FALL 2009

THE Common Denominator

UCLA DEPARTMENT OF MATHEMATICS NEWSLETTER

Blurred

Deblurred

Original

The blurry image is generated by the convolution of the original image with an average kernel size of 100 X 100 pixels. The deblurred image is obtained by nonlocal total variation (NLTV) regularization with Bregman iterations. Using block by block NLTV denoising, the problem is solved by the Bregmanized Operator Splitting method. *Image reconstruction performed by Assistant Adjunct Professor Xiaoqun Zhang*

INSIDE

UCLA

UCLA Math Takes a Walk on the Applied Side

These are heady times for the Department's applied math group, which recently climbed to a high-water mark third place ranking in the most recent *U.S. News & World Report* survey of graduate school programs. Individual honors abound as well: Stan Osher was newly elected to the American Academy of Arts & Sciences and is set to give a plenary address on new algorithms in information science at the 2010 International Congress of Mathematicians. Andrea Bertozzi was honored for her profound contributions to diverse areas of applied mathematics as the Society for Industrial and Applied Mathematics' (SIAM) youngest Sonia Kovalevsky lecturer. The applied group's most recent addition, Joey Teran, was named by *DISCOVER* magazine as one of the brightest young scientists for his pioneering work in virtual surgery. And Russ Caflisch, founding member of the California Nanosystems Institute, completes his first year as director of IPAM, the NSF-funded math institute that fosters cutting edge collaborations between world-class mathematicians and scientists.

PDEs: framework for applied math Partial differential equations (PDEs), the governing equations that quantify physical phenomena, are the common framework for the group's research which divides into two broad areas: physics-based problems and data-driven problems (e.g. imaging). As Professor Chris Anderson explains, "When I'm asked to talk to graduate students about the program, I say the one thing you'll learn is PDEs because that's what we do here." Chris works with applied physicists at HRL Laboratories to develop simulation tools for the design of quantum dots as part of its efforts to build a quantum computer. Russ also shares his research interest in materials modeling with additional work in plasma dynamics and fluid dynamics.

Whichever side of the applied equation they fall on, the Department's applied math faculty are distinguished by their outwardly focused nature and keen interest in research that impacts and revolutionizes medicine, biology, criminology, information science, robotics, visual effects and materials science.

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UCLA Math Takes a Walk on the Applied Side

continued from page 1

Paul Roberts, renowned for his contributions to problems of magnetohydrodynamics (MHD) of the earth's core and the dynamo theory, developed courses on fluid mechanics and has a joint appointment with the Institute of Geophysics and Planetary Physics. Alan Laub, founding director of the Institute for Digital Research and Education (IDRE) also crosses over departments, carrying a second appointment in electrical engineering. His mathematical focus is numerical linear algebra with emphasis on small dense problems and matrix analysis. Rejecting the practice of "throwing their work over the wall," the applied group seeks outside collaborations with scientists, doctors, engineers, physicists, the military, animators and others to help solve real world problems. Fortunately for the group, UCLA's world-class research environment offers a vast pool of onsite scientific customers in the engineering school, medical center, and the fertile ground of IPAM.

Strong applied/pure faculty bonds The group also harmoniously co-exists with the Department's talented pure math core, leveraging in-house theoretical expertise to enhance its applied research. A well-known example is the breakthrough results by Terry Tao, Emmanuel Candes (Stanford) and Justin Romberg (Georgia Tech) in compressed sensing, which have had major impact on advancements in image processing. Honorary applied group member and IPAM Director Emeritus Mark Green explains, "The amity between pure and applied math started when Stan Osher and Bjorn Engquist arrived. They knew how to sell the rest of the department on applied math and they brought in the rest of the group. When Tony Chan became the first applied chair, that again said something. We could have an applied chair and not worry that this would be the end of the world as we knew it. Indeed, it marked a new beginning." Tony continues to take on the world as the new president of Hong Kong University of Science and Technology this September after serving as the NSF assistant director in charge of its mathematical and physical sciences directorate. Tony's ascendancy in global scientific leadership is more evidence of the group's versatility across multiple borders.

House of algorithms Veteran image processing guru Stan Osher offers this take on their success: "We're the house of algorithms." His work in the late 1970s and mid-1980s with Bjorn Engquist, students, and frequent visitor Ami Harten impacted shock calculations, culminating in essentially nonoscillatory (ENO) schemes. With Lenny Rudin, Stan applied ideas from shock waves to imaging, advancing the field significantly. As the co-developer (with James Sethian) of the level set method in the late 1980s, Stan's research transformed the visual effects industry with this powerful technique that simulates every imaginable component of a digital environment, including plants, clouds, clothing, hair and water. On Google, "level set method" gets 1,850,000 hits with applications in two-phase fluid flow, solid mechanics, computer vision, nanoscience, control and many other fields. Most recently, Stan and his "genius" graduate student entourage are developing techniques to solve optimization problems that arise from compressed sensing, which allows images and signals to be reconstructed from small amounts of data. The "Split Bregman" method is one such new promising technique that Stan co-developed with graduate student Tom Goldstein for image denoising in magnetic resonance imaging (MRI) technology. The method has already attracted widespread interest. The group's image processing innovators also build on the ideas of others, including nonlocal means, a revolutionary process for image denoising developed by French researcher Jean-Michel Morel, a frequent visitor and collaborator. Algorithms from discrete math, such as graph cuts, are also being creatively employed to efficiently solve certain image science problems.

Swarms of research Director of Applied Mathematics Andrea Bertozzi's 2009 SIAM Sonia Kovalevsky lecture "Swarming by Nature and by Design" could also describe her numerous research interests, which literally swarm across the scientific community. Her expertise in swarming (large-scale coordinated movement, with no centralized control, observed in fish schools, locust swarms and bird flocks) represents one of the many applications of PDEs she focuses on that also include image processing, remote sensing and complex fluids. Andrea is particularly excited about a new research project on the Atomic Force Microscope (AFM) that melds her research in imaging with her mathematical swarming models that she has translated into robotic platforms in the applied math lab. The AFM project forges an interdisciplinary partnership with the Lawrence Berkeley National Laboratory's Molecular Foundry. The goal is to design transformative computation-based methods for real-time data acquisition and analysis in chemical and biological experiments conducted at the nanoscale level. "This is really exciting for me because I work on problems in control and sensing and I work on problems in image processing and I've never been able to combine the two," says Andrea. The Defense Threat Reduction Agency through NSF recently funded her potentially groundbreaking remote sensing project to develop algorithms for sensor systems for use in the detection of chemical and biological materials. Andrea's work aims to improve techniques for rapidly processing and understanding evolving information from diverse platforms to accurately identify and track threats that are critical to the country's security.

X-box + math = virtual surgery
http://www.spotlight.ucla.edu/faculty/joseph-teran-virtual-surgery/

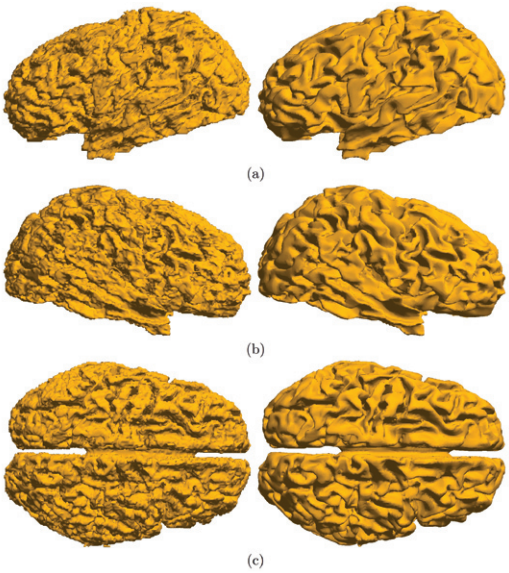
Addressing more local threats, Andrea is also part of a high profile interdisciplinary team, including UCLA anthropologist Jeff Brantingham and University of California, Irvine, criminologists, who are working with the Los Angeles Police Department on diverse crime modeling projects with the goal of better policing through detection and prediction. The Army Research Office is now looking to apply these models to track insurgent activities abroad. In the area of fluid flows, Andrea and her Lawrence Livermore National Laboratory (LLNL) colleague Alice Koniges will be developing numerical simulations of fracture and multimaterial debris flow for LLNL's new National Ignition Facility (NIF). The facility

uses lasers to create a new energy source by fusing hydrogen into helium. Andrea has enlisted Stan and Joey Teran for their expertise on solids and fluids modeling to simulate the blast wave and analyze how debris shoots off the component parts. Donning hard hats and protective gear, Andrea and Joey were recently treated to a VIP tour of the facility. "It was pretty cool," says Andrea. "But the chamber is so full of radiation after the ignition that they can't go in there for a full week."

