2005

DEPARTMENT OF MATHEMATICS
newsletter

university of california at davis
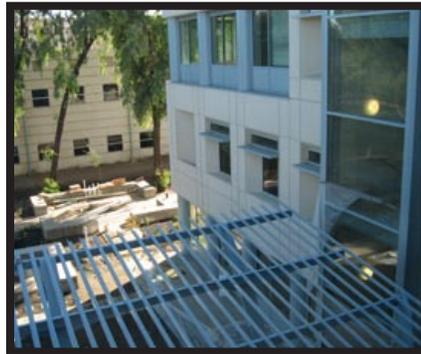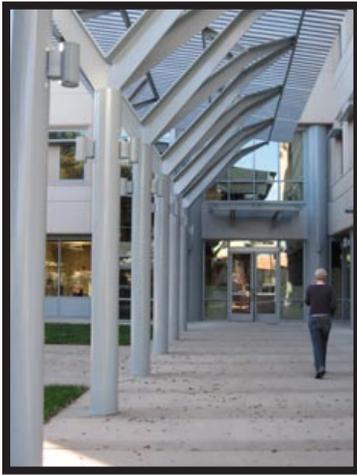
the new face
of Math

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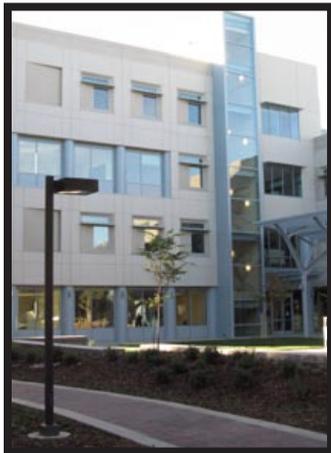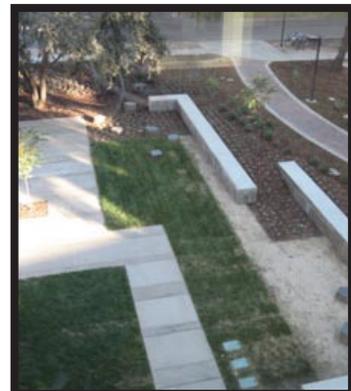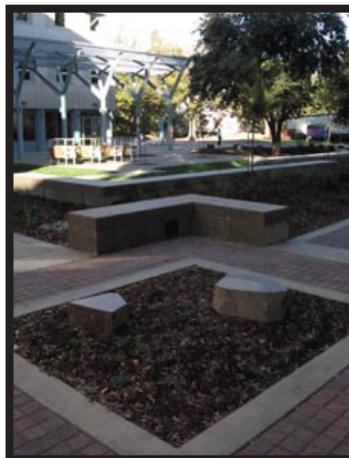
new faculty

Biello

Joe Biello is a new Assistant Professor in the department. He received his Ph.D. in astrophysics from the University of Chicago in 2001, where he studied convection in late stages of stellar evolution. He then moved into applied mathematics and joined the Department of Mathematical Sciences at Rensselaer Polytechnic Institute as a VIGRE postdoctoral fellow. There he began to apply his interest in fluids to terrestrial atmospheric dynamics. At RPI he taught courses ranging from undergraduate ordinary differential equations, to mathematical fluid dyamics, to general relativity. Subsequently, before coming to UC Davis, he held a research scientist position at the Courant Institute at New York University, working with Andrew Majda on problems in tropical meteorology.

Joe's research interests include multiscale asymptotics, particularly as applied to incompressible fluid dynamics, fluid stability theory, and Hamiltonian moment reduction for the incompressible Euler equations. Along with Majda, he has developed a theory for the structure of the Madden-Julian oscillation, a large scale, quasi-periodic organization of winds and precipitation over the tropical oceans. Currently, he is interested in modeling the multiscale phenomena which arise in the tropical atmosphere and the influence these processes have on the midlatitudes (i.e. in places like Davis). As part of this work, he has derived a novel set of partial differential equations that describe the effect of moisture on the tropical dynamics of the atmosphere.

He and his wife, Connie, arrived in Davis this year from New York City after spending the summer hiking and camping their way across Canada.
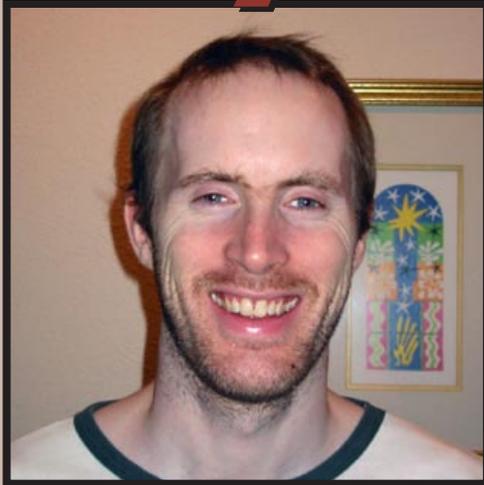
Morris

Ben Morris joins the department as an Associate Professor. Ben received his Ph.D. in Statistics from the University of California at Berkeley in 2000, where his thesis advisor was Alistair Sinclair. He had also been an undergraduate in Mathematics and Statistics at UC Berkeley, and, after his Ph.D., Ben was awarded an NSF Postdoctoral Fellowship and stayed in the Bay Area, first working with Persi Diaconis at Stanford and then Yuval Peres at Berkeley. In 2003, Ben moved to Indiana University as an Assistant Professor, and in 2004-2005 he was a visiting researcher at the Microsoft Corporation in Redmond WA.

Ben's research interests include discrete probability and randomized algorithms, and he enjoys working on problems that are easy to state but challenging to solve. Many of his papers are related to mixing times for Markov chains. For instance, he solved one of the most notorious open problems in card shuffling, the Thorp shuffling problem, by showing how many shuffles using a simple shuffling rule—proposed 30 years ago by Thorp—are required to randomize a deck of cards. (Such results are of wide importance in many applications, beyond playing cards!)

