THE Common Denominator

UCLA DEPARTMENT OF MATHEMATICS NEWSLETTER

Sum of its parts
equals AMS Award for UCLA Math

For "providing an outstanding model of all that a mathematics department can be," UCLA received the American Mathematical Society's (AMS) 2007 Award for an Exemplary Program or Achievement in a Mathematics Department. The award recognizes a mathematics department in North America that has distinguished itself by undertaking an unusual or particularly effective program of value to the mathematics community, internally, or in relation to the rest of society. UCLA is the second recipient of this award.

AMS praised the Department for "a comprehensive vision for its undergraduate, graduate, and post-doctoral training programs that involves important interactions with the NSF-funded Institute for Pure and Applied Mathematics (IPAM) at UCLA. Through these unusually large training programs, UCLA has become one of the biggest pipelines to mathemati-

cal careers in the United States." Also cited was the Department's pioneering math education group, serving K through 12th graders and their teachers with innovative programs aimed at increasing mathematics competency in California public schools. Its 52-strong "first-rate faculty of internationally recognized mathematicians," along with the arrival this fall of six distinguished new recruits, reinforces its position among the top 12 mathematics programs in the country (most recent National Research Council ranking). UCLA is also one of the top four programs in applied mathematics (*U.S. News & World Report*, 2006). Yet, despite its size and scope, indeed perhaps because of it, the Department has succeeded in creating a unique synergy among its faculty and its complementary training programs, which is at the heart of the award.

Sum of its parts equals AMS Award for UCLA Math

"The American Mathematical Society is the best of its kind in the world. We are very honored by this award," says Christoph Thiele, professor and department chair.

2007-2008 Academic Year

Faculty 58

Postdocs 45

Graduate students 178

Undergraduate majors 850

IPAM participants (annual estimate) 1,000

As demonstrated by over 850 mathematics majors in 2006, the undergraduate program has experienced tremendous growth in the past decade. Degrees were up 56 percent from 160 in 1996 to 249 in 2006. So what is the big appeal? In a word: choice. The Department is a pioneer of the broad-based mathematics major. Understanding the importance that math brings to other disciplines, faculty have sought to forge partner programs with other departments, resulting in an array of undergraduate degrees impressive in scope. In addition to pure and applied (science and engineering) degrees, majors include math/applied science (with four sub-specialties, including the individual plan), mathematics of computation, mathematics for teaching (teaching careers), mathematics/economics, and atmospheric sciences/mathematics.

The Department also offers opportunities for undergraduates to participate in research through its summer program—Research Experiences for Undergraduates (REU). The program has the active participation of senior faculty and postdoctoral mentors, and was broadened in the last two years to include the applied mathematics laboratory under the direction of Professor Andrea Bertozzi.

The year 2000 was a turning point in the Department's graduate program with the awarding of a $5 million NSF grant—Vertical Integration of Research and Education, or VIGRE. The goal of the program is to initiate changes in the way professional mathematicians are trained, specifically promoting interaction between mathematics and other fields, and increasing the number of U.S. citizens and permanent residents in math and science. Renewed in 2005, the program has supported 154 students since its inception. The continuing success of the program is attributable to collective faculty efforts to redevelop the program into one where students learn in a research group environment, starting early in their studies. The Department sought to further broaden graduate students' research experience in 2005, initiating the Graduate Summer Internship Program in which students work outside of the Department with faculty from other disciplines or industry.

This year's hiring has resulted in the addition of 12 young researchers in fall 2007, making the Department's postdoctoral program one of the largest in the country. Currently, 45 postdocs work under different research faculty in the Department, sometimes across disciplines. This integration of research interests and the opportunity to train under diverse faculty is a huge draw.

In perhaps the most high-profile, synergistic move of the Department, five math faculty—Tony Chan (now at NSF), Eitan Tadmor (now at the University of Maryland), Bjorn Engquist, John Garnett and Mark Green—capitalized on UCLA's nascent culture of cross-disciplinary collaboration by creating an institute for pure and applied mathematics, or IPAM. Mark, who became the institute's director in 2001, attributes its success to the size and strength of UCLA's science departments, including a first-rate medical school, together with forward-thinking mathematics faculty who are actively involved in IPAM.

Well over 1,000 participants a year now come through IPAM's doors, interacting in programs that are designed to create visionary, interdisciplinary collaboration between mathematicians and scientists from biology, medicine, engineering and other disciplines, as well as industry and national laboratories. The institute's mission is nationally focused and geared toward assembling a broad research community ranging from distinguished professors to young ladder faculty, postdocs, graduate students and undergraduates.

Like IPAM, the Department's highly successful, K–12 math education programs sprang from and continue to be nurtured by the efforts of innovative Department educators. Professor Emeritus Phil Curtis, who will turn 80 next year, is credited with inspiring math education at UCLA. Last June, the Curtis Center was established in his honor to formally bring the programs together. Professor Ted Gamelin currently serves as the faculty leader and the Department provides office space and administrative services, such as computing and accounting. Today it is the most extensive outreach program for the K–12 community housed in a research mathematics department.

The synergy of its comprehensive training programs is at the core of the Department's acknowledged success in educating current and future mathematicians. UCLA's culture of interdisciplinary collaboration that made IPAM possible is also a big factor. Bottom line, the Department is a collaborative bunch that sees itself at the forefront of raising the national profile of math and preparing the way for unprecedented opportunities for mathematicians in the 21st century.

View the complete award article in the June/July Notices of the AMS online at www.ams.org

events

A Field Day for Higher Math

UCLA Mathematics Hosts Fields Medalists Symposium

Surrounded by the gothic flourishes and stained glass windows of UCLA's Kerckhoff Hall, a standing-room-only crowd of 150-plus mathematicians, alumni, students and numbers enthusiasts gathered to hear some of the world's most prominent mathematicians. Four UC recipients of the Fields Medal—often referred to as the Nobel Prize in mathematics—did not disappoint, all giving unique talks in their fields of interest.

UCLA Chancellor Norman Abrams opened the all-day symposium with an acknowledgement of UC's most recent Fields medalist, Terry Tao, who won the award in 2006 at the improbably young age of 31. Presenting in order of receiving the award, 1990 Fields medalist Professor Vaughan Jones of UC Berkeley initiated the talks, following introductory remarks by UCLA mathematics chair Professor Christoph Thiele. In response to the claim that he "famously wore his New Zealand rugby jersey" when accepting his medal, Vaughan admitted, "There is some truth to it. I not only wore the rugby jersey, I wore rugby shorts and boots when I gave my talk at the Congress in Kyoto … the legend has grown." He continued to warm up the crowd

Terry Tao speaks on "Structure and Randomness in the Prime Numbers" in his January 2007 public lecture following his Fields Medal in 2006.

Peter Lax of the Courant Institute of Mathematical Sciences sits with Marguerite Mautner before he delivers the 2007 Mautner Memorial Lecture "Using Mathematics to Explain the World Around Us" to the public.

with his lively talk "Flatland: A Great Place to Do Algebra." It described his mathematical journey through the dimensions, including the notion of the "fourth dimension" and beyond that holds magical appeal for many. Vaughan illustrated his concepts through Edwin Abbott's classic book *Flatland*, which revolves around a society of two-dimensional intelligent beings and the difficulty they have conceptualizing the third dimension.