Virtual worlds: surgery and special effects Simulations that keep surgical patients alive and well are Joey Teran's goal in his trailblazing collaboration with surgeons to create virtual surgery worlds powered by math. "The idea is pretty simple: make a video game that is predictive for surgical procedures with 3-D graphics, just like Playstation or X-box," says Joey. A relatively simple procedure that he and his colleagues can currently simulate is the surgical removal of a malignant melanoma. The surgeon or trainee makes incisions, deforms and sutures the tissue in real time, while the simulator solves the governing equations. Joey is currently designing algorithms for simulations on Intel's powerful multi-core platform to manipulate more complicated organs, such as the heart. In related work, he has developed building block algorithms that help solve equations of blood flow through arteries and impassed valves. His graduate student, James Von Brecht, became personally invested in the project because his mother has a heart valve disorder. Says Joey, "The idea is to take an MRI of someone who has the diseased valve and then build a computational model from the MRI specifically tailored to that person. It could help prototype new valve designs." Joey's research extends into the virtual worlds of special effects for the movie industry. Working as mathematical consultants to Disney's animators, he and his students have made a number of breakthroughs in hair simulation and fracturing rigid objects. Since making the strategic decision to develop new technologies in-house, the studio has encouraged Joey and his team to push the creative envelope. "That's nice for us, because we can go in and help them take risks with approaches to challenges, like hair."

Imaging for medicine and the military Luminita Vese's image processing research recently brought her together with New York placental pathologist Dr. Carolyn Salafia with the goal of predicting disease in adults and developing treatments for pregnant women by studying their placentas. Says Luminita, "The blood vessels of the placenta images can be seen as random shapes. The main goal is to make correlations between results we get from analyzing images of placentas with specific disorders that may occur." Luminita also mines the Department's pure math resources for her imaging work, specifically in the analysis group. "We needed to learn some tools from harmonic analysis, and John Garnett helped guide us through." She and John are now collaborating on an NSF grant to better model textured and non-textured images. Explains Luminita, "Many images have clutter that needs to be analyzed. We try to remove the textured details from a real image to get the cartoon (e.g. smooth) part that contains the important information." These techniques can be applied to satellite images for target and road detection, as well as medical images.

Hand-animated character with hairstyle simulated by hybrid/geometric collision algorithm. Images © Disney



Level set based nonlocal surface restoration

On the borders of applied math Other math faculty members play productively along the borders of applied research. Inwon Kim focuses on nonlinear PDEs with particular emphasis on free boundary problems, the classical example of which is the Stefan problem of melting ice or supercooled water. Inwon and mathematical physicist/probabilist Lincoln Chayes are collaborating on a Stefan problem for supersaturated solutions where the central issue of interest concerns the evolution of the ice/water interface. Recent work with Lincoln includes investigation on a price formation model, where ideas from PDE theory and interacting particle systems are combined. Pure mathematician Jim Ralston has recently found a way to use his long-time study of Gaussian beams (which are akin to lasers) to analyze wave motion. Explains Jim, "There are a lot of cases where wave motion is highly oscillatory, like light waves or waves in the atmosphere, and computing these things can be very time consuming." Beams turn out to be very efficient for resolving these situations, and there is enormous potential for applications in the atmospheric sciences and geophysics. "For one of the recent oil finds in the Gulf of Mexico," Jim enthuses, "the numerics were done with beams."

The applied group and its talented collaborators continue to tap rich reservoirs of research across scientific fields. Gushes Stan: "This place has a remarkable history of building things that people actually use without giving up mathematical rigor."

faculty news

New Faculty

Igor Pak comes to the Department as professor in the combinatorics and discrete mathematics group. He possesses a rare combination of expertise in many areas of algebraic and geometric combinatorics together with strong expertise in probabilistic combinatorics. These are talents that promise potential collaboration with researchers in representation theory and the Department's probability group. Igor is notably prolific, having already published 65 papers. He has had continuous support from the National Science Foundation and the National Security Agency, and has made significant and substantive contributions to such diverse areas as random walks on groups, partitions bijections, tilings, the geometry of convex polytopes, and the combinatorics of the symmetric group. After finishing his undergraduate studies at the Moscow State University in 1993, Igor received his PhD in mathematics from Harvard University in 1997 under Persi Diaconis. He was an associate professor at the University of Minnesota since 2007, and has held positions at Yale University and MIT.

Monica Visan joins the Department as assistant professor in the analysis and PDE group as one of the top young researchers in the field of nonlinear Schrödinger equations. Since completing her PhD at UCLA under the direction of Terence Tao in 2006, Monica has made significant progress towards one of the major open problems in her field of interest, the global regularity and well-posedness problem for the mass-critical nonlinear Schrödinger equation. She also focuses more generally on the area of nonlinear dispersive equations. Monica was an assistant professor at the University of Chicago in 2008, having spent the prior two years as a fellow of the Institute for Advanced Study in Princeton. She was also a recipient of the prestigious Clay Liftoff Fellowship, which recognizes young mathematicians who have demonstrated mathematical research of quality and significance, and who show the potential to be leaders in their field.

Faculty News Highlights

In April, UCLA Mathematics Professors **Stanley Osher** and **Terence Tao** joined 210 distinguished scholars, scientists, writers, artists, and corporate and philanthropic leaders who were elected to the American Academy of Arts & Sciences in recognition of their preeminent contributions to their disciplines and to society at large. Terry and Stan were two of six UCLA professors to be named new fellows this year. An independent policy research center, the **American Academy of Arts & Sciences** undertakes studies of complex and emerging problems. Current academy research focuses on science and global security, social policy, the humanities and culture, and education.

In its special ***DISCOVER 50*** issue, the popular science magazine spotlighted the achievements of individuals who are making the most important contributions to American science. Of those 50 "best brains in science," UCLA mathematicians **Terence Tao** and **Joseph Teran** made the "20 under 40" list that highlights young visionaries who are transforming their fields. Terry is heralded for his contributions across mathematical fields and for his breakthrough research in compressed sensing. Joey is lauded for his cutting edge applied research in virtual surgery applications for medical imaging. For more information on this special issue, visit http://discovermagazine.com/2008/dec.

Andrea Bertozzi was invited by the Association for Women in Mathematics (AWM) and the Society for Industrial and Applied Mathematics (SIAM) to give the **2009 Sonia Kovalevsky Lecture** at the society's annual meeting. Andrea spoke on "Swarming by Nature and by Design." Established in 2003, the lectures honor women who have made fundamental and sustained contributions to applied or computational mathematics.

Professor and Chair **Sorin Popa** was awarded the **2009 Ostrowski Prize** for his recent striking work in von Neumann algebras and orbit equivalence ergodic theory. The prize is awarded every two years for outstanding achievements in pure mathematics and the theoretical foundations of numerical analysis by an international jury from the universities of Basel, Jerusalem, Waterloo and the academies of Denmark and the Netherlands.

Tony Chan has been appointed the next president of **Hong Kong University of Science and Technology** for a five-year term, effective September 1. A UCLA professor of mathematics since 1986, Chan was dean of the Division of Physical Sciences from 2001 to 2006 in the College of Letters and Science. In October 2006, Chan took a temporary leave from his faculty position at UCLA to become the NSF assistant director in charge of its Mathematical and Physical Sciences Directorate.

SIAM named **Russel Caflisch** and **Stanley Osher** as new fellows to its inaugural **SIAM Fellows Program**, an honorific designation conferred on members distinguished for their key contributions to the fields of applied mathematics and computational science.

Stanley Osher was conferred the degree of doctor of science (honoris causa) from **Hong Kong Baptist University** for his "remarkable achievements in the advancement of science, in particular applied mathematics," as well as his "substantial contributions" to the university's department of mathematics.

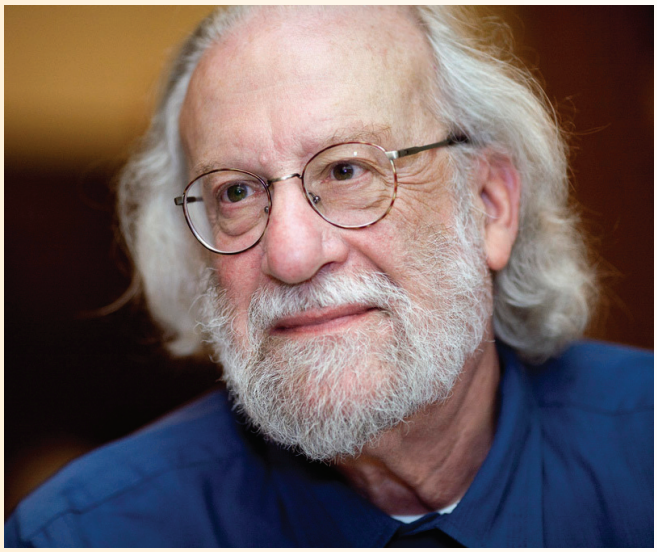
Leo Sario
Professor of Mathematics, Emeritus

In memoriam, 1916–2009

In Finland during World War II, Leo Sario was recognized as an excellent teacher and officer who made key contributions to the defense of the country, all while diligently pursuing his mathematical studies. After the war, Leo received his PhD under Rolf Nevanlinna and helped to establish the National Academy of Finland. Moving to the U.S. in the 1950s, he worked at Princeton, MIT, Stanford and finally UCLA, from which he retired in 1986. Leo created the theory of principal functions and wrote five major books including *Riemann Surfaces* with Lars Ahlfors, *Classification Theory of Riemann Surfaces* with M. Nakai, and *Principal Functions* with Burton Rodin. He also published over 130 research papers and mentored 36 doctoral students.