Having lived in the Bay Area for 12 years, Ben is glad to be returning to Northern California. In his spare time, he likes to spend time with his wife and two children, exercise, and watch TV.
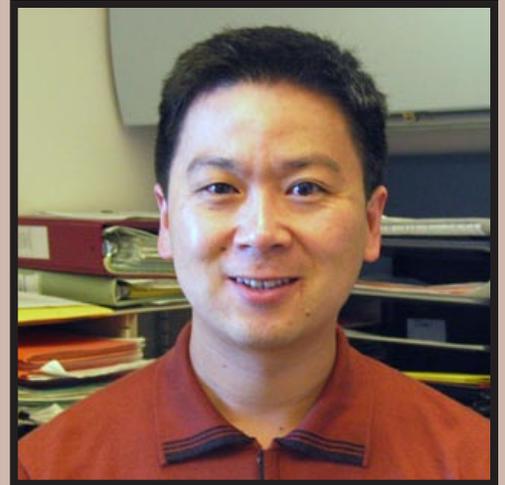
Xia

Qinglan Xia joins the department as an Assistant Professor. He received his Ph.D. from Rice University in 2002, supervised by Robert Hardt. After his graduation, and before coming to UC Davis, Qinglan spent the next three years at the University of Texas at Austin working with Luis Caffarelli on optimal transport problems.

Qinglan's work ranges from problems in pure mathematics, such as the use of rectifiable currents to study intersection homology theory, to very applied problems, such as the formation of tree leaves and the cracking of mud. Despite his broad research interests, his mathematical tools are drawn mainly from the field of geometric measure theory. His work on ramified mass transportation has opened a new research area in the field of optimal transport problems and has stimulated the interest of many other researchers. Here at UC Davis, Qinglan will continue his interests in applying geometric measure theory to other fields.

Qinglan was born in a remote village in China and grew up there. Given the extensive training in agriculture he had during his childhood, he thinks Davis may be a perfect place for him to practice. In his leisure time, he likes to play with his seven month old daughter Emily and travel with his wife Yingjuan.

MOGILNER'S POSTDOCS

This year, Professor Alex Mogilner leads a large, lively and diverse group of postdoctoral researchers in our department, who collaborate with him on the mathematical modeling of cell biological phenomena.

Dr. Boris Rubinstein is spending his fourth year here in Davis. He is involved in a multi-scale study of cell migration. He models a cell crawling on a surface as a two-dimensional (motile cells are flat) domain with a free boundary. Mechanically, this domain is a visco-elastic shell subjected to active contractile forces generated by molecular motors. Chemically, this domain is a polyelectrolyte gel turning over rapidly; in addition, the cell's cytoplasm is full of reacting and diffusing molecules regulating the mechanics. Movements of the cell boundaries are determined by local mechano-chemical conditions. Mathematically, the problem of modeling this staggeringly complex system is reduced to a system of PDEs which Rubinstein and Mogilner solve numerically using a Finite Element method. They regularly talk to three laboratories, in Stanford, North Carolina and Switzerland, and compare the predictions of their model with experimental results. This interaction creates a close "experiment-theory loop."

Boris received his degrees in Engineering Physics from Ekaterinburg, Russia, in the cold Ural mountains (Davis' winter is like the Ural's summer, and you don't want to know what winter is like in the Urals!)—the same place Alex Mogilner studied. Boris then went to Israel and worked at the Technion on problems in nonlinear optics. Before coming to Davis, he spent two years at Northwestern University, near Chicago, where he worked on fluid dynamics. Boris is very experienced with mathematics, physics and computation. He lives in Davis with his wife and daughter and likes to read widely. He is, in fact, a walking encyclopedia of everything you can imagine, from history to engineering. As with some other researchers, he is not a "social animal", but if you draw him out, you will hear amazing stories.

Dr. Revathi Ananthakrishnan is here for her third, and final, year. She collaborates with Alex and experimentalists at UCSF on modeling the mechanics and biochemistry of actin gels, which constitute the dynamic scaffolds inside the cells of our body. These gels determine the cells' shape and cohesion into organs, and chemical deviations can lead to mechanical defects that cause severe illnesses. Revathi, like Boris, uses various software packages—such as Femlab, Virtual Cell, etc.—to solve equations describing these gels.

Revathi's undergraduate degree is in physics from India. She then did her Ph.D. in Texas and Germany, also in physics, before coming to Davis to work with Alex. She is very fond of Indian cooking and of gold jewelry and traditional Indian clothes (which is how you can recognize her in the corridor).

Dr. Joe Fass has just started to work with Professor Mogilner, and they plan to use what is now called a "systems biology" approach to study cells. This refers to large scale, ad hoc computer simulations of some aspect of cell behavior. The simulated models are created and chosen by computer, rather than by researchers, following general algorithms. Joe is particularly expert in all kinds of stochastic simulations.

Joe did his Ph.D. in Biomedical Engineering and, before coming to Davis, worked at the University of Minneapolis and Colorado State University in bioengineering and cell biology laboratories. When not studying cells, he likes the outdoors, motorcycles and sports.

Also, in February through June, Professor Mogilner will have a long term visitor, **Dr. James Oliver** from the Centre for Mathematical Medicine at Nottingham University in England. James is an applied mathematician and wants to develop analytically solvable models for migrating cells. (Hm-m! comments Alex: *good luck with that!*)

Besides these people, there are three other researchers who work with Professor Mogilner at the laboratory in the Center for Genetics and Development: **Drs. Patrizia Sommi, Ingrid Brust-Mascher, and Gul Civelekoglu-Scholey**. Although they are seldom spotted in the Department of Mathematics, they slave away from morning to dawn in the laboratory doing experiments on and modeling of cell division in fruit flies.

All these people are supported by NSF and NIH grants. More information about them and their research with Professor Mogilner can be found on his web site:

http://www.math.ucdavis.edu/~mogilner/

new vraps

Duchin

Moon Duchin has a brand new Ph.D. from the University of Chicago. Before that, she received a joint undergraduate degree in Mathematics and Women's Studies from Harvard University. Her research is in geometric topology (especially Teichmuller theory), geometric group theory, and ergodic theory. She is working with Misha Kapovich and several other faculty members and postdocs who study topics such as low-dimensional topology and random walks.

Besides mathematics, she enjoys philosophy and cultural studies, biking, karate, rugby, and the charter school movement. Not necessarily in that order.

Woo

Alex Woo received his Ph.D. from UC Berkeley in December 2005. His research focuses on combinatorial problems coming from commutative algebra, algebraic geometry, and representation theory. He is carrying out research both with his faculty mentor Anne Schilling and with Jesus de Loera. He also continues his own investigations of Schubert varieties.

Alex was an undergraduate at Williams College in Massachusetts. He majored in music and mathematics and continues to play the piano, even occasionally writing music as well.