1994 medalist and UC San Diego Professor Efim Zelmanov steered the symposium in a more technical direction. His lecture "Profinite Groups," focused on cutting-edge research in group theory. Then, 1998 medalist UC Berkeley Professor Richard Borcherds posed the question "What is A Quantum Field Theory?" Richard, best known for his work in lattices and group theory—most notably in explaining the monstrous moonshine phenomenon—has moved to the area of mathematical quantum field theory in recent years. UCLA Professor Terry Tao finished the day with "Nilsequences and the Primes." It was a comprehensive talk on structure and randomness in Fourier analysis and number theory, with an emphasis on the role of nilflows in characterizing the "structure" or "conspiracies" which seem to control the additive behavior of primes.

For a DVD of any or all of the lectures, contact Lisa Mohan at lisam@math.ucla.edu

2006–2007 Distinguished Lecture Series

Continuing the Department's tradition of inviting world-class mathematicians to share significant developments and trends in current mathematics, three distinguished speakers participated in the lecture series in applied mathematics, geometry, and number theory.

Renowned applied mathematician **David Levermore** of the University of Maryland spoke on "From Boltzman Equations to Gas Dynamics," an exposition of the foundational problem of explaining the dynamics of gases in terms of the fundamental differential equation of atomic kinetic theory.

Fields Medalist **Shing-Tung Yau** of Harvard University, a leader in geometric analysis, lectured on "Geometric Structures on Manifolds." The talks and his invited stay in the Department highlighted a particularly exciting time for the geometry group.

Shou-Wu Zhang, a leading number theorist, spoke on "Rational Points on Curves," a series that garnered broad appeal among analysts and number theorists with its focus on the relationship of analytic behavior of L-series to classical topics of solving equations.

Distinguished Lecture Series 2007–2008 Preview

November: Fields Medalist **Charles Fefferman** of Princeton University
January: Nevanlinna Prize winner **Avi Wigderson** of the Institute for Advanced Study
May: Visionary number theorist **John Coates** of the University of Cambridge

Visit our website at www.math.ucla.edu and select "Distinguished Lectures" for comprehensive online notes and transparencies of last year's series and updates for 2007–2008.
Special thanks to Professor Veeravalli Varadarajan for his stewardship of the program.

New Faculty Round It Out

Chandrashekhar Khare joins the Department as professor in the number theory group. After solving the Serre modularity conjecture with Wintenberger (and Kisin), Shekhar has become an international star in Galois representations and their compatible systems. Serre's conjecture has been outstanding for almost three decades and essentially asserts that all p-adic Galois representation under appropriate arithmetic conditions comes from (readily computable) elliptic modular forms (complex analytic objects). The solution of the conjecture has made headlines in number theory, and summer schools and conferences are currently being held across the world in the U.S., France, India and Japan on the proof. Shekhar completed his PhD at CalTech, then joined the Tata Institute of Fundamental Research in Mumbai, India, in 1995 and the University of Utah in 2001. He received the Young Scientist Award from the Indian National Science Academy in 1999 and was elected to associate membership in the Indian Academy of Sciences.

Yehuda Shalom joins the Department as a professor with a broad research agenda. Yehuda's work lies at the intersection of ergodic theory, Lie groups and geometric group theory. His thesis, "Discrete subgroups of Lie groups," was a natural entry point to dynamical systems, and since 1998 he has made surprising contributions to the field. Recently, his work has moved into rigidity in orbit equivalence. He was an invited speaker at the European Congress of Mathematicians in 2004 and at the ICM in Madrid in 2006, where he had the rare honor of choosing between one of two sections to address the Congress. Recently, Yehuda was awarded the prestigious 2007 Erdös Prize in Mathematics by the Israel Mathematical Union for his "impressive ability to establish deep theorems by combining ideas and methods from different fields." Yehuda received his PhD in 1999 under Hillel Furstenburg at the University of Jerusalem and was a tenured professor at Tel-Aviv University.

Benjamin Sudakov brings his striking expertise in discrete mathematics to his appointment in the Department as professor and the lead researcher who will rebuild the combinatorics/discrete group at UCLA. Formerly at Princeton University, Benny is well known for utilizing all the modern tools used in combinatorics—the probabilistic method, linear algebra, harmonic analysis, and spectral techniques—to creatively solve many significant problems, including several conjectures of Erdös. His research in probabilistic and extremal combinatorics has important applications to various aspects of information theory and computer science, as well as connections between these fields and more traditional areas of mathematics. An émigré to Israel from Russia, Benny earned his MSc in 1993 and his PhD in 1999 under Noga Alon at Tel-Aviv University. He has been awarded a Sloan fellowship and an NSF CAREER grant.
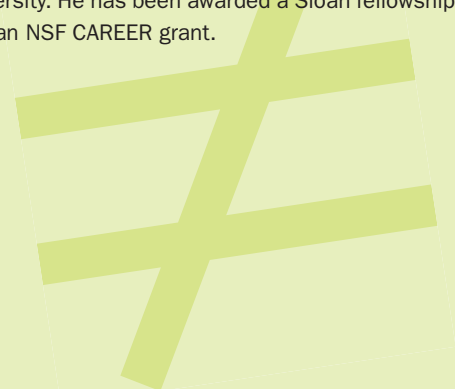
Matthias Aschenbrenner joins the Department's logic group as associate professor, working in applied model theory. Matthias completed his PhD at the University of Illinois in Urbana-Champaign in 2001 under Lou van den Dries. His thesis included one of the most outstanding recent results in computational algebra, winning the prestigious annual Sacks Prize, which is awarded to the best dissertation in logic worldwide by the Association for Symbolic Logic. With his promising work, Matthias takes his place among UCLA math's storied model theorists of the past—C. C. Chang and A. Robinson.

Paul Balmer comes to the Department as associate professor in the algebra group. Formerly at the Eidgenössische Technische Hochschule Zurich (ETH), Paul has been working in the field now known as Balmer-Witt theory, which solved a 30-year-old problem called the Gersten conjecture in the algebraic theory of quadratic forms. Paul's ideas have also synthesized and explained many of the deepest results of other mathematicians over this three-decade period and are applicable to a number of fields in algebra. Paul received his Doctorat des Sciences in 1998 at the University of Lausanne under M. Ojanguren.

New Fellows on Tap

This fall, the Department welcomes Hedrick fellows **Shouxin Dai**, **Cyril Houdayer**, **Rizwanur Khan**, **Karel Pravda-Starov**, **Thomas Richthammer** and **Bailin Song**; VIGRE fellow **Richard Oberlin**; and Computational and Applied Mathematics (CAM) fellows **Martin Short** and **Xiaoqun Zhang**. View the Department's website for a complete list of who's new and what they do.

