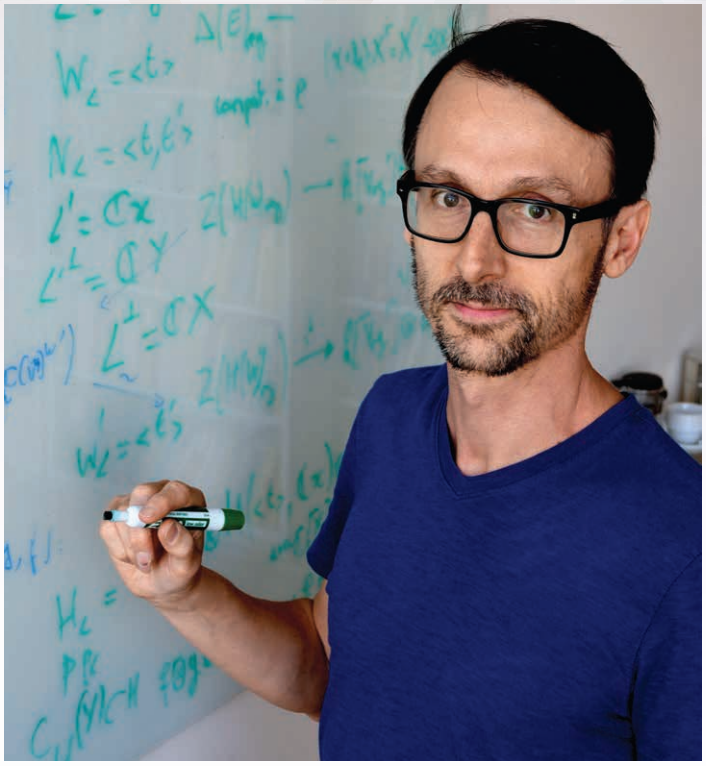
FALL 2015

THE Common Denominator

UCLA DEPARTMENT OF MATHEMATICS NEWSLETTER

Raphaël Rouquier joined the Department in 2011, following a distinguished academic career that includes the Waynflete Professorship at Oxford University and the rank of Directeur de Recherches at France's premier research organization, Centre national de la recherche scientifique (CNRS). Completing his PhD at the age of 22, Raphaël has since become a world leader in algebra, earning numerous honors and awards. Most recently, the Simon Foundation's Mathematics and Physical Sciences Division selected him as a 2015 Simons Investigator, an honor supporting "outstanding scientists in their most productive years, when they are establishing creative new research directions, providing leadership to the field, and effectively mentoring junior scientists." Established in 1994, the Simons Foundation's mission is to support discovery-driven research. As a Simons Investigator, he will receive $100,000 per year for five years in support of his research, and the Department will receive $10,000 per year to be used at the chair's discretion to further ongoing research and outreach. A consequence of Raphaël's scholarship is the initiation of a new field in mathematics: higher representation theory.



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UCLA

Higher Representation Theory

by Raphaël Rouquier

Representation theory is a central part of algebra, and beyond: a well-known quote of Gelfand is that "representation theory is all of mathematics." It plays a key role in the analysis of the structure of finite groups, of Lie algebras and Lie groups, and in number theory, via the Langlands program, for example. It is also a key concept in physics, notably in quantum mechanics. Conversely, conformal field theory and string theory led to major new ideas in representation theory (vertex operator algebras, for example).

Classically, representation theory is tied with group theory. Groups arise in the description of the symmetries of a given object (mathematical or not!). Representation theory starts with a group and studies all objects with symmetries of a type encoded by that group. For example, a vector space with a given group as symmetries will correspond to the data of a representation of the group as matrices.