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Mathematics on the Rise

by Motohico Mulase, Department Chair

Motohico on the last day in his Kerr office

Motohico enjoying his new MSB office

The new building has many inviting rooms to help foster collaboration

The new Alder Room is a comfortable place to relax

One hundred years ago the gates of the University Farm were opened. It marked the starting point of the journey of our university. As the Farm evolved into an institution of autonomous research and higher learning, the Department of Mathematics was founded. Today we have grown into an internationally acclaimed research and education center of the Central Valley.

At the centennial of UC Davis, we have acquired a newly constructed Mathematical Sciences Building (MSB). The atmosphere of MSB is inviting, bright, and transparent, symbolized by abundant exterior and interior glass walls. Faculty, postdoctoral researchers, and students are seen in Scholarly Activity Rooms learning, discussing and producing new results. The beautifully landscaped courtyard off the colloquium room provides an ideal place for casual discussions after seminars and colloquia. A visiting faculty has noted that our building exhibits the characteristics of a great research institute, such as MSRI, encouraging and inviting discussions. Behind the closed doors of the individual offices, people are working hard and thinking deeply. I think.

With this move, a new program has been launched in the department: the Arthur J. Krener Assistant Professorship in Mathematics. In response to the extensive university service of Distinguished Professor Krener and the generous gift of he and his wife, Mrs. Jeanne M. Reese, to the UC Davis Foundation, Chancellor Vanderhoef, acting on the recommendation of Dean Ko, approved the naming of the program, to be effective July 1, 2006. This program is aimed at bringing strong, new Ph.D.s (less than four years after the receipt of their degree) to the department for up to three years to conduct research and teaching at both the undergraduate and graduate levels.

One hundred years ago the site of the university was a flat land. No tall or large buildings were to be seen. Mathematics was never associated with the town, then called Davisville. Today, we have created a spike of excellence in the flat land. Our second century is starting with boosted momentum.

Recognition of Distinguished Professor Krener continues; we recently learned (December, 2005) of his selection for the 2006 Hendrik W. Bode Lecture Prize by the IEEE Control Systems Society. Other faculty members have also garnered awards. Roman Vershynin received a 2005 Alfred P. Sloan Foundation Research Fellowship, the eighth Sloan Fellowship bestowed to UC Davis mathematics faculty. Michael Kapovich has received an invitation to deliver an address in the geometry section of the International Congress of Mathematicians, to be held in Madrid in Summer 2006. Within the university, Monica Vazirani received a 2005 Faculty Development Award.

Our presence in federal funding is notable. Cheer, Gravner, Hass, Krener, Lewis, Nachtergaele, Puckett, Schilling, Schwarz, Strohmer, and Xiao received new or renewed federal grants as lead PIs during this past year. The coordinated effort of Puckett, Cheer, De Loera, Rains, and Saito has successfully brought an NSF-SCREMS grant. Thanks to the excellent preparation of Thompson, the NSF-VIGRE grant in the Department was extended to its full 5-year term. The ratio of the lead PIs of federal grants to the Mathematics faculty is now over 82%, and the total budget of these active grants housed in the department exceeds 13.5 million dollars.

Starting January 2006, the headquarters of the Journal of Mathematical Physics published by the American Institute of Physics will be housed in our department, with Bruno Nachtergaele's appointment as the Editor. Wets continues to serve as the Managing Editor of the Journal of Convex Analysis. Freund, Gravner, Hass, Hunter, Mogilner, Shkoller, Soshnikov, Strohmer, and Tracy currently serve on the editorial boards of major research journals.

We also welcome a number of distinguished visiting professors from throughout the world: Professors Jerry Kaminker (IUPUI, Fall 2005), Georg Pflug (Vienna, Spring 2006), Yuri Suhov (Cambridge, Fall 2005), Dov Bronislaw Wajnryb (Technion, Spring 2006) and Hiro-Fumi Yamada (Okayama, Winter-Spring 2006). The excellence and activity of the research programs of our permanent and visiting faculty provides an outstanding research and training environment for graduate and undergraduate students.

The department enjoys the exceptional service of a great staff, led by Managing Services Officer Tracy Ligtenberg. The high effectiveness and morale of our staff are most appreciated, providing fuel to the success of our faculty, and supporting the well being of the department as a whole.

Yes, this is the place to be. Please come and visit us!

Life After Davis...
...and After Hurricane Katrina!

Nicole Hoover, MA 2001
& Alexander Barchechat, PhD 2003

When Alexander was first offered a VIGRE Postdoc at Tulane University in New Orleans, we were both very excited. I immediately applied for teaching positions in the area and was soon offered a full-time position at the University of New Orleans. This was a great opportunity for me since it is almost unheard of in California for someone with a brand new Master's degree to land a full-time teaching position (especially at a university). The Tulane Math Department helped us arrange for an apartment, so we packed up a truck with all of our belongings and our two cats and headed for the Big Easy. I remember driving along I-10 over the bayou, surrounded by more green than I had ever seen.

During the first few months there, we were both experiencing some intense culture shock. Pedestrians do <u>not</u> have the right-of-way, turn signals had yet to be discovered and drive-through daiquiri shops were commonplace. The first time I saw someone litter (with a garbage can two feet away), I almost had a heart attack. We also had to learn the local pronunciation for the street names to avoid ridicule! But New Orleanians are some of the friendliest, funniest and most generous people I've ever met. The locals thought we were crazy to not have a car, but aside from having to carry rain gear and a tire repair kit every day (the roads were terrible), it was just fine. We ended up having a much more intimate knowledge of the city and the people by traveling by foot or bike.

After a year at UNO, I was appointed the Department Coordinator for Precalculus Trigonometry, while Alex was running the Topology seminar at Tulane. Our third summer there (2005), we stayed in town since Alex was running an REU program and I was teaching summer school. Toward the end of the summer, Alex left to visit Montreal, while I stayed home to start my fall semester. On Friday, August 26, I was at school teasing my colleague who kept tracking Hurricane Katrina headed for the Florida Panhandle. The next morning I received a message from Alex's mom saying she heard there was a hurricane headed for New Orleans and asking if I was ok. I turned on the TV and saw a little category-2 storm heading my way. A friend called to offer me one of his cars so that I could evacuate. I politely went to his house to pick up the car, with no intention of evacuating. I kept my eye on the storm throughout the day, and went to bed that night (Katrina now a category-3), pretty sure I would still not be leaving. At around 2:00 am, another friend called. All I remember is "category 4," "mandatory evacuation" and "15 feet of water." I begrudgingly got myself out of bed, dragged everything in from outside, packed a few things, gathered up our two cats, and headed north for my brother's place in Memphis. Given the hour, there was no evacuation traffic and I made it in good time.