Joseph Teran joins the Department as assistant professor in the applied mathematics group as one of the most promising young computational scientists in the country. Joey's focus on solid mechanics and human bio-mechanics is both synergistic and complementary to the applied group's current expertise in image processing, computational fluid dynamics, and computational materials science. He also has exciting research collaborations in medicine. Joey was a featured speaker at the Intel Developer Forum Fall 2007, where he demonstrated a simulator used in virtual surgery applications. Joey earned his PhD in scientific computing and computational mathematics at Stanford University under Ronald Fedkiw and recently completed an NSF postdoctoral fellowship at the Courant Institute at NYU.

faculty news

2008 Conferences Mark Milestones

The conference "**Hodge Theory and Algebraic Geometry**" on February 22–23 will coincide with IPAM Director Mark Green's 60th birthday. A public symposium is planned for Thursday, February 21, featuring lectures by UCLA Professor Tony Chan and Yale University Professor Peter W. Jones. Check the Department website for updates.

Professor Veeravalli Varadarajan will celebrate his 70th birthday with the two-day conference "**Symmetry in Mathematics and Physics**" on January 18–19.

In honor of his 80th birthday, Professor Emeritus Phil Curtis will be celebrated on March 13–15, with the "**2008 Curtis Center Mathematics and Teaching Conference**."

The Docteur Is In

In December, Professor Stanley Osher was conferred the docteur honoris causa from École Normale Supérieure (ENS) de Cachan. ENS is among France's prestigious Grandes Écoles whose alumni include eight laureates of the Fields Medal. Honored for his contributions in reshaping the discipline of numerical analysis, Stan invented innovative numerical technologies and applied them to nearly all fields of numerical simulation, including aeronautics, material science, brain science, and movie industry special effects. This summer, the

Number Theory Conference

Faculty members Haruzo Hida, Don Blasius and newcomer Shekhar Khare, in association with Columbia University Professor Eric Urban and Princeton University Professor Chris Skinner, will host the week-long conference "**Selmer groups, L-functions and Galois deformation**" on March 24–29. This research-oriented instructional workshop will bring together top researchers and graduate students to inspire progress on the Bloch-Kato conjectures and their p-adic analogues, and the Iwasawa-Greenberg main conjectures.

United States Association for Computational Mechanics (USACM) gave its 2007 Computational and Applied Sciences Award to Stan for his pioneering work in high resolution schemes for hyperbolic conservation laws and Hamilton-Jacobi equations, level set methods for moving fronts involving topological changes, and total variation and PDE based image processing techniques.

Prime Time for Tao

2006 Fields Medalist Terry Tao continues to garner awards for his achievements. In December he received the 2006 SASTRA Ramanujan Prize for his impact in combinatorics and ergodic theory and for his extreme versatility, working with a wide range of collaborators in number theory, harmonic analysis, representation theory, and partial differential equations. In April, Terry was honored with the Ostrowski prize 2005 for his exceptional work in the area of analytic and combinatorial number theory, along with Professor Ben Green of the University of Cambridge. Acknowledging his unique accomplishments, Terry was profiled in *The New York Times*' March 13, 2007, Science Times feature. Most recently, he was among six mathematicians selected as new fellows of the Royal Society of London for 2007.

The After Math: James H. White Retires

Professor Emeritus Jim White joined the Department in 1968, specializing in differential geometry and its applications to molecular biology. A key result in the field is "White's formula," which relates local twisting and global supercoiling of the DNA double helix. Jim is also noted for the extensive citation of his work and for his long association with the late Nobel prizewinner Sir Francis Crick. He was awarded the UCLA Distinguished Teaching Award and served as the Department's undergraduate vice chair. Outside mathematics, Jim's career as a professional singer with his late wife Kari Windingstad has included participation in the Roger Wagner Chorale, the Los Angeles Philharmonic, and other groups, as well as tracks for films, including *Home Alone* and *Jurassic Park*. Flexing yet another muscle, Jim was a workout companion of Governor Schwarzenegger in Arnold's bodybuilding days.

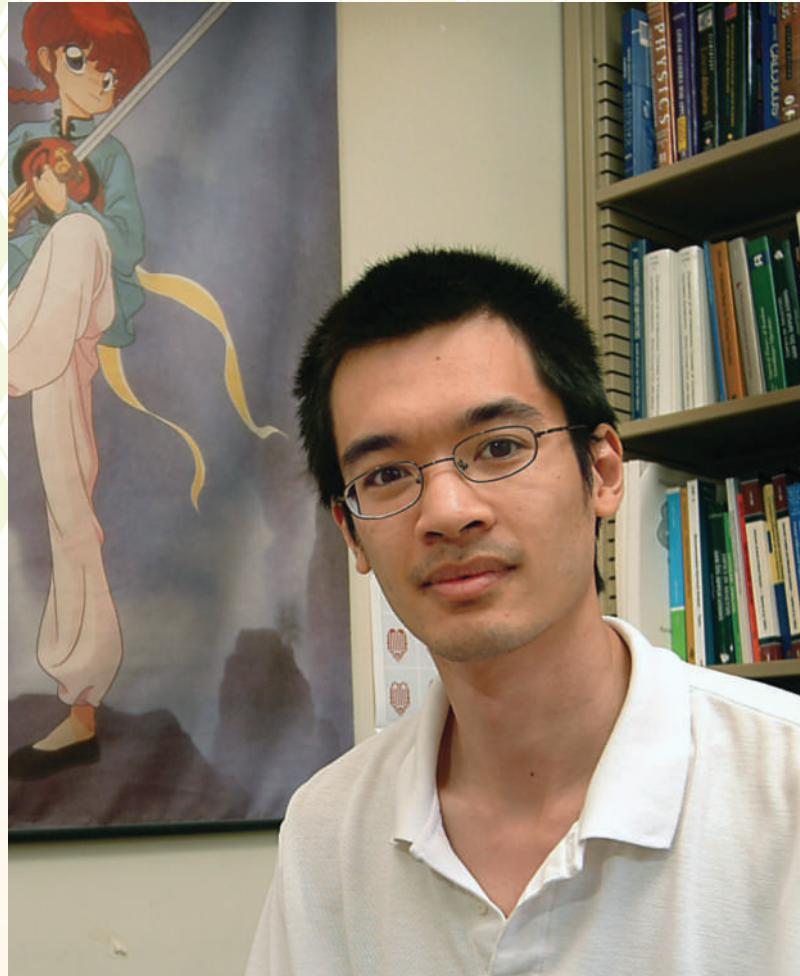# Well-Posed for a Chair

Endowed Professorship for Tao

Terry Tao has become the first scholar appointed to the James and Carol Collins Chair in the UCLA College of Letters and Science. This appointment precedes another first for Terry, when last August he became the only math professor in UCLA's history to win the Fields Medal. At 32, Terry has already made numerous and profound contributions across multiple branches of mathematics, including number theory, harmonic analysis, partial differential equations, combinatorics, representation theory and signal processing.