In the mid-90s, Crane and Frenkel suggested that there should exist some new mathematical object, a "categorified Lie group," whose representations would give rise to 4-dimensional quantum field theories (TQFTs). This was inspired by earlier constructions in dimension 3 relying on quantum groups. TQFTs are toy models for quantum field theories, and dimension 4 is crucial for physics, but the physicists' constructions rely on non-mathematically

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Higher Representation Theory

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justified path integrals. Crane conjectured that categorification should be the right setting for a theory of quantum gravity. Dimension 4 is also the most interesting for topology, and Donaldson constructed new invariants of 4-dimensional manifolds by using the space of solutions of certain elliptic partial differential equations associated with a given Lie group (Yang-Mills instantons).

While classical algebra appears to be related to topology of surfaces (cf picture for the associativity relation), the new algebraic structures related to topology in dimension 3 are now pervasive. For example, braids (cf picture) give a model for the notion of braided monoidal category, an important structure in the representation theory of quantum groups and affine Lie algebras that accounts for subtlety in the commutativity of tensor products of representations. Some of those structures correspond to complicated axioms, which turn out to express basic topological properties.

The first instance of categorification is the following: Define a 0-category to be a set, and a (−1)-category to be a cardinal. Sending a set to its cardinal is decategorification (a well-defined process, contrary to categorification). Categorification is used in combinatorics: Certain identities $a = b$ are deduced from a bijection $A \xrightarrow{\sim} B$ from a set A with a elements to a set B with b elements. The next level of decategorification sends a 1-category (that is, a category) to the set of isomorphism classes of objects, a 0-category. For example, the decategorification of the category of finite-dimensional vector spaces is the set of non-negative integers. Note that the direct sum of vector spaces corresponds to the sum, while the tensor product corresponds to the product of integers. Given a category with some extra structure (abelian, triangulated for example), a more interesting object, the Grothendieck group, arises as a quotient of that set.

The first construction of categories, as suggested by Crane and Frenkel, was done in a joint work with Chuang over 10 years ago. The original problem involved symmetric groups and proving that an explicitely defined complex was exact. The technical difficulties were overwhelming, but we eventually realized that we could generalize the problem to a much more general question that did not involve symmetric groups anymore. Such a complex could be built from very general categories endowed with some extra structure, which, in the case of symmetric groups, came essentially from embedding a small symmetric group in a larger one. That extra structure, a 2-representation of sl2, is the categorification of the notion of representation of the Lie algebra sl2(C) of 2 by 2 traceless complex matrices. Now, the crucial point is that the question about complexes for general 2-representations of sl2 can be reduced to the case of simple 2-representations, which are building bricks for general 2-representations. In that case, the problem can be solved by an easy explicit calculation. Note that this reduction method could not be applied in the framework of representations of symmetric groups, and the new framework was built in order to allow this reduction. In some sense, this illustrates a Grothendieck-type principle: In order to solve a problem, generalize it until it becomes trivial!

Higher representation theory studies categories endowed with an action of a given monoidal category. A key fact: There are interesting examples related to classical Lie structures, and these admit an interesting theory of 2-representations. For those examples, 2-representations can be tensored, and this operation should lead to interesting invariants of 4-dimensional manifolds. For example, this operation gives rise to Khovanov knot invariants, which are knot invariants categorifying the classical Jones polynomial. Basic constructions with 2-representations involve homological algebra (cohomology-type constructions) and homotopical algebra (homotopy-type constructions). These formula-free constructions give rise, once decategorifed, to complicated formulas from the world of quantum groups.

Great advances have been made in representation theory in the past 40 years through the

Academic Rankings of World Universities in Mathematics – 2015

World Rank	Institution	Country/ Region	Total Score
1	Princeton University		100.0
2	Stanford University		89.4
3	Harvard University		87.2
4	University of California Berkeley		82.6
5	Pierre and Marie Curie University - Paris 6		81.4
6	King Abdulaziz University		79.2
7	University of Oxford		72.1
8	**University of California Los Angeles**		**71.9**

