University of Michigan, and one year as an Assistant Professor at Oklahoma State University before joining our department in 2000.

Xianghong's field of research is complex analysis and dynamical systems. Our former colleague Franc Forstneric, now at the University of Ljubljana, says that "Gong has solved several notoriously difficult problems regarding questions of convergence of normal forms in various types of complex-analytic and geometric problems." Xianghong's research achievements already establish him in the top small group of young mathematicians in his field. Dr. Gong's mathematical research has been supported by NSF grants since 1997. Recent invitations include workshops on Geometric Analysis of PDE and Several Complex Variables in Brazil, Complex Dynamics Conference in Michigan, and a series of lectures at Nanjing University in China. He was one of the organizers of the special session on Several Complex Variables at the recent AMS meeting in Madison.



**Tonghai Yang** received the PhD in mathematics from the University of Maryland in 1995; his thesis advisor was Stephen Kudla. Before joining us as Assistant Professor in 2000, Tonghai spent one year at the Institute for Advanced Study (Princeton), two years as Hildebrandt Research Assistant Professor at the University of Michigan, and three years as an Assistant Professor at the State University of New York at Stony Brook. During 1999-2000, he was an AMS Centennial Fellow at Harvard University.

Dr. Yang's research fields are number theory, arithmetic geometry, and representation theory. According to his mentor Ken Ono, Tonghai "is a leading world expert on critical values of Hecke L-functions" and "has developed a beautiful theory in which these values are given as values of automorphic theta functions." He also says that Tonghai is "actively engaged in an important and deep

program on the Taylor expansions of Eisenstein series."

Yang's research contributions have been recognized through grants and many invited talks. In addition to the AMS Centennial Fellowship, he has had continuous NSF support since 1997. Recent invitations include a talk at a Modular Forms meeting in Oberwolfach, a seminar talk at Harvard University, and a series of six lectures on CM abelian varieties and Hecke L-functions at the Morningside Center of Mathematics in Beijing. For several years, Tonghai has been organizing our Number Theory seminar.

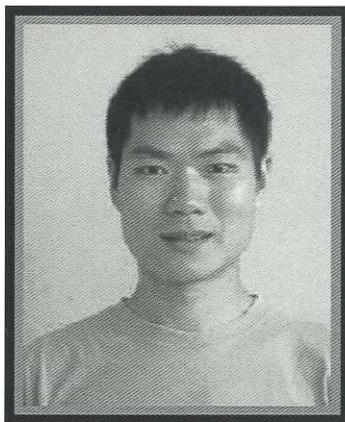
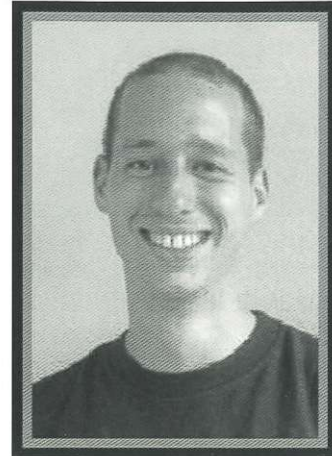
### UW-Madison's 2003-04 Freshman Class

The credentials of this year's freshman class are the best ever. The class – approximately 5,578 students – has a high school academic grade point average of 3.66. Fifty-five percent graduated in the top ten percent of their high school class, and 93 percent graduated in the top quarter. No doubt there are many very good mathematics students among them that we hope to recruit as mathematics majors.

## Van Vleck Visiting Assistant Professors

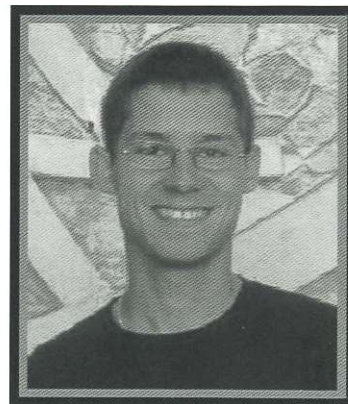
Three new PhDs joined us this year in three-year postdoctoral appointments.

**Marton Balazs** grew up in Budapest (Hungary) where he was a physics student at Eötvös University. He was a PhD student in the Department of Stochastics, part of the Institute of Mathematics of Technical University of Budapest. His advisor was Bálint Tóth and his thesis was titled "Coupling Methods in Stochastic Deposition Models." The research interests of Dr. Balazs include interacting particle systems, stochastic deposition processes, and coupling methods in stochastic processes.



**LiJing Wang** was born in China and attended Nankei University. He received the PhD from MIT in 2003 where his advisor was Gang Tian. The title of his thesis was "Asymptotic Expansion of Bergman Metrics with Twisted Bundle." His principle area of research is that of transcendental algebraic geometry and symplectic geometry, especially their relation. Dr. Wang is currently interested in the relationship of stability of holomorphic bundles over projective manifolds and canonical metrics.

**Andrej Zlatos** was born in the Slovak Republic and attended Comenius University in Bratislava. His PhD in mathematical physics is from the California Institute of Technology in 2003 where his advisor was Barry Simon. His thesis was titled "Sum Rules and the Szegő condition for Jacobi Matrices." While at Caltech, he received the Scott Russell Johnson Prize for Excellence in Graduate Research (2002) and the Scott Russell Johnson Prize for Excellence in Dissertation in Mathematics (2003). Dr. Zlatos is working on spectral theory of Schrödinger operators, in particular, dynamical properties of the Fibonacci Hamiltonian.



Continuing Van Vlecks are: **Alfred Dolich**, **Govind Menon**, **Malabika Pramanik**, **Natalia Rozhkovskaya**, **John Vano**, and **Jesenko Vukadinovic**. **Seung Yeal Ha** left after the fall semester to take a job at Seoul National University.

## Visiting Faculty

In 2003-04 there are again a large number of visitors from other insititutions spending an extended period of time in Madison collaborating in research with our faculty. These include the following, listed with their dates in Madison and the collaborating faculty member.

**Suk-Geun Hwang** [PhD 1985, R. Brualdi],  
Kyungpook National University, Korea  
09/01/02–08/31/04 (R. Brualdi).

**Christine Heitsch**, also a postdoc with the  
Bioinformatics group in the Chemistry  
Department at UW-Madison,  
09/16/02–08/31/04 (E. Bach).

**Hamid Eghbalian** [PhD 2000, A. Assadi],  
also a postdoc in the Center for  
Biological Informatics at UW-Madison,  
05/15/03– 05/31/05.

**Alessandro Cincotti** University of Catania,  
Italy, 06/15/03–05/24/04, (J. Propp).

**Slavik Jablan** The Mathematical Institute,  
Belgrade, Yugoslavia, 09/01/03–  
11/01/03, (D. Crowe).

**Joaquim Ortega-Cerda** Universitat of  
Barcelona, Spain, 09/01/03–  
07/30/04, (P. Ahern).

**Tom Weinmann** ETH-Zentrum, Zurich,  
09/01/03–05/07/04 (J. Robbin).

**Zhonghi Huang** Tsinghua University,  
China, 09/01/03–12/15/03 (S. Jin).

**David Quigg** Bradley University,  
09/02/03–12/31/03 (D. Griffeth).

**Morris Hirsch** UC-Berkeley, California,  
09/15/03–09/14/05 (J. Robbin).

**Jianzhong Pan** Academia Sinica, China,  
01/14/04–02/24/04 (Y. Ruan).

**Tomoaki Itano** Kyoto University, Japan,  
02/03/04–03/04/04 (F. Waleffe).

**An-Min Li** Sichuan University, China  
04/01/04–05/31/04 (Y. Ruan).

**Stefan Hildebrandt** University of Bonn,  
Germany, 04/12/04–05/07/04  
(P. Rabinowitz).

**Kung-Ching Chang** Peking University,  
China, 04/16/04–06/15/04  
(Y. Ruan and X. Chen).

In addition, the following three visitors teamed-taught the Logic Seminar course in the fall semester:

**Denis Hirschfeldt** University of Chicago, IL,  
09/03/03–09/29/03.

**Juris Steprans** York University, Canada,  
11/17/03–12/15/03.

**Mirna Dzamonja** [PhD 1993, K. Kunen],  
University of East Anglia, UK,  
10/06/03–10/31/03.

Please visit our website for current events,  
this newsletter and other information on our programs.

<http://www.math.wisc.edu>

## Sabbaticals and Leaves

### 2003-04 Academic Year

**Amir Assadi** is based in Madison during his academic year sabbatical and is making a sequence of short visits to the laboratories of his collaborators across the country (Cambridge, Houston, Bloomington and Salk Institute in San Diego). He was also invited to join the Genome Center of Wisconsin as an Affiliate last Fall, so the intervening intervals are spent at GCW, where there are a group of active and energetic post doctoral fellow and graduate students. His time is primarily spent between learning more molecular and systems biology, and collaborating with various laboratories on modeling the brain function and some new projects in systems biology. He attended the joint Annual Meeting in Phoenix, where he was invited to give a lecture in the Special Sessions on: Mathematical Modeling in Neuroscience, Biomedicine, Genetics and Epidemiology,

**Georgia Benkart** is on sabbatical leave for the whole academic year. During the fall semester, she attended a meeting in Banff

(which she coorganized) and an international conference at the Korea Institute for Advanced Study in Seoul. When she wasn't on visits to Canada to work on research projects with collaborators there or working on finishing a monograph on the Recognition Theorem (a missing piece of the puzzle of the classification of simple modular Lie algebras), she has been in Madison checking up on her doctoral students. One finished in August, one in December, and three are hoping to finish in May.

**Thomas Kurtz** is spending the academic year at the Institute for Mathematics and its Applications (IMA) at the University of Minnesota where he is helping to lead a year-long program on Probability and Statistics in Complex Systems. In December, Tom took two weeks off from IMA to visit India where he spoke at the Conference on Stochastic Processes and Interacting Particle Systems at the Indian Statistical Institute in Delhi.