In number theory, Terry and his collaborator, University of Bristol Professor Ben Green, made a groundbreaking discovery in their research on primes—numbers larger than one and divisible by only itself and one. Euclid proved that there are infinitely many primes and ever since, mathematicians have been searching for patterns in their distribution. Terry and Ben proved that the set of prime numbers contains infinitely many equally spaced progressions of all finite lengths (e.g., an equally spaced progression of length three is 3, 7, 11). Their discovery revealed that somewhere in the prime numbers there is an equally spaced progression of length 100, and length 1,000, and every other finite length. Implicit in their proof was the use of Szemerédi's theorem, which not only does not apply to prime numbers, but contains four proofs that very few mathematicians understand collectively. In real world terms, the proof may have applications to modern cryptography, which is based on the difficulty of factoring the product of two large primes.

Terry is also well-known for his work on the classical Kakeya problem, a challenging set of five problems in harmonic analysis that involves rotating a needle 180 degrees in a flat plane while keeping the needle inside a region of smallest possible area. To date, Terry and his colleagues have obtained the most precise known estimate of the size of these particular geometric configurations in Euclidean space. While the higher dimensional version of the problem is not yet solved, connections to other important problems in Fourier analysis, combinatorics and differential equations have grown out of Terry's work on the problem.

Using their theory of "honeycombs," Terry and his UC Berkeley colleague Allen Knutson solved an old algebraic conjecture of Alfred Horn, the UCLA professor whose work in the 1950s was the foundation of logic programming. Terry's work also simultaneously settled many other open questions from representation theory, algebraic geometry and combinatorics. Especially striking is the breadth of interest and understanding Terry displayed in solving this very visible conjecture in a field far distant from his main research.

Further demonstrating his trademark versatility, Terry's work with Caltech mathematician Emmanuel Candes has resulted in major advances in signal processing theory. Their remarkable results have practical applications in industry. Because they explained how and why it is possible to nearly recover sparse signals, Siemens is now using their discoveries to recover MRI data from polar measurements. Their additional results on stability theorems, which are important because noise is always present in signal processing problems, has produced significant applications in compression, medical imaging and sound processing.

Terry has also tackled some of the most intractable of partial differential equations that arise in Einstein's relativity theory with his research on wave equations. Wave maps are solutions of a generalization of the classical wave equation to the setting of functions from Euclidean space to some manifold, such as a sphere. An important problem with nonlinear wave equations is called well-posedness: Does the equation have smooth solutions that exist for all time, or do all solutions "blow up" in finite time? Terry's work established global existence for spherical wave maps with initial data in the critical Sobolev space, and proof that solutions do not "blow up."

Considered by many to be the best mathematician of his age, Terry has written over 130 research papers with over 50 collaborators. He has also published four books, including a problem-solving guide for young people, an analysis textbook for undergraduates, and an advanced research monograph in combinatorics.

Graduate Recruitment Scorecard

It was a record year for the 2006–2007 incoming class with all 37 PhD students passing the basic exam, and 17 passing all three qualifying exams by spring 2007. ■ Demonstrating the Department's growing global reputation and ability to compete for first-rate students worldwide, the new 2007–2008 class of 34 includes 17 international students from Greece, Vietnam, Armenia, Lebanon, Switzerland, Canada, Italy, China, Korea and Turkey. ■ Nearly one third of the new class are women, representing a significant increase in female talent from last year's 12 percent. ■ The Department continues to strengthen its number two ranking in logic (*U.S. News & World Report*, 2006), attracting seven talented new PhD students in the field. ■ The 2007 graduate class continues to excel with 11 graduates securing teaching or postdoctoral positions at top-tier universities, five going in to private industry, and one joining the Air Force.

Spotlight on Grad Students

Mission: Math

What does a Joint Terminal Attack Controller do after eight years in the Air Force and special operations? Mathematics, of course. Over three tours of duty in Iraq and Afghanistan, combat veteran Nickolas Del Pego focused on spatial deconfliction, radio theory, satellite communications and laser operations. Says Nick, "Mathematics poured through every aspect of my job, and my mathematical skills helped me distinguish myself as an operator." When jumping out of airplanes to coordinate air strikes became routine, Nick's next step was to return to a goal that had long eluded him—his formal education. Nick picked up his undergraduate studies at UC San Diego, an experience that changed his view of math. While the other pursuits he had mastered seemed finite, the possibilities in math were endless. With his interests in number theory and modern algebra, Nick believes that graduate study at UCLA is the challenge he has long been searching for: "There's always something new. When one area closes, another one opens up. Mathematics has captivated me."

First-Year Analysis: Pretty Cute but Not Shallow

As a Cambridge-educated Briton courted by a number of U.S. graduate math programs to study analysis, PhD candidate Tim Austin recalls receiving a string of very long, polite emails from competing universities very pleased to make him offers and expressing lofty hopes that he would thrive at their institutions.

Says Tim, "Then I got an email from [Graduate Vice Chair] Don Blasius that said: 'UCLA, question mark,' and I began to get the idea that maybe this place was a little bit different." His first two weeks of orientation confirmed his suspicions when he was assigned to Professor Bill Duke. Tim was nervous about the requirements of an American university and what it took to be a graduate student here. "Bill looked at me and said, 'Well, I don't know about requirements really but the sooner you start behaving like a mathematician and not like a graduate student, the happier we'll all be.'" Tim took that advice to heart and has been thriving—UCLA style—ever since.

Tim was a recipient of the Horn-Moez Prize for Excellence in First Year Graduate Studies and was recently named one of the first two fellows to the S.L. and Betty Huang fellowship in the College of Letters and Science. He credits his famous—but down-to-earth—advisor, Terry Tao, for guiding his research on different extensions of Szemerédi's theorem. Says Tim, "You meet plenty of people who've had some very austere, senior professor as their PhD supervisor and they have very reverential meetings. Terry isn't like that at all. I can just walk in and ask what do you think, even if it's not a piece of research he's done before. Terry has such diverse interests and that's a lot of fun." Tim's rejection of decorum extends to his view of a lot of the math he works on, which he likes to describe as "pretty" but not "beautiful." Sometimes he finds a problem doesn't relate to anything of great significance and downgrades it to "cute."

Chair Christoph Thiele views Tim's work this way: "Tim gives beautiful lectures in the analysis seminar and is performing as an advanced researcher rather than a student." His seminar "It's Hard to Find the Perfect Date" addressed the math behind a current Internet frontier: image search, in which Google (or other search engine) looks for images that are similar to an uploaded image, such as a face. The applications to online dating services are readily apparent, which no doubt some may view as "incredibly shallow." Current research shows that mathematical tricks used to get around currently inefficient methods of searching large image databases are ineffective and will not result in a perfect match. Mathematically speaking, shallow may not win out after all.

## Cryptography: Secure Connection between Math and Computer Science

Computer Science Professor Rafail Ostrovsky pinpoints the key reasons why he was lured from a lucrative position working on network security issues in the wake of 9/11 at New Jersey-based Bell Communications Research to start a graduate cryptography program at UCLA in 2003: a first-rate computer science group and the math department. Praising the brilliance of UCLA mathematicians who he could also talk to, Rafail and his colleague Amit Sahai set out to start a dialogue between the Department's number theorists and the theoretical computer scientists, who are on the cutting edge of the increasingly sophisticated relationship between cryptography and mathematics. Since cryptography uses the language of mathematics to prove that a protocol is secure, it sits between the fields of computer science and mathematics. And while the "hardness" of problems may frustrate number theorists, it's wonderful for cryptographers whose goal is to build systems that are as secure as the problems behind them are hard to solve. Says Rafail, "We can't prove that our system is secure, like electronic voting, or a digital signature, but what we can say is it's as secure as some famous mathematical problem and if somebody breaks our system, well, they just solved a 300-year-old mathematical problem and they should win a major prize in mathematics."