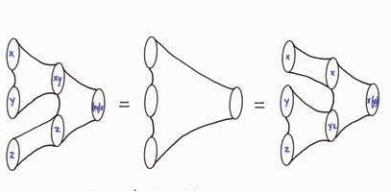
The UCLA Mathematics Department rose to **8th place** worldwide in the 2015 Shanghai rating of World Universities in Mathematics. UCLA continues to rank **5th** in the U.S. in mathematics.

use of geometrical methods. When a group acts on a geometrical object (a manifold, an algebraic variety), it acts on its cohomology, and this produces representations of the group. More generally, representations of various algebras have been constructed on cohomology from correspondences between varieties. This is now understood, in many cases, as coming from 2-representations on categories of sheaves. This has recast part of geometric representation theory as a construction of 2-representations. Furthermore, it has allowed us to obtain equivalences between categories of sheaves and categories of representations of other algebras as arising from different constructions of a given simple 2-representation. This eventually leads, via crystal or canonical bases methods combined with relative versions of Hodge theory, to combinatorial formulas for characters or dimensions of simple modules. The construction of 2-representations in those geometrical examples show that beyond the symmetries expressed by correspondences, another level of symmetries appear, related to a new type of Hecke algebras: quiver Hecke algebras. The geometrical objects arising in representation theory are moduli spaces. A typical example is that of projective spaces, which parametrize lines in a given vector space, or more generally, Grassmannians, which parametrize subspaces of a given dimension in a given vector space. Algebraic geometry is extraordinarily good at producing new objects out of given ones, as moduli spaces of sheaves or of subvarieties.

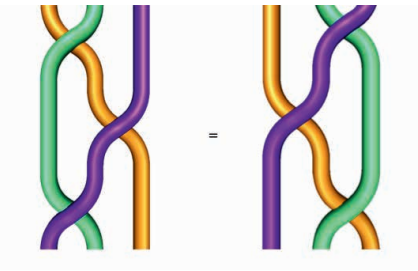
Such moduli spaces are extremely useful in geometry (they provide new invariants), in algebra and in number theory. Unfortunately, they tend to have bad properties and should often be studied in the more abstract homotopical setting of derived stacks. Algebra is much more rigid than geometry, and there are very few ways to construct interesting new structures from given ones. Higher representation theory is expected to partially fill that void and provide constructions of complicated categories from simple ones.

A current direction is the search for a homotopical setting for all invariants constructed via moduli spaces. One can also hope that 2-representation theory will be useful in number theory, in order to provide algebraic substitutes for geometrical objects that do exist for function fields, but not for number fields.

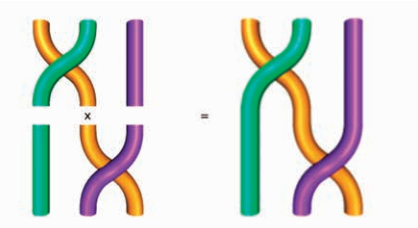
The study of representations and other mathematical objects has often required the study of relations between objects: This is embodied in the notion of category. Relations between categories (equivalences or more general functors) have turned out to best express some fundamental mathematical results – the Riemann-Hilbert correspondence relating topology and analysis is a striking example. The new emerging paradigm is that it is worthwhile to study not merely relations between categories, but relations between relations. Some new algebra arises then, expressing symmetries of higher order, and higher representation theory aims at organizing that information.



Associativity relation x(yz)=(xy)z



Equality of braids



Product of two braids by concatenation

Top 10 colleges for a major in math

Rank	Department
1.	Harvey Mudd College: Claremont, CA
2.	Colorado School of Mines: Golden, CO
3.	Massachusetts Institute of Technology: Cambridge, MA
4.	**University of California Los Angeles**
5.	Carnegie Mellon University: Pittsburg, PA
6.	University of Chicago: Chicago, IL
7.	Cornell University: Ithaca, NY
8.	Washington University in St. Louis: Saint Louis, MO
9.	University of Pennsylvania: Philadelphia, PA
10.	California Institute of Technology: Pasadena, CA

A *USA Today* article, featuring College Factual rankings, listed UCLA as #4 out of 10 top colleges for math.