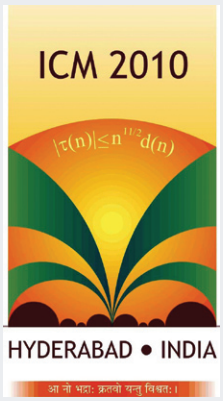
The following account by University of California, San Diego, Professor Burt Rodin of his student days with Leo gives a charming portrait of his mentor as a teacher and a person:

> "It is the influence of his unique personality that is uppermost in my mind at this time.
>
> He was a superb mentor to graduate students. Among his other gifts was an ability to focus powerfully on a subject and let nothing distract him. He told me that trait enabled him to shepherd a law through the Finnish Congress enabling the support of science. It won him Finnish knighthood and the honor of having the legislation bear his name. He had me meet with him twice a week during those student days in order to discuss my progress on the dissertation. Each week one of these meetings took place in the UCLA swimming pool. We swam in adjacent lanes, doing the breast stroke with our heads above water and talked about my research on Riemann surfaces. This was his lesson to me on focusing. Let me also mention the most difficult thing he ever asked of me, though it might be hard to appreciate in this age of informality. It took place the day I passed my final oral exam. He told me that according to academic tradition I could no longer address him as 'Professor Sario.' Henceforth I would have to address him as 'Leo.'"



The After Math: Professor Nathaniel Grossman Retires

Professor Emeritus Nathaniel Grossman came to UCLA in 1966 after two years as assistant to Marston Morse at the Institute for Advanced Study at Princeton. Nick published papers on differential geometry, mathematical geodesy, asymptotics and special functions, and celestial mechanics, as well as a textbook on celestial mechanics. He was awarded a Humboldt Research Fellowship in Munich and a National Research Council fellowship at the National Geodetic Survey in Washington. He mentored four doctoral students. His university service included five years as the faculty representative on the publishing board of *The Daily Bruin*. Since 1971, Nick and his wife Cindy have always had at least one Welsh Corgi in their house.



International Congress of Mathematicians 2010 Preview

ICM 2010 will showcase a spectacular spate of invited talks for Department faculty. Applied mathematician **Stanley Osher** will lead the way with a plenary address on new algorithms in information science. Fellow UCLA Math colleagues **Paul Balmer**, **Chandrashekhar Khare**, **Dimitri Shlyakhtenko**, and **Benjamin Sudakov** are invited lecturers in algebra, number theory, functional analysis, and combinatorics, respectively. UCLA alum and IPAM science advisory board chair **Peter W. Jones** will also give a plenary address. The congress will be held in Hyderabad, India, August 19–27, 2010.

focus on research

Combinatorics: Methods and Applications

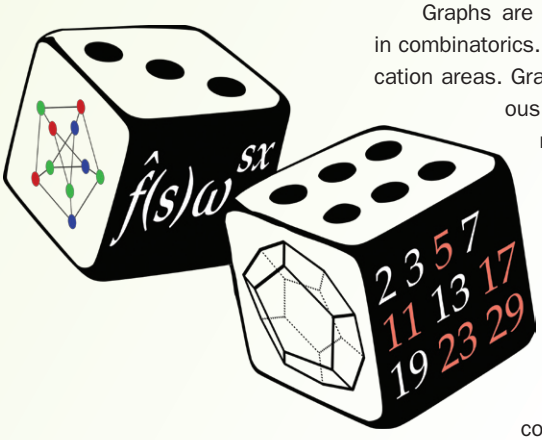
by Professor Benjamin Sudakov

Since joining the Department in 2008 to revitalize the combinatorics group, UCLA mathematics professor Benjamin Sudakov has employed his expertise to organize IPAM's fall 2009 long program focused on modern combinatorial methods and their applications to other areas of mathematics and computer science. Below, Benny provides background on his field and describes some recent joint work with N. Alon and A. Shapira, which illustrates application of combinatorics to algorithms and complexity theory.

> "Modern combinatorics utilizes numerous sophisticated and powerful research methods. They play an important organizing role in combinatorics similar to that which deep theorems of great generality play in more classical areas of mathematics."
>
> *Benny Sudakov*

Combinatorics is the fundamental mathematical discipline that studies discrete objects and their properties. Although it can be argued that such investigations began as soon as humans learned how to count, the field has seen tremendous growth during the last 50 years. In the past, discoveries in combinatorics were made based on sheer ingenuity. Modern combinatorics has greatly matured from this early stage and utilizes numerous deep and highly developed research methods. The arsenal of modern combinatorial techniques borrows ideas from such areas as probability, algebra, harmonic analysis, topology and number theory. Much of the rapid growth of combinatorics can be traced to the success of these new methods and the tight connection between combinatorics and computer science. As a result, combinatorics now occupies a central place among the mathematical sciences.

Graphs are among the main objects of study in combinatorics. They are ubiquitous in many application areas. Graphs can be used to model numerous types of interactions that arise in natural, organizational and computational systems. In many instances, we are given a graph G, and we would like to know whether it has some property P. If G fails to have this property, it is very natural to try to modify it mildly so that the resulting graph does have property P. A fundamental computational problem is to find the smallest number of edge deletions and additions needed to turn G into a graph satisfying property P. We denote this least number of changes by $E_P(G)$. Specific instances of graph modification problems arise in several fields, including molecular biology and numerical algebra. We say that a graph property is *monotone* if it is maintained under the removal of vertices and edges. In solving the graph modification problem for a monotone property P, it clearly suffices to *delete* edges. We refer to this version as the edge-deletion problem. Two examples of interesting monotone properties are k-colorability and the property of not containing a copy of a fixed graph H. Modern combinatorial methods have allowed us to make very substantial progress on the study of the edge-deletion problem for monotone properties.



For any fixed $\varepsilon > 0$ and any monotone property P we have a deterministic algorithm that gives a very good approximation of $E_P(G)$ for any given graph G. If G has n vertices, then the algorithm makes an additive error of at most εn^2. The algorithm runs in time that is linear in the size of G. Given the above it is natural to ask for which monotone properties better additive approximations of E_P can be achieved. Our second main result essentially resolves this problem by giving a precise characterization of those monotone graph properties that can be thus approximated.

As we show, if not all bipartite graphs have property P, then E_P can be approximated in polynomial time within an additive error of $n^{2-\delta}$ for some $\delta > 0$. On the other hand, if all bipartite graphs satisfy P, then for any $\delta > 0$ it is *NP*-hard to approximate the distance to P within an additive error of $n^{2-\delta}$. As is typical of present-day combinatorics, our work makes essential use of some modern and advanced machinery:

Regularity lemma: A surprising and extremely powerful result proved by Szemerédi states that the vertices of every large enough graph can be partitioned into a constant number of parts such that the edges between most of the parts are random-like.

Subsequently, efficient algorithms for finding such a partition were discovered. The regularity lemma was an essential tool for Szemerédi's celebrated proof that any dense subset of integers contains long arithmetic progressions. More advanced versions of this lemma imply that every graph G can be approximated by a small (fixed size) weighted graph W, so that $E_P(G)$ is an approximate solution of a related problem on W. Since W has a fixed size, we can now resort to a brute force solution.

Extremal graph theory: A century-old theorem of Mantel says that a triangle-free graph on n vertices has at most $n^2/4$ edges, and the only extremal example is a complete bipartite graph with equal parts. This is a special case of Turán's classical theorem that a complete r-partite graph with equal parts has the largest number of edges among graphs with no clique of size $r+1$. These are the origins of extremal graph theory, where a major question asks for the maximum number of edges in a graph that contains no copy of a fixed graph H. A reformulation of Turán's theorem is that the minimum number of edge deletions needed to destroy all $(r+1)$-cliques in a complete graph is the same as to make it r-partite. Far-reaching extensions of Turán's theorem show that the same phenomenon holds for many other non-complete graphs. Such extensions have played a crucial role in our work.