Rafail and pure math faculty in number theory—including Don Blasius, Bill Duke and Jon Rogawski—soon established what amounts to a joint mathematics/computer science PhD program. Says Don, "We now have seminars and courses that prime the pump from number theory to cryptography." For its efforts this year, the Department graduated its first cryptography PhD—William Skeith—who was the first math student to knock on Rafail's door looking for an advisor. William is turning his thesis on encrypted searches with Rafail into a start-up company, and more talented crossover math students are in the pipeline. Don and Rafail are thrilled about this new mingling of math and computer science students, which will create joint funding opportunities, as well as postdoctoral positions and public sector and private industry jobs for pure math graduates. In recognition of the success of this initiative, the Department has made Rafail its first joint appointment in math and computer science. With math grad students now knocking regularly on his door, Rafail sees even more convergence: "Mathematics is getting closer to the theory of computation or said another way, computer is science is maturing to get closer to mathematics. I like saying it both ways."

Special Awards Ceremony

Bernadine Sorgenfrey Weston congratulates Professor Veeravalli Varadarajan upon receiving the Robert Sorgenfrey Distinguished Teaching Award at the Department's 2007 Special Awards Ceremony. Actuarial instructor Loong Kong also received the award. Postdoctoral awardees were Nathan Ryan and Alex Usvyatsov.
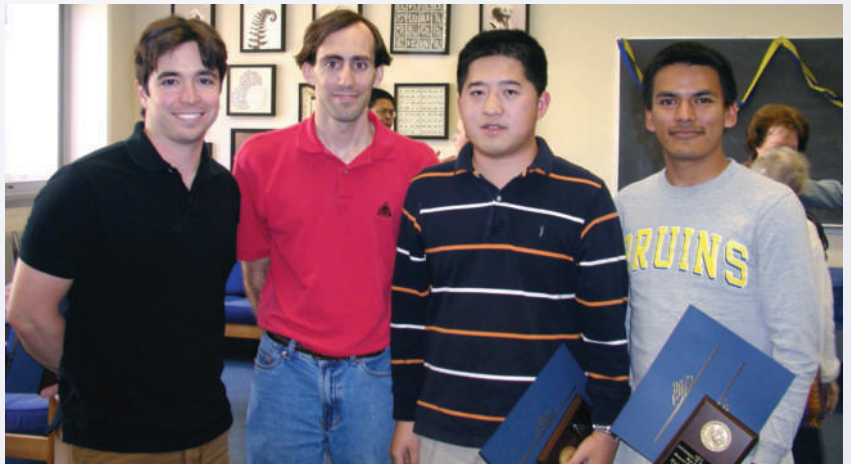
This year's graduate student recipients of the Robert Sorgenfrey Distinguished Teaching Award are Craig Citro, Will Conley, Hengli Wang and Ricardo Salazar.

Graduate students Vjekoslav Kovac and Tim Austin receive the 2007 Horn-Moez Prize for Excellence in First Year Graduate Studies.

undergraduate news

Awards and Scholarships

Vladislav Voroninski received honorable mention for the 2007 Computing Research Association's Outstanding Undergraduate Award. ■ First-year students **Meghanan Reddy** and **Alyssa Whitwell** were recipients of the 2006–2007 Clay Trust Honors Scholarship for Physical Science. ■ **Adam Ericksen** and **Keith Merrill** were awarded a prize for their poster presentation "Fixed points of maps of a non-aspherical wedge" at the March meeting of the Southern California–Nevada section of the Mathematical Association of America.

Actress-Mathematician-Author Danica McKellar models the 2007 Department T-shirt. Contact Lisa Mohan at lisam@math.ucla.edu for available colors in men's and women's styles.

Prize Students

■ This year's Sherwood Prize was awarded to pure mathematics majors **Michael Bannister** and **Samantha Nieveen**. Michael plans to pursue his graduate studies in algebraic geometry at the University of Michigan. Samantha also claimed the Basil Gordon Prize for her score on the Putnam exam, becoming the Department's first two-time recipient of the award. She will pursue an actuarial career at Farmers Insurance. ■ The Ira L. Boyle Transamerica Scholarship was awarded to mathematics/economics junior **Susan Cheung**, who took a summer internship as an actuarial analyst with Transamerica Occidental Life Insurance. ■ The Daus Prize went to four students: **Keith Merrill**, a pure math major, will pursue his PhD in mathematics at UC Davis. **Matthew Stimpson**, also a pure math student, is weighing career options in actuarial science and finance before he pursues his PhD. Applied math grad **Lindsay Henson** joins Cornerstone Research as an analyst specializing in litigation consulting. Mathematics/economics major **Yu Man Tam** will take a research analyst position at the Federal Reserve Bank of St. Louis with a long-term goal of pursuing graduate studies in economics.

Commencement 2007 Attracts Star Power

Declaring math to be her "secret weapon" for success, 1998 UCLA math alumna Danica McKellar delivered the Department's 2007 commencement address to an enthusiastic crowd of student fans. Best known for her roles on the television series "The Wonder Years" and "The West Wing," Danica also co-authored The Chayes-McKellar-Winn Theorem and has been an ardent promoter of girls' math education. Her new book *Math Doesn't Suck: How to Survive Middle School Math Without Losing*

UCLA actuarial alumni and Actuarial Club officers

Your Mind or Breaking a Nail gives aspiring female mathematicians the tools to master math concepts that relate to real life. To view her entertaining and inspiring address, visit www.uclalumni.net/News-Links/home.cfm.

Math Clubs Gear Up

■ The UCLA chapter of the Honorary National Mathematics Society **Pi Mu Epsilon** sponsored a spring talk by Professor Terry Tao on the cosmic distance ladder—the hierarchy of mathematical methods that astronomers use to determine distances to celestial objects. ■ The **Actuarial Club** geared its winter talk to students interested in the real world experience of actuaries. UCLA math alumni Ellen Luo (Bucks Consultants), Lorenz Glaza (Kaiser Foundation Health Plan), Shan Fernando (Mercer HR Consulting), Weston Lenker (Towers Perrin) and Christopher Wada (PacifiCare) shared their passion and experience working as actuaries in health care, insurance and consulting. They also strategized about passing qualifying exams and discussed the opportunities for student internships.

Getting Published

Honors student **Vladislav Voroninski** contributed to two articles for the proceedings of the 2007 American Control Conference: "A Second-Generation Micro-Vehicle Testbed for Cooperative Control and Sensing Strategies" with Professor Andrea Bertozzi and electrical engineering graduate students; and "Robotic Path Planning and Visibility with Limited Sensor Data" with lead author and math graduate student Yana Landa, Professor Andrea Bertozzi, and others.

