FALL 2017

THE Common Denominator

UCLA DEPARTMENT OF MATHEMATICS NEWSLETTER

Joey Teran presents his special effects research for the Disney movies, *Frozen* and *Moana*.

INSIDE

UCLA

UCLA Math Brings Cutting-Edge Research to Alumni Summer Event

The Department hosted an exceptional outreach event in the summer, bringing 160 alumni, their families and friends together for an afternoon of scholarship and fun. The highlight of the event was a presentation by UCLA Professor Joseph (Joey) Teran, who gave an overview of his research.

A father of two small children, Joey particularly enjoyed presenting his work to the youngsters in the crowd. He uses mathematics and computers to model the behavior of physical objects in unique ways. One alum said, "My favorite part of the presentation was introducing math to my teenager as a real-world, cool application." The presentation captivated all ages, as Joey explained how his work is impacting both virtual surgery and the movies.

Virtual Surgery

Virtual surgery enables surgeons to practice procedures on a three-dimensional copy of a patient, including the internal organs, before operating on the actual patient. This digital double is an enormous benefit, especially in intricate, challenging operations. Joey has focused much of his research in this area, explaining, "It's a cheaper alternative to cadavers and a safer alternative for patients."

Ten years ago, Joey's team began with small human tissue samples, using the finite element method. More recently, his team has switched to the material point method (MPM), which allows for simulations of much larger areas of the body, such as whole organs.

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UCLA Math Brings Cutting-Edge Research to Alumni Summer Event

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Currently, his team is working with the UCLA Center for Advanced Surgical and Interventional Technology to create a prototype virtual tissue simulation of the liver capable of real-time interaction for medical training simulation. Says Joey, "We're working right now to get real liver samples and then do some mechanical tests. That way we can make sure the computer simulation closely replicates the real tissue. At the same time, we're developing a mathematical model to describe the tissue. Then we'll create a simulation algorithm and bring everything together."

Disney Animation

Joey presented his special effects research, which he uses in his consulting role for Disney films. Over the last few years, he has employed physics and math to animate the snow scenes featured in *Frozen* and the water scenes in *Moana*. Alum Shaun de Vera '95 commented, "I particularly found it interesting how his work translates for graphic artists who aren't mathematicians; also, how his math models create images that align with humans' very specific sense of reality."

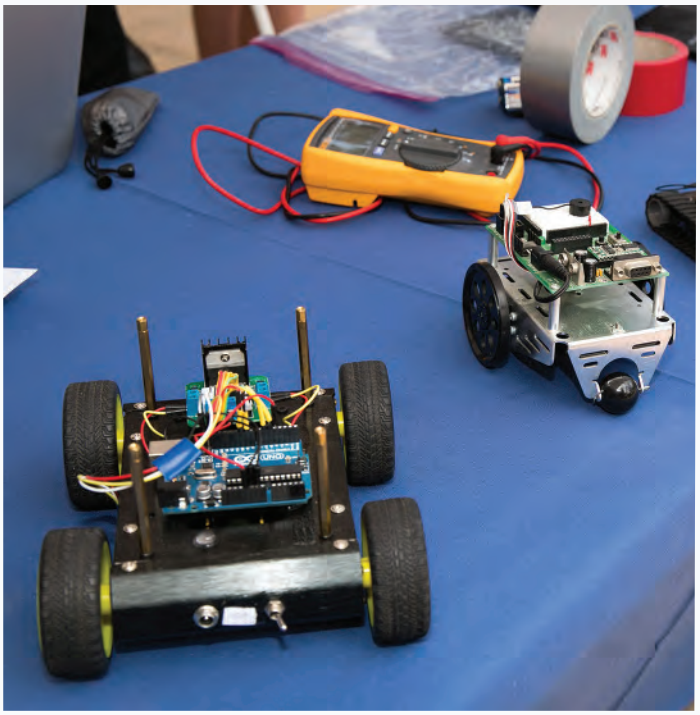
After Joey's presentation, attendees moved to the Court of Sciences to enjoy a reception and participate in interactive activities that were especially interesting to the young and the young at heart. A *Frozen*-themed bounce house provided a place for children to expend their stored-up energy. A Kids Math Corner offered logic puzzles and math games borrowed from the Los Angeles Math Circle, a Department program that offers free enrichment for schoolchildren who have a passion for math. Members of the student-led

A Bruin Actuarial Society member shows teens how a game of Blackjack incorporates the fundamentals of actuarial math.

Bruin Actuarial Society showcased the fundamentals of actuarial mathematics through the game of Blackjack. Winners were entered into a raffle for a math t-shirt. And everyone enjoyed the photo booth filled with math props.

A demonstration of "swarm robotics" was given by students from UCLA's applied math REU (Research Experiences for Undergraduates) summer program, which is sponsored by the NSF. The students use a stochastic law to control a swarm of robots. Although math cannot predict the precise movement of an individual robot, students can make statistical inferences about the robot's behavior and apply it to the entire swarm. Swarm robotics is just one of the many high-quality REU projects conducted at UCLA over the last decade. The program is open to UCLA undergrads and masters students from other Los Angeles colleges and universities. Marissa Gee, an REU

Math enthusiasts.



Swarm robotics used in Applied math REU research demonstrations.

Alum Shaun de Vera '95 (left) and friend show their math pride at the photo booth.

student from Harvey Mudd College said, "I think it's a really great opportunity to not only do math research, but to learn how to present math to non-math people so they can comprehend it." The alumni event was a great way for REU students to practice their presentations.

The afternoon wrapped up leaving alumni feeling proud to be part of an innovative department that reaches out to its alumni in a stimulating and fun-filled way and collaborates with the community beyond UCLA. Alum Shaun De Vera described the event perfectly: "It helped to reinforce the idea that UCLA math isn't just the classroom and the research. It's also a force that promotes culture, engagement and fun! I hope these events inspire kids, in particular, to go to college and maybe enter STEM fields."

Stay up to date with department events by visiting the UCLA Department of Mathematics website: www.math.ucla.edu/alumni.

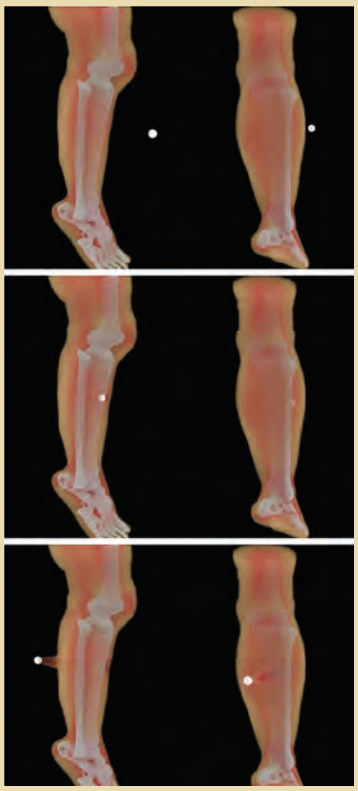
An Alum watches his daughter solve a logic puzzle in the Kids Math Corner.