Spectral techniques: If the graph G has vertex set V and edge set E, we define its adjacency matrix as follows: $A=(a_{u,v})_{u,v\in V}$, where $a_{u,v}=1$ if $uv \in E$, and $a_{u,v}=0$ otherwise. This is a symmetric matrix and hence has real eigenvalues and an orthonormal basis of eigenvectors. It turns out that there is a tight relation between the eigenvalues of A and several structural properties of the graph G. For example, if G has n vertices, is d-regular (i.e., every vertex has d neighbors), and the second largest in absolute value eigenvalue of A is much smaller than d, then G has strong pseudo-random properties. In particular, the number of edges between any two sets of

vertices U, W is roughly $d|U||W|/n$, which is the expected value for the number of edges in the random graph with edge probability d/n.

Interestingly, prior to our results, the computational complexity of even the *precise* determination of E_P was unknown. This was open already for such an elementary property as being triangle-free. In 1981, Yannakakis posed the question of finding a large collection of natural graph properties for which computing E_P is *NP*-hard. Our work clearly answers this question in a strong form.

events

2009 Special Awards Ceremony

Robert Sorgenfrey Distinguished Teaching Awards

Graduate student Jane Sherman receives her award. Other graduate awardees were Nicolette Meshkat, Neelesh Tiruviluamala and Eamonn Tweedy.

Left: Postdoctoral awardee Fred Park

Below: Faculty awardee Susie Håkansson

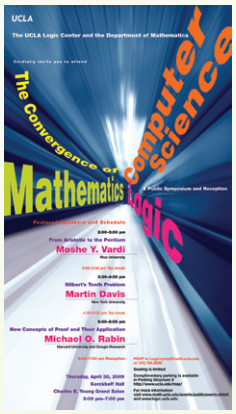
Professor Michael Hitrik was also an awardee.

Lockheed Martin Outstanding Undergraduate Research Award in Applied Mathematics

Sheida Rahmani Lockheed Martin award recipient

Feng Guan was awarded the **Horn-Moez Prize for Excellence in First-Year Graduate Studies**. **Dissertation year fellowships** were awarded to Luke Cherveny, Mi Youn Jung, Thai Hoang Le and Guo-Ying (Helen) Lei. Sanghoon Baek received the **Beckenbach Award**.

Logic Center Happenings



Public Symposium: The Convergence of Logic, Mathematics and Computer Science

The UCLA Logic Center hosted its first public symposium since its founding in 2004. World renowned logicians Martin Davis of New York University, Michael O. Rabin of Harvard University and Google Research, and Moshe Y. Vardi of Rice University attracted 100-plus students, researchers and alumni across mathematics, computer science, linguistics and philosophy. Their lively and accessible talks spanned the history of logic back to the Greeks, Hilbert's tenth problem and zero knowledge proofs.

Michael O. Rabin

Moshe Y. Vardi

Martin Davis

Video lectures available for podcasting on UCLA on iTunes U at http://deimos3.apple.com/WebObjects/Core.woa/Browse/ucla-public.2371910282

Logic Summer School for Undergraduates

For three weeks in July, the UCLA Logic Center held a special summer school to introduce aspiring mathematicians to central results and research techniques from mathematical logic. Eighteen undergraduates from the U.S., China, Germany and Turkey took intensive courses covering first-order logic and Gödel's incompleteness theorem, forcing and independence in set theory, and non-standard analysis.

Visit http://www.logic.ucla.edu for future events and updates on summer school 2010.

UCLA Day

For the second annual UCLA Day, the Department and IPAM hosted an open house for alumni, supporters and their families to network with fellow Bruins and meet researchers who presented some of their most cutting edge work.

A Celebration of Tony Chan

UCLA Math Professor Tony Chan was honored to recognize his contributions to UCLA and to celebrate his new position as president of Hong Kong University of Science and Technology. Tony recently stepped down as assistant director of NSF's Mathematical and Physical Sciences Directorate. UCLA Vice Chancellor of Research Roberto Peccei and Charles Elachi, director of the NASA Jet Propulsion Laboratory, along with colleagues, collaborators and students gathered to share their appreciation. Having worked closely with Tony on the founding of IPAM, Mark Green described him as the most optimistic person he had ever met, saying: "Tony's is not a blind optimism. It is an evidence-based optimism. I had not yet learned about Bayesian statistics at this point, but now I can say that while Tony's likelihood function is firmly rooted

in reality, his Bayesian prior pulls very strongly in the direction of optimism." All agreed that Tony is visionary in his endeavors, possesses staggering connections and boundless energy, and above all, is great fun to work with.

Public Events Preview

UCLA Science Faculty Research Colloquium Series

2008 National Academy of Sciences member and probabilist Professor Tom Liggett will speak on "Stochastic Models for Large Interacting Systems in the Sciences." Join fellow alumni and math enthusiasts for this free public lecture on January 11, 2010, at 4:00 p.m. in the Physics & Astronomy Building, Room 1425, with a reception to follow. Check for updates at http://www.math.ucla.edu/events/publicevents.shtml.

Free podcasts of select UCLA Math public lectures and symposium are now available through UCLA on iTunes U at www.math.ucla.edu/itunes.

2008–2009 Distinguished Lecture Series

Mario Bonk of the University of Michigan surveyed the modern theory of quasiconformal mappings on metric spaces and its applications to several areas, including boundaries of hyperbolic groups, fractal geometry, and the Thurston characterization of post-critical rational functions.

Gregory Margulis of Yale University surveyed the field of homogeneous dynamics (a combination of ergodic theory and algebraic group theory) and its many deep applications to number theory.

Elias Stein of Princeton University reviewed the many advances in harmonic analysis in the last few decades and how they are currently being applied to yield new insights and results in several complex variables.

Coming Attractions

2009–2010 Distinguished Lecture Series

January 5–9: Pierre-Louis Lions, Collège de France

January 10–17: Barry Mazur, Harvard University

Feb 22–27: Leonid Polterovich, Tel Aviv University

April (TBA): Ken Ono, University of Wisconsin-Madison

graduate news

Top Students Spend Their Summers in Analysis

Outgoing chair Christoph Thiele celebrated the 10th anniversary of his popular Summer Schools in Analysis, which bring together promising young analysts across the U.S. for an engaging week-long learning experience covering cutting edge topics. As lead organizer, Christoph attributes the schools' success and NSF's continued support to the unique format. "Often summer schools work like this: the organizer invites some distinguished faculty to give lectures. We are doing the opposite—the students lecture." He and two to three distinguished co-organizers assign seminal research papers in a specific subject area to a select group of up to 12 graduate students and postdocs. They prepare two lectures each based on these topics, which they present to the group over five math-packed days. This intense schedule of 24 lectures and interactive discussion is not without its rewards—the schools take place in memorable locations, including UCLA's Lake Arrowhead conference center and mountain resort; this year it's Snowbird, Utah. The non-university settings provide a special opportunity for social as well as mathematical interaction for top analysts at similar career junctures. Says Christoph, "After 10 schools, we have almost 100 alumni, and they spread the word. They learn a lot of math, how to talk about math, how to do math with others and how to bond with other mathematicians." One student described his and his fellow participants' experience as an "important lighthouse in their careers." As for Christoph, he also enjoys learning more about evolving topics in his field. "Plus," he says, "I'm paying back. I did it when I was young and enjoyed it." NSF funds permitting, students from UCLA and across the country can look forward to more deep analysis in exotic locations. For more information about the schools, visit: http://www.math.ucla.edu/~thiele/summerschools.

Major Training and Research Groups Grants

The Department was awarded two major NSF Research Training Groups (RTG) grants, one in algebra/number theory and the other in analysis. The multimillion dollar, five-year RTG grants will fund 21 graduate student fellowships in 2009–2010, enable specialized research retreats and workshops aimed at advanced graduate students, and provide postdoctoral support. Undergraduate activities will also receive funding, including summer preparation for math graduate programs, the UCLA Logic Center's undergraduate summer school, and training for undergrads in number theory. The analysis RTG grant will support the Los Angeles Math Circle, a weekly math enrichment program for K–12 students. The RTGs are part of the NSF initiative to enhance the mathematical sciences workforce in the 21st century.

The number theory group was awarded a highly competitive NSF Focus Research Group (FRG) grant for a second time, testament to the success of its previous FRG. The joint award with leading number theorists at Columbia University, the University of Maryland and Princeton University will foster collaborative research through international conferences, including one at UCLA. The grant will also support multiple graduate student fellowships in number theory.

Class Measures

PhD applicants (average)	300+
Long-term PhD completion rate	78%
Average PhD completion time	5–6 years
Fall 2009 PhD class	36
Domestic	24
Foreign	12
Female	6
Average GRE quantitative percentile	90%
Average GRE verbal percentile	77%
Average GRE subject percentile	73%
Average GPA/upper division math	3.9
Average GPA/graduate course	3.9

Postdoctoral Plans

The majority of the Department's 19 PhD graduates will continue their research studies in postdoctoral positions or as tenured faculty at top institutions, including Princeton University's Institute for Advanced Studies; University of California, Berkeley; University of California, San Diego; and the University of Washington. Careers in industry include placements at Stealth Software Inc., a security software firm, and the financial mathematics master's program at New York University.