Honors student **James H. von Brecht** co-authored "Occlusion Tracking Using Logic Models" with math postdoc Sesh Thiruvenkada and Professor Tony Chan, which appeared in the proceedings of the International Association of Science and Technology for Development (IASTED) Conference on Signal and Image Processing.

math education

Math Education Gets Centered

Philip C. Curtis Jr. Center for Mathematics and Teaching Is Founded

The Department has a strong tradition of involvement in the entire spectrum of mathematical activity with programs ranging from pre-collegiate mathematics to advanced current research. Its support of high quality K–12 mathematics has been significantly shaped by Professor Emeritus Phil Curtis, who played a singular role in establishing most of its current math education programs. Building on this tradition, on June 5, 2007, the Department established the Philip C. Curtis Jr. Center for Mathematics and Teaching to further excellence in these endeavors.

In the immediate future, the center will expand the Department's current efforts in undergraduate preparation of highly qualified math teachers, teacher professional development, and K–12 outreach programs and curriculum enhancement. Long term, the center plans to conduct research that will provide new knowledge about the learning and teaching of mathematics at the pre-collegiate and undergraduate levels.

Professor Emeritus and Faculty Director Phil Curtis (with plaque) honored at Center announcement dinner

Back row, from left: Dorothy Curtis, MCPT Executive Director Shelley Kriegler, Curtis Center Executive Director Heather Calahan, CMP Executive Director Susie Håkansson, Department CAO Judith Levin, former MDTP UCLA Site Director Barbara Wells

Front row, from left: Professor Ted Gamelin, Professor Bruce Rothschild, Department Chair Christoph Thiele

2006 – 2007 Report Card

Math Content Program for Teachers and Students (MCPT)
In March, MCPT submitted its algebra readiness text to the California Board of Education for review, and in August the text garnered strong recommendations from the mathematicians and teachers panels. MCPT looks forward to the final review in November. Adoption by the Board would mean widespread use of the text in public schools.

Executive Office of the California Mathematics Project (CMP)
Ten of the 19 CMP sites were each awarded approximately $400,000 to provide a four-year comprehensive professional development program to increase mathematics teacher retention. The programs began last spring with over 250 teachers participating in intensive professional development.

Math and Teaching Conference
MCPT, CMP and MDTP (Mathematics Diagnostic Testing Project) hosted the first UCLA Mathematics and Teaching Conference in February. National Academy member and Yale Mathematics Professor Roger Howe gave the keynote talk, with 200 local mathematics teachers, teacher leaders, university educators, and professors in attendance to learn about pedagogy, mathematics, and current research in math education.

Undergraduate Teacher Preparation Programs
Redoubled recruitment efforts resulted in a tripling of the enrollment in the Department's Joint Math Education Program and a doubling of the enrollment in its Subject Matter Preparation Program (SMPP). UCLA math education also submitted a proposal to the California Commission on Teacher Credentialing to renew the SMPP, which allows students to earn "subject matter competence" by completing a group of traditional departmental courses, and the Teaching of Mathematics course.

New and Improved

Mathematics Teacher in Residence Program
Groundwork was laid for the establishment of a Mathematics Teacher in Residence Program, modeled after the successful Visiting High School Teacher Program founded by Professor Curtis in 1980. In the 2008–2009 academic year, the program will bring an outstanding local high school calculus teacher to the Department for one year to teach pre-calculus and other mathematics courses to future teachers. This investment in an exceptional teacher leader creates a network of liaisons in California secondary schools.

Los Angeles Mathematics Circle (LAMC)
This fall LAMC will join the Curtis Center. Originating in Eastern Europe, the Math Circles migrated to UCLA in 2005 under the direction of UCLA Anderson School of Management Professor Ely Dahan. LAMC's initial focus was on preparation for Mathematical Association of America-sponsored mathematics competitions.

LAMC comes full circle under Assistant Adjunct Professor Olga Radko, who herself was inspired as a seventh grader by a Math Circle at the Moscow State University. LAMC will feature Department faculty members and lecturers, who will meet with local middle and high school students on Sundays to discuss classical mathematics topics, solve problems, and train for competitions.

Visit www.curtiscenter.math.ucla.edu/mathcircle for more information and to sign up.

IPAM

IPAM in the Public Eye
2007 Public Lectures

Divine Wind: the History and Science of Hurricanes
MIT Professor of Meteorology Kerry Emanuel discussed the science of hurricanes and their role in human history, as well as the effect of climate change on hurricane activity. Hosted by: IPAM/UCLA Institute of the Environment/Joint Institute for Regional Earth System Science and Engineering (February). IPAM Workshop: Small Scales and Extreme Events: The Hurricane.

How Topology Will Save Moore's Law: Quantum Computation via Exotic States of Matter
Fields Medalist and Microsoft Research Project Q Director Michael Freedman discussed the possibility of finding natural quantum computers through the study of two-dimensional systems of interacting electrons, which are topological states of matter exhibiting nonabelian statistics. Hosted by: IPAM/California NanoSystems Institute (CNSI) (February). IPAM Workshop: Topological Quantum Computing.

The Nature of Roughness in Mathematics, Science and Art
Yale University Professor and IBM Fellow Emeritus Benoit Mandelbrot is world renowned for his work on fractal geometry. Hosted by: IPAM/ UCLA Department of Mathematics/ CNSI (April). IPAM Workshop: Random Curves, Surfaces and Transport.

Visit IPAM's website http://www.ipam.ucla.edu/ for updates about future public lectures.

IPAM Showcases Research to Congress

Pictured from left: IPAM Associate Director Christian Ratsch; NSF Deputy Assistant Deborah L. Lockhart (Computer and Information Sciences & Engineering); IPAM Director Mark Green; NSF Director Arden L Bement, Jr.; and NSF Assistant Director Tony Chan (Mathematical and Physical Sciences) in the Rayburn House Office Building

In recognition of its rising national profile, IPAM was selected to represent UCLA at the 13th Annual Coalition for National Science Funding Exhibition and Reception on June 26 in Washington, D.C. The event showcases the crucial role NSF plays in supporting basic scientific research and education. IPAM team members Mark Green, Christian Ratsch, and RIPS student-mentor Yana Landa presented their exhibit "Training Young Scientists for the Real World: From Hollywood to National Security" to members of Congress and their staff.

Modeling the Human Mind
Graduate Summer School at IPAM

Always looking to push the envelope of IPAM's "mantra of dialogue," director Mark Green saw new ground broken at the institute's three-week 2007 Graduate Summer School program "Probabilistic Models of Cognition: The Mathematics of Mind." Over 200 researchers from the fields of cognitive science, psychology, linguistics, and philosophy joined mathematicians, statisticians and computer scientists to develop a common mathematical framework for modeling human cognition. The goal was to understand how the mind performs inference and decision under uncertainty in such areas as vision, memory, reasoning, learning, planning and language. Says Mark, "There are a lot of situations where we are not provided with complete information, yet most humans come to the same conclusion. How do you model that?" A first week tutorial in Bayesian inference, based on an 18th century probability theorem that quantifies the use of prior knowledge to make inferences about the world, served as a launch point for tackling the question of how to create a computational framework for modeling the mind's complex cognitive processes. The inductive leaps the human mind makes currently remain beyond the scope of conventional machine intelligence systems. Says Mark, "The program has a revolutionary potential to really change the field." Presentations from the workshops are available online at http://www.ipam.ucla.edu/programs/gss2007/.