Computer Modeling to Simulate Injury in the Human Body

The material point method (MPM) is a numerical technique used to simulate the behavior of solids, liquids, gases and any other continuum material. Lagrangian elements, called material points, make up a human body. These material points have a background mesh or grid that is used to calculate gradient terms, such as acceleration and the deformation gradient. Unlike the finite element method, MPM uses particles, not mesh points, to store information on the state of the calculation. MPM is better suited for modeling large material deformations.

A recent publication[1] explains how the MPM method can be used to simulate an injury from a single ballistic projectile passing through a person's lower left leg. (The publication combines the MPM method with other methods to further simulate hemorrhaging.) The MPM method uses particles, or material points, to track Lagrangian quantities, particularly mass, velocity and deformation gradient. The governing equation is solved on a background Eulerian grid, where ρs is the local material density, v is velocity, σ is the Cauchy stress tensor, g is the gravity and D/Dt denotes the material derivative. Each of the three materials is assigned with its corresponding elasto-plastic constitutive model parameters.

$$\rho_s \frac{Dv}{Dt} = \nabla \cdot \sigma + \rho g$$



Using MPM avoids the need to explicitly model coupling and contact between particles. The external projectile (modeled as a sphere here for simplicity) is kinematically moved and treated as a rigid body collision object during the impact simulation. The simulation timescale of the projectile impact is on the order of 1ms.

1 Teran J, Jiang C, Ram D, Santhanam A, Terzopoulos D, Benharash P, Dutson E, Teran J, Chong K (2017). Visualization of vascular injuries in extremity trauma. Med Biol Eng Comput. doi: DOI 10.1007/s11517-017-1619-9. https://www.ncbi.nlm.nih.gov/pubmed/28188471

faculty news

The After Math

Russel E. Caflisch

Russel (Russ) is a skilled academic leader and one of the country's foremost applied mathematicians with interests in fluid dynamics and plasma physics, epitaxial growth, Monte Carlo methods and computational finance. Following his baccalaureate degree from Michigan State University in 1975, he pursued graduate studies at the Courant Institute of Mathematical Sciences at New York University (NYU) under George Papanicolaou, earning a PhD in mathematics in 1978. In graduate school, he was awarded a Hertz Foundation Graduate Fellowship and a Sloan Foundation Research Fellowship.

Russ held faculty positions at Stanford and NYU before joining the Department in 1989 with a joint appointment in materials science and engineering. During his UCLA career, he has served as a PhD advisor for 22 students and published over 260 articles. His invited lectures include the 2006 International Congress of Mathematicians. He has participated in numerous boards and associations, and in 2001, he became a founding member of the California NanoSystems Institute (CNSI) at UCLA where he chaired the IT Infrastructure Committee for four years.

In 2008, Russ was named director of the UCLA-affiliated Institute of Pure and Applied Mathematics (IPAM). While successfully guiding IPAM's aggressive research agenda for the next eight years, he maintained his own research program, focusing on modeling; analysis; development of new algorithms; and computations for several different, mostly physics-based, applications. He was named a fellow of the Society for Industrial and Applied Mathematics in 2009, the American Mathematical Society in 2012, and the American Academy of Arts and Sciences in 2013.

Upon his retirement from UCLA this year, Russ returned to his alma mater, NYU, to assume the directorship of the Courant Institute of Mathematical Sciences, an ambitious and entrepreneurial institute with a strong record of advancing global scholarly enterprise.

James Ralston

James (Jim) completed his Harvard undergraduate degree in three years and obtained his Stanford PhD with Ralph Phillips in 1969. He came to UCLA in 1971 after postdoctoral work at the Courant Institute of Mathematical Sciences at New York University. His 45 years at UCLA leave us important contributions to teaching, research, and departmental administration.

Jim has served as Department chair, acting chair, vice-chair (twice) and faculty director of The Curtis Center for Mathematics and Teaching. His Curtis Center work underscored the Department's investment in mathematics education, while as chair he resurrected the departmental newsletter to showcase faculty and student achievements and nurture alumni relations.

Jim's research focuses on partial differential equations and inverse problems. It has been recognized by a Sloan Fellowship and many years of speaking invitations and National Science Foundation support. His papers study physically interesting problems, avoid undue abstraction and get written only after a problem is fully solved. His first paper proved sound waves do not decay in an exterior domain containing arbitrarily long reflected line segments. Much of his later work, joint with UCLA's Gregory Eskin, concerns scattering theory. For 10 years he edited *Communications in Partial Differential Equations*.

He has taught courses at all levels, from calculus and graduate seminars to teacher preparation. He supervised 14 PhD theses between 1974 and 2012 and mentored some outstanding postdoctoral fellows. As Curtis Center director, he guided the Department's highly regarded bachelor's degree program in mathematics education. Jim's fifth floor office door is always open and any question from student or colleague gets his full attention.

Jim's other interests include bicycling (he cycles to work daily), mountain hiking (he is founding chair of our Hikes Committee), the piano—and all things French.

Conferences

2017 Association for Women in Mathematics Research (AWM) Symposium

In April, the UCLA Department of Mathematics and IPAM hosted the 2017 AWM Research Symposium for 375 attendees. The latest research by women mathematicians was presented across a wide-range of topics in pure and applied mathematics, statistics, math education and the history of mathematics. The program was highlighted by four plenary talks. Workshops included a Wikipedia edit-a-thon, which provided an opportunity for editors of online communities to update and revise their content about women in mathematics. AWM encourages women and girls to study math and pursue active careers in the mathematical sciences and advocates for equal opportunity in the field.

2016 – 2017 Distinguished Lecture Series

Every year, the Department brings eminent mathematicians to UCLA for a series of lectures and networking opportunities with faculty and graduate students. This year, the event hosted four prominent lecturers. Roman Bezrukavnikov (MIT) examined the connection between geometric categorification and representation theory, as well as the geometry and algebra of quantisized symplectic resolutions. Igor Rodnianski (Princeton) showcased a variety of mathematical phenomena appearing in general relativity, touching upon basic properties of the Einstein equations and their connections to the Fefferman-Graham construction of conformal invariants. Claire Voisin (College de France) presented on Kahler geometry and its link between topology and complex geometry. Geordie Williamson (University of Sydney) spoke on the theory of algebraic representations, the geometric Satake equivalence and Finkelberg-Mirkovic conjecture, and the Hecke category of higher representation theory. The Distinguished Lecture Series is currently supported by the Larry M. Weiner Fund.

UCLA Curtis Center Mathematics and Teaching Conference

In March, The Curtis Center held its 10th anniversary conference, honoring its founder, Philip C. Curtis, who passed away this year. The conference focuses on professional development of middle and high school math instructors, highlighting current math education research, teaching techniques and subject matter topics in plenary and breakout sessions. This year featured Dr. Phil Daro, co-author of the common core state standard for mathematics (CCSS-M).