Prestigious Fellowships, Prizes and Awards

The Clay Mathematics Institute named 2009 PhD **Victor Lie** a Clay Liftoff Fellow. Lie completed his PhD under Professor Christoph Thiele and is widely known in the field for his paper, "The (weak-L^2) Boundedness of the Quadratic Carleson Operator." Victor used the Liftoff award this summer at the University of Chicago. He will assume a three-year Veblen Research Instructorship, which is a joint position at Princeton University and the Institute for Advanced Study. The Clay Liftoff Fellowships are awarded to young mathematicians who show the potential to be leaders in their field.

2009 PhDs **Mark Blunk** and **Michael Vanvalkenburgh** were named recipients of the NSF Mathematical Sciences Postdoctoral Research Fellowship (MSPRF). Mark will use his fellowship at the University of British Columbia; Michael will conduct his research at the University of California, Berkeley.

Current PhDs **Russell Howes**, **Maria Pavlovskaia** and **Hakan Seyalioglu** were awarded NSF Graduate Research Fellowships. Tim Austin won a graduate fellowship from Microsoft Research.

The Association for Symbolic Logic (ASL) awarded **Inessa Epstein** the prestigious 2008 Sacks Prize for her dissertation, "Some results on orbit inequivalent actions of non-amenable groups." The prize is awarded to the best dissertation in logic worldwide; this year it is shared by Inessa and another recipient. Inessa received her PhD in 2008 under UCLA Mathematics Professor Gregory Hjorth and is currently an NSF Mathematical Sciences Postdoctoral Research Fellow at Caltech.

Postdoctoral fellow **Jérôme Darbon** received the 2009 Chancellor's Award for Postdoctoral Research. Of the 1,089 registered UCLA postdoctoral scholars, 15 were chosen for the honor. Five of the 15 were awarded the $4,000 prize for research accomplishments that show clear potential for meaningful and enduring implications in their fields. Jerome works in applied math with Professor Stan Osher, developing fast algorithms that may revolutionize the way the numerical community looks at nonlinear elliptic equations arising from variational problems with applications in image processing.

The Canadian Applied and Industrial Mathematics Society (CAIMS) honored postdoctoral fellow **Colin Macdonald** with the Cecil Graham Doctoral Dissertation Award for his thesis, "The closest point method for time-dependent processes on surfaces." Colin received his PhD under Steve Ruuth at Simon Fraser University and works with applied math professor Stan Osher. Steve also worked with Stan as a postdoc.

Jesse Peterson was awarded a 2009 Sloan Research Fellowship in mathematics. Jesse received his PhD in 2006 under UCLA Mathematics Professor Sorin Popa and is currently an assistant professor at Vanderbilt University, studying von Neumann algebras.

Chalk Talk with Grad Students

Yingying Li: Knows Where the Problems Are Buried

Yingying Li remembers when she first approached applied mathematician Stanley Osher to be her advisor, and he asked her if she wanted to check out other professors first. When she told him that he was her only choice, he agreed. Yingying has been tackling Stan's interesting image processing problems ever since. Her recent project on inverting the diffusion equation sprung from her work on a prior project on compressed sensing. Says Yingying, "Professor Osher said maybe we can use the algorithm from compressed sensing and see what happens. And it turns out it's not bad." Yingying points to the practical importance of the problem, specifically as it relates to the diffusion of toxic pollutants buried in the ground. "Suppose somebody buried toxic waste somewhere. If you imagine the pollution concentration at multiple locations, you can use my inverted diffusion method to discover where it was buried." And real world complications are no problem for Yingying. Topographical obstacles, such as rocks, can be factored in to mimic actual geography, which makes the case harder and more interesting. She has also applied the method for solving the inverse heat equation to recover sparse heat sources. Yingying assesses her progress this way: "After the first project, Professor Osher said, 'I don't regret taking you on as my student.'" She doesn't need an algorithm to find the compliment buried in there.

Zaher Hani: The Beauty of Analysis

A native of Lebanon, Zaher Hani grew up with an older brother and sister who nurtured his scientific curiosity early on. "I used to listen to them discuss math and physics and think that was very cool. They gave me their university books to read." In college, Zaher soon discovered that his advanced undergraduate analysis coursework provided the intellectual challenge that he was seeking, and mathematics became his passion. The Department's analysis group, with its reputation for research diversity, was the prime draw for Zaher. As his thesis advisor, Terry Tao introduced Zaher to his current research on the nonlinear Schrödinger equation, a nonlinear dispersive partial differential equation originating from quantum physics. Zaher's aim is to prove some turbulence results for the equation in the periodic case. Zaher credits Terry for not only focusing his research, but for his ability to distill complicated equations into fundamental ideas. Says Zaher, "One of the skills I've tried to learn from Terry is to change a very technical statement into one that is easier to understand and remember so that when I need to use an idea somewhere else, I wouldn't need the exact equation, but I would have the idea." And while the harmonic analysis and PDEs he studies have important applications in physics, engineering and other applied sciences, Zaher recalls a sentiment expressed by the Department's new faculty analyst Monica Visan. "She said for us, these applications are neither a turn on or turn off. For me, there is a mathematical beauty and symmetry in these problems, and they are very nice tools."

undergraduate news

UCLA Math Alumni Share Career Adventures

The Department hosted its annual spring alumni career panel to showcase careers in mathematics and beyond. **Lindsay Henson** (Cornerstone Research), **Nick Marechal** (The Aerospace Corporation), **John T. Donald** (Yahoo!), **Demetrios Brizolis** (Daabco Industries, Inc.), **Marla Mattenson** (Helen Bernstein High School), and **Dan D. Gutierrez** (AMULET Development Corp.), represented a wide range of professional backgrounds, including economic and financial consulting, aerospace technology, analytics, real estate, teaching, Web technology and astrophysics.

If you are interested in participating on our 2010 alumni panel, contact Lisa Mohan at lisam@math.ucla.edu.

Student Steps in for 2009 Commencement Address

Departmental honors and scholars student Carey Shenkman implored his fellow grads to do the most with their math degrees–or as Carey would say "an epsilon more"–and pursue their dreams. A pure math student, Carey dreams of practicing international law while pursuing a master's in probability theory; he also has interests in diplomacy and radio journalism. Carey will apply to graduate programs in the fall.

Alterraun Verner Tackles Football and Proofs

http://www.youtube.com/watch?v=Ko2B6jdwLw8

Actuarial Program Motivates Exam Takers

Thanks to the support of the Ira Boyle Memorial Fund, the Department's undergraduate actuarial science program has provided reimbursement for its students who passed actuarial examinations. This year's record 29 exam reimbursements are more than double last year's total, highlighting the popularity and growth of the program. Actuaries in the U.S. and Canada achieve professional status by passing a set of examinations prescribed by the Casualty Actuarial Society (CAS) or the Society of Actuaries (SOA).

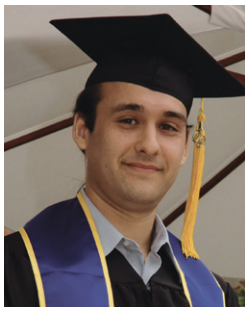
UCLA Putnam Mathematics Team Scores

The UCLA team ranked 28th in the December 2008 competition, which included 3,627 students from 545 colleges in Canada and the United States. From UCLA, **Zhihong Chen** was the top scorer with 50 points, and a shared individual ranking of 112.5th. **Tristan Chen** (38 points, 242.5th), **I-an Chen** (37 points, 252.5th) and **Anton Bokov** (30 points, 335.5th) rounded out the UCLA team led by Professor Geoffrey Mess. This fall, associate professor Ciprian Manolescu, a three time Putnam Fellow at Harvard, will join the UCLA Putnam team training effort. For more information, visit http://www.math.ucla.edu/ugrad/putnam/.

Prizes, Publications & Awards:

■ **Daus Prize** Math-econ major **Joseph Kuehn** graduated summa cum laude with a 3.87 GPA. He will pursue a PhD in economics at UCLA. ■ **Sherwood Prizes Pablo Bert** is a departmental scholar in pure math who also earned departmental honors–he will teach mathematics at several SoCal community colleges. **Jose Manzo** is an applied math major with a minor in statistics and an active member of the Undergraduate Mathematics Student Association (UMSA)–he has been on the dean's honors list throughout his academic career. He plans to work in industry or pursue a graduate degree in statistics at UCLA. **Hooman Sherkat-Massom** notably received both departmental honors and honors in Latin, graduating magna cum laude with a 3.94 GPA. He will pursue a PhD in topology at the University of California, San Diego. ■ **Basil Gordon Prize** University of Melbourne, Australia exchange student **Zhihong Chen** was the top scorer on the William Lowell Putnam Mathematics Competition (50 points, tied for 112.5 place). While attending UCLA, Zhihong majored in math and attained a 4.0 GPA. He is now employed at Goldman Sachs in Australia. ■ **Lockheed Martin Outstanding Undergraduate Research Award in Applied Mathematics Sheida Rahmani** received the award for her multispectral pan-sharpening research work generated from her 2008 Research Experiences for Undergraduates (REU) project led by Assistant Adjunct Professor Todd Wittman. As a result, Sheida is lead author on a paper submitted to the journal *IEEE Geoscience* and *Remote Sensing Letters*. She also received a prize for her undergraduate poster at the 2009 annual meeting of the Society for Industrial and Applied Mathematics in Denver, Colorado.