USA TODAY

faculty news

Get to Know UCLA Math's Paige Greene

UCLA Assistant Adjunct Professor Paige Greene has been selected as one of three non-senate faculty members to receive the university-wide Distinguished Teaching Award. First established in 1961, the award has since expanded to include all senate and non-senate faculty members along with talented teaching assistants. In winning this award, Paige joins a very select group of UCLA's finest teachers "who bring respect and admiration to the scholarship of teaching."

What led to your decision to pursue mathematics?

Before my junior year in high school, I had a summer job with the Office of Economic Opportunity. My mother was the executive director of the Centreville Maryland office. She was responsible for many things, including setting up a school for adults to study for the GED exam. She could not find anyone who could teach the math part of the course, and so she hired me. It was magic to see the students learn with careful, patient teaching, and I found my calling with this experience.

Where did you attend college?

I attended the Community College of Baltimore County and then the University of Maryland in Baltimore County (UMBC). I worked part-time jobs in order to pay for my expenses. Even though I had grants, we did not have enough money to pay for everything. I am the fifth of nine children, and I was the first to go to college. After I transferred to UMBC, I started working for my community college as a teaching assistant in the math lab. In the evenings and on Saturdays, I supervised the self-paced arithmetic and algebra classes in the remedial math labs, which paid well with health benefits and tuition reimbursement. I felt rich! I have not ever done, or wanted to do, anything but teach.

What were your first experiences after college?

After I graduated from UCLA in 1983 with the MAT degree in mathematics, I taught at Santa Barbara City College for 12 years. Then I went to Switzerland for 10 years where I taught English as a second language, learned German, and did private tutoring in mathematics at the international school. That was a lot of fun. I was hired as a math lecturer at UCLA in 2007. I like working with first-year students a lot, and I know I am helpful during their transition from high school to university life.

Who were the teachers who inspired you?

I was greatly influenced by Carl Cuneo of the mathematics department at the Community College of Baltimore County. I studied calculus I, II and III with him. He was very involved with his students; his lectures were magical

— filled with funny stories, great illustrations, good advice — and he had an effective way to convey the subject clearly. I am Carl Cuneo when I teach.

How would you describe your teaching philosophy?

First, I believe that students are truly capable of learning mathematics, despite whatever perceptions they may have developed earlier. If they are taught well, they can and will learn. Second, I believe that the most effective way to convey the subject is to present it clearly, without any undue complexity but also without any oversimplification. What the students need and what they appreciate is minimal clutter and confusion and a lot of examples to supplement the discussion of general ideas. I believe that my students really need to know what I am teaching, and I never short-change them as to content. Mathematics developed historically from the consideration of specific problems, and this is still the most effective way to learn it. With the right step-by-step approach, even the most complicated things can be made comprehensible.

What interests do you pursue when you're not teaching?

I like my front yard! I spend a lot of time there. My yard is full of birdfeeders, and I participate in the Great Backyard Bird Count, launched in 1998 by the Cornell Lab of Ornithology and the National Audubon Society. I also consider my front yard to be a Monarch Watch Waystation, which are places for monarch butterflies to produce and sustain their migration. I have planted milkweed plants, the only host plant for the larvae. Without them, the monarchs would not be able to produce. I get a lot of peace and relaxation watching the birds and butterflies in my front yard. We have house finch and goldfinch; they like the sunflowers that I grow. The oak titmouse is a frequent visitor too. I see the monarchs lay their eggs and watch the caterpillars become chrysalis and emerge as butterflies. My house and yard are somewhat of a "tourist attraction." Neighbors bring their friends and visitors to see the birdhouses, flowers and butterflies. If you come by, you might see me in the front yard, preparing lectures, reading a book, or playing with my grandson.