Faculty Honors

- **Matthias Aschenbrenner**, **Andrea Bertozzi**, **Ciprian Manolescu**, **Igor Pak** and **Sucharit Sarkar** have been invited to give lectures at the 2018 International Congress of Mathematicians, one of the world's premier forums for presenting and discussing new mathematical discoveries.
- **Andrea Bertozzi** was named Math + X Investigator by the Simons Foundation, which recognizes a research collaboration between mathematics and the California NanoSystems Institute. She will receive $1.5 million for research support over five years.
- **Andrea Bertozzi**, **Stan Osher** and **Terry Tao** have each been listed as a 2016 Highly Cited Researcher. Highly cited papers are defined as those that rank in the top 1% of citations by field and publication year in the *Web of Science*, an online scientific citation indexing service.
- **Andrea Bertozzi** and **Mason Porter** have each been named as a Fellow of the American Physical Society (APS). Andrea was recognized for "seminal work on thin film fluid analysis and modeling." Mason was recognized for "fundamental contributions to the development of new methods and applications in complex networks." At 40, he is among the youngest APS fellows. Through the fellowship, APS recognizes exceptional contributions to physics, an honor reserved for 0.5% of members each year.
- **Marek Biskup** has been named a 2016 Fellow of the Institute of Mathematical Statistics for excellent research in the interface of probability theory and statistical physics. Only 10% of active members have earned the status of fellow.
- **Artem Chernikov** received an NSF 2017 Faculty Early Career Development (CAREER) award, given to support promising young faculty. Artem will work on applications of the generalized stability in model theory to pseudo-randomness and Ramsey-type phenomena for restricted families of hypergraphs.
- **Ciprian Manolescu** was elected as a 2017 Fellow of the American Mathematical Society for his contributions to Floer homology and the topology of manifolds. The fellows program highlights outstanding achievements of the mathematical sciences community.
- **Deanna Needell** was a co-awardee of the Institute for Mathematics and its Applications 2016 Prize, which recognizes individuals who have made a transformative impact on math and its applications. She has served as a mentor for several UCLA RIPS and REU summer programs.
- **Mason Porter** received a 2017 SIGEST Award from Siam for his paper, "Core-Periphery Structure in Networks," as well as a 2017 Faculty Mentor Award from the Council for Undergraduate Research (CUR). The SIGEST award recognizes a recent paper from one of SIAM's specialized research journals, chosen on the basis of exceptional quality and potential significance. The CUR award provides research opportunities for faculty and students at all institutions serving undergraduate students.
- **Wotao Yin** received the 2016 Morningside Gold Medal of Applied Mathematics and **Jun Yin** received the 2016 Silver Medal in Mathematics at the 7th International Congress of Chinese Mathematicians. The medals are awarded to outstanding mathematicians of Chinese descent.

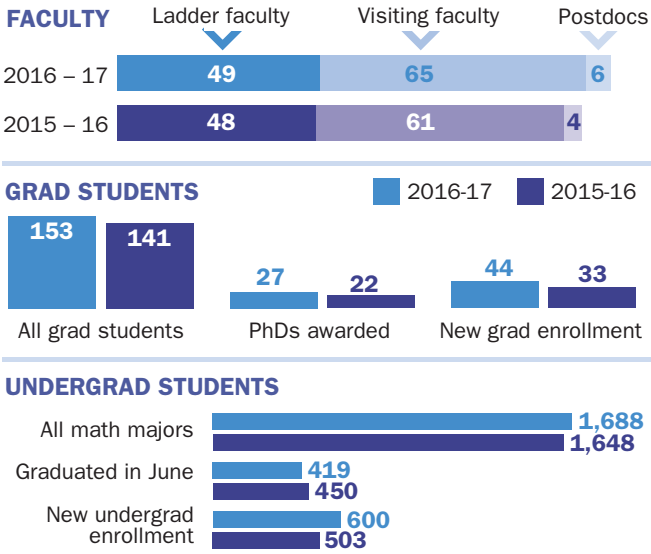
faculty news

Institute for Pure and Applied Mathematics, funded by the National Science Foundation

Dimitri (Dima) Shlyakhtenko has been appointed IPAM's new director, succeeding Russ Caflisch, who retired from UCLA this summer and is now the director of New York University's Courant Institute of Mathematical Sciences. Dima earned his PhD from UC Berkeley in 1997 and has been a member of the UCLA math faculty since 1998. His research on operator algebras includes free probability theory, von Neumann algebras, C*-algebras, L2-invariants and Poisson geometry. Dima is the lead organizer of IPAM's spring 2018 long program in quantitative linear algebra.

To learn more about IPAM, visit: www.ipam.ucla.edu.

UCLA Math Department by the Numbers



New Faculty

Tim Austin

Tim's research interests are in analysis, probability and ergodic theory. His recent work has focused on some classical questions about entropy in ergodic theory, and on a more recent notion called sofic entropy, which has connections to group theory and statistical physics. He earned his PhD at UCLA in 2010 under Terry Tao. For the following five years, he was a Clay Research Fellow, dividing his time between Brown University and New York University (NYU). He subsequently spent two years at NYU as an associate professor where he was a member of the Simons Collaboration on Algorithms and Geometry based at the Simons Foundation in New York City.

Deanna Needell

Deanna's research focuses on compressed sensing, signal processing and stochastic optimization. She works on algorithmic design as well as theoretical analysis. She earned her PhD at UC Davis in 2009 under Roman Vershynin and was a postdoctoral fellow at Stanford with Emmanuel Candes. She subsequently joined the faculty at Claremont McKenna College before coming to UCLA. She has received an NSF CAREER award, an Alfred P. Sloan Fellowship, an MSRI Research Fellowship, and the IMA Prize. In addition to her scholarship, she is actively involved in outreach, including work with the Women in Data Science and Mathematics network.

Guido Montufar

Guido works on machine learning, addressing a diversity of mathematical problems, especially in the context of neural networks and deep learning. He studied mathematics and physics at the Technische Universität Berlin and earned his PhD from Max Planck Institute for Mathematics in the Sciences in 2012. He was a postdoctoral fellow at Pennsylvania State University, working on the geometry of hierarchical learning, with extended research stays at RIKEN Brain Science Institute and the Santa Fe Institute. He was awarded competitive research grants within the DFG Emmy Noether Programme and the ERC Starting Grant call.

Jun Yin

Jun's research areas are probability theory and statistical physics with an emphasis on random matrix theory and interacting particle system. He earned his PhD in physics from Princeton University in 2008 under Robert Seiringer. Following postdocs at Harvard University, he joined the University Wisconsin-Madison mathematics department and was promoted to associate professor in 2016. During his tenure, he held a Jon Von Neumann Fellowship at the Institute for Advanced Study at Princeton in 2013 – 2014. His awards include the 2014 Sloan Research Award, a 2016 NSF CAREER Award and a 2016 Morningside Silver Medal.

in memoriam

Philip C Curtis Jr.

1928 – 2016

Phil Curtis passed away peacefully on December 19, 2016, at home and surrounded by family, from the cumulative effects of Parkinson's disease. He was 88. Phil was a man of many passions and deep interests. He embraced life fully, pursuing the things he loved and bringing the people he loved along with him. He was a role model and mentor for all who knew him.