When the storm initially hit on Monday, it sounded like not too much damage had occurred. Meanwhile, Alex was still in Montreal, his Monday flight home had been canceled. While keeping a close eye on the news though, things started to change. There was a breech in one levee, then another; the city was starting to fill with water. At first I was not too worried, our house was raised about 3 feet off the ground. Then I started to see the scenes on the news that horrified the country and the world. When it became clear that there wasn't going to be a flight back for Alex, he came to Memphis to join me. We watched the news nonstop, searching for any familiar faces. We didn't see any friends or students, but I did recognize a couple of people with whom I had ridden the bus. I went back and forth between feeling guilty and relieved that I was somewhere safe.

Eventually we became aware of how extensive the damage was, to New Orleans in general and our apartment in particular. Meanwhile, Joel Hass contacted Alex to offer us a position at UC Davis for the fall quarter. Given that this was Alex's last year at Tulane and that we had nowhere left to live in New Orleans, we asked if we could stay for the year. Motohico Mulase told us to come on out. Not only did the department give us a job, they found a great place for us to live. Celia Davis put the word out that we would need some household items, and we received such a response that we had to turn some stuff down! The generosity and caring we have received has really been overwhelming.

Just recently we finally had the opportunity to go back and see what was left. We did not recognize the city that had come to be our home. The poorer neighborhoods, which used to be full of people and music, were completely deserted. The more affluent parts had workers gutting houses and preparing for construction. All the life and character of the city was gone, and I'm not sure if it will ever be back with such strength. Our home was completely devastated. Even though we only had about 3 feet of water inside, the mold and stench had colonized every inch of the house and we ended up walking away with one box of very smelly belongings. Neither of us was able to enter our offices at our schools, though both universities claim they will be re-opening soon. The one highlight of the trip was seeing a sign on the way to the Red Cross center. It read "Creole Creamery now open!" It was our favorite ice cream place, so we stopped in for a couple of milkshakes.

This chapter in our lives is now over, and I can't think of a better place than Davis to start a new one. Alex and I will both forever be thankful for what the Math Department has done for us, we truly feel like part of a family.

Coast guard officer in a search and rescue effort, looking for survivors.
Photo courtesy of the Department of Defense

Katrina, Aug 29 2005 1915Hrs UTC

The Department's Annual Awards Ceremony was held on June 8, 2005. On this occasion, the Department honors its best undergraduate students and its best teachers among the faculty and graduate students. The Department also awarded 58 undergraduate degrees this past academic year. Congratulations again to all of our degree and award recipients.

Outstanding Teacher of Lower Division Mathematics

This yearly recognition of exceptional lower-division teaching in our Department was presented by Interim Vice-Provost Fred Woods to **John Chuchel**.

Professor Chuchel taught six lower division classes this past year, averaging an amazing teacher evaluation of nearly 4.8 out of a 5.0 maximum score. Students often praised Professor Chuchel's clarity, his challenging but fair tests, and especially his use of colored chalk! Many say he was the best math teacher they have ever had, and one student summed it up by saying "This man is a WILD BEAST."

Departmental Citations

These citations recognize the very top graduates of our undergraduate program, who have taken a very strong selection of mathematics courses, distinguished themselves with exceptionally high grade point averages, and received enthusiastic endorsements from the faculty.

Aaron Balog has an overall GPA of 3.93, and his upper division math GPA is 3.98. Aaron has taken one graduate class, MAT250A, and has received four A+s in his upper division math classes. Aaron has done research with two faculty members and has participated in the Department's REU program.

Michael Bishop has an overall GPA of 3.86 and a GPA of 3.98 for his upper division math classes. Two of his grades in his upper division math classes have been A+. He took the Putnam Exam in 2003 and did well. According to his instructors, "he did well in his classes and he's very sharp." Michael has been a reader in the department for the past two years.

Robert Gutierrez has an overall GPA of 3.78 and a 3.8 in his upper division math classes. One of Robert's instructors commented that "he has an inquisitive mind and is a very good student. It was a pleasure teaching him." Robert is famous for his q-tip constructed polytopes and was relied upon to participate in math club activities that involve outreach to the public demonstrating math in fun ways.

Julianne Kopriva has an overall GPA of 3.72 and a GPA of 3.73 for her upper division math classes. Julianne has been very active in the math club and was an important member of Math Café, which provides tutoring to all math students, especially in upper division classes. Julianne is currently in UC Davis' MAT program to earn a Master's degree and a teaching credential.

Chung Kwan Pong, otherwise known as Paul, has a GPA of 4.0 and has at least 13 A+s in his upper division math classes. He took the Putnam Exam in 2003 and did extremely well (score of 20, one of the top 3 from Davis). According to his Math 128A instructor, "Mr. Pong was truly exceptional. His exams, both midterm and final, were perfect, his programming assignments were perfect and his homework scores were near perfect. His average for the course was 99.9%. In the twenty years that I have been at UC Davis, this is the closest anyone has come to earning a near perfect score in any of my courses."

Gus Wiseman has an overall GPA of 3.65 and has taken over ten graduate classes as an undergraduate student. Gus is an exceptional student in many ways. He is very independent and self-motivated in his work and has already been conducting original research, largely under his own direction. According to one faculty member, Gus is "the most advanced undergraduate student I have met at UC Davis."

Leslie Young

John Chuchel

Nicholas Nguyen

Chung Kwan Pong

Michael Bishop, Julianne Kopriva, & Gus Wiseman

Alice Stevens

William Karl Schwarze Scholarship in Mathematics

This scholarship is made possible by a bequest in the amount of $10,000 annually made to the Department by William Karl Schwarze, who received his bachelor's degree in our Department and subsequently became a high school teacher of mathematics in San Francisco. Mr. Schwarze remembered his studies in the Department with such fondness that he decided to leave funds for students in our Department who demonstrate outstanding mathematical scholarship and exceptional promise of making a strong professional contribution as a mathematics teacher at the pre-college or undergraduate college level.

The recipient of the award, presented by Dean Winston Ko, was **Leslie Young**.

Leslie Young is a student in two programs: the Master of Arts in Teaching and the Mathematics Ph.D. She excels both as a teacher of mathematics and as a student. Her teaching experience ranges from working with 5th and 6th graders, to teaching two classes at UC Davis as an Associate Instructor. A faculty member who visited her classes comments "I was overwhelmed. She is the best new teacher I have seen in at least ten years and one of the better teachers of any age or experience that I have ever seen."