RIPS-Beijing: IPAM Goes Global

Further expanding its borders, IPAM brought its successful six-year Research in Industrial Projects for Students (RIPS) summer program to Beijing in partnership with Microsoft Research Asia (MSRA). Ten U.S. and 10 Chinese undergraduates were competitively selected to work in five mixed teams on mathematically-based, real-world research problems at MSRA's facility in Beijing. IPAM Director Mark Green initially test-marketed the concept with his own kids, who validated the idea of doing really interesting research at a cool place abroad. After a whirlwind orientation week of acclimation and cultural exploration, the U.S. students settled down to live and work with their counterparts for two months. Under the guidance of a faculty mentor, as well as an MSRA industry mentor, the student groups worked out solutions, produced technical papers, and formally presented their findings to their industry "client." Concludes Mark, "They came away with an invaluable perspective." IPAM is already thinking about expanding the program to other scientific hotspots. Bangalore, India, anyone?

微软亚洲研究院
美国UCLA纯数学与应用数学研究所
2007年中美大学生暑期训练营

Research | IPAM

alumni news

What the UCLA Mathematics Department Means to Me

by Dan D. Gutierrez, UCLA Class of 1978

I was a mathematics/computer science major at UCLA from 1973 to 1978. At the time, I was really only interested in the computer science courses, but as part of the joint major I had to take quite a bit of math. I didn't appreciate the math then, but I relish it now after nearly three decades in the computer industry. I've taken an about face with respect to my intellectual interests. Maybe I've tired of computers after all that time, but the math is exciting to me now and it's pretty much all I think about.

I look back fondly upon my days at UCLA in the math department. Many of my most memorable classes and best professors were there. Professors Raymond Redheffer, Thomas Ferguson, Alfred Hales, and Theodore Gamelin were a few of the best. The most important thing I got out of my math classes at UCLA was the ability to think analytically and solve problems. I used this ability over and over again in my professional years that followed.

Around 1995 my mathematical metamorphosis began when I attended a lecture on string theory at the Griffith Observatory by Brian Greene of Columbia University. Although I never had any interest in physics while at UCLA, for some reason I started to appreciate the immense problems cosmologists try to solve. But I knew that to fully understand string theory, I would have to brush up on my math. So for the next five years I relearned calculus, linear algebra, differential equations, statistical methods, and real/complex analysis. It was a pleasurable journey indeed.

Since then, my desire to understand string theory has waned, but that's only because my rediscovery of math has opened so many new doors for me. Now I am actively pursuing a career in astrophysics, in particular gravitational wave astronomy. I am participating in the LIGO Scientific Collaboration (LSC), and the Mock LISA Data Challenge. These are mathematically intense projects, and I've had to absorb a significant amount of physics and math as a result. I am having the time of my life, and I must sincerely thank the Department for providing the foundation I've used to realize this dream.

*You can reach Dan at ddgutierrez@UCLAAlumni.net*

Alumni Updates

Amanda Folsom was awarded an NSF Mathematical Sciences Postdoctoral Research Fellowship (MSPRF) in June. Embarking on her new three-year fellowship, Amanda will perform research in the field of number theory and modular forms at the University of Wisconsin-Madison with Professor Ken Ono. Amanda completed her PhD under Professor William Duke in 2006.

Brown University Professor **Chi-Wang Shu** received the 2007 SIAM/ACM Prize in Computational Science and Engineering at the SIAM Conference on Computational Science and Engineering in Costa Mesa in February. Chi-Wang completed his PhD under Professor Stanley Osher in 1986.

Stanford University faculty member **Ron Fedkiw** spoke at the annual meeting of the American Association for the Advancement of Science in February as part of the symposium "Blockbuster Science: Math and Science Behind Movies and Entertainment." As a consultant for Industrial Light & Magic, Ron developed the PhysBAM core math engine that helped create realistic water in *Poseidon* and Davy Jones' tentacles in *Pirates of the Caribbean: Dead Man's Chest*. Fedkiw earned his PhD in 1996 under Professor Stanley Osher.

George Chapline won the 2007 Computing Anticipatory Systems (CASYS) 2007 award for his work on neural networks and the brain. George received his undergraduate math degree in 1961 and was a member of the UCLA Putnam team.

Email Lisa Mohan at lisam@math.ucla.edu to share your news.
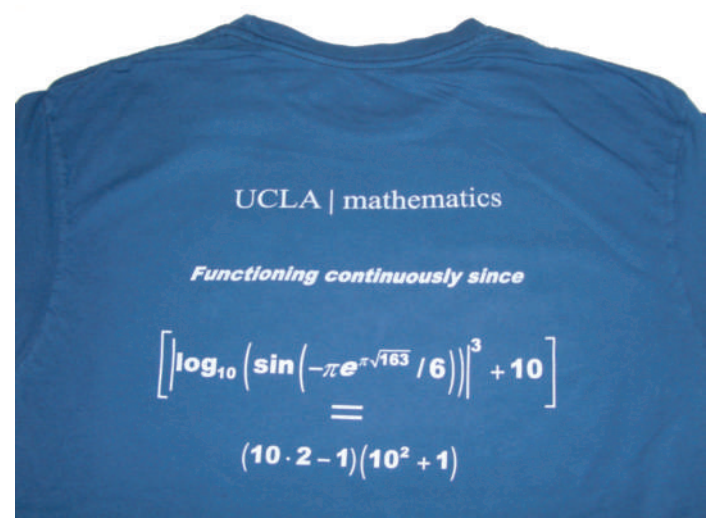
Back view of 2007 Department T-shirt. Contact Lisa Mohan at lisam@math.ucla.edu for available colors in men's and women's styles.

gifts

Endowed Chair for Terry Tao

Executive Dean Patricia O'Brien of the College of Letters and Sciences named Professor Terry Tao as the first scholar to the College's newly established **James and Carol Collins Chair**. While the vast majority of endowed chairs are designated in one particular field, the Collins Chair may be awarded to a professor in any of the College's more than 30 departments. This $1 million chair is a significant show of support for Terry's promising research going forward, as well as for the Department's commitment to recruit, nurture and retain the world's best mathematicians.

First Math Chair On the Horizon

Inspired by Terry Tao and the Department's unique contributions to the research community, UCLA alumna **Sierra Chen** has generously pledged to fund the first endowed chair, specifically in math. Sierra received her MA in mathematics in 1993. The *UCLA College Report*, a showcase of the people and progress in the College of Letters and Science, will feature Sierra in its upcoming winter 2007 issue, available November 15 online at http://www.college.ucla.edu/report/.

Special Thanks Goes to...