Faculty News Highlights

Prizes, Awards, Fellowships, Honors & Service

- **Paul Balmer** received a Research Prize from the Humboldt Foundation.
- **Andrea Bertozzi** finished her first term as a Scientific Research Society Sigma Xi Distinguished Lecturer, awarded for outstanding individuals who are at the leading edge of science.
- The Simons Foundation named **Rowan Killip** a 2015 Simons Fellow.
- **Ciprian Manolescu** was featured in *Quanta Magazine* for his breakthrough research on the triangulation conjecture.
- **Donald Martin** was elected to the 2015 Class of the Fellows of the American Mathematical Society "for contributions to mathematical logic, especially proofs and applications of determinacy, as well as service to the profession."
- **Alexander Merkurjev** received the Department Distinguished Teaching Award for faculty.
- **Stan Osher** surpassed 75,000 combined publication citations. Very few scientists ever reach such a goal. Approximately one of Stan's papers gets cited every hour.
- **Lloyd S. Shapley's** article, "College Admissions and the Stability of Marriage," co-authored with UC Berkeley's David Gale and originally published in *The American Mathematical Monthly*, was selected for the collection, *The Best Writing on Mathematics: 2014*.
- **Terry Tao** was interviewed by Pulitzer Prize journalist Gareth Cook for *The New York Times Magazine* and made an appearance on "The Colbert Report."

faculty news

New Faculty

Artem Chernikov

Fall 2015

Artem works in model theory, a branch of mathematical logic with many applications in algebra and combinatorics. While his thesis focused on questions in pure model theory, he is now moving toward applications to combinatorics and topological dynamics. Artem grew up in Russia and received his bachelor's diploma in information systems and technologies from the St. Petersburg State University of Telecommunications. Subsequently changing his focus to mathematics, he earned a master's degree at the Berlin Mathematical School in 2009 and a doctorate at the Université Lyon 1 under the supervision of Itaï Ben Yaacov. He was awarded the 2013 Sacks Prize for the best thesis of the year in mathematical logic around the world. He completed a postdoc at the Hebrew University of Jerusalem (2012 – 2013), a semester at UC Berkeley's Mathematical Sciences Research Institute (2014), and most recently a postdoc at Université Paris Diderot - Paris 7.

Andrew Marks

Fall 2015

Andrew's area of research is mathematical logic, especially descriptive set theory and related areas. His doctoral thesis focused on calibrating the difficulty of classifying equivalence relations from computability theory by invariants, which led to the isolation of several combinatorial problems integral to this study. His more recent work has focused on other problems in descriptive graph combinatorics and applications to ergodic theory and probability. In 2012, he completed a PhD at UC Berkeley under the supervision of Ted Slaman and recently completed a postdoc at the California Institute of Technology.

Mike Hill

Fall 2015

Mike is an expert in algebraic topology with a particular focus on equivariant and chromatic homotopy theory. In 2009, with Doug Ravenel and Mike Hopkins, Mike solved the Kervaire invariant one problem, settling a long-standing problem with implications for homotopy theory and for geometry. This accomplishment resulted in an invitation to speak at the 2014 International Congress of Mathematicians. Mike received his PhD from MIT in 2006 under the direction of Mike Hopkins. Following postdocs at the University of Virginia and Harvard University, he returned to UVA as an associate professor. While there, he was awarded an Alfred P. Sloan Research Fellowship in 2011.

Georg Menz

Winter 2016

While Georg Menz has a versatile interest in analysis, PDE and statistics, with applications in finance, physics and material sciences, he focuses his research on equilibrium and non-equilibrium dynamics of spin systems, scaling limits, sampling of probability measures, and functional inequalities. He received his PhD in 2011 from the University of Bonn. In his PhD thesis he solved, together with his former advisor Felix Otto, an important conjecture on the log-Sobolev inequality for Kawasaki dynamics. Following graduation, he was a postdoc at the Max Planck Institute for Mathematics in the Sciences. In 2013, he moved to the U.S. as a Szegö Assistant Professor at Stanford University. Georg will join the Department's probability group in 2016.