Phil is survived by his wife of 66 years, Dorothy Smith Curtis; his five children, Philip Curtis III, Anne Knapp, Peter Curtis, Marion Usselman and Alan Curtis, and their spouses; his 10 grandchildren; and 9 great-grandchildren; his large extended family, including siblings Myron Curtis and Janet Green; and scores of friends and colleagues. They will miss his ingenuity, curiosity, optimism, wise counsel and unwavering loyalty and generosity. He is preceded in death by his grandson, Spec. Jonathan Michael Curtis.

Born in Providence, Rhode Island, on March 6, 1928, Phil was the eldest son of Philip and Marion Curtis. He graduated from Pawtucket High School in 1945 and entered Brown University where, after a brief tour in the Army, he earned a BA in mathematics in 1950. A Fulbright Scholarship in Amsterdam followed and then entry into Yale University where Phil completed his PhD in mathematics.

He joined the Department faculty in 1955 where he remained for over 50 years. Phil was known for his pioneering theoretical work in the Banach algebras, as an influential member of the University of California's Board of Admissions and Relations with Schools, a founder of the UC Mathematics Diagnostic Testing Project, and a leading advocate for improving mathematics education in secondary schools. The UCLA Philip C. Curtis Jr. Center for Mathematics and Teaching was named in his honor. Phil had an abiding love of opera, classical music, fine wine, trains, history, travel, hiking, cross-country skiing and organizing and leading adventures of all kinds. He was devoted to his wife, his family and his friends.

— The Curtis family

Rodolfo Vittorio De Sapio

1936 – 2017

Rodolfo Vittorio De Sapio (Rudy to everyone who knew him) passed away on January 24, 2017, from cancer. His longtime partner, Andrea Williams, passed away a couple of years before his death, which deeply affected him. There are no surviving relatives, but some of his colleagues were with him at the end.

Rudy's parents immigrated to the U.S. from Italy, settling in New York. He grew up bilingual and in many ways Italian. He made trips to Italy throughout his life and had a special fondness for friends who were Italians or of Italian origin. For him, the American and Italian cultures blended seamlessly, which made him one of the most charming and gregarious of persons. He had many interests, including baseball, of which he had an encyclopedic knowledge, especially when it came to the New York Yankees. I have the rare distinction of stumping him once with a trivia question.

Rudy earned his PhD in math at the University of Chicago in 1964, specializing in algebraic and differential topology. He began his career as an Instructor at Stanford University and joined the UCLA math faculty in 1966. He published many brilliant papers in the top international journals in his field and was well on his way to becoming a recognized figure in algebraic and differential topology. He was deeply interested in the problem (still unsolved) of the existence of complex structures on the six-dimensional sphere. However, he suddenly lost his drive for research for reasons that are not entirely clear, even now.

Beginning in the '80s, he developed a deep interest in teaching and soon came to be regarded as among the best in the Department. Once I saw a written comment by one of my students, which said that I was very good – almost as good as De Sapio. When I showed it to Rudy, he could not stop laughing. He kept meticulous and beautiful notes on the courses he taught, and he wrote a book during that period, *Calculus for Life Sciences*, which was well received. His research reignited in 2000, and he began writing papers again, one of which was a very fine expository review with some new ideas on spin and the principle of triality.

He left his mark on the people around him in a way that reflected his kindness, his love of life, his humor and his abiding respect for everyone. My wife and I were privileged to have a close relationship with him and Andrea over

the course of 20 years. I lunched with him in my office every Monday. I last visited with him a couple of days before he died, and he was still up for a chat. We discussed the print in his dining room, Leonardo da Vinci's The Lady with the Ermine, and recalled the story behind it. His last few weeks were painful but made somewhat bearable by the efforts of a former student of his, Paige Greene of our faculty. His friends and colleagues mourn the passing of a good colleague and a decent man.

— V. S. Varadarajan
Professor Emeritus
Distinguished Research Professor, UCLA

math education

Celebrating 10 Years of the Los Angeles Math Circle

The Los Angeles Math Circle (LAMC) is a free enrichment program for schoolchildren K-12. It was founded by Olga Radko in 2007 with the strong support of then Department chair Christoph Thiele. Over the years, the program has grown exponentially from a handful of high school students to over 230 participants of all school ages. An additional 100 students have been attending LAMC summer sessions during recent years.

What LAMC Does

The core mission of LAMC is to showcase the beauty of mathematics and its applications and to hone students' problem-solving skills. LAMC also prepares students for a variety of competitions, creates a social context for mathematically inclined children and creates an interest in STEM careers. Alumni have gone on to study mathematics, physics, computer science, statistics and engineering at UCLA, UC Berkeley, MIT, Caltech, University of Chicago and other prominent universities. Some alumni are in PhD programs at Caltech, UC Berkeley and the University of Washington.

LAMC is very fortunate to have received strong support from the Department and its faculty over the years, many of whom have given presentations and volunteered their time and advice. The program could not exist without the involvement of over 30 UCLA graduate and undergraduate students who teach in the classes. These instructors undergo training and participate in development of the curriculum. Advanced LAMC students volunteer to assist younger ones during the summer session where they gain a valuable teaching experience while setting an excellent example. Unsurprisingly, a number of former LAMC instructors have pursued careers in science education, teaching in public and private schools. Some former instructors have gone on to work at The Art of Problem Solving, a San Diego-based company specializing in high quality math instruction.

Over the last 10 years, LAMC has amassed a vast body of curricular materials, which are available for free on its website (http://www.math.ucla.edu/~radko/circles/). LAMC encourages and assists math circle satellites, often run by groups of parents. In addition, several advanced math circle participants have started afterschool outreach programs in their local communities. LAMC supports both of these programs through mentorship and seed funding.

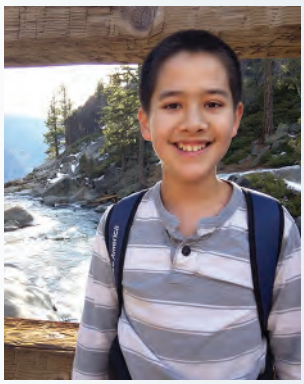
What makes LAMC very special are the schoolchildren. While most attend because they love math, some are also motivated by math competitions, winning national prizes in contests such as Math Kangaroo, all stages of American Math Competition, and the Bay Area Math Olympiad.

LAMC Projects

As it has grown, LAMC has initiated a number of innovative projects that go beyond the traditional math circle curriculum. Last year, Math Mentorship was established in which students who have a strong interest in math but need more guidance work with instructors in small groups in addition to their regular classes. Teacher Partnerships is a project that allows elementary, middle and high school teachers to gain math circle training and experience. LAMC founder Olga Radko and Oleg Gleizer, curriculum developer and lead instructor for the program, published a book in 2015, *Breaking Numbers into Parts*. The book is based on LAMC's early elementary school curriculum and is available on amazon.com. In development are two additional books for older students.