John P. McTague, **John D. Kohler**, **Michael A. Kriss** and an anonymous donor who have made substantial gifts to support Professor Terry Tao's research activities. ■ **Bernadine Sorgenfrey Weston** for her support of our annual Robert Sorgenfrey Distinguished Teaching Awards. ■ The **Larry Morris Weiner Trust** for its support of our colloquium series and the 2007–2008 Distinguished Lecture Series. ■ **Patty R. Boyle** and the **Boyle family** for their support of the Ira L. Boyle Transamerica Scholarship and the Ira L. Boyle Memorial Fund.

Giving Opportunities

Horn-Moez Prize

$50K

$41.7

$40K

$30K

$20K

$10K

$0

The Curtis Center Endowment

The Curtis Center invites you to help us raise $50,000 during the 2007–2008 academic year. This amount will provide the center with a permanent endowment that generates annual income and guarantees sustainable support for the center's comprehensive math education activities, including undergraduate preparation for careers in teaching, K–12 outreach, and professional development for teachers.

Horn-Moez Prize for Excellence

Established by Dr. Ali Amir-Moez in honor of his PhD mentor, UCLA Professor Alfred Horn (1918–2001), this fund supports our graduate students by recognizing high academic achievement and superior results on first-year qualifying exams. Our goal is to turn this vital source of graduate student support into a permanent endowment. We are less than $10,000 away from $50,000, the level needed to generate annual interest income to fund the awards in perpetuity. We can do it with your support. Help us get there this year.

Wanted: Chancellor's Associates for Math

Alumni, parents and friends who contribute $2,500 or more annually to UCLA have played an integral role in making UCLA one of the most respected universities in the world. Now these gifts can be specifically directed to the campus area of your choice. The Department of Mathematics would be honored if you would consider joining fellow Chancellor's Associates, who provide a sustainable foundation for our future. Your annual investment in math will help support student scholarships and awards, as well as maintain the Department's commitment to cutting edge research and education. For more information about becoming a Chancellor's Associate visit http://www.theuclafund.ucla.edu/leadership/associates.html.
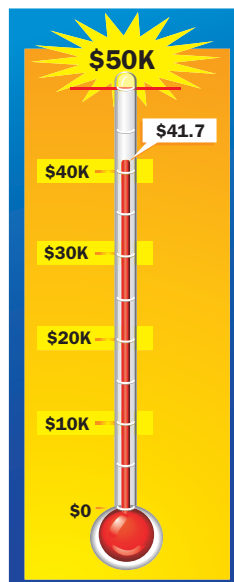
our donors

July 1, 2006–June 30, 2007

Dr. William O. Alltop
Edie R. Babbe
David B. Babbe
Richard E. Balsam
E. James Bevan
Dr. Joseph E. Borzellino
J. Michael Bossert
Meg W. Bossert
Patty R. Boyle
Dora E. Briones De Garcia
Donald W. Bullock
John Burnett
Gail M. Cardenas
Sierra Chen
Catherine R. Chyi
Ms. Frances A. Hirai-Clark
Dr. Ronald J. Clark
Michael A. Coca
Laura S. Coca
Christopher J. Ennis
The Epstein Trust
Michael J. Fatur
David J. Finkel
Bernard H. Fliegelman
Nicholas Fortis
Eugene M. Friedman
Gustavo Garcia
Dr. Jack M. Gill
Stephen M. Godfrey

Terry M. Godfrey
David T. Gregorich
Dan D. Gutierrez
Kim Nhat Ha
Elizabeth A. Hale
Brieane K. Hamaoka
Jana F. Happel
Sayuri Hashii
Yvette Hassakoursian
David T. Higuchi
Caraly S. Higuchi
Linda J. Holloway
Susan X. Huang
Ruth L. Hughes
Lornel Idriceanu
Lynn H. Iwamoto
John Kempkey
Wilhelmina L. Kempkey
Chulho Kim
John D. Kohler
Michael A. Kriss
Dr. Donald P. Lade
Victor La Forest
Dr. Sikun Lan
Nancy S. Lawler
Katherine K. Layton
Sheldon S. Lee
Richard S. Levine

Carrie R. Levine
Li Liu
Dr. Lynn M. Mather
Daphne J. McCarley
John P. McTague
Carmen O. Mercado
Richard E. Milo
James M. Murphy
Samantha L. Nieveen
Dr. Lloyd L. Philipson
Raymond Phuong
Dr. Edward H. Robbins
Sandy L. Sakai
Tracy Sakai
Howard L. Shuken
Nettie Shuken
Bernadine Sorgenfrey Weston
Jeffrey W. Snyder
Stern Family Foundation
Michael K. Tarbell
Bradley K. Tawa
Kathy Tawa
Christoph Thiele
Louis H. Watanabe
Larry Morris Weiner Trust
Pamela F. Wong
Joan M. Wood
Manami Yamauchi

Verizon Foundation (matching gift)
Bank of America Foundation (matching gift)
Federated Department Stores Foundation (matching gift)
American Mathematical Society (Departmental award)

If your name should be included on this list, please contact Lisa Mohan at lisam@math.ucla.edu.

We gratefully acknowledge our anonymous donors.

Dear Friends, Colleagues, Students and Alumni:

It is with great pleasure that I invite you to enjoy the second annual edition of *The Common Denominator*, following our successful revival efforts in 2006. And what a great year it has been since last we reported the outstanding news that UCLA Math can now count a Fields Medalist among us!

As a center of excellence for cutting-edge research in mathematics, including interfaces with other disciplines, the Department strives to create a world-class training ground for young talent at all stages with no upper bound for achievement—we are unabashed believers in infinity when it comes to what our mathematicians can accomplish. Yet, while the individual accomplishments of faculty and students are to be heralded, UCLA Math, at its heart, has a tradition of harmonious collaboration among its diverse constituents, resulting in an institution far greater than its individual parts. One of this year's highlights, the AMS award for an Exemplary Program or Achievement in a Mathematics Department, is a strong validation of this collective effort to inspire, develop and bring mathematical knowledge to the scientific community and beyond.

Personally, I have made it the primary goal of my chairmanship to foster this harmony through the rejuvenation of our faculty recruitment efforts. This fall, we take exceptional pride in six internationally renowned new faculty members, all of whom bring enormous depth and promise to the Department. I like to think that our trademark collaborative nature clinched the deal for these unique mathematicians, who chose to join us despite multiple opportunities.

Equally rewarding was getting newly connected with our alumni and supporters throughout the year at events such as the Fields Medalists Symposium, the Mautner Memorial Lectures and other public forums. There is no better reward for our work than the success and involvement of our former students. Many generous donations have made this a record year for contributions, resulting in another first: two endowed chairs in math and room for more at our expanded table. This vibrant community of alumni and friends are our partners in success, and we are grateful for their investment in our mission to bring the beautiful promise of mathematics to the 21st century.

Yours sincerely,

Christoph Thiele

UCLA Department of Mathematics
520 Portola Plaza
6363 Math Sciences
Box 951555
Los Angeles, CA 90095-1555
310-825-4701

http://www.math.ucla.edu/

UCLA Department of Mathematics
520 Portola Plaza
6363 Math Sciences
Box 951555
Los Angeles, CA 90095-1555