Spotlight on Students



Pablo Bert, pure math

Mastering Math for Teaching

Pablo Bert had no plans for higher education until he enrolled in a math class at Los Angeles Valley College (LAVC), just steps from his apartment. It was a small commitment that changed his life. Pablo also found that he had a knack for teaching as a tutor in the lab there. His calling would lead him to UCLA Math, where he was initiated into a summer REU under Professor Emeritus Ron Miech, an experience Pablo recalls as one of his best. After taking an algebra sequence with Professor Richard Elman, he was officially hooked and made the decision to pursue his master's with the goal of teaching at the university level. Pablo credits math for his personal transformation, saying, "I feel like I'm almost a different person in terms of reasoning and problem solving, looking at problems systematically rather than emotionally." He also embraces math as a challenging way to tease his brain at a very high level, an approach he will be sharing as a mathematics instructor at three SoCal colleges this fall: California State University, Northridge; LAVC; and Los Angeles Mission College. UCLA may still figure in his future: "There are a few master's degree people teaching here. I know it's rare, but if you've been teaching for many years and they know you're good, who knows? In 20 years, I can teach here."

Ning Tendo, math-econ

From Cameroon to Consulting

From Cameroon in west Africa to community college in west Los Angeles, then finally to UCLA, Ning Tendo had always planned on a career in biochemistry. But it was her chemistry with math outside the lab that led Ning to switch her major to math-econ, where she not only excelled but was excited about potential careers in business consulting. It wasn't until a summer Research Experiences for Undergraduates (REU) in 2008, however, that recruiters came calling. Says Ning, "I think the REU was the most important thing that helped me to get a job." Under the supervision of applied team mentors Professor Andrea Bertozzi and Assistant Adjunct Professor Todd Wittman, Ning worked with fellow undergrads on tracking crime hotspots by applying various video tracking algorithms, including optical flow and particle filters, to real crime data. They found they were able to track crime hotspots reasonably well in short time frames, but predicting crime was more complex. The experience was not only a resumé highlight but a personal milestone. "It was really nice because we got to do a big presentation and that opened me up." Ning joins Deloitte Consulting this fall as a business technology analyst, customizing client-specific Oracle software systems.

Nicole Barbero, applied math

Teaching Math for America

One of 33 UCLA students accepted to Teach for America (TFA), Nicole Barbero is part of an unusually select group this year–a record 35,000 individuals applied from more than 130 colleges and universities. TFA is a national corps of top recent college graduates who commit to teaching for at least two years in urban and rural public schools. Teaching has always been a goal for Nicole, but it wasn't until her third year at UCLA that she discovered TFA through a fellow member of an undergraduate theater troupe, which she was actively involved in as a producer and performer. Her acting chops will help in the classroom. Says Nicole of the intensive summer TFA training, "My performing arts skills have come in handy–I've had a lot of mentors tell me you're putting on a show for an hour every day." Nicole was also eager to share her deep love for mathematics with non-math majors in her training group. This fall Nicole will teach algebra and geometry at John F. Kennedy High School in Richmond, California.

Jason Sorger, applied math/computational and systems biology (cybernetics)

Math Motivates Leadership

Inspired by UCLA alumni parents and a sister attending UCLA's MD/MBA program, Jason Sorger continues his true Bruin family's legacy with the unabashed enthusiasm and achievement that landed him several campus leadership positions, high honors, and most recently, admission to Harvard Business School. Initially a computational and systems (formerly cybernetics) major, Jason added applied math to further his ambition to model life systems. These complementary fields also advanced his inventive and critical thinking, facilitating his work as a board member of ASUCLA, treasurer of Hillel at UCLA, president of the UCLA Interfraternity Council, and a researcher biomodeling Atrazine pathways. Hooked on game theory, Jason became passionate about math during Assistant Adjunct Professor Keith Ouellette's real analysis class and Professor Haruzo Hida's complex analysis class. This 2008–2009 UCLA Senior of the Year and Distinguished Senior awardee is currently involved in several entrepreneurial endeavors and is pursuing positions in the IMF or World Bank to gain real-world experience before entering graduate school in 2011. Says Jason, "I want to create or work at a venture with broad impact, and learn to expand and develop it at Harvard. My time with UCLA's world-renowned math and cybernetics faculty has changed the way I view myself and the world. It has been a privilege to attend UCLA."

math education

Center Packs in Circles of Activity

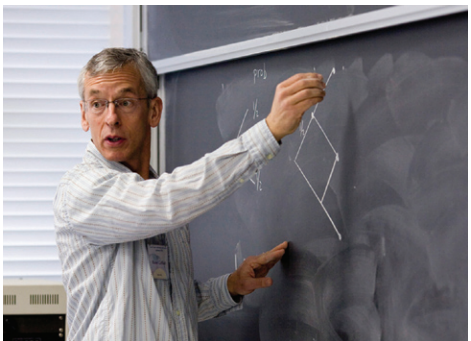
K-12

Math Festival Attracts Hundreds

The Math Sciences Research Institute (MSRI) at Berkeley invited the Curtis Center to host the first Southern California Julia Robinson Mathematics Festival. MSRI provided funding through its Blachman Fund. The center secured IPAM as co-host and Northrop Grumman as corporate sponsor. Math faculty, graduate students, and IPAM visitors guided over 200 students at 20 different activity stations representing the breadth of the field. Professor Joey Teran gave the keynote talk. The 2010 festival will be co-hosted with IPAM and sponsored by the Center for Talented Youth at Johns Hopkins University on February 13. View the festival at http://www.youtube.com/watch?v=z8TCtoGQII8.

Los Angeles Math Circle (LAMC)

The circle nearly tripled in size to four groups, attracting a diverse body of over 80 K–12 students. Strong faculty involvement contributed to high quality content. Several graduate and undergraduate students facilitated problem solving sessions. In the American Mathematics Competition, four students achieved National Honor Roll distinction in grade 8; twelve students progressed to the second round of the 9–12 grade level; and eighth-grader Ryan Yoo advanced to the last stage, the USA Math Olympiad. For more information, visit http://www.math.ucla.edu/~radko/circles.



IPAM Director Russ Caflisch speaks at the Mathematics and Teaching Conference as part of IPAM's new collaboration with the center.

Teacher Continuing Education

Mathematics Diagnostic Testing Project (MDTP)

Over 1,600 local teachers utilized MDTP's UCLA site. Cash-strapped schools particularly valued the site's workshops, as well as the free distribution of tests and diagnostic results. MDTP also partnered with Daskala to debut an online version of its testing materials. This year center Faculty Director Professor Bruce Rothschild joined MDTP statewide leadership.

Math Content Program for Teachers (MCPT)

In its 10th year, 350 teachers took MCPT math courses, which qualify elementary school teachers to teach middle school mathematics. MCPT piloted virtual classroom software to teach teachers to use *Introduction to Algebra*, published by the Center for Mathematics and Teaching, Inc. (CMAT). MCPT developed a new CMAT algebra text called *MathLinks*. The program also provided teacher professional development to Green Dot Public Schools and Little Lake City School District.

The California Mathematics Project (CMP)

The executive office presented results from its Supporting Teachers to Increase Retention grant at international and domestic conferences. With the California Mathematics Council, CMP formed the Algebra Initiative Committee to write guidelines for educating teachers to help students learn algebra by grade eight.

Crossing Borders in Math Education

Executive Director Heather Calahan represented the center at the National Academy of Sciences' U.S.–China Math Education Workshop this August, giving an invited talk on qualifications for master teachers.

Undergraduate Teacher Preparation

UCLA California Teach MATH

The center improved the existing program by enhancing coursework and incorporating early completion of credential program requirements. Program enrollments hit 220, and despite the challenging job market, all 15 graduates were offered teaching positions.

Annual Mathematics and Teaching Conference

Two hundred secondary and university instructors enjoyed talks across the center's programs and a keynote talk by eminent math-ed research team Deborah Ball and Hyman Bass. Over 60 California Teach MATH students and alumni attended the reunion portion where Palisades Charter High School math department chair Cheryl Onoye received the first annual teacher leadership award.