Leslie's success in graduate courses is no less impressive. She has a 3.97 GPA, and a professor who taught one of her classes noted that not only was Leslie's own performance outstanding, but she has an exceptional ability to inspire her fellow graduate students.

Leslie's devotion to mathematics, her passion for teaching, and her high level of scholarship make her an ideal and most deserving recipient of the Schwarze Award.

Robert Lewis Wasser Prize

The Robert Lewis Wasser Memorial Fund is named in honor of Robert Lewis Wasser, a very promising young mathematician, who tragically died in an automobile accident in 1993 just before the beginning of his junior year at UC Davis. The endowment's goal is to benefit promising mathematics students at UC Davis.

Interim Vice-Provost Fred Woods and Robert's grandmother, Vera May Wasser, presented this year's award in the amount of $500 to **Nicholas Nguyen**.

Award of Prizes in the Spring Mathematics Contest

Each year some very talented students participate in the Spring Mathematics Contest, which is open to all undergraduates. This year's first prize, in the amount of $500, went to **Chung Kwan Pong**. Michael Bishop, Robert Gutierrez, Jessica Harris, Judy Jieying Tan, and Gus Wiseman each shared honorable mentions.

Henry L. Alder Prize for Excellence in Teaching

Professor Henry Alder was an active member of our Department from 1948 to 1994. Even in his retirement, Professor Alder continued to teach and be a strong advocate for quality teaching almost until his death in 2002. Part of Professor Alder's legacy is an endowment known as The Henry L. Alder Graduate Fellowship in Mathematics, providing support for our graduate students through the Henry L. Alder Prize for Excellence in Teaching. This prize is given each year to the person who is deemed to be the top teacher among all graduate students in mathematics. This year the award was presented by Interim Vice-Provost Fred Woods.

This year's recipient was **Alice Stevens**. Alice taught for the first time in Summer 2004, when she was an Associate Instructor for a 16C class with an enrollment of 46 students. She received an overall teaching evaluation of 4.8 out of 5.0. In addition, student comments were universally positive, including such mentions as "Great job teaching" and "Alice is a really good teacher who is very clear and organized. Best instructor ever!" With such success in her first time teaching, it is clear that Alice is destined to be a great and natural teacher.

News from the GRADUATE PROGRAMS

by Michael Kapovich, Vice Chair for Graduate Matters
Blake Temple, Chair, Graduate Group in Applied Mathematics

It was another successful year for the Ph.D., MA, MS and MAT graduate programs in Mathematics and Applied Mathematics. Several students won prestigious fellowships: Diana Needell won a UCD & Humanities Research Award as well as Graduate Student Research Mentorship Fellowship; Philip Sternberg received a UCD & Humanities Research Award; Jessica Kuang won the UC Davis Dissertation Year Fellowship; Eva Strawbridge received the Cota-Robles 2-year Fellowship and Brandy Wiegers won the Professors for the Future Award. In addition, Barbara Villatorro and Leslie Young won NSF fellowships, and Robin Wilson won a dissertation year Ford Fellowship.

Thirty-seven new students have joined our department this year: 12 in Applied Mathematics and 25 in Mathematics, bringing our Department to a grand total of 127 graduate students. The level of the research activity in our graduate programs continue to grow, evidenced in part by the many research seminars meeting every week. Our VIGRE program, which centers around Research Focus Groups (RFGs), was extended for two more years as a result of a highly successful review and site visit. The reviewers were very impressed by our program and made special mention of the enthusiasm of our students. In 2005-2006, the RFGs are:

Optimization and Control, Jesús A. De Loera
Hyperbolic Geometry, Michael Kapovich
Quantum Dynamics, Bruno Nachtergaele
Band-limited Methods and Fast Algorithms, Hong Xiao

Join us in congratulating THE DEGREE RECIPIENTS FOR 2004-2005

Momar Dieng, Ph.D., Mathematics
Angela Gallegos, Ph.D., Applied Mathematics
Christopher Jerdonek, Ph.D., Mathematics
John Tamaresis, Ph.D., Applied Mathematics
Chris Berg, M.A., Mathematics[*]
Rory Kinoshita, M.S., Applied Mathematics

Randall Robertson, M.S., Applied Mathematics
Emil Sargsyan, M.A., Mathematics
Alice Stevens, M.A., Mathematics[*]
Sarah Williams, M.S., Applied Mathematics[*]
Brian Wissman, M.A., Mathematics[*]

[Continuing as Ph.D. students]*

Alice Leung Prize

Alice Siu-Fun Leung received a Master's degree in Mathematics in 1975 from UC Davis. In her will, Ms. Leung generously provided an endowment to award annual scholarships to graduate students in mathematics. This award is given to students who have shown exceptional promise in all aspects of mathematics, including research, scholarship, and teaching.

This year was an exceptional one for the Leung Prize. It is unusual to see a graduate student whose research record resembles that of a postdoctoral scholar, and this year Dean Ko presented the award to two such candidates.

John Steinberger has written 6 papers in the area of combinatorics, one of which has been published, one of which is under revision, and four of which are under review. One of these papers is co-authored with Don Coppersmith of IBM labs, and the rest are single-authored. These papers include results on vanishing sums of roots of unity, cyclotomic arrays, indecomposable tilings, and quasiperiodic group factorizations. The problems are ones that John chose on his own, and did not come from his advisers (Professors Jesus de Loera and Roman Vershynin). Such independence is uncommon for someone at this stage. John is remarkable for his independence, originality, technical strength, and creativity, and this is surely only the beginning of an outstanding mathematical career.

Zhihua Zhang is working with Professor Naoki Saito on applied harmonic analysis. Specifically, he is developing the polyharmonic local sine transform. This work has the potential for a profound future impact on data and image representation and compression. Zhihua came to Davis in Fall 2004 with a Master's degree from the Chinese Academy of Sciences, and his research here has flourished. He has published 14 papers since 2000, an unprecedented number for a graduate student, 7 of them since 2004. Zhihua is poised to complete

John Steinberger & Zhihua Zhang
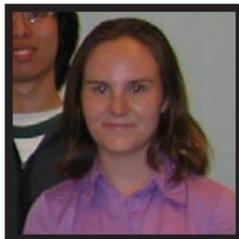
Jennifer Healey

Lauren Lui & Chris Neff

his Ph.D. in record time, and go on to become an applied mathematician of great distinction.