Children and parents report that they feel very fortunate to have found this vibrant community of math lovers where their children can explore exciting mathematics and make like-minded friends. LAMC owes a huge debt of gratitude to the UCLA community to make this happen. The outpouring of support has enabled this important program to flourish and maintain its free-of-charge policy.

In celebration of its 10th anniversary this year, LAMC has established an endowment campaign. UCLA Dean of Physical Sciences Miguel García-Garibay has pledged to double all donations provided so that the fundraising goal of $100,000 is met by July 2018. The endowment will ensure that LAMC continues to attract hundreds of bright children to mathematics free of charge, showcases the beauty and importance of this fundamental STEM subject and serves as a training ground for young math instructors.



Tyler Weigand

Now a 10th grader at Harvard Westlake School, Tyler has been an LAMC star throughout his years of participation. He has placed first in the annual Math Kangaroo competition six times and twice received a Distinguished Honor Roll award in the American Math Competition (AMC 8). Tyler teaches younger students in the geometry class and taught in a math circle group of kindergarteners during the summer of 2016. While math is his passion, Tyler has a wide range of interests, from robotics and science to piano.

Natalie Deering

An LAMC participant since first grade, Natalie is currently a 6th grader at the Geffen Academy at UCLA, a college preparatory school for grades 6-12. She is one of the most advanced LAMC participants in her age group, having moved up a level twice. In addition to regular classes, Natalie is the top student in the geometry class and participates in the invitation-only Olympiad Training. Last year, she was the only LAMC student to receive an honorable mention in BAMO-8, a highly prestigious math Olympiad focusing on very advanced problem solving, intended for 8th graders. Natalie is pictured with her mentor, UCLA undergraduate student Konstantin Miagkov, as she received this award.

Megan Joshi

Now a graduating senior at Newbury Park High School, Megan was an LAMC student for over five years. She was also a favorite instructor for many young students when she taught in two recent LAMC summer sessions. She is the winner of many math competitions: a Gold Medalist in Math Prize for Girls Olympiad, a three-time USA(J)MO qualifier, and an invitee to the highly selective national Math Olympiad Summer Program. Currently, Megan participates in the MIT PRIMES-USA, an innovative research program for high schoolers, where she works on maximal self-intersection numbers of closed curves on various surfaces. Passionate about education, she founded STEM for Girls, a program designed to inspire middle school girls to pursue careers in STEM disciplines.

BRIDGES – An NSF-Funded Collaboration

BRIDGES was developed and executed through a collaborative effort by The Curtis Center, the USC Viterbi School of Engineering, and the Glendale Unified School District. The grant was designed to deepen the mathematical modeling skills of middle and high school math and science instructors. Sixty instructors completed 40 hours of training and then worked with a team of mathematicians, scientists and Curtis Center math experts to develop lessons for mathematical modeling in science. Students and instructors in the Department's Math 105 course were embedded in the grant activities. Faculty collaborators for the project include Chris Anderson (UCLA), David Mumford (Harvard), Mike Nakamaye (UNM), Jim Ralston (UCLA) and Luminita Vese (UCLA).

Mathematics Diagnostics Testing Project (MDTP)

In 2016 – 2017, MDTP:

- Piloted and released a new, free online testing platform that will give teachers improved access to student diagnostic results
- Scored 100,000+ student diagnostic tests and sent detailed results back to teachers
- Provided free materials and services to 1,000+ teachers across Los Angeles and Ventura counties
- Conducted school site visits, conferences and Saturday morning workshops for hundreds of math educators to strengthen their pedagogical knowledge

graduate news

2017 Graduate Students Take Flight

Ian Charlesworth

It wasn't until the first year of his undergraduate studies that Ian came to love math and switched his major. Starting graduate school, he knew he liked analysis and combinatorics, but when he discovered free probability, he crossed the continent to attend UCLA. Under the tutelage of Dima Shlyakhtenko, he studied the theory of non-commutative probability, and under his guidance, proved combinatorial properties characterizing bi-free independence of random variables within a framework where random variables are operators acting on both sides of a Hilbert bi-module. Ian is continuing his research as a visiting assistant professor at UC San Diego.

Laure Flapan

Despite growing up in a mathematical family, Laure resolved to study linguistics. But she was inspired by her high school calculus teacher and attended Yale University as a math undergraduate, where she was first exposed to the beauty of algebraic geometry by Tobias Dyckerhoff. In graduate school at UCLA, she further pursued her interest in the field, working with Burt Totaro, to whom she credits a greatly expanded appreciation for, and understanding of, the interconnectedness of mathematics. Her research is in Hodge theory, which explores connections between algebraic geometry, topology and arithmetic geometry. Laure received a postdoc position at Northeastern University as an RTG/ Zelevinksy Research Instructor.

Julian Gold

Julian's parents nurtured his interest in math during childhood. After a period of dormancy in high school, this interest resurfaced at UC Davis, where he gravitated towards geometry and topology. After taking classes in analysis and statistical physics as a UCLA graduate student, he worked under Marek Biskup in areas of probability, inspired by physics. His thesis uses recently developed tools, such as the Wulff construction in higher dimensions, to characterize the shape of large droplets of a theoretical material. He also studied the shape's two-dimensional droplets when attached to a boundary. Julian was recruited as an RTG Postdoctoral Fellow at Northwestern University.

Christopher Ohrt

Chris discovered his passion for math during an eighth-grade competition and quickly started taking college courses in high school to satisfy his craving for more math. While in his master's program at the University of Regensburg, he was offered the chance to do an exchange year at Brandeis. There he fell in love with American nature, food and culture. He subsequently entered the UCLA PhD program, focusing his research on geometric topology and higher torsion invariants under fellow German, Christian Haesemeyer. At UCLA, he developed a strong interest in teaching and spent his summers as an instructor at the USA/Canada Mathcamp. Chris is now a Szegö Assistant Professor at Stanford.

Matthew Stoffregen

Matt's interest in mathematics began in high school and advanced with each passing year, although he only became a math major well into his college years at the University of Pittsburgh. There he became interested in topology during many hours spent struggling with A.M. Armstrong's *Basic Topology*. He also maintained an interest in analysis thanks to the guidance of his mentor, Stuart Hastings. At UCLA, Ciprian Manolescu introduced him to the wild world of 4-dimensional topology; his first research experience involved Seiberg- Witten equations, combining topology and analysis. Matt is at MIT on an NSF/CLE Moore postdoc.

Ian Zemke

Ian became interested in math as a child, which led him to study analysis and geometry at the Uni-

versity of Washington. There he got his first taste of mathematical research at an REU, where he focused on inverse problems in electrical networks, a combinatorial problem of recovering an electrical network contained in a black box by testing protruding nodes. As a UCLA grad student, he studied low-dimensional topology under Ciprian Manolescu, developing his thesis on topological quantum field theories in Heegaard Floer homology. For the next few years, Ian will study at Princeton as an NSF postdoc.