IPAM

Amber Puha Catches New Wave as Associate Director

Waves of opportunity keep rolling in for probabilist and former competitive surfer Amber Puha who joined IPAM as an associate director in September for a two-year term. A California State University, San Marcos (CSUSM), mathematics professor for the last decade, Amber decided to take on the challenge after a chance e-mail from her former UCLA PhD advisor Tom Liggett brought her to the attention of IPAM Director Russ Caflisch. Amber's research interests evolved from interacting particle systems to stochastic or "random" networks–including computer and communications, traffic and manufacturing networks–with a focus on increasing their efficiency. This summer Amber spent most of her time off the waves consulting at the Institute for Defense Analysis in its Center for Communications Research, where UCLA Professor Emeritus Alfred Hales served as former director. When CSUSM's surf team won the 2009 National Scholastic Surfing Association championship in June, its first in school history, its faculty advisor of nine years missed the action. Says Amber, "I was actually in China for Tom Liggett's 65th birthday conference. I told Tom you have to know just how important you are to me that I missed the championship."

UCLA Folklorist Networks at IPAM

UCLA humanities and Scandinavian scholar Tim Tangherlini calls his participation in IPAM's Mathematics of Knowledge and Search Engines program one of the most transformative of his career. The payoff has been big with the National Endowment for the Humanities set to fund an IPAM summer workshop addressing the application of computational techniques to the study of networks in the humanities. The increase in attention to networks–think Facebook–implies that they are a new phenomenon. In fact, networks have always been a key focus of the humanities and are internal to any work of art. For instance, in the novel there is the social network of characters, as well as the more abstract network of language; traces of networks of inspiration and influence are also present. With the digital revolution making available tens of thousands of literary works for study, the time is ripe for scholars to move away from reading canonically to large-scale analysis powered by math. Says Tim, "A good example is my folklore data. I've got 6,500 storytellers telling a quarter of a million stories to each other in various dialects of Danish over a period of 50 years. Would I be able to discern patterns in a repertoire of storytellers that aren't immediately apparent by just looking at the data?" When a colleague recently wrote a book about the use of proverbs in President Obama's political speeches, Tim is eager to go deeper: "Why don't we connect every speech to a speechwriter and every speechwriter to a politician or a network of politicians. Then let's find all the proverbs in all speeches over time and develop a map of who is influencing who."

Public Lecture Series at IPAM

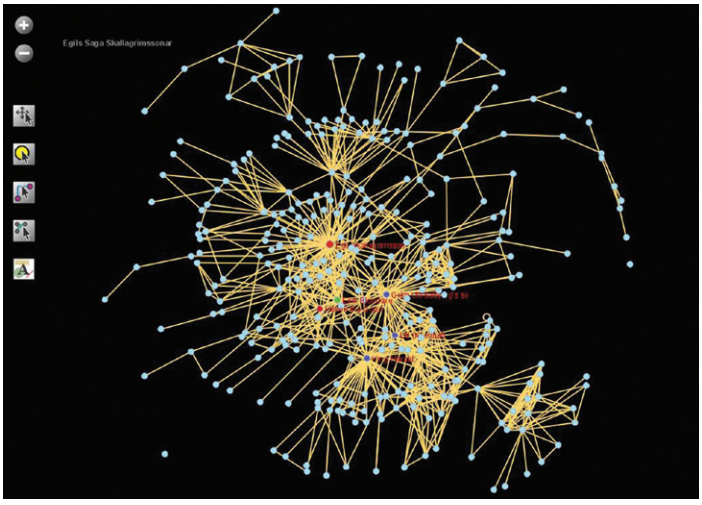
The Internets We Did Not Build

Internet architect **David Clark** discussed alternate designs for the Internet and described how the network that these designs would induce would differ from what we see today. Hosted by the Institute for Digital Research and Education at UCLA and UCLA Computer Science Department (November 2008). IPAM Workshop: Beyond Internet MRA: Networks of Networks.

Climate Change and the Mathematics of Sea Ice

University of Utah professor and Arctic/Antarctic explorer **Kenneth Golden** described recent advances in the use of mathematics to understand such critical processes of how fluid flow through porous sea ice mediates ice growth and melting, biomass build-up, and the reflection of solar radiation; and related electrical properties of sea ice important in monitoring its thickness. Hosted by IPAM, IoE, JIFRESSE, IGPP, the UCLA Department of Mathematics, and the UCLA Department of Atmospheric and Oceanic Sciences. (April 2009). IPAM Workshop: Flows and Networks in Complex Media. To view Ken's lecture online, visit http://164.67.141.39:8080/ramgen/ipam/golden/climate.smil.

IPAM presents its inaugural annual newsletter. Download a copy at http://www.ipam.ucla.edu/newsletter.aspx.



Network graph of the first 25 chapters of Egils saga. View an animation of the Egils saga network graph at http://www.humnet.ucla.edu/humnet/scandinavian/es_1-25_persistent.mov.

alumni news

A Tribute to UCLA Math Professor Charles G. Lange from a Former Student

by Gordon N. Ellison, UCLA Class of 1959

UCLA Mathematics Professor Charles G. Lange joined the Department in 1968 and remained on the faculty until his death in 1993. He was noted for his many contributions to applied mechanics and singular perturbation theory.

In about 1969 I enrolled in an applied mathematics class offered by UCLA Extension and taught by Dr. Charles Lange. At that time I was writing a FORTRAN program using a Fourier series/Green's function solution for microelectronics applications. Dr. Lange's course included a portion on Green's functions, a subject I had studied rather extensively while pursuing my master's. On the last evening of the course, after I turned in my final exam, I asked Dr. Lange about a problem that slightly resembled my application, telling him that I would not ask for specific help, as I didn't have consultation money. We talked about the math and the simple example. It was the Memorial Day weekend and I went home and solved the little problem. On Monday, Dr. Lange called me at home, having located my phone number through the student card catalog. During our conversation, he said he had a solution to the problem. We compared solutions, and he told me I knew what I was doing and didn't need a consultant. Using the math that I learned from Dr. Lange, I discovered that my previous theory was not quite correct, and in some cases would have resulted in very large errors. I totally revised my code.

A year or so later, I published a paper wherein I acknowledged Dr. Lange's assistance. * I am not exaggerating when I say that that single problem launched a 30-year career. I have related this story many times over the years and can almost feel the fear when considering what the outcome might have been had I not taken Dr. Lange's course and had he not taken the time to help me.

In my youth I was not sufficiently clever (or perhaps generous enough) to find Dr. Lange and express my thanks in an appropriate manner. In the last several years I have performed several Internet searches trying to find him. In late August of this year, I was once again telling my wife of my indebtedness to Dr. Lange, and that I had never found him. A new Google search turned up his obituary. My only consolation is that I can take the opportunity to tell other professional educators that those little things they do for even the least accomplished of their students sometimes have a very great and positive impact on their lives.

My advice to students is to always study and work to be the best that they can be—and for physics and engineering students in particular, take all the applied math courses that you can manage.

Gordon N. Ellison, Newberg, OR
gellison@imaps.org
BA Physics, UCLA 1959; MA Physics, USC 1966
Tektronix Chief Scientist, Retired
Assistant Adjunct Professor of Mechanical Engineering, Portland State University

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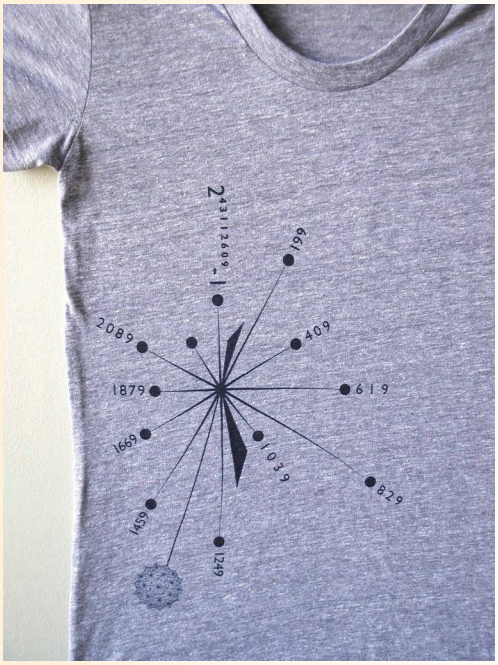
* G.N. Ellison, "The Effect of Some Composite Structures on the Thermal Resistance of Substrates and Integrated Circuit Chips," *IEEE Trans. on Electron Devices*, vol. ED-20, pp. 233-238, March 1973.