Eric C. Ruliffson Scholarship in Mathematics

Eric Canady Ruliffson attended UC Davis from 1964-1968, loved the study of math and excelled in it. He was first and foremost a problem solver, which helped him to achieve life-long personal and professional success. While attending UC Davis, Eric worked as a summer intern in the actuarial department of Pacific Mutual Insurance in Los Angeles, and was hired by them upon graduation. After serving in the Navy, Eric attended graduate school in demography at UC Berkeley. In 1973 he resumed his actuarial career at Pacific Mutual Insurance and continued as a benefits consultant in the San Francisco office of Coopers and Lybrand. He became a partner with the firm and achieved the status of Fellow in the Society of Actuaries. He was also elected to the Board of Partners for Coopers and Lybrand, the first actuary to be so honored, and served on the Board of Partners for PricewaterhouseCoopers, the world's largest consulting firm.

With Sandra Ruliffson, Eric Ruliffson's wife, in attendance, Interim Vice-Provost Fred Woods presented this year's award scholarships to **Jennifer Healey** and **Daniel Reynolds**.

Barry M. Goldwater Scholarship

The Barry M. Goldwater Scholarship and Excellence in Education Program was established by Congress in 1986 to honor Senator Goldwater, who served his country for 56 years as a soldier and statesman, including 30 years of service in the U.S. Senate. The purpose is to provide a continuing source of highly qualified scientists, mathematicians, and engineers by awarding scholarships to college students pursuing careers in these fields.

Professors E. Gerry Puckett and Craig Benham were on hand to present this year's scholarship to **Lauren Lui** and **Chris Neff**.

With Renewed VIGRE

by Bruno Nachtergaele

The VIGRE project at UC Davis (VIGRE is pronounced vigor) started its fourth year after a successful third year review and renewal. The VIGRE grant has been instrumental in accelerating the transformation of the Department of Mathematics into a world class research and education unit. VIGRE stands for Vertical Integration of Graduate Research and Education. The central focus is indeed on the Ph.D. programs. At Davis these are the Ph.D. programs in mathematics and applied mathematics. The main goal of the National Science Foundation with the VIGRE program is to increase the number of US students who successfully pursue a Ph.D. in the mathematical sciences, and to better prepare them for the wide variety of career paths open to mathematics Ph.D.s. Graduate school, of course, is just a phase in one's career and the "Vertical" in VIGRE emphasizes that achieving this goal requires integrated action in the phases that come before and after it: mathematics undergraduate education and the postdoctoral experience. To facilitate initiatives that streamline this process, the VIGRE grant provides stipends for undergraduate students, fellowships for graduate students, and part-time fellowships for postdocs which are combined with a teaching appointment. With the VIGRE-funded Research Experiences for Undergraduates, undergraduate students are given a peek at the world of mathematics research. For graduate students, VIGRE fellowships free up time to work on thesis research and to pursue related activities such as internships. Graduate students are also given the opportunity to gain experience in mathematics instruction. The postdoctoral fellows have a reduced teaching load, receive summer salary, and a small fund for research expenses and travel.

At Davis we pay great attention to creating an inviting and supporting environment for young researchers. The Research Focus Groups play a key role in achieving such an environment. Each year four topics are selected from proposals of the faculty. They represent broad areas of active research in the Department.

Faculty, postdocs, graduate and undergraduate students participate in informal seminars and reading groups covering both introductory and advanced material on the topic, as well as progress reports about ongoing research by members of the group. In the last four years an impressive array of research topics have been the subject of one or more

Roman Vershynin
Sloan Winner

Dr. Vershynin was born in Ukraine in 1974. He received his Ph.D. from the University of Missouri, Columbia, in 2000. Since then, he has held a Postdoctoral Fellowship at the Weizmann Institute of Science, Israel (2000-02), and a Pacific Institute for Mathematical Sciences Postdoctoral Fellowship at the University of Alberta, Canada (2001-03). He was appointed to a tenure-track Assistant Professorship in our Department on July 1, 2003.

What does this award mean to you, Roman?

"It means that many other people like the mathematics I like and do. Our Department, my peers, the Award Committee, other people whose opinion were solicited... Not all of them were specialists in my area. It's been nice to know that the type of science I perceive as interesting is appreciated by the general mathematics community."

Will you be pursuing new areas of research?

"I am investing much of my time into problems that lie on the border of mathematics and computer science. I would like to see what we mathematicians can say about high-dimensional structures that arise in theoretical computer science. High dimensional spaces have been studied extensively in mathematics, in particular in geometric functional analysis. But only recently this stream of "pure" mathematical knowledge has started to pour into the "applied" community, resulting in a breakthrough on several problems, e.g. the exact recovery problem for sparse signals due to Donoho, Candes-Tao and others."

Dr. Vershynin is a rising star in the area of geometric and functional analysis. He has solved long-standing problems in the field, and has made numerous essential and leading contributions to a variety of areas of mathematics, including combinatorics, probability theory, convex geometry and computer science. We are very pleased, and not at all surprised, that Dr. Vershynin has been recognized with a Alfred P. Sloan Research Fellowship in Mathematics.
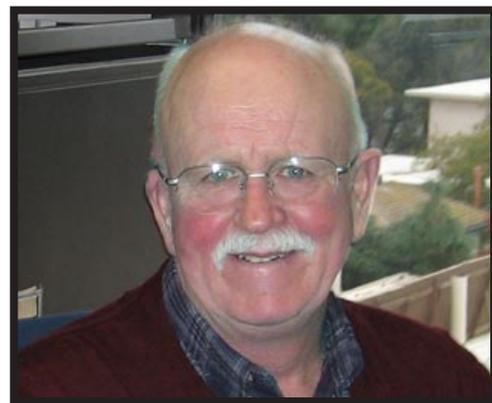
Krener & Reese
Support Budding
Professors

As reported earlier in the UC Davis Dateline, Arthur J. Krener and his wife, Jeanne M. Reese, recently donated $50,000 to the College of Letters and Science. This generous gift creates an endowment to supplement the Krener Assistant Professor program in the Department of Mathematics. The program provides prestigious postdoctoral research and teaching positions to young mathematicians. Krener Assistant Professors spend up to three years at UC Davis establishing their academic careers.

Krener received his Ph.D. in Mathematics from UC Berkeley in 1971, and joined our faculty as Assistant Professor in the same year. He served as Department Chair from 1987 to 1992. The title of Distinguished Professor of Mathematics was granted to him in 2003.