Wei Zhu

Wei's interest in math and physics began in junior high. He subsequently entered Tsinghua University, majoring in both fields. There Wei became even more fascinated by math, which encouraged him to study applied mathematics at UCLA, where he pursued his dream of doing research. His interests span the fields of mathematical image processing and machine learning. He worked under Stan Osher, focusing on classification and reconstruction of images and high-dimensional data using manifold-based variational models. Wei was recruited to Duke University as a Phillip Griffiths Research Assistant Professor.

WIM members at an informal get-together.

Women in Math (WIM)

An informal group of graduate students, postdocs, faculty and visitors, Women in Math (WIM) aims to foster community among women colleagues and provide them with extra support in the Department. As a new grad coming from Taiwan, Stephanie Wang remembers feeling overwhelmed adjusting to life in a new country and dealing with the demands of graduate school. Then she learned that she was the only woman in her class of new grads. Stephanie recalls, "One day, I received an email from Women in Math, inviting me to an ice cream social where I could connect with other women in the Department. I really appreciated them reaching out to me. Since that day, I've been motivated to support women students in the Department, elsewhere on campus and at other schools. In addition to the social benefits, it's a really good way for us to network."

The challenges that women in math face are not unique to UCLA, as the field is dominated by men across the globe. This year, WIM is initiating a mentorship program, connecting graduate students with undergrads. Says Stephanie, "We are creating a sense of comradeship among women mathematicians much like the one that exists among our male counterparts. By sharing tips to success, we can help pass on our gained experiences and knowledge to our fellow undergrads."

WIM is also expanding its community outreach activities. The group currently participates in AWISE Stem day where UCLA students talk to high schoolers about entering STEM fields. Right now, WIM is small, but Stephanie is excited to see how they can grow the network and extend their efforts outside of UCLA to other graduate programs. Please visit math.ucla.edu/women-in-math to learn more.

graduate news

Graduate Awards

Every year the Department honors outstanding graduate students and faculty teaching. Here are the 2017 awards and recipients.

Graduate and faculty awards recipients.

- **Robert Sorgenfrey Distinguished Teaching Award** (faculty) Michael Hill
- **Distinguished Teaching Award** (lecturers) Michael Andrews, Matthew Haberland, Evan Randles
- **Departmental Teaching Award** (teaching assistants) Bon-Soon Lin, Joseph Hughes, Julian Gold, Joshua Keneda
- **Beckenbach Award** Joseph Hughes
- **Dissertation Year Fellowship Award** Ben Bellis, Xiyang Luo, Danh Nguyen Luu, Dimitrios Ntalampekos, William Schlieper
- **Horn-Moez Prize for Excellence in First-Year Graduate Studies** Bjoern Bringmann, Bar Roytman
- **Gillette Outstanding Research Award** Laure Flapan
- **Girsky Fellowship Award** Jacob Rooney, Fangbo Zhang
- **O'Neill Travel Award** Stephen Miller
- **Pacific Journal of Mathematics Dissertation Prize** Ian Charlesworth, Ian Zemke, Wei Zhu

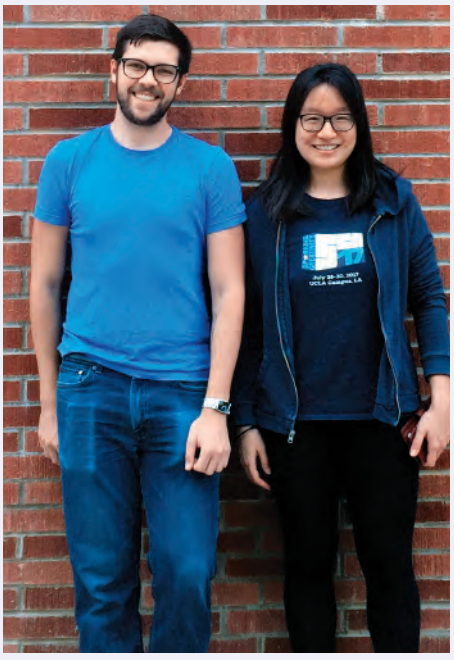
Math Graduate Student Organization (GSO)

The Tye Lidman Memorial Challenge consists of graduate students competing by eating donuts, doing pushups and juggling in a timed setting, all judged according to a linear algebra formula. This competition has become a math tradition every year at the annual Graduate Student Organization (GSO) talent show. Tye Lidman graduated from the Department in the early 2000s and was the first to attempt the challenge, which set a precedent going forward.

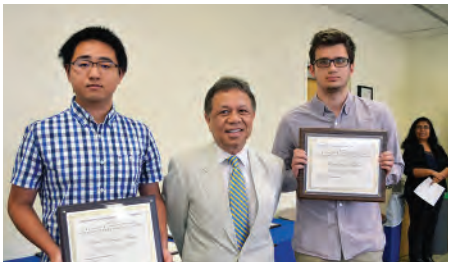
"The older you get in graduate school, the more focused you become on your research, and you tend to put blinders on to get your work done; so events like the talent show are good opportunites to interact with other students," says Ian Coley, who is co-president of GSO, along with Zach Norwood.

In addition to fostering social get-togethers, GSO offers professional development through its weekly seminars where students present various math topics to an audience. "The GSO seminars are a good introduction to what you will do in the future," says Ian. "You can give a mathematical talk and get a sense of where you need to improve in addition to sharing something that you're passionate about." GSO also provides best practices and posts teaching tips on its Wiki page.

As co-presidents, Ian and Zach hope to secure funding for the seminar series this school year. They point out that more people will attend events if there's food. While members used to take turns bringing snacks, it's not feasible anymore with increasing attendance. Ian and Zach are also working on cross-programming with other departments in the UCLA physical sciences division to network and provide more opportunities for members. Visit the math department website for inquiries regarding GSO seminars or other events.



GSO co-president Ian Coley and WIM's Stephanie Wang.



Arens Putnam scholars Clark (Xiaoyu) Huang (left) and Konstantin Miagkov (right) with math alum Don Phan '77 (center).

Awards for Outstanding Undergraduate Achievement

- **Actuarial Science Student Award** Brian Jay Hsu, Tianxiang Yuan, Zheqing Zhu
- **Basil Gordon Prize** Clark (Xiaoyu) Huang
- **Daus Prize** Yucheng Deng, Cole Wilkening Hugelmeyer, Noah Ben Olander, Guoan Wang
- **Outstanding Actuarial Science Student Award** Jonathan Leo Wang
- **Outstanding Math/Econ Student Award** Jiwei Zhang
- **Richard F. Arens Putnam Scholars Award** Clark (Xiaoyu) Huang, Konstantin Miagkov, Yunbei Xu
- **Sherwood Prize** Wenjun Cai

New UMSA members meet their fellow math peers at the first general meeting.