In memoriam

A.V. Balakrishnan

1922 – 2015

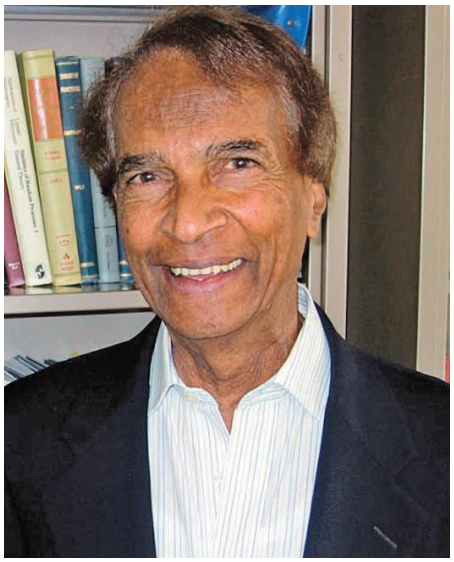
After a distinguished 50-year career as a UCLA faculty member, A.V. Balakrishnan (Bal) died March 17, 2015. He taught stochastic processes, linear systems and optimal control to thousands of students in engineering and mathematics, supervising 54 doctoral students.

Bal grew up in Chennai, India, earning both his bachelor's and master's degrees from the University of Madras. He earned an additional master's degree in electrical engineering in 1950, and his doctorate in mathematics in 1954, both from the University of Southern California. Following his PhD, Bal worked as a project engineer at the Radio Corporation of America (RCA), taught at USC and UCLA, and served as a researcher at Space Technology Laboratories.

Bal joined UCLA engineering in 1961 and earned a reputation as a teacher and scholar of the highest order. He has also maintained a joint appointment in math. He uniquely published single-authored papers, encouraging his students to publish their work under their own names. Twice he served as chair of the UCLA Department of Systems Science and for several years as the director of the Flight Systems Laboratory at UCLA, supported by NASA. Bal was named a Fellow of IEEE in 1966 and a Life Fellow in 1996. He received the NASA Public Service Medal in 1996; the Richard E. Bellman Award in 2001 from the American Automatic Control Council (AACC) for distinguished achievements in control theory; and the Distinguished Alumni Award in Academia from the USC Viterbi School of Engineering in 2004.

Bal will be missed by generations of engineering and mathematics students.

— Vijay K. Dhir, PhD
Dean of the University of California, Los Angeles Henry Samueli School of Engineering and Applied Science



Robert J. Blattner

1931 – 2015

The Department lost a distinguished member of its faculty with the passing of Robert J. Blattner on June 13, 2015. His brilliance and versatility made him a prominent part of our Department during his tenure. Those who came into contact with him will not forget him. Bob was one of the people my wife and I admired and were fond of. We met when I came to UCLA in 1965; he was among our first friends and remained so.

In addition to his academic contributions, Bob served the mathematics community with a strong sense of duty, both during and after his active career. His attitude towards life was one of great intensity and integrity. His personal activities included a love of classical music, leading him to take an active interest in the LA Opera and the LA Philharmonic.

Bob earned his AB from Harvard University in 1953 and his PhD from the University of Chicago in 1957. His thesis supervisor was Irving Segal, although his work subsequently was deeply influenced by the work of George Mackey (his undergraduate advisor at Harvard) on induced representations. Mackey extended the scope of Frobenius' theory of induced representations for finite groups, created in the late 19th century, to all locally compact separable groups. Mackey's work depended on detailed use of very subtle measure-theoretic arguments, and Bob reformulated and proved some of the main results of that theory in the smooth context and without any separability assumptions. Years later, in collaboration with his second wife, Susan Montgomery, Bob treated algebra actions as well as dualities for Hopf algebra modules, inspired partly by the work of Takesaki on dualities for von Neumann algebras. These works were actually among the forerunners of the theory of quantum groups and noncommutative geometry that emerged later.

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