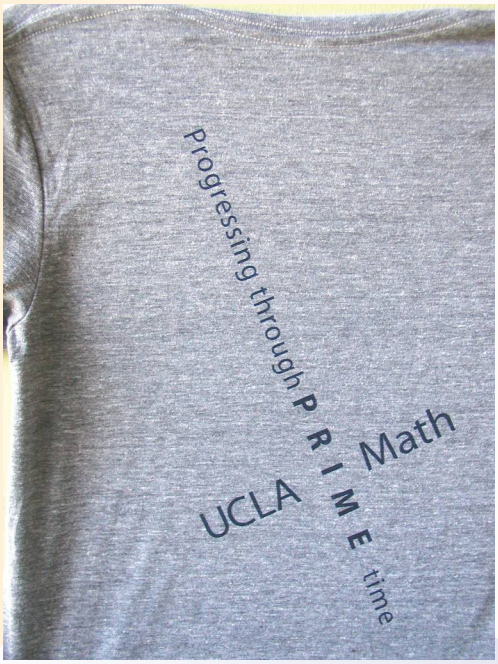
It's Easy to Stay in Touch with UCLA's Lifetime E-mail Forwarding

As a UCLA graduate, you can stay connected to UCLA Math no matter how many times you change your e-mail provider and without sending a change of address to your contacts. Sign up for this free Lifetime E-mail Forwarding service at http://www.uclalumni.net/NewsLinks/lifetime.cfm.

Sean Kim, math-applied science, Bruin Actuarial Society president

Nicole Abruzzo, math-econ, Undergraduate Mathematics Students Association (UMSA) co-president





UCLA Mathematics Prime T-shirt

Theme: UCLA Math progressing through prime time
Inspiration: UCLA Math prime numbers research and the 2008 Mersenne prime discovery by the mathematics computing group
Contributors: D. Hernandez, L. Mohan, C. Thiele, R. Weisz and everyone who contributed to the mathematics featured on the shirt
Specs: Manufactured and printed in Los Angeles, California by American Apparel and Ultimate Graphics

All gifts to UCLA Math of $125 or more include a complimentary T-shirt available in a range of colors and styles for men and women. If you would like to obtain additional shirts, please contact Lisa Mohan at lisam@math.ucla.edu.

Wanted: UCLA Math Fans Wearing Their Pride

Alumni and supporters are invited to submit photos of themselves wearing any of our T-shirts from years past in exotic and not-so-exotic locales around the world. Just tell us who you are, where you are, and we will feature you rocking your UCLA Math pride on our soon-to-be revitalized alumni and supporters website. Submit your best shot to lisam@math.ucla.edu.

giving

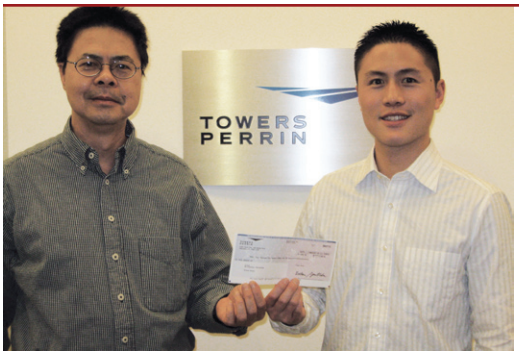
Pay It Forward and Get Rewarded

Whether you are a UCLA Math alum or a supporter who recognizes the power of math to help solve our most challenging problems, you can sustain our teaching and research mission through the UCLA Fund, the university's central giving program where you can donate directly to the UCLA Department of Mathematics. In addition to providing unrestricted support to the university, UCLA Fund donors enjoy attractive membership courtesies. To find out more, visit http://www.uclafund.ucla.edu/. You can also make a direct online donation to the Department at www.math.ucla.edu (click on Support UCLA Math).

Schmalzried Sisters Estate Supports Mathematics Teacher Training

UCLA alumnae Erma and Wilma Schmalzried have left a generous $25,000 bequest to support the Department's K–12 mathematics teacher training programs. Both sisters attended UCLA in the late 1930s. Erma received a BA in mathematics in 1936 then pursued a master's in math and a teaching credential in 1938. Wilma graduated with a BA in economics in 1937. Their gift will help grow the Philip C. Curtis Jr. Center for Mathematics and Teaching endowment.

UCLA alumnae Erma and Wilma Schmalzried



Actuarial program director Loong Kong and Simeon H. Ling of Towers Perrin

Industry Signals Support for Actuarial Science Program Expansion

The success of the Department's undergraduate actuarial science program has spurred new giving by prominent actuarial firms. 2001 UCLA Math alum Simeon H. Ling of Towers Perrin helped direct the company's $2,500 gift to the program. Buck Consultants (Los Angeles) also made a donation of $1,000. If your firm would like to know more about becoming a UCLA Math Actuarial Expansion Plan industry partner, contact program director Loong Kong at lkong@math.ucla.edu or (310) 910-2684.

Impact

S. L. and Betty Huang provided generous graduate student support by funding an annual award in mathematics. Number theorist Ashay Burungale, a student of Professor Chandrashekhar Khare, is this year's recipient.

A grant from the **Employees Community Fund of Boeing CA** supported the Los Angeles Math Circle.

Generous gifts by UCLA Math alum **Robert Lynn**, math circle parents **Gia and Chan Yoo**, and **Phil and Dot Curtis** were matched by an anonymous $25,000 gift to reach our $50,000 endowment goal for the Philip C. Curtis Jr. Curtis Center for Mathematics and Teaching.

The Cimarron Group made a gift-in-kind of a powerful computing cluster to be used to enhance computational research activities.

As the industry sponsor of the Julia Robinson Math Festival, **Northrop Grumman** provided funds for festival activities and prizes to bring higher math to the SoCal K–12 community.

Lockheed Martin sponsored the 2008 Outstanding Undergraduate Research Award in Applied Mathematics. Senior applied math student Sheida Rahmani was this year's recipient.

Remembering J. Fred Weston 1916–2009

Professor Emeritus J. Fred Weston will be remembered for his intellect, charm, generosity and pioneering scholarship in finance, which has made UCLA Anderson School's finance group one of the top faculties in the world. Fred and his late wife Bernadine Sorgenfrey-Weston supported UCLA Math through the Robert Sorgenfrey Teaching Awards, which were established in 1996 to honor exemplary teaching in the Department. Fred recognized the important link between math and finance and Professor Sorgenfrey in particular. "I was a long time friend of Bob Sorgenfrey. All of our doctoral students in economics and management were required to take Bob's analysis course. It had a major impact on the ability of our doctoral students to develop models." The Department is particularly grateful for the continued support of the Sorgenfrey awards by Fred and Bernadine's family.

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July 1, 2008–June 30, 2009

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We gratefully acknowledge our anonymous donors.

If your name should appear on this list, contact Lisa Mohan at lisam@math.ucla.edu. Gifts made after June 30, 2009, will appear in our fall 2010 newsletter.

UCLA

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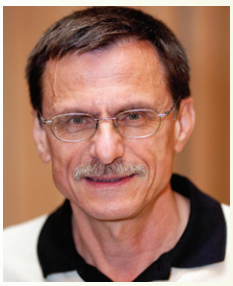
Dear Friends, Colleagues, Students and Alumni:



Welcome to our annual fall edition of *The Common Denominator*. As you know, the last three years have seen the Department's visibility increase exponentially. While our success can be shared across our accomplished faculty and students, I would like to personally commend outgoing chair Christoph Thiele. The vigor and passion he brought to his leadership stint and his renewal of our commitment to sharing our love of mathematics with our alumni and supporters deserve our profound gratitude. Whether you have deepened your connection to UCLA Math through reading our newsletter, attending a public event, keeping up with us online, making a financial contribution, or participating in the life of the department in other ways, you play a key role in our continued vitality. I feel a great deal of responsibility as new chair at a time of severe economic constraints. But at the same time, I feel stimulated and energized by these challenges and remain quite optimistic that our department will continue to thrive.

This year we are pleased to feature the real world impact of our applied mathematics group, which has climbed to number three in the most recent *U.S. News & World Report* graduate program rankings. Building on the group's momentum, Andrea Bertozzi was honored for her fundamental contributions to applied math as the Society for Industrial and Applied Mathematics' 2009 Sonia Kovalevsky lecturer. We also welcome two new outstanding faculty additions to our combinatorics, and analysis and PDE groups. Faculty accolades abound, including the election of Stan Osher and Terry Tao to the American Academy of Arts & Sciences. On the popular science front, Terry and Joey Teran have been named among the country's 20 brightest young scientists by *Discover* magazine. Next summer on the biggest mathematical playing field of all—the 2010 International Congress of Mathematicians—faculty bats will come alive in a series of invited talks led by Stan Osher's plenary address on information science, and invited talks in several research areas by Paul Balmer, Shekhar Khare, Dima Shlyakhtenko and Benny Sudakov.

Countering the blow of state budget cuts, our graduate program has received several large NSF grants to help fund our graduate students as well as postdoctoral, undergraduate and K–12 activities. We are also fortunate to have a growing and committed alumni and donor base that supports our mission to educate a problem-solving workforce for a strong California economy and a competitive America.

Thank you for all you do. I look forward to getting to know you in the coming year.

Sincerely,
Sorin Popa

UCLA Department of Mathematics

Fall 2009 Newsletter

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