Since the time of his arrival to the campus, Krener devoted his research, teaching, and service to transforming the Department into the mainstream international research institution we have achieved today. He is the living history of the excellence of our Department. Numerous awards and honors bestowed to him include John Simon Guggenheim Memorial Foundation Fellowship in 2001, University Fellowship from the National Statistical and Applied Mathematical Sciences Institute in 2004, W.T. and Idalia Reid Prize in Mathematics of the Society for Industrial and Applied Mathematics in 2004, and the 2006 Hendrik W. Bode Lecture Prize of the Institute of Electrical and Electronics Engineering Control Systems Society. In 2000, the same society selected one of his earlier papers among the Twenty-Five Seminal Papers in Control Theory Published in the 20th Century for its major impact on the field.

Visitors to the Department

Georg Pflug

Georg Pflug is a Professor in the Department of Statistics and Decision Support Systems at the University of Vienna (Austria). He is Vienese by birth and studied law, mathematics and statistics at the University of Vienna where he received his Ph.D. in Mathematics in 1976.

After a few years at the University of Giessen, he returned to the University of Vienna where over the years he has been departmental chair, dean and member of the University Senate.

In addition to 70 articles published in leading journals in his field, Pflug is the author of three books, the latest "Optimization of Stochastic Models" (1996, Kluwer), and is now working on a book dealing with risk measures, a subject of vital importance in stochastic optimization as well as mathematical finance.

He has been the principal investigator of various theoretical and applied projects that include: pension fund management, data dependency in financial optimization, AURORA-advanced parallel and distributed algorithms for computational finance, optimal design of insurance contracts, and risk management in liberalized electricity markets.

Bronek Wajnryb

Bronek Wajnryb will be visiting for Spring Quarter. He is a Professor in the Department of Mathematics at the Technion - Israel Institute of Technology in Haifa, Israel, where he has been since 1980. He has also been a visitor at Columbia University in 1986-87, UBC in Vancouver 1987-88, the Max Planck Institute in Bonn in 1994-95 and IHES in 1980. He is best known for his discovery of the structure of the mapping class group.

Yoshiko Ogata

Yoshiko Ogata received her Ph.D. in Physics from the University of Tokyo in 2004. She was awarded a Research Fellowship for Young Scientists from April 2005 to March 2008 by the Japanese Society for the Promotion of Science, and held a postdoctoral position at the Centre de Physique Theorique at the University of Marseille in 2004-2005. She comes to UC Davis to work with Professor Bruno Nachtergaele on the statistical mechanics of quantum lattices.

Yuri Suhov

Yuri Suhov, Professor of Applied Probability, University of Cambridge and St John's College, Cambridge, Great Britain, visited the Math Department during the Fall quarter, 2005. Professor Suhov is known for his outstanding research in Mathematical Physics, Dynamical Systems and Probability Theory. His visit was complemented by a short visit to Davis, in November 2005, by his Cambridge Ph.D. student Motohisa Fukuda. A series of presentations have been given, on the problem of additivity of quantum information channels, a hot topic in Quantum Information Theory. Members of the Davis Math Department and Ph.D. students from a wide range of interests were given an opportunity to discuss rapidly developing directions in one of the most exciting areas of modern research.

Jerry Kaminker

Distinguished Professor Albert Schwarz has arranged to have **Professor Kaminker**, one of the leading experts in noncommutative geometry and index theory, as a visitor in the Fall quarter. Jerry Kaminker retired from the IUPUI Mathematics Department in the summer of 2005. A retirement conference in his honor took place at Penn State. However, Professor Kaminker does not consider himself a retired person; the only consequence of the retirement is that he does not have any obligation to teach. He is planning to continue his research and to teach; we are very happy to serve as host to his visit!

Hiro-Fumi Yamada

Professor **Hiro-Fumi Yamada** is a leading expert in representation theory, quantum algebras, and integrable nonlinear systems. He has published over 30 refereed journal articles to date. He received his Ph.D. from Hiroshima University, Japan, in 1987. He was a member at the Institute for Advanced Study, Princeton, from 1989 to 1990. Since then he held positions at Tokyo Metropolitan University and Hokkaido University. Since 2000, he has been a Professor at Okayama University. Dr. Yamada also served as Chair of his department a few years ago. In Davis, he will teach graduate courses on Lie groups and Lie algebras, and plan to conduct research with our representation theory group and Mulase.

Research Focus Groups: Hyperbolic Geometry, Optimization and Control, Applied and Computational Harmonic Analysis, Quantum Dynamics, Geometric Topology, Partial Differential Equations and Applications, Combinatorial Methods in Representation Theory, Random Matrices and Statistical Mechanics, String Theory and Geometry, Hecke Algebras and Orthogonal Polynomials, Probabilistic Aspects of Convexity and Combinatorics, Quantitative Biology.

The department is now gearing up to submit a new proposal for the next five years of funding. This will include expansion of the brand new Krener Assistant Professorships into a full fledged postdoctoral program, ambitious innovations to our undergraduate majors designed to optimally serve other campus units with a need for mathematics instruction, to provide more options for our own majors, to better prepare those who plan for graduate school, and last but not least, to build on the spectacular expansion and improvement we have achieved in the Mathematics and Applied Mathematics Ph.D. programs.

For more information and updates on our current activities in the VIGRE project see: http://www.math.ucdavis.edu/research/vigre/

Spreading the Good News

Monica Vazirani and Anne Schilling organized a workshop on "Generalized Kostka Polynomials" at the American Institute for Mathematics (AIM) in Palo Alto July 18-22, 2005. These workshops are quite different from a usual conference as they focus on working together in groups on open problems identified during the first couple of days of the meeting. The meeting was very stimulating and both would say definitely a success!

Abigail Thompson was elected to a 3-year term on the Editorial Boards Committee of the American Mathematical Society.

Joel Hass was appointed to the Committee on Conferences and Meetings of the American Mathematical Society.

Roger Wets was awarded the Special "Pioneer" Prize by the Stochastic Programming Community in October 2004. In July of 2005, Wets gave a plenary lecture at the 25th *Coloquio Brasileiro de Matematica* (the annual meeting of the Brasilian Mathematical Society) in Rio de Janeiro. In August, he gave the opening plenary address at theInternational Conference on Complementarity Problems at Stanford.

Yvonne Lai, an A.B.D. in Mathematics, was awarded a 2005 Chancellor's Achievement Award for Community and Diversity.

Life After Davis

Jim Primbs
Class of 1994

As a senior in high school at Davis Senior High, I had already been exposed to UC Davis through a program that allowed high school student to take college courses. I had used it to take courses in math, physics, chemistry and statistics. So, by the time I enrolled at Davis as a freshman, I was already familiar with the math department and a number of its courses.