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### Others on non-sabbatical leave this year are:

**Anatole Beck** (spring semester, 2003-04) at the London School of Economics (England).

**Alexander Kiselev** (spring semester, 2003-04) at Princeton University.

**Donald Passman** (spring semester, 2003-04) at the Center for Communications Research in LaJolla, California.

**Thanos Tzavaras** (academic year, 2003-04) at the University of Crete (Greece).

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### 2004-05 Academic Year

Eight faculty have been awarded sabbaticals for 2004-05.

**Alejandro Adem** will spend a fall semester sabbatical at the Max Planck Institut in Bonn (Germany) working on applications of topology to mathematical physics.

**Yong-Geun Oh** will spend the academic year at Stanford University working on homology theory and symplectic geometry. He plans to write a monograph on these subjects.

**Peter Orlik** will have an academic year sabbatical and will spend the fall semester at MSRI in Berkeley where he is one of the organizers of the program on Hyperplane Arrangements and Applications.

**Yongbin Ruan** plans to spend a fall semester sabbatical at Princeton University and the Institute for Advanced Study doing research on applications of topology and geometry to physics. He plans to write a graduate level text in this area.

**Leslie Smith** will spend an academic year sabbatical doing interdisciplinary research at the Los Alamos National Laboratories, with shorter visits to Harvard University.

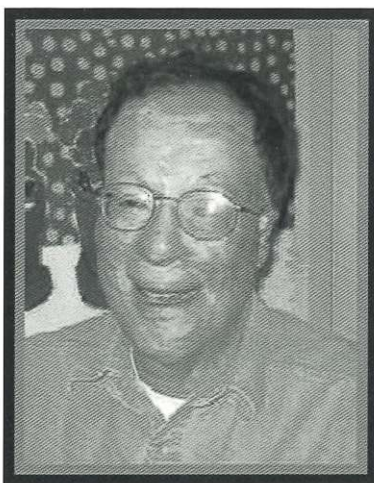
**Dietrich Uhlenbrock** will have an academic year sabbatical in which he plans to explore alternate modes of instruction at the precalculus level, and to prepare a modified calculus curriculum featuring applications to biology.

**Stephen Wainger** plans to spend a spring semester sabbatical at Princeton University working on problems at the interface of harmonic analysis, number theory, and ergodic theory.

**Fabian Waleffe** will spend an academic year sabbatical at Los Alamos National Laboratories working on problems of turbulence, with shorter visits to Harvard University.

## Honors and Awards

### I. Martin Isaacs Named MAA Pólya Lecturer

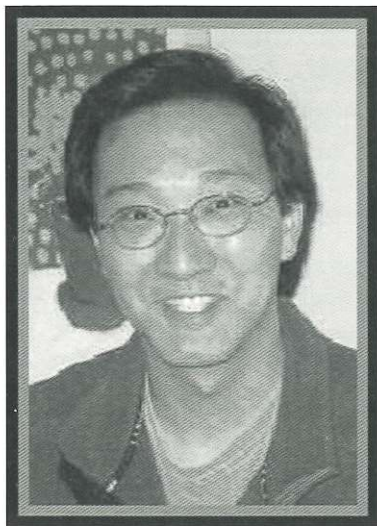


Each year the Board of Governors of the Mathematical Association of America selects a Pólya Lecturer, to serve for two academic years. **Marty Isaacs** has been selected for 2003-04 and 2004-05. On a rotating basis, sections of the MAA can invite one of two Pólya Lecturers to their annual regional meetings. Marty's first Pólya lecture will be given in Anchorage, Alaska.

Marty received his PhD from Harvard University in 1964 under the supervision of Richard Brauer. He was appointed as an Associate Professor at UW-Madison in 1969 after three years at the University of Chicago, and was promoted to Professor in 1971. Over the years, Marty has received many teaching awards and is well-known for his inspiring teaching and lecturing. He received a UW-Madison Distinguished Teaching Award in 1985, the Benjamin Smith Reynolds Award for Teaching Engineering Students in 1989, and the Wisconsin Section MAA Teaching Award in 1993. Marty is also a recent winner (for the second time!) of the Sliffe Award of the MAA. This award is primarily intended for high school teachers and is given on the basis of nominations by students.

Students at Madison Memorial High School nominated Marty for his work on the Mathematics Talent Search. He was nominated for the first Sliffe Award by students at Madison West High School. Professor Isaacs is the author of over 125 papers and three books: "Character Theory of Finite Groups (Academic Press, 1976), "Algebra: A Graduate Course" (Brooks/Cole, 1993), and "Geometry for College Students" (Brooks/Cole, 2000). Among his recent invitations to speak at a conference, is an invitation to speak in Naples, Italy in April 2004. Nineteen graduate students have completed PhD dissertations under Marty's supervision.

## Ken Ono Awarded a Chaired Professorship



Professor **Ken Ono** who has been on our faculty since 1999 is now the Solle P. and Margaret Manasse Professor of Letters and Science. This is an endowed chair funded by a generous gift to the College of Letters and Science. Ken was also awarded a John S. Guggenheim Fellowship in the amount of \$40,000 from the Guggenheim Foundation; only four mathematicians in the USA and Canada were awarded Guggenheim Fellowships in 2003.

In June 2003, Ken gave 10 lectures as the Distinguished Lecturer for the NSF-CBMS Conference on Number Theory which was held at the University of Illinois in Urbana-Champaign. Out of these lectures came the book "The Web of Modularity: Arithmetic of the Coefficients of Modular Forms and  $q$ -series" which is being published in January 2004 by the American Mathematical Society. The book is appearing in the NSF-CBMS Series.

Among his many recent and future activities are:

The REU entitled "Investigating Elliptic Curves and  $q$ -series" that he ran this summer. Eight talented undergraduates were selected from an applicant pool of 130+. The REU consisted of lectures, many given by Jeremy Lovejoy (former VIGRE Van Vleck Visiting Assistant Professor), Gwyn Coogan, Rohit Chatterjee and Jackie Anderson. The students were divided into 2 teams:

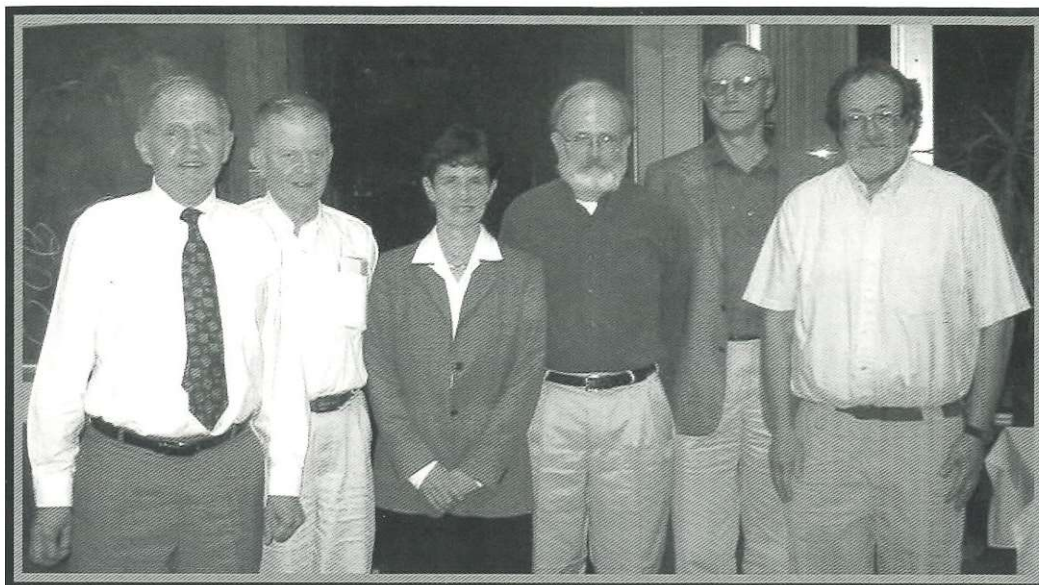
- Team 1    Stephanie Basha (Santa Clara University)  
               Jayce Getz (Harvard University)  
               Harris Nover (CalTech)  
               Emma Smith (MIT)
  
- Team 2    Daniel Corson (MIT)  
               David Favero (Brown University)  
               Kate Liesinger (University of Chicago)  
               Sarah Zubairy (University of Rochester)

**Team 1** wrote a paper generalizing a theorem of Atkin and Zagier on the supersingular locus of elliptic curves. Their result generalized the notion of the Hasse invariant using new families of orthogonal polynomials obtained by integrating against 'modular measures'. Their paper has been accepted for publication in the Journal of Mathematical Analysis and Applications. This team won first place in the MAA poster session at the recent joint AMS-MAA Meetings in Phoenix.

**Team 2** wrote a paper generalizing an Inventiones paper of George Andrews, Freeman Dyson, and Dean Hickerson. These students investigated the properties of the so-called 'mock theta functions.' They found new mock theta functions, and used them to compute values of certain Dedekind zeta-functions at negative integral arguments. This paper has been recommended for publication.

Ken gave the Milton Brockett Porter Lecture series (5 lectures on number theory) at Rice University this past spring. He also gave a series of 10 lectures at Postech University in Korea in January 2004. At the 'Who Wants to be a Mathematician?' competition for high school students in Wisconsin that is being hosted by the American Mathematical Society in Madison on April 16, 2004, Ken has been asked to give public lecture highlighting this event.

## Six Retirees Feted at Faculty and Staff Dinner



R. Turner, R. Askey, M. Certain, D. Rider, C. de Boer, S. Bauman

Our annual dinner was held on May 6, 2003 on top of Van Vleck Hall. Six retirees were honored for their service to the Department of Mathematics, the College of Letters and Sciences, and UW-Madison: **Richard Askey**, **Steven Bauman**, **Carl de Boer**, **Melinda Certain**, **Daniel Rider**, and **Robert Turner**. The combined total years of service adds up to a whopping 200 years! Each of the retirees is now enjoying emeritus status, and some are regularly in Van Vleck Hall keeping up with professional and departmental activities.

**Richard Askey** received the PhD from Princeton University in 1961. He spent 2 years as Dickson Instructor at the University of Chicago before coming to Madison as an Assistant Professor in 1963. He became (full) Professor in 1968. In 1986 he was named the Gabor Szegő Professor of Mathematics, and in 1995 he was awarded the John Bascom Professorship in Mathematics by the University. Dick is a member of the National Academy of Sciences and is an Honorary Fellow of the Indian Academy of Sciences.

Dick Askey is the world's foremost authority on special functions and he has had a profound influence on that subject. His dedication to mathematics and mathematics education is unsurpassed. Besides a great number of papers, Dick has also written or edited 6 books, including "Special Functions" (with G. Andrews and R. Roy) which was published by Cambridge University Press in 1999. This 650 page book contains a wealth of information and is destined to become a classic.

Several people spoke about Dick at the dinner, and not to be outdone, Dick had some

parting comments.

As Ken Ono said, Dick being the world authority on special functions, means hypergeometric functions and basic hypergeometric series. He (along with Wilson) are responsible for completely developing new sets of orthogonal polynomials. Over the last few decades, these results and Askey's 'scheme' for classifying relationships between such functions have played important roles in a striking number of areas. Ken went on to say that one way to measure the influence of a mathematician and the quality of his work is through the theorems he did not prove but the theorems proven using his work and "his school". This includes, among others:

1. de Branges' solution of the Bieberbach Conjecture.
2. Proof of the irrationality of  $\zeta(3)$  ... more recently the irrationality of infinitely many values of  $\zeta$  at odd integers.
3. Applications to the study of quantum groups.
4. Algebraic geometry of 'hypergeometric varieties' (i.e. rigid Calabi-Yau varieties).

5. Arithmetic formula for the Eichler-Selberg trace formula (an important player in Deligne's proof of the Weil Conjectures).

Longtime collaborator George E. Andrews sent a message to be read where he thanked Dick for the countless ways he has aided him in his career, saying that there was probably an army of mathematicians who would echo his sentiment. George went on to say that he has come to regard Dick not only as a generous, outstanding, and insightful mathematician, but also as a saint for his work on mathematics education in the USA. George concluded by saying that whenever his wife suggests that he is travelling a little too much, he responds with: "If you think I travel a lot, let me tell you about Dick's schedule!"

Bruce Berndt [PhD 1966, R. Smart] was at the dinner and offered some remarks. He related what a good decision he made in choosing Wisconsin for graduate work, saying that otherwise his life would have gone in a much different direction, and would not have been so rewarding and fulfilling as it is now. He also told about the bad decision he made, namely, as a graduate student dropping a course that Dick Askey was teaching on special functions. He said that he had attended Dick's lectures for one or two weeks, and asked himself why all these hypergeometric function formulas were interesting. He said he made a huge mistake for now he knows why all these formulas are interesting. While he later learned the mathematics that was covered in the course, what he missed were all the insights that Dick brought to the subject. As Bruce put it: "Dick has a vast knowledge of the history of special functions, and his ability to place theorems in a historical context enormously increases one's understanding and appreciation of the subject"; "Dick has a wonderful ability to put results in a broader framework so that one can see how results fit into a more comprehensive view of mathematics"; "Dick always emphasizes how good proofs are 'natural', and this also leads to greatly increased understanding."

In a message to faculty following the retirement dinner, Dick thanked many people for helping make the forty years he and his wife Liz have been in Madison so pleasant. He said that the intellectual level of the Math Department has been high since well before he got here, and continues to be high as he retires. He wished the younger members of the department the best and hope that when they retire

they will look back on their time here as he does and conclude that they never could have predicted how they would develop because of the intellectual climate here and that the time here went so fast that they don't know where it went.

**Steve Bauman** received the PhD in Mathematics from the University of Illinois in 1962, and then spent two years as an instructor at Princeton University. He joined the faculty of the Department of Mathematics as an Assistant Professor in 1964, becoming (full) Professor in 1976. During his career at Madison, he held visiting positions at Northwestern University and Spelman College. Over the span of thirty-eight years, Steve's contributions to research and his dedication to education and service have been very important to the department.

Steve's early contributions to research focussed on finite group theory, covering such topics as automorphism groups, nonsolvable and solvable groups, and composition series. Six graduate students wrote PhD dissertations under his guidance.

Georgia Benkart spoke of Steve's legendary contributions to education and service to the department and the university. He served as the Teaching Assistant Supervisor for many years and was on the various departmental committees concerned with graduate students and teaching assistants. He planned, organized, and conducted our very successful summer training program for international teaching assistants. He served on the Faculty Senate many times and was a strong advocate of faculty rights and responsibilities.

Steve's devotion to students and education is vividly illustrated by his many campus-wide activities such as: Mentor in the Chancellor's Scholar Program, Fellow of the Bradley Learning Community and member of the Bradley Hall Steering Committee, and elected Fellow of the Campus Teaching Academy. He often taught classes in Bradley Hall in an environment which promoted learning and inquiry. Steve's skill as lecturer and teacher was well known by students. In 1992 he received the prestigious Wisconsin Power and Light Underkoefler Teaching Award. This was followed in 1996 with the Distinguished Teaching Award given by the Wisconsin Section of the Mathematics Association of America. His interest in teaching led him to organize a seminar in mathematics education which was regularly

attended by both faculty and graduate students.

Perhaps the most famous "Bauman story" is this: In 1989 when the Bauman's house caught on fire, the fire department phoned to notify Steve. Ann Caruso ran down to his calculus lecture in B102 to tell him. Steve explained to the class that he was going to have to leave because his house was on fire – but first he finished the problem he was solving. As Georgia said, it seems appropriate that the department confer on Steve a title he has earned – "the Hero and Nero of Calculus."

**Carl de Boor** came to UW-Madison in 1972 as Professor of Mathematics and Computer Sciences and as a member of the Mathematics Research Center. He received the PhD in 1966 from the University of Michigan where the chair of his PhD committee was R. C. Bartels [PhD 1938, I. Sokolnikoff]. Carl worked as an Associate Senior Research Mathematician at the General Motors Research Laboratories from 1960 to 1964, and was an Associate Professor of Mathematics and Computer Sciences at Purdue University before coming to Madison. In 1983 Carl was awarded the P. L. Chebyshev Professorship of Mathematics and Computer Sciences, and in 1987 he was honored with the Steenbock Professorship of Mathematical Sciences. Carl's publication list is extensive including 4 books. He had 2 PhD students at Purdue and 8 at UW-Madison.

Carl is a worldwide leader and authority in the theory and application of splines (piecewise polynomials), which play a decisive role in computer-aided design and manufacturing and many other applied areas. He was awarded the John von Neumann Prize by SIAM in 1996. In 1993 he was elected to the National Academy of Engineering, and in 1997 to the National Academy of Sciences. Carl also is a member of the Deutsche Akademie der Naturforscher (1998) and a foreign member of the Poland Academy of Sciences (2000). He holds honorary doctorates from Purdue University (1993) and the Technion in Israel (2002).

At the dinner Hans Schneider spoke of his and his wife Miriam's long standing friendship with Carl and its possible basis in the shared experience of the turmoil in the Europe of their youth. In Carl's case this included flight from his home and hunger nearing starvation after World War 2, and then difficulty in being admitted to high school and university in East Germany. Hans speculated that these experiences

may have been a spur to Carl's huge achievements as a research mathematician.

While Carl and his wife Helen have moved to a beautiful new home on Orcas Island off the mainland of Washington State, he maintains a small condominium in Madison for what we hope will be frequent visits.

**Melinda Certain** came to Madison as a graduate student in 1965, along with her husband Phil Certain who came as a graduate student in Chemistry (and is now the Dean of the College of Letters & Science). She received the PhD in 1974 with a dissertation supervised by Richard Askey. Melinda was an AAUW postdoc at the Mathematics Research Center and then a Lecturer in the Mathematics Department. In 1983-84 and 1987-88, she worked as a statistical consultant for Wisconsin Power and Light, and was an Assistant Professor of Mathematics at Lawrence University in Appleton from 1984 to 1986.



John Wiley and Melinda Certain

Since 1988 Dr. Certain has been a Faculty Associate in the Department of Mathematics and has spent many of those years as the director of our very successful Wisconsin Emerging Scholars Program (WES). As director, Melinda has mentored and inspired graduate students who are interested in good teaching. At the dinner, Claire Rider told how many graduate students who are interested in teaching as well as research have benefitted greatly from their contact with Melinda. During her tenure as WES director, she supervised 31 graduate students and about 50 undergraduate assistants hired to work with the WES students. TAs in the WES program uniformly have praised the training and mentoring they received and their WES experience, and speak of Melinda's infectious enthusiasm for teaching. In 2003 she received the Chancellor's Hildale Award for Academic Staff in recognition of her outstanding work as a teacher and director of WES (see photo above).

For many years, Melinda also organized the MegaMath meets for middle school students in Dane County outside Madison. The number of students participating in these meets has increased over the years, attesting to their popularity. In addition to her work at the University, Melinda has been involved with the board of Preschool of the Arts, served on committees at her church, and been an active member of the Rotary Club.

**Dan Rider** received his PhD from UW-Madison in 1964 where his thesis advisor was Walter Rudin. He then left Madison to become a C. L. E. Moore Instructor at MIT and then Assistant Professor at Yale University. He returned to Madison as an Associate Professor in 1968 and was promoted to (full) Professor in 1971.

Dan's research was in the area of harmonic analysis on Abelian groups and compact groups. He was an Alfred P. Sloan Foundation Fellow from 1969 to 1971, and was an invited speaker at the International Congress of Mathematicians in Nice in 1970. At Madison, he had two PhD students. Steve Wainger who, along with Walter Rudin, spoke about Dan related how he owed a debt of gratitude to him. Dick Askey and Steve had proved some theorems about expansions in Legendre polynomials and were hoping to generalize them to expansions in spherical harmonics. When Dan was still a graduate student he obtained some results on spherical harmonics which showed that their proposed generalizations couldn't possibly be true. If it were not for Dan, Steve says he might be still trying to obtain these results!

During his career, Dan provided exemplary service to the department and university. He was TA Coordinator for 6 years during which time he introduced innovative programs such as shadowing for new international TAs, mentoring of weaker TAs by stronger ones, and videotaping all new TAs with faculty feedback. Dan served on the TA Evaluation Committee for about 20 years and was an undergraduate advisor for many years. Outside the department he served on the University-TAA Bargaining Committee and the Graduate School Fellowship Committee.

**Bob Turner** received the PhD in Mathematics from New York University in 1963, where his advisor was K. O. Friedrichs, and joined our faculty as an Assistant Professor the same year, becoming (full) Professor in 1971. His work covered a broad area of analysis and its

applications, including: spectral theory and its applications to differential equations; nonlinear analysis and its global implications; applications in elasticity and fluids, the study of traveling waves in stratified fluids; and more recently, neurophysiological modeling applied to locomotion in the nematode *Ascaris suum*.

Bob's early work grew out of a study of perturbation of operators with discrete spectra and led to extensions of existing results on boundary value problems for ordinary differential operators. Around 1970 he started investigations on nonlinear operator problems and continued in this vein for many years. More recently, he became involved in neurophysiological modeling and this involved learning many aspects of a new science and taking part in seminars and courses in that area. Bob had a stint doing 'wet' laboratory work with worms - somewhat beyond what most mathematicians do in learning about an area of application.

Bob taught many courses in the graduate program areas of partial differential equations, ordinary differential equations, functional analysis, and spectral theory, and had six PhD students. He worked on undergraduate courses in differential equations and linear algebra promoting the use of computers in these courses. For several years, Bob was Graduate Coordinator and Chair of Graduate Advising, and was heavily involved in graduate student recruitment as part of the Admissions Committee. While at Madison, Bob had many invitations to go to international conferences, in Germany, France, Britain, Brazil, and Italy, to do short courses on specialized topics in Italy, and to spend years on leave at Oxford University and the University of Pisa.

Bob and his wife, Rosine, are 'Italophiles' and now spend 6 months a year in Pisa. (Besides being fluent in Italian, he also learned Mandarin Chinese a number of years ago.) He is an excellent pasta cook and an expert on local mushrooms. (There have been occasions where there was some cautiousness with the 'pasta con funghi' he prepared, not only for the quality of the mushrooms, but for the certain resemblance between pasta and worms!)

Paul Rabinowitz, who spoke about Bob at the dinner, told some "Turner stories." Once when Bob had some difficulties with blood circulation in his hands, he sought out a book in the medical library which recommended holding one's hands in a container of warm water while one was lightly dressed in a cool environ-

ment. So on a cold and windy day, there was Bob in shirtsleeves on an outside porch, hands in warm water. The result? A bad cold that took some time to get rid of! Another story concerns his "Mobile Archive Project." Being surrounded by a lot of old exams and papers which he thought had to be kept as department records

in crowded spaces, he began sending stacks of these papers to people in other departments via campus mail with a letter explaining that the papers were to be kept in circulation by forwarding to another soul. Bob never got any of the papers back, and there was a shortage of campus envelopes in the department!

## Special Lectures

### 8th Wolfgang Wasow Memorial Lecture

The year 2003 marked the tenth anniversary of the death of Wolfgang Wasow. The 8th Memorial Lecture, funded by a generous endowment established by Wolfgang's children, was given on November 12, 2003 by Nancy Kopell on "Rhythms in the nervous system: From cells to behavior via dynamics."



Nancy Kopell

Nancy Kopell is the William Goodwin Aurelio Professor of Mathematics and Science at Boston University and is one of the leading biomathematicians in the world. She is co-director of the Center for BioDynamics (CBD) at Boston University, a multidisciplinary center which aims to train undergraduates, graduates, and postdoctoral fellows in leading techniques from dynamical systems theory and its applications to biology and engineering. A former MacArthur Foundation Fellow, Professor Kopell was elected to the National Academy of Sciences in 1996.

The abstract of her lecture was:

*The nervous system produces rhythmic electrical activity in many frequency ranges, and the rhythms displayed during waking are tightly tied to cognitive state. This talk describes ongoing work whose ultimate aim is to understand the uses of these rhythms in sensory processing, cognition and motor control. The method used is to address the biophysical underpinnings of the different rhythms and transitions among them, to get clues to how specific important subsets of the cortex and hippocampus process and transform spatio-temporal input. We focus on the gamma rhythm (30-80 Hz), which is associated with attention and awareness, and theta (4-12), associated with active exploration and learning of sequences. Via case studies, we show that different biophysics corresponds to different dynamical structure in the rhythms, with implications for function. The mathematical tools come from dynamical systems, and include the use of low-dimensional maps, probability and geometric singular perturbations.*

Professor Kopell also gave a more technical lecture "A neuron as a chain of oscillators: dynamics of a dopaminergic neuron" in the Applied Math/PDE seminar on November 13, 2003.

### Announcing 2004 Wasow Memorial Lecture

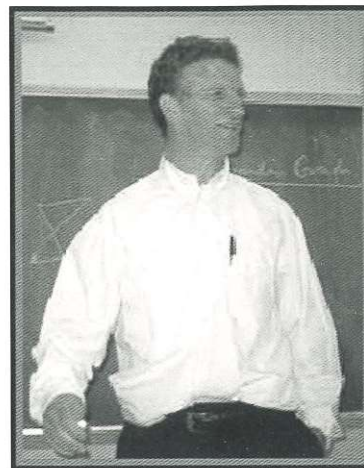
Michael Christ  
UC-Berkeley  
September 13, 2004

## 8th LAA Lecture

The 8th annual LAA Lecture was given by **Peter Sarnak** of Princeton University and New York University on October 17, 2003. The title of his lecture was "Ramanujan Graphs" and his abstract reads as follows:

*Highly connected but sparse graphs ("expanders") have proven to be fundamental building blocks in many algorithms in computational complexity theory. We review the definition (in terms of eigenvalues of the adjacency matrix) and construction of Ramanujan Graphs, these being optimal in this connection. We then discuss recent developments related to the eigenvalues and random graphs and matrices as well as higher dimensional Ramanujan Buildings.*

Peter Sarnak is Eugene Higgins Professor of Mathematics at Princeton University and Professor of Mathematics at the Courant Institute of Mathematical Sciences, NYU. Professor Sarnak has made many major contributions to number theory and to problems in analysis motivated by number theory. He is a 2003 winner of the AMS's Levi L. Conant Prize, a 2001 winner of the Ostrowski Prize, and a 1998 winner of SIAM's Pólya Prize. He was elected to the U.S. National Academy of Sciences and the U.K. Royal Society in 2002. He has supervised the theses of over 30 graduate students.



Peter Sarnak

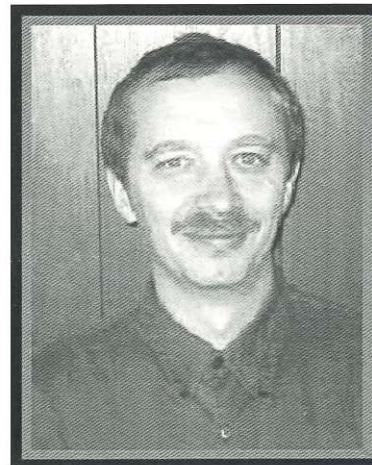
Announcing  
**2004 LAA Lecture**  
 Craig Tracy  
 UC-Davis  
 April 16, 2004

## Staff News

### New Member of the Academic Staff

**Wojciech Wieczorek** has been appointed as an Assistant Faculty Associate with title Assistant Undergraduate Advisor. His responsibilities, beyond classroom teaching, include certain critical undergraduate needs: assisting with and developing innovative undergraduate programs, advising (honors) undergraduates, overseeing our MathLab, and collecting and analyzing data relevant to short- and long-range planning. Prior to this appointment, Dr. Wieczorek was a Van Vleck Visiting Assistant Professor.

Wojciech received the PhD from Michigan State University in 1995. His thesis, written under the direction of Ronald Fintushel, was concerned with universal relations satisfied by Donaldson invariants of 4-manifolds containing essentially embedded 2-spheres. Wojciech's current research focuses mainly on studying the structure of Donaldson and Seiberg-Witten invariants of smooth low dimensional invariants.



Wojciech Wieczorek

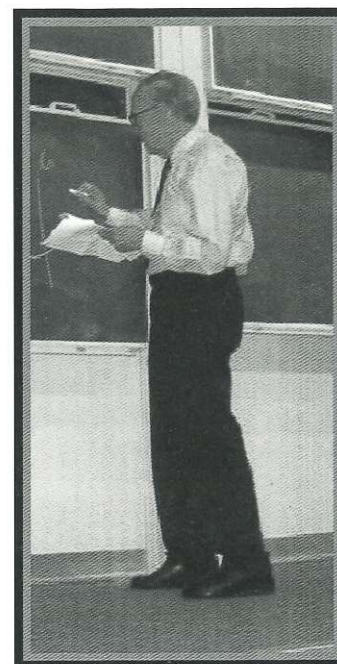
## Conference News

### Great Lakes Geometry Conference May 1-4, 2003

The Great Lakes Geometry Conference is a rotating event held once a year at an institution in the Great Lakes region. These events are meant to showcase particularly active areas of research in geometry and benefit students, postdocs and researchers throughout the Midwest.

On this occasion the conference met for 4 days at UW-Madison. There were 14 plenary lectures, listed below:

|                  |                                                                                     |
|------------------|-------------------------------------------------------------------------------------|
| G. Tian          | "Recent Progress in Kahler-Ricci Solitons"                                          |
| T. Colding       | "Sharp Estimates for Mean Curvature Flows of Graphs"                                |
| H. Bray          | "Yamabe Invariants of 3-manifolds"                                                  |
| F. Hirzebruch    | "Manifolds Fibered in Elliptic Curves"                                              |
| C. L. Terng      | "Geometry of Submanifolds in Space Forms and Integrable Systems"                    |
| J. Y. Chen       | "Singularity of Mean Curvature Flow of Some Calibrated Submanifolds"                |
| J. Jost          | "Green Functions and Conformal Geometry"                                            |
| B. Lawson        | "Boundaries of Analytic Varieties in $P(n)$ and Projective Gelfand Transformations" |
| Z. Lu            | "The Szegő Kernel of Unit Circle Bundle"                                            |
| R. J. Milgram    | "The Geometry of Serial Linkages, Together with Recollections of Gene Calabi"       |
| J. P. Bourgignon | "The Geometry of the Space of Kaehler Potentials"                                   |
| J. P. Wang       | "Geometry and Topology of Manifolds with Positive Spectrum"                         |
| Y. T. Siu        | "Hyperbolicity in Function Theory"                                                  |
| X. Rong          | "On Fundamental Groups of Positively Curved Manifolds with Symmetry"                |



F. Hirzebruch

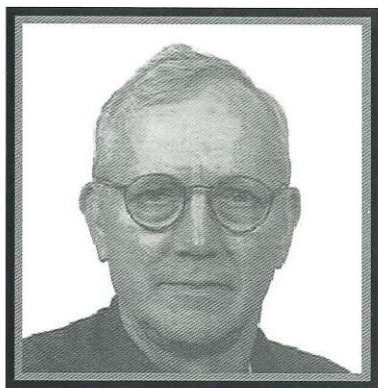
The topics covered the most important areas of geometric analysis. As part of the conference, **F. Hirzebruch** (Max-Planck-Institut für Mathematik (Bonn)) delivered a Distinguished Lecture in the UW Math Department with the title "Representation Theory and Algebraic Geometry." This talk was intended specifically for graduate students. There were approximately 60 participants in the conference, including students and mathematicians from all over the US.

On May 2 we held a panel discussion about problems in Geometric Analysis, chaired by Gang Tian. A lively 90 minute discussion took place, with blackboard participation by leaders in the field. A list of open problems will be developed based on this fruitful interaction.

Finally, we should mention that this event was dedicated to Gene Calabi on occasion of his 80th birthday. His enormous impact on the field and his charismatic presence made this event especially memorable.

*Contributed by Alejandro Adem*

## Conferences Celebrate Birthdays of Richard Askey and Carl de Boor



Carl de Boor

On December 3, 2002 **Carl de Boor** celebrated his 65th birthday and retired from the university at the end of Spring 2003. In previous cases (such as his 60th birthday) Carl stood firm against the idea of having a scientific meeting in honor of the occasion. This time, he reluctantly allowed a few of his friends to hold a small meeting at Dagstuhl, Germany (which is the CS equivalent of Oberwolfach).

The week-long meeting took place during May 2003. The participants came from several different circles of applied mathematics. Some were Carl's personal friends (Gene Golub, our former colleague Mike Crandall, John Rice), some were Carl's former students (all graduated at UW, and almost all with a mathematics degree). Some were researchers from the approximation theory community (Ron DeVore, who spent two sabbaticals at UW, Larry Schumaker who visited UW at the old times of the MRC and many others). UW was "represented" at the meeting by Paul Rabinowitz (who was also an organizer), Dick Askey, and me. The complete list of participants, as well as the entire scientific agenda, can be found at [www.waveletidr.org](http://www.waveletidr.org) (look under "meetings").

While the meeting, by all means, was a terrific one scientifically, it stood out due to two "social-like" issues. First, until arriving at the site, Carl did not know who the participants of the meeting were (save two of the organizers, at least not officially. . .). Second, while he was joined by his wife Helen, four other members of his family (three of his kids, as well as his eldest grandson, Corwin) made a surprise appearance at the site right at the beginning of the special banquet. The date of the banquet coincided with Corwin's 6th birthday, so it is fair to say that the meeting celebrated Corwin's birthday, not Carl's. . .

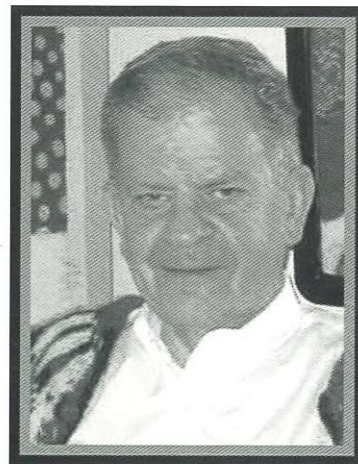
*Contributed by Amos Ron*

## The International Workshop on Special Functions, Orthogonal Polynomials, Quantum Groups, and Related Topics

The International Workshop on Special Functions, Orthogonal Polynomials, Quantum Groups, and Related Topics was held on October 18-22, 2003 in Bexbach/Saarland, Germany, and it was dedicated to **Dick Askey** on his 70th birthday.

The workshop opened with welcome addresses by representatives from local politics and industry where participants learned about geographical and historical peculiarities of the Bexbach region. The talks given by conference participants from four continents covered the different topics and fields of research that have been significantly influenced by Richard Askey and his work, and furthermore showed their actual and future development. These included: classical special functions (and their relations with other fields),  $q$ -special functions and  $q$ -analysis (and quantum groups), the land beyond  $q$  (elliptic and other generalizations), and various other topics (number theory, combinatorics, . . .).

Included among the lecturers were: Dick's coauthor George Andrews, "The Two Scariest Formulas in Ramanujan's Lost Notebook" (the opening talk), Warren Johnson [PhD 1993, R. Askey], "The Pfaff-Cauchy Derivative Identities, Hurwitz Type Extensions, and Applications", and UW-Madison colleague Paul Terwilliger, "Tridiagonal Pairs and the Quantum Affine Algebra  $U_q(sl_2)$ ". The closing talk was given by Dick who reflected on many of the results that were presented in this workshop. He highlighted



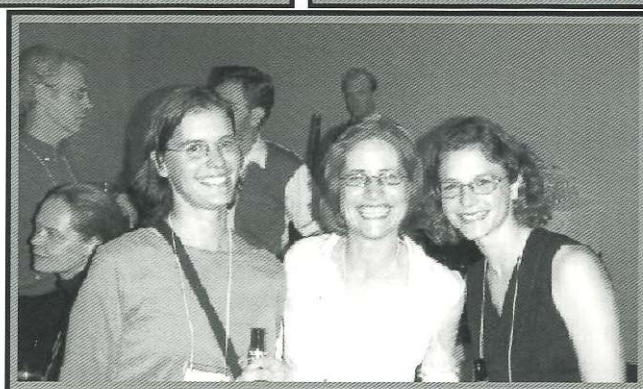
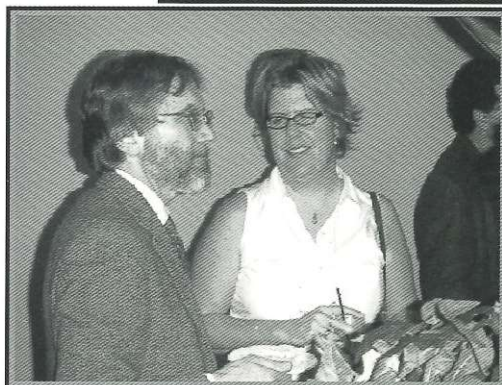
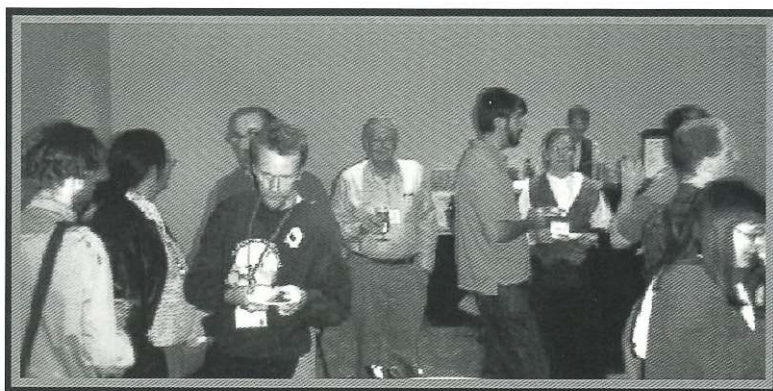
Richard Askey

some of the results, by putting them in the right perspective, and presented some of his favorite subjects.

During the banquet on the last evening speeches were given by George Andrews, Tom Koornwinder and Sergei Suslov. At 9 p.m. participants were asked to go outdoors for the special event, which was a spectacular fireworks in honor of Dick, almost as large in scale and beauty as the fireworks on a queen's birthday. A special issue of the Ramanujan Journal will be published in honor of Dick, which will also contain papers associated with lectures given in Bexbach.

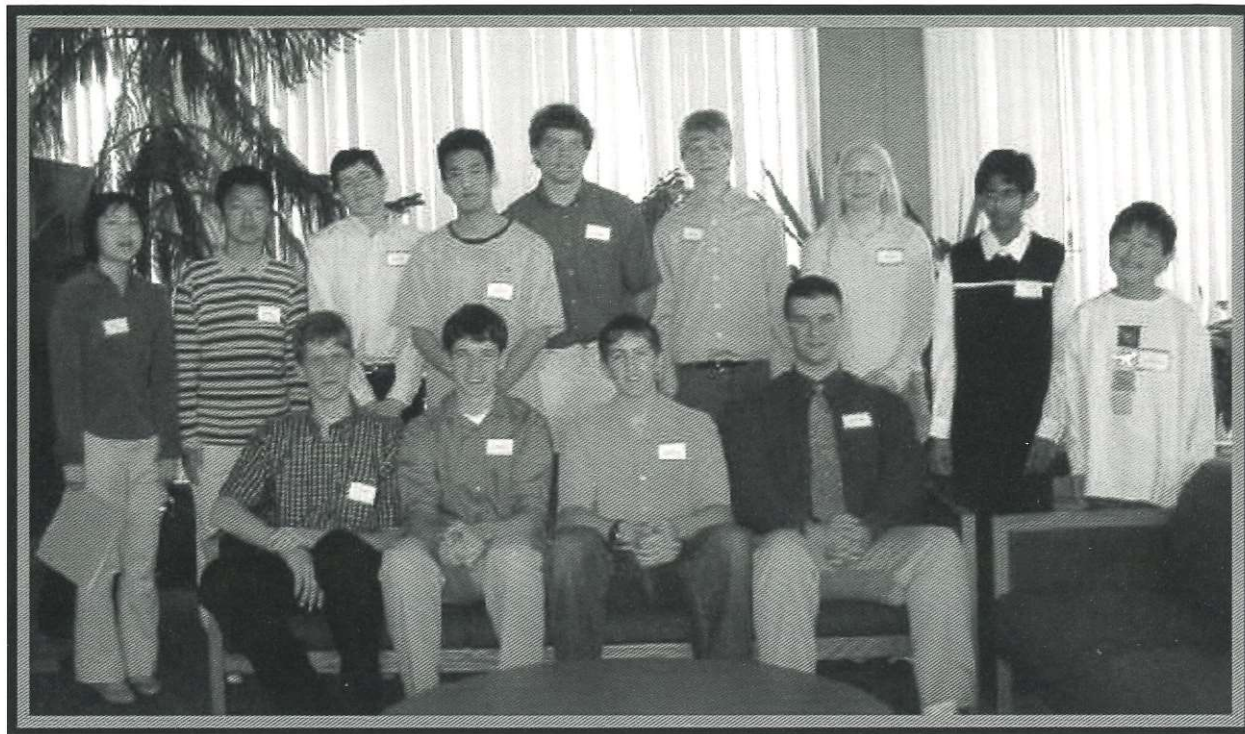
## Annual Wisconsin Reunion and Reception

The annual Wisconsin Reunion was held at the joint Mathematics Meetings in Phoenix on January 9, 2004. Nearly 75 former PhD students at UW-Madison, faculty, and Wisconsin friends gathered in the Hyatt Regency Hotel to renew friendships and to enjoy some of the tasty hors d'oeuvres. It was wonderful to see again so many of our former students and to hear about their mathematical successes and their other activities. Next year the reunion will be in Atlanta and we hope to see many of you there.



## Student and Instructional News

### Talent Search Honors Day



**top:** Po-Ling Loh, Richard Qian, Ilya Gurevic, Yoh Suzuki, James Antony,  
Mike Wage, Kristy Simmons, Gajanathan Muthuvel, Que Kim  
**bottom:** Andy Bodoh, J. P. Sheehan, Jack Huppert, David Kaspar

The current year marks the 40th anniversary of our statewide, middle and high school Mathematics Talent Search. As usual, last year the top performers were invited to a program on May 8, 2003 to acknowledge their accomplishments. There were 21 students invited. Announced as winner of the \$24,000 Van Vleck Scholarship to attend UW-Madison was 9th grader Nick Wage of Appleton East High School; Nick was accompanied by his father Michael Wage [PhD 1976, M. Rudin]. The youngest participant in the festivities was Que Kim a sixth grader from Whitewater Middle School. Previous scholarship winners Chad Koch (2001) and Mike Rusch (1996) also attended the luncheon and ceremony.

The program consisted of talks by Richard Askey on "A Look at Fibonacci Numbers" and Bret Larget (Statistics) on "Probability and Evolutionary Trees." Following the awards ceremony the honorees went on a tour of the Geology Museum.

The Talent Search continues in the capable hands of Marty Isaacs and Don Passman, now joined by new faculty member Lev Borisov.

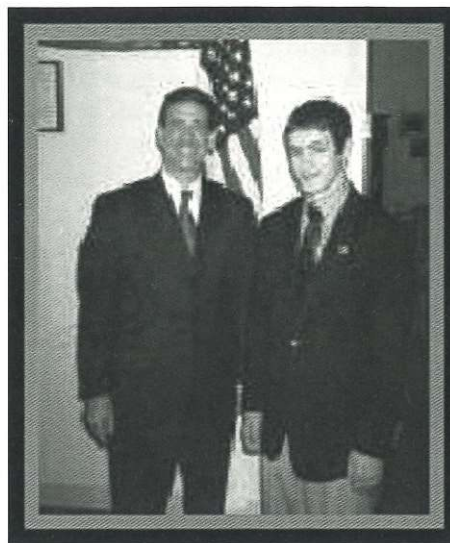
Three problems from the current year's collections are:

1. Decide whether the number  $\sqrt[3]{99 - 70\sqrt{2}} + \sqrt{8}$  is an integer and prove that your answer is correct.
2. Suppose that each positive integer is colored either red or blue. Show that there exist three positive integers  $x < y < z$  having the same color such that  $z - y = y - x$ .
3. Find all positive integers  $n$  such that the number  $n^4 + n^3 - 8$  is a perfect square. Prove that you have found all possibilities.

## Two Madison High School Students Bring Home Gold AGAIN!

At the International Mathematical Olympiad held in Tokyo this past summer, two Madison high school students, **Daniel Kane** (Madison West High School) and **Po-Ru Loh** (Madison Memorial High School) were the two top scorers on the USA team, earning them Gold Medals again (see last year's Van Vleck Notes). The hardest problem (so we are told) in the competition was a problem in analytic number theory, and Daniel Kane was the only USA team member with a complete solution. In spite of these two excellent competitors, the USA team only took third place (behind Bulgaria and China). Po-Ru's sister, Po-Ling Loh, another very talented high school student, was also among the top 12 high school students in the IMO qualifiers, who later competed for the 6 spots on the USA team. Daniel is now a freshman at MIT, and Po-Ru is a freshman at Cal Tech where his brother Po Shen Loh is also a student. You can read more about the "Loh dynasty" in the August/September issue of *FOCUS* (page 17) published by the Mathematical Association of America.

**Daniel Kane** has won a prestigious \$50,000 scholarship by the Davidson Institute for Talent Development for his project "Two Papers on the Theory of Partitions" as a representation of "a prodigious achievement in the field of Mathematics." He was awarded this special honor at a ceremony at the Library of Congress (see the accompanying photo with Senator Russ Feingold of Wisconsin). Daniel was accompanied by Ken Ono who has been his research mentor.



Senator Feingold and Daniel Kane

Daniel has written 3 research papers. One, "On an elementary approach to partition asymptotics," will be appearing in the Ramanujan Journal. Another paper proves a famous conjecture of George E. Andrews and Richard Lewis on Freeman Dyson's crank function. This paper has been accepted for publication by the Proceedings of the American Mathematical Society. He was also the focus of a CNN Headline News feature story in October 2003 which was partially filmed in Van Vleck Hall. Ken Ono was his research mentor on all three papers.

## Boian Popunkiov Named Integration Champ

An "Integration Bee", arranged by Jim Reardon of the Physics Department and sponsored by the "Wonders of Physics" program, was held in Sterling Hall recently. The competition was in two parts: A written qualification round, 50 integrals to evaluate in 60 minutes, and a week later a second round "live" at the board. The second round had pairs of contestants (from the 14 top finishers in the first round) going head-to-head working out integrals at the board: The first to circle a correct answer won the round, and two losses resulted in elimination. The answer had to be correct up to an additive constant and could include complex arithmetic so long as it would evaluate to a real value. If neither contestant got a correct answer within the available time, the same pair would have to try a new integral.

Both graduate students and undergraduates were eligible to participate: The overall winner got a \$100 gift certificate for the UW Bookstore, and the top undergraduate got \$100 cash. (If the winner had been an undergrad he/she would have gotten both prizes.) The contest excited a lot of interest among math grad students, whether for the money or the thrill of competition not being clear... Five math grad students took part in the second round, and there was a large

contingent of supporters from Van Vleck cheering them on. Sometimes it took four integrals to decide which of a pair was the winner. Boian Popunkiov, a student of Alex Nagel, emerged as champion and was crowned "Grand Integrator of Madison." Other grad students participating were Jackie Anderson, Adam Berliner, Debraj Chakrabarti, and Jeremy Rouse, and all placed highly in the results.

While some of the integrals on the written test were more tricky than difficult (e.g. expressions which evaluated to constants if looked at the right way) some of the integrals were distinctly non-trivial. In case you want to test yourself, here are a couple of sample problems: The hardest problem on the written test was probably  $\int \sqrt{\tan x} dx$ . Remember, you had 72 seconds on the average to do these! The final problem in the fact-to-face competition was

$$\int \frac{(1 + e \cos \phi)^3}{\sin^2 \phi} d\phi$$

which can be applied to determine how fast the perihelion of Mercury drifts. ( $e$  is eccentricity, not the base of natural logarithms!)

Contributed by Bob Wilson

## Undergraduate Scholarship Awards

Our annual Student Awards Ceremony was held on May 7, 2003 in the 9th floor conference room of Van Vleck Hall. We have some truly excellent undergraduate mathematics majors, some of whom received awards at this ceremony.



**top:** James Patek, Liana Prescott, Tim Grilley, Jeremiah Wilke, William Brady, Abraham Smith  
**bottom:** Kyle Mandli, Brendan Younger, Adam Feldmann, Scott Schneider, Chad Koch,  
 and Undergraduate Advisor, Gloria Mari-Beffa

| Award                                                                                                 | Award Recipient                                                    |
|-------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------|
| Koellen Leadership Prize in AMEP<br>(see last year's Van Vleck Notes,<br>page 18, for this new prize) | Kyle Mandli                                                        |
| David and Janet Kirkbride Scholarship<br>in Mathematics                                               | James Patek                                                        |
| Mark H. Ingraham Scholarships                                                                         | Benjamin Cain<br>Scott Schneider                                   |
| Higgit Scholarship                                                                                    | Chad Koch<br>William Brady                                         |
| R. Creighton Buck Prize<br>for Creativity in Mathematics                                              | Abraham Smith                                                      |
| Irma L. Newman Scholarship                                                                            | Kendra Nelsen                                                      |
| Prof. Linnaeus Wayland Dowling Scholarships                                                           | Jeremiah Wilke<br>Liana Prescott<br>Tim Grilley                    |
| Frank D. Cady Scholarships                                                                            | Brendan Younger<br>Daniel Shumow<br>Abigail Scott<br>Adam Feldmann |

### New Undergraduate Room

Van Vleck Hall now has an Undergraduate Conference Room for use by undergraduates. Room 407 Van Vleck Hall has been nicely carpeted and furnished for our mathematics majors to use between and after classes. There seems to be constant activity in that room most hours of the days, with undergraduates working on research projects, studying in groups, kibitzing, and sometimes just relaxing.



## Eleven PhDs Awarded in 2003

Eleven PhDs were awarded by UW-Madison in calendar 2003.

Their names, thesis advisors, current position, and thesis title are listed below.

**Alkan, Emre** (Advisor, Ken Ono), J. L. Doob Research Assistant Professor, University of Illinois-Urbana, Urbana IL 61801, *Multiplicative number theory with applications to modular forms and enumeration of groups.*

**Chakrabarti, Manish** (Advisor, Georgia Benkart), Assistant Professor, Department of Mathematics, DePaul University, Chicago, IL, *Representations of modular and quantum Weyl algebras and of generalized Heisenberg algebras.*

**Cho, Cheol-Hyun** (Advisor, Yong-Geun Oh), Boas Assistant Professor, Mathematics Department, Northwestern University, Evanston IL, *Holomorphic discs, spin structures and Floer cohomology of the Clifford torus.*

**De Sousa Dias Lopes, Samuel A.** (Advisor, Georgia Benkart), Faculdade de Ciências Universidade do Porto, do Porto, Portugal, *On the structure and representation theory of the quantized enveloping algebra  $U_q(g)^+$ , for  $g$  semisimple.*

**Givens, Berit N.** (Advisor, Ken Kunen), Assistant Professor of Mathematics, Cal Poly Pomona, Pomona, CA, *Hypergraphs and chromatic numbers, with applications to the Bohr topology.*

**Hu, Shengda** (Advisor, Yongbin Ruan), Postdoc, Mathematics & Statistics, Université de Montréal, Montréal, Canada, *Semistable degeneration of Toric varieties and their hypersurfaces.*

**Lee, Youngsuk** (Advisor, Leslie Smith), Postdoc, Simon Fraser University, Vancouver, Canada, *An isotropic energy transfer in beta-plane and rotating flows.*

**Miller, Daniel J.** (Advisor, Patrick Speissegger), Postdoc, Mathematics, University of Toronto, Toronto, Canada, *A preparation theorem for Weierstrass systems*

**Mortenson, Eric T.** (Advisor, Ken Ono), Postdoc, Max Planck Institute of Mathematics, Bonn, Germany, *The modularity of a certain Calabi-Yau threefold and supercongruences for truncated hypergeometric series.*

**Velikina, Julia V.** (Advisor, Amos Ron), Department of Medical Physics, UW-Madison, *Twisting transform and replicable functions.*

**Voelker, Meta** (Advisor, M. Ferris), Senior Analyst, ALPHATECH, Inc., Arlington, VA, *Optimization of slice models.*

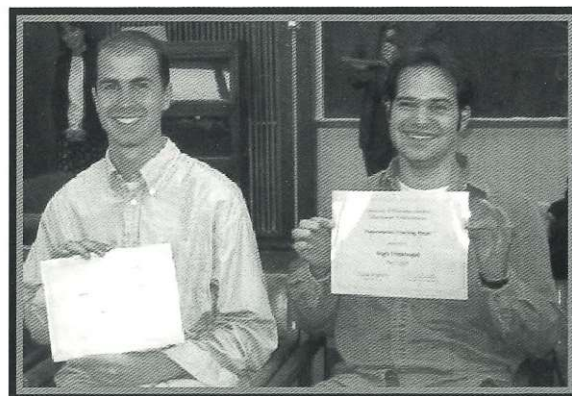
## New Graduate Students in Fall 2003

Thirty-one new students began graduate study in Mathematics at UW-Madison this past fall. They came from many different institutions and six different countries. Their names and undergraduate institutions are listed below.

|                       |                                                           |
|-----------------------|-----------------------------------------------------------|
| AKERS, Benjamin       | Pennsylvania State University                             |
| BAE, Myoungjean       | Yonsei University                                         |
| CASPER, Theron        | University of Utah                                        |
| CHUBA, Sharon         | Pennsylvania State University                             |
| DUEBER, David         | University of Illinois-Urbana/Champaign                   |
| ENGLISH, Jared        | University of Maryland-College Park                       |
| GODJALI, Ali          | UC-Berkeley/San Francisco State University                |
| GODSHALL, Jonathan    | Duke University                                           |
| HAIN, Seth            | University of Nebraska-Lincoln                            |
| HE, Biyu              | Xi'an Jiaotong University/Cambridge University            |
| HENDRICKSON, Anders   | St. Olaf College/University of Michigan/St. Paul Seminary |
| HILGENBERG, Dennis    | Purdue University                                         |
| HOLZER, Jesse         | Carleton College                                          |
| HORN, Paul            | Rensselaer Polytechnic Institute                          |
| HUNTER, James         | Amherst College                                           |
| JOHNSON, Evan         | St. Olaf College                                          |
| JOHNSON, Paul         | University of Illinois-Chicago                            |
| KUMAR, Rohini         | Bangalore University                                      |
| LAZA, Nicolae         | Gettysburg College                                        |
| NEELY, John           | Carleton College                                          |
| NOVAK, Kyle           | UW-Madison                                                |
| POSADA, Jaime         | Universidad de los Andes (Bogota, Colombia)               |
| RAULT, Patrick        | College of William & Mary                                 |
| ROUSE, Jeremy         | Harvey Mudd College                                       |
| SHI, Yingzhe          | Tsinghua University                                       |
| TANG, Yudong          | Beijing University                                        |
| TORRES GIESE, Enrique | Inst. Politecnico Nacional (Mexico)                       |
| WANG, Bing            | University of Science and Technology of China             |
| WU, Longqing          | Academia Sinica/Peking University                         |
| ZHU, Keya             | Zhejiang University                                       |
| ZUHR, Kathryn         | Mt. Holyoke College                                       |

## Awards to Graduate Students

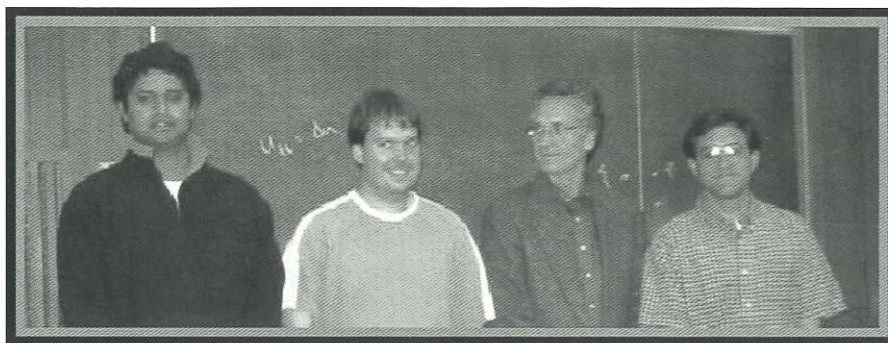
At the annual student awards ceremony on May 7, 2003, awards were presented to several graduate students. **Brent Benesh** and **Sergio Fratarcangeli** were given Teaching Awards for their work as Teaching Assistants.



Bret Benesh and Sergio Fratarcangeli

## Sustained Excellence in Teaching Awards

Recognized for Sustained Excellence in Teaching Awards were **Timothy Boester**, **Adrian Jenkins**, and **Prabhu Ravindran**.



Prabhu Ravindran, Adrian Jenkins, Dietrich Uhlenbrock and Timothy Boester

## L&S Teaching Fellow



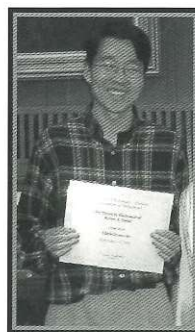
Adrian Jenkins

**Adrian Jenkins** was chosen as an L&S Teaching Fellow for 2003. This L&S program recognizes teaching assistants in the college who have made important contributions to the college's teaching mission and who have a noteworthy teaching record. There were only 15 fellows selected from about 1700 TAs on campus. Adrian was nominated by the department and selected in a college-wide competition. Each L&S Fellow is given a \$1,000 stipend and, during Welcome Week in the fall, organizes a workshop for incoming graduate students on a topic that will help them as teachers. Adrian is working on his dissertation research in complex analysis with Pat Ahern.

## Excellence in Mathematical Research Awards



Emre Alkan and Steve Wainger

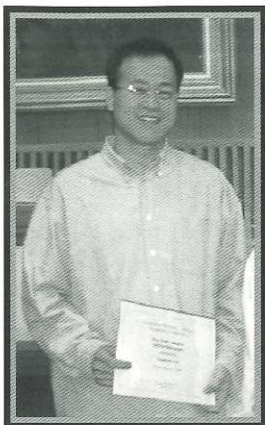


Cheol Hyun Cho



Eric Mortenson

Three graduate students were honored with Excellence in Mathematical Research Awards. They are **Emre Alkan**, **Cheol-Hyun Cho**, and **Eric Mortenson**. Emre, now at the University of Illinois, worked with Ken Ono and his thesis was titled "Multiplicative number theory with applications to modular forms and enumeration of groups." Currently at Northwestern University, Cheol-Hyun worked with Yong-Geun Oh with thesis "Holomorphic discs, spin structures and Floer cohomology of the Clifford torus." Eric's thesis was titled "The modularity of a certain Calabi-Yau threefold and supercongruences for truncated hypergeometric series" and Ken Ono was also his advisor; he is now at the Max Planck Institute in Bonn.



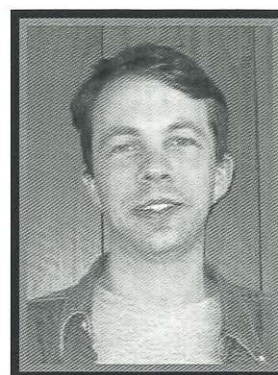
Youngsuk Lee

### John Nohel Prize

Awarded the John Nohel Prize in Applied Mathematics for his dissertation "An isotropic energy transfer in beta-plane and rotating flows" was **Youngsuk Lee**. Youngsuk's advisor was Leslie Smith. He currently holds a post-doctoral position at Simon Fraser University in Vancouver, Canada.

### CISCO Fellowship

**Jeff Kline** received a CISCO fellowship from the CS department, for a second and last year. The fellowship is not related to his research topic (new representation of NMR data), but rather to his involvement in an interdisciplinary project concerning the analysis of Internet traffic measurements. Jeff is a student of Amos Ron.



Jeff Kline

### Hirschfelder Fund Scholarship to Three Graduate Women



Emilie Wiesner, Jue Wang,  
Jaclyn Anderson, Melinda Certain

The recipients of this year's Elizabeth S. Hirschfelder Award are **Jaclyn Anderson**, **Jue Wang**, and **Emilie Wiesner**.

Jackie is a 2000 graduate of the University of Nebraska-Lincoln. She is working with Ken Ono on problems in partition theory from the perspectives of both number theory and combinatorics. The first result of her thesis has been submitted for publication in a paper entitled "On the Existence of Rook Equivalent  $t$ -cores".

Emilie graduated from Washington and Lee University in 2000. She is working with Arun Ram in representation theory.

Jue graduated from Peking University, China in 2001. She is working with Fabian Waleffe on the traveling wave solutions of the Navier-Stokes equations for incompressible flow.

NSF Graduate Fellows this year are **Karl Mahlburg** and **Kathryn Temple**. UW-Madison Graduate School Fellow is **Jaime Pina**. New graduate students who were awarded VIGRE fellowships are **Sharon Chuba**, **David Dueber**, **Anders Hendrickson**, and **Jeremy Rouse**.

On a Mexican Fellowship is **Enrique Torres-Giese**; on a Thai Fellowship is **Keng Wiboonton**. Air Force Institute of Technology Fellow is **Kyle Novak**.

## Other News

**Alejandro Adem** has been elected to a three year term on the Physical Sciences Divisional Committee of UW-Madison. He succeeds Andreas Seeger who served in 2000–2003.

**Carl de Boer** and **Alexander Nagel** were among the 29 UW-Madison faculty who, according to a survey by the citation indexing company Thomson ISI, are the most cited researchers in their fields. Citations of published research are key indicators of the influence of scholarly work.

**Nigel Boston** is giving a series of four 2-hour lectures in Taiwan this summer at a coding theory workshop, flying there directly from speaking at Frey's 60th birthday conference in Essen, Germany. He is also invited to speak in Berlin and England in early summer and to visit the MAGMA Computer Algebra group in Sydney, Australia. Here in Madison he is coorganizing the Computational Sciences Lecture Series with others in his interdisciplinary cluster. Plans are to have about 3 mini-conferences each year for four years (supported by a Cluster Enhancement grant), each with three speakers from different disciplines speaking on some common theme. The first has already taken place and it was on computational vision; the second will be on February 19, 2004 and will be on graphical models (aka Bayesian networks). For details (and posted video of the talks), see <http://www.engr.wisc.edu/CSLS/> The cluster group is also starting an informal lunchtime multidisciplinary seminar series to be held in Union South, with the first on January 30, 2004 featuring Moo Chung of Statistics and Rob Nowak of ECE, talking about medical imaging.

**Richard A. Brualdi** has been elected as the Chair of the Editorial Boards Committee of the American Mathematical Society for 2004.

**Jerry Keisler**, Professor Emeritus since

May of 2002, has moved to New Hampshire to be near his children and grandchildren. He keeps in touch with the department electronically and is continuing his research.

**Steffen Lempp** gave an invited Association of Symbolic Logic (ASL) address "The proof-theoretic strength of some combinatorial principles" at the annual meeting of the American Mathematical Society in Phoenix (Arizona), January 7–10, 2004. He then gave a tutorial at a workshop in computability in Nelson, New Zealand, where he says that the advertised beach hotel sounds really great on a cold day.

**Paul Milewski** is the incoming TA Coordinator replacing Bob Wilson who is retiring from that position.

**Ken Ono** is now the new Graduate Coordinator replacing Don Passman who has stepped down from this position.

**Peter Orlik** delivered a series of 8 lectures on "Arrangements of Hyperplanes" in the Scandinavian Summer School at Nordfjordeid, Norway (Sophus Lie's birthplace) in the program Algebraic Combinatorics. The other lecturers were Sergey Fomin and Volkmar Welker.

**Joel Robbin** is incoming associate chair replacing Dietrich Uhlenbrock who is stepping down and who will be on sabbatical this coming academic year.

The affiliate appointments in the Department of Mathematics for **Eric Bach** (Computer Science), **James Bucklew** (Electrical and Computer Engineering), **Amos Ron** (Computer Science), and **John Strikwerda** (Computer Science) were renewed for another three years. In addition, **Jin-yi Cai** (Computer Science) was given a three year affiliate appointment in the Department of Mathematics.

**George Andrews** (Penn State University) and "Wisconsin Friend" has been elected to the National Academy of Sciences.

## Death Notices

**Edward F. Moore** died on June 14, 2003 at age 77. Ed received his Mathematics PhD in 1950 from Brown University. Before coming to Madison in 1966 as Professor of Mathematics and Computer Sciences, he worked at Bell Telephone Laboratories in New Jersey. Professor Moore was one of the founders of Automata Theory where the Moore Machine is named after him. In graph theory, certain metrically regular graphs are called Moore graphs. Their existence is known except for the possible Moore graph with values  $d = 2$  and  $k = 57$  of the parameter set ( $d$  is the diameter and  $k$  is the degree of regularity). Ed Moore was one of the contributors to the early development of the Department of Computer Sciences. He was also active in the local branch of the National Speleological Society and the Bat Conservation International.

## Alumni News and Comments

<http://math.wisc.edu/directories/alumni.html>

**Matthew Boylan** [PhD 2002, K. Ono] a VI-GRE Assistant Professor at the University of Illinois at Urbana-Champaign was awarded the "Selfridge Prize for Excellence in Mathematics" at the West Coast Number Theory Conference in December 2003.

**Sergio Fajardo** [PhD 1984, H. J. Keisler] has recently been elected mayor of Medellin, Colombia. He has been a Professor of Mathematics at the University of Los Andes in Bogota, but Medellin is his home city. He ran as an independent and, according to the news reports, his election was a surprise.

**Daniel Kalman** [PhD 1980, J. Harvey] was awarded two MAA Writing Prizes at MathFest (the MAA's annual summer meeting) in 2003. For his paper "Doubly Recursive Multivariate Automatic Differentiation" (June 2002, 187-202) he was given the Carl B. Allendoefer Award for expository articles published in *Mathematics Magazine*. For his paper "An undetermined linear system for GPS" (November 2002, 384-390) he was given the George Pólya Award for expository articles published in the *College Mathematics Journal*.

**Warren P. Johnson** [PhD 1993, R. Askey] was awarded the MAA's Lester R. Ford Award at the MathFest in 2003. This award for expository writing in *The American Mathematical Monthly* was given for his article "The curious history of Faà du Bruno's Formula" (March 2002, 217-234).

**William G. Leavitt** [PhD 1947, C. C. MacDuffee] has achieved a pinnacle that many of us can only dream about. He has now published mathematics papers in eight decades. His first article was based on his Masters Thesis and was published in *The American Mathematical Monthly* (1939). His most recent article "On  $\beta$ -classes" was published in *Acta Math. Hungar.* (90 (2001), no. 3, 243-252, and was written jointly with H. France-Jackson. Bill mentioned that his wife Jane was a secretary in the department when they got married. The then department chair, Mark Ingraham, had to get a special waiver of nepotism rules so that they could get married in December 1941. Fortunately we have come a long way since then.

### Address Correction and Alumni News

Please help to update our database of alumni.

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<http://math.wisc.edu/directories/alumni/>

If the information is NOT correct please use our electronic version to correct:

<http://www.math.wisc.edu/directories/alumni/contact.html>

or send correct information to:

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Madison, WI 53706-1388

([brualdi@math.wisc.edu](mailto:brualdi@math.wisc.edu))

You can also use this to inform us of your activities for use in the next newsletter.

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E-mail Address: \_\_\_\_\_

**top:** David Griffeath, Alex Nagel, Tom Kurtz, Richard Brualdi, Alejandro Adem, Simon Hellerstein

**bottom:** J. Marshall Osborn, Joshua Chover, Hans Schneider



## THE CHAIRS



### Support Staff

**top:** Dee Frana, Gen Novara, Peggy Conklin, Sherry Lange, Jane Schwantz, Linda Rice, Sheri Pittman

**bottom:** Diane Reppert, Vicky Whelan, Sharon Paulson, Mark Castillo

## Department of Mathematics Annual Fund Drive

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

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- ☐ 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.*
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- ☐ 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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