Undergraduate Mathematics Students Association (UMSA)

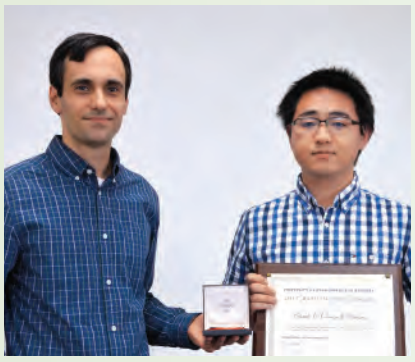
With over 150 members, UMSA is dedicated to connecting undergraduate students with the larger math community, professionally and socially. Says Tanisha Harlalka, current president of UMSA, "The math community outside UCLA isn't as closely connected as in computer science or engineering, so it can be difficult for undergrads to form relationships." UMSA strives to close this gap by hosting several events on campus each year.

The Career Fair and Alumni Mocktail Party, in particular, brings math professionals together with undergrads for career advice and networking opportunities. "The earlier students can be exposed to the workforce, the better they can navigate their own career aspirations," says Tanisha. Other events, such as UMSA's annual BBQ, casino night and scavenger hunt, provide more opportunities for math undergrads to socialize.

Giving back to the community is a high priority, which UMSA accomplishes by tutoring high school students. Says Tanisha, "It's a good way for undergrads to gain experience as well as break the stigma surrounding math by emphasizing its endless real-world applications. Hopefully we can help inspire more teens to pursue math." This year, Tanisha would like to build a more robust tutoring program as well as expand partnerships with outside companies. For more information about UMSA, please visit www.math.ucla.edu/~umsa/.

2016 UCLA Putnam Team Places 7th

The UCLA Putnam team (Emre Girgin, Clark [Xiaoyu] Huang and Konstantin Miagkov) ranked seventh out of 415 institutions. Individually, Clark Huang ranked #13 in North America, with the highest score of a UCLA student in recent history (87 points). Konstantin Miagkov and math undergrad Yunbei Xu ranked #42 overall, and received honorable mentions. Other individual high scorers from UCLA were Osman Akar, Wenjun Cai, Emre Girgin, Luke Harmon, Johannes Hosle, Ruizhe Jia, Ryo Kudo, Ken Willyard and Qiyao Zhu. A total of 25 UCLA students participated.



Putnam faculty advisor Ciprian Manolescu (left) with Clark (Xiaoyu) Huang, ranked 13th in North America.

undergraduate news

UCLA Math Welcomes Back Alumnus Demetri Brizolis as Commencement Speaker

Three-time UCLA math alumnus Demetrios (Demetri) Brizolis returned to campus to give the 2017 commencement address to over 400 graduates, their families and their friends. Demetri is president of Daabco Industries, Inc., a privately held investment firm that he and his wife, Ann, founded in 1989. Prior to forming Daabco, Demetri was senior vice president of Imperial Corporation of America, a multi-billion-dollar financial services company based in San Diego, where he headed the commercial real estate lending division.

Demetri earned his BA, MA and PhD degrees in mathematics at UCLA. He has served as a part-time visiting associate professor at UCLA since 2012 and has taught at Cal Poly Pomona and USC. He also conducts research and publishes papers in the area of algebraic number theory.

In his commencement speech, Demetri encouraged graduates to fearlessly pursue their dreams, whether in academia or industry. He described the business environment today, which offers more options than previous generations enjoyed. Hedge funds and tech companies, including large corporations, such as Apple, Google and Facebook, are aggressively seeking mathematicians. Demetri concluded his message by telling students, "From this day forward, you are officially 'mathematicians,' and, as such, you are revered, yet feared! You are descendants of a unique pedigree. You now belong to an elite club; your entry fee, in the form of years of hard work, has already been paid. By accepting that membership, you are also accepting an obligation – your dues, so to speak – to use your discipline wisely; to inspire others; to create a ripple in the ether of knowledge; and above all, to leave a positive mark in history for the benefit of humankind."

Commencement Speaker Demetri Brizolis

Bruin Actuarial Society (BAS)

"Communication and other soft skills are more important than ever in today's competitive market," says Dan Sui, president of Bruin Actuarial Society (BAS) for the upcoming academic year. BAS helps to prepare undergrad students as actuaries by utilizing resources that will help them learn about the industry and network with potential employers.

"My favorite part of being involved with BAS is meeting like-minded people who want to use their math skills in the business and finance world," says Dan. Case competitions are a good example, offering the opportunity to solve real world actuarial problems and present the results to a panel of judges. "It's very challenging and requires intense teamwork, but I've found I've made some of my closest friends during the process."

In addition to case competitions, BAS hosts less challenging events, such as a spring banquet and an annual career fair. The fair is one of the largest in the nation in terms of the number of companies that attend.

BAS membership has grown significantly since its inception and remains a critical asset to actuarial majors. Dan gives an example: "Because of more opportunities elsewhere in the country, companies are relocating from California to cut costs. The challenge for BAS is to maintain and strengthen corporate ties to ensure opportunities for new entry-level actuaries." Prospective students and firms interested in building connections with UCLA actuaries, please contact bruinactuaries@gmail.com.

BAS officers wrap up the annual spring banquet.

Matching Gift Program

UCLA Physical Sciences Dean Miguel García-Garibay is dedicating resources to inspire others to give by launching the Physical Sciences Matching Gift Program aimed at significantly changing the future of UCLA physical sciences through endowed support during The Centennial Campaign for UCLA.

PROGRAM INFORMATION

- Through June 30, 2018, qualifying gifts of $100,000 to $1 million to ALL physical sciences endowments will be matched at 100%. For example, a $500,000 gift will become $1,000,000!
- Gifts eligible for matching funds must support new or existing endowments.
- Gifts may be designated to support scholarships, student awards, graduate student fellowships, postdoctoral fellowships, faculty research, chairs, physical space and many other endowment options within the physical sciences departments, institutes and centers (pending appropriate approval).
- Only cash gifts and pledges will be matched. (Corporate matching gifts and deferred planned gifts are not eligible for the match.) Pledges are payable over a maximum of five years. This match will be applied when the full gift amount designated has been received by the university.
- There are limited funds, which are available on a first-come, first-served basis.

To learn more about the matching gift program, contact Sharon Chang at schang@support.ucla.edu.

Catching up with Tom Goldstein

UCLA math alumnus Tom Goldstein received his PhD from UCLA in 2010, followed by postdoctoral study at both Stanford and Rice universities. In 2014, the University of Maryland recruited him to its Department of Computer Science as an assistant professor. This year, Tom received a Sloan Fellowship, which includes $60,000 in research support. We interviewed Tom about his UCLA experience and his research.

Why did you choose UCLA for your graduate education?

I really liked the way the Department integrated pure and applied math. I also liked the breadth of the research that is done at UCLA. That makes it intellectually a good place to be. And it's a student-friendly program – people here care about making sure students are funded and moving through the program at an appropriate pace.

What was it like working with Stan Osher as your advisor?

Stan really gives his students intellectual freedom to explore what they want to do and come up with their own solutions to the problems while at the same time making sure they're targeting good problems in an effective way and moving things along.

How has your UCLA education influenced your career?

Being at UCLA opened a lot of doors for me. When I started grad school, I wasn't convinced I wanted an academic job, but I had such a positive experience here, I was inspired. Being at UCLA created opportunities to meet top quality people in my field and helped to build the kind of network you need if you want to be successful in academia.

How did you become interested in machine learning?

At UCLA, I was doing optimization and image processing. The kinds of problems we were solving require the same types of mathematical methods that are really important for machine learning. Researchers are using machine learning now to solve large problems, like neural networks and learning algorithms. So as the field of machine learning has been pushed towards more sophisticated deep learning methods, optimization has become a big problem. I've sort of taken my knowledge of optimization spaces and poured it over into machine learning.

Can you describe some of the applications of your current research?

Right now, people are really interested in computer vision applications, like object recognition, face recognition and similar tasks that recognize patterns. A lot of my large-scale computing work has been focused on better methods for training neural networks that solve these tasks. While artificial neural networks can look at images and tell you what's in them, training these learning devices takes a long time. One of my goals is to find scalable solutions so you can distribute these training tasks over a large number of workers in the cloud and speed up the amount of time it takes to complete the task.

How will you use your Sloan Fellowship?

One of the nice things about funding from the Sloan Foundation is that I can use it to support really interesting high-risk, high-reward projects. I'm looking forward to developing totally new types of optimization methods, but when you step off the path and try to do something completely new, the research becomes higher risk and more difficult to fund from conventional sources. Grants like the Sloan fellowship provide a great opportunity to do this kind of work.

alumni news

Trending Careers in Mathematics and Beyond

The Department partnered with the UCLA Career Center for this year's Career Week event, the largest turnout of any south campus department, with over 120 attendees. The workshop was designed to help current students (undergraduate and graduate) identify career paths that will utilize their mathematics training. Four UCLA math alumni returned to share their professional experiences and give advice to students to help them identify concrete steps toward their career goals. Adam Hudes '01 spoke about his experience as an actuary at Kaiser Permanente, where his focus is on the valuation and analysis of outside medical costs and the risks associated with the provisions of the Affordable Care Act. Mary Grace Gardner '06, area portfolio leader and chief of staff to the senior vice-president and area manager for Kaiser Permanente, Diablo Service Area, uses mathematics and statistics to assist leadership and operational teams with using, collecting and analyzing data for decisions. Meghana Reddy '11, a senior data visualization engineer with the content analytics team at Netflix Inc., uses large-scale data to build viz tools, metrics and analytic insights into the consumption of content on the service. Alexey Stomakhin '13, a senior software engineer at Walt Disney Animation Studios, develops tools for simulation of environmental effects, including the Disney films *Frozen* and *Moana*.

Left to right: Alums Meghana Reddy and Mary Grace Gardner, Christina-Marie Santillan (math staff member), alum Alexey Stomakhin, Roni Lavi (career counselor) and alum Adam Hudes.

Why I Give to the UCLA Math Department

I donate to the UCLA Math Department to help support the outstanding graduate program, and in particular, the graduate students. I received my PhD in math from UCLA in 1965. I was privileged to have Ernst G. Strauss as my advisor, a superb mathematician and scholar, a wonderful mentor, and a great human being. My experience in the Department and with my advisor has had a profound and lasting effect on my life and the work that I have done. I hope that my donations will help other graduate students in the Department have similar experiences to the ones I had as a graduate student and that they achieve a high level of success in their chosen field as well as satisfaction in their lives.

– George H. Senge

World Universities in Mathematics – Academic Rankings

UCLA mathematics now ranks **6th** worldwide (up from 8th in 2015), according to the 2017 Shanghai Global Ranking of Academic Subjects, Mathematics.

World Rank	Institution	Country/ Region	Total Score
1	Princeton University		349.9
2	New York University		286.4
3	Pierre and Marie Curie University - Paris 6		284.0
4	Massachusetts Institute of Technology (MIT)		282.1
5	University of Paris-Sud (Paris 11)		277.9
6	**University of California Los Angeles**		264.3
7	University of Cambridge		263.3
8	Stanford University		263.2

Best Grad Schools U.S. News & World Report 2017 Rankings

In the United States, UCLA's graduate program in mathematics ranks **7th** overall, and in every specialty, it is ranked among the top 10, according to the latest *U.S. News and World Report*'s Best Graduate Schools survey.

Ranking		Score
#1	Massachusetts Institute of Technology – Cambridge, MA	5.0
#2	Princeton University – Princeton, NJ	5.0
#3	Harvard University – Cambridge, MA	4.9
#3	University of California Berkeley – Berkeley, CA	4.9
#5	Stanford University – Stanford, CA	4.8
#5	University of Chicago – Chicago, IL	4.8
#7	California Institute of Technology – Pasadena, CA	4.6
#7	**University of California Los Angeles – Los Angeles, CA**	**4.6**
#9	Columbia University – New York, NY	4.5

Specialty

#1	Analysis
#2	Applied Math and Logic
#5	Algebra/Number Theory/Algebraic Geometry
#6	Discrete Mathematics and Combinatorics
#10	Geometry and Topology

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July 1, 2016 – June 30, 2017*

We are pleased to thank and acknowledge our many supporters.

Gifts of three digits and above made after June 30, 2017 will appear in our fall 2018 newsletter.

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Dear Friends,

It is a great pleasure to welcome you to the latest edition of our newsletter. This past year has been a great success for mathematics at UCLA.

We are a large department with many brilliant faculty members and students. In fact, we are ranked #7 in the U.S. according to the 2017 *U.S. News and World Report*. In one area of mathematics (analysis) we are ranked #1 while in applied math and in logic we are ranked #2. In every mathematics field we are in the top 10.

We hosted a community outreach event this summer, welcoming alumni, their families and friends to enjoy a family-friendly afternoon. The event featured Joey Teran's cutting-edge research used in Hollywood movies and virtual surgery, followed by a reception that included research demonstrations and kids' activities.

Every year our faculty and students receive many accolades and honors, and this year is no different. Let me single out two. Five UCLA faculty members have been invited to give lectures at the 2018 International Congress of Mathematicians (ICM). The UCLA undergraduate team ranked #7 out of 415 institutions in the 2016 Putnam Mathematical Competition; individually, Xiaoyu Huang ranked #13 in North America, with the highest score of a UCLA student in recent history.

This year, the Los Angeles Math Circle (LAMC), a free enrichment program that brings talented schoolchildren to UCLA, celebrates its 10th anniversary. LAMC prepares students for a variety of competitions, creates a social context for mathematically inclined students and attracts students to careers in STEM disciplines.

We are saddened at the passing of two faculty members. Phil C. Curtis Jr., who founded the statewide UC/CSU California Mathematics Diagnostic Testing Project, passed away in December. Rodolfo (Rudy) Vittorio De Sapio, regarded as one of the best teachers in the Department by his students, passed away in January.

Two colleagues, James Ralston and Russel Caflisch, retired this year. This fall, we are joined by four new faculty members.

In each issue of *The Common Denominator*, we record our many donors in recognition of their contributions, which help us maintain important Department programs. I thank them once again. I also want to thank our entire math faculty, staff and student body, who are the engines of our success.

Sincerely,

William Duke

UCLA Department of Mathematics
Fall 2017 Newsletter

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