While at Davis, I double majored in math and electrical engineering. In my final year, while taking a partial differential equations class, Professor Puckett suggested that I do a senior thesis, and recommended that I work with Professor Krener, whose interests in control theory were a good fit, especially taking into consideration the EE side of my major. Professor Krener was kind enough to oversee my thesis, even though I hadn't had the opportunity to take a class from him. My senior thesis was on H-infinity estimation, and this was really my first introduction to modern control theory and to research.
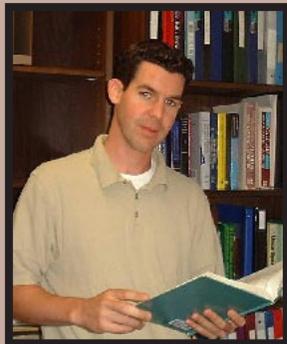
My senior thesis experience led me to pursue graduate studies in the area of control theory. I first completed a masters degree in electrical engineering at Stanford, and then joined the Control and Dynamical Systems Department at Caltech for my Ph.D. The solid background that I received in math at Davis, and the jump start into the world of research that Professor Krener had given me from my senior thesis, allowed me to move quickly into research, and I completed my thesis in an area called receding horizon control in a little over 3 years.

Following my Ph.D., I did a post-doc at Caltech for 2 years under the supervision of my Ph.D. adviser, John Doyle. Professor Doyle was well known for his work in robust control theory, but at the time, he was interested in branching out and exploring new applications of control theory in other fields. So, I was part of a group of Doyle's grad students and post-docs that were doing research in areas as different as physics, networks, systems biology, and finance. My area was finance, which was a subject that I had always been interested in, but never had the opportunity to do research in.

With two other post-docs, I embarked on a study of finance with the idea of using control theory tools. We naturally gravitated toward the mathematical side, and began to explore option pricing theory. It is an area of finance that utilizes a number of different areas of mathematics, from stochastic processes for modeling asset prices movements, to partial differential equations that describe the fair price of an option. My solid math background allowed me to develop financial intuition without getting overly bogged down by the mathematical details of the theory. In a fairly short time, we were able to begin making contributions, and wrote some papers developing new computational algorithms for analyzing the performance of dynamic hedging strategies, which are at the core of the theory of option pricing.

Primbs is now an assistant professor at Stanford

After my post-doc finished, I joined the Management Science and Engineering Department at Stanford as an assistant professor. Right now I am in my fifth year at Stanford. This department is an excellent fit for my interests and background in that it brings the quantitative tools of an engineering department to problems in the realm of business. I teach courses such as Investment Science and Financial Engineering that emphasize the mathematical tools in finance. My research is focused on that area as well, and involves an interesting blend of stochastic processes, control theory, optimization, and numerical analysis applied to mostly pricing and portfolio optimization problems. In looking back, I never would have predicted that I would end up teaching and running a research group in finance. I believe that having a strong math background was critical to my success, especially in my ability to change direction from control theory to finance. In many cases, math is the largest barrier to entering a new field. I am very thankful that my studies at UCD gave me that strong math background, and the supportive faculty encouraged me to pursue research and graduate studies. With UCD being such a great example, I only hope that I can provide that sort of atmosphere and encouragement for my students.

Emeriti Update

Sherman Stein's study of the gravity equation f(x+h) - f(x-h) = 2f'(x) appeared in the April Monthly. In spite of his vow to stay away from the math wars he has served as a critic of a 4th grade text under development. In addition, he has continued to referee and review papers.

Kurt Kreith continued his work with the California Mathematics Project and served as a consultant to the Transition Mathematics Project in Washington State. His teaching activities included Freshman Seminars and a 4-week summer course for talented high school students enrolled in COSMOS. He was an invited speaker at the Asilomar meeting of the California Mathematics Council.

Takayuki Tamura continues his service as reviewer for Mathematical Reviews and Zentralblatt fur Mathematik. He also continues to publish poetry in Tanka monthly in the United States and Japan, and continues to contribute a short essay to a Monthly Covell Gardens Newsletter. In spite of every busy day for caregiving, he gives every spare moment to studying and writing the two problems: semilattice indecomposable semigroups and sexagenary cycles.

Staff News

2004-05 brought new faces to the Math Staff: **Perry Gee** in Student Services, **Dena Gilday** and **Elena Karn** in Business Services, and **Karen Beverlin** in the Journal of Mathematical Physics. Two of the positions were previously occupied by Catie Bull and Pam Tise; one is a new position that works jointly with the COSMOS program. The staff additions garnered a promotion for Jessica Potts as she now serves as Business Manager and Budget Officer for Mathematics and COSMOS. Another well-deserved promotion occurred when Celia Davis was made manager and supervisor of the Student Services unit. Overall, these changes are positive for our administrative operations and of course, we are very happy to have the new staff join our seasoned team!

An important accomplishment this year that reflects well on the Department is the revision of our website. Changes were necessary to showcase the many enhancements we have made to our research and teaching programs. Our overall goal was to provide a much more comprehensive, easily navigable, and meaningful web interface for all visitors and users to the Mathematics Department. The final product was achieved through the collaboration of faculty and staff, especially those staff in Student Services. Individual kudos are due to Marianne Waage in Technical Services for all her design ideas, unflappable patience, and invaluable expertise towards the final product.

The main highlight for the year has been the planning involved for our new building and the subsequent move that will occur. It has been 30-years since the Department last moved and it is evident in all corners of our Kerr Hall world. Our first step in planning was the placement of Department members—faculty, vraps, lecturers, staff and graduate students—in offices in the new building. Part of the effort was handled through the Faculty Representative Committee (FRC) and furnishings were decided by the Décor Committee. In every phase of the process, staff has gone above and beyond their daily duties to ensure the many details would be in place for a seamless move. One staff member has been actively involved in every aspect of the furniture and moving arrangements, Richard Edmiston in Business Services. He has been instrumental in working with the furniture and moving companies to ensure all our necessary pieces are in place. We are undoubtedly a much larger operation than we were 30 years ago, therefore, recognition and a big "thank you" is due to ALL staff for their crucial efforts in facilitating this historic event!

Donation Form

Your gift is welcome! The Department of Mathematics wishes to thank all alumni, parents, students, faculty, staff, and friends who support the Department. You may return this form to:

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Alumni News Update

We want to hear from you! Please send us information about yourself so that we can stay in touch and share in your experiences outside of UC Davis.

Send email to:
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We will do our best to include it in the next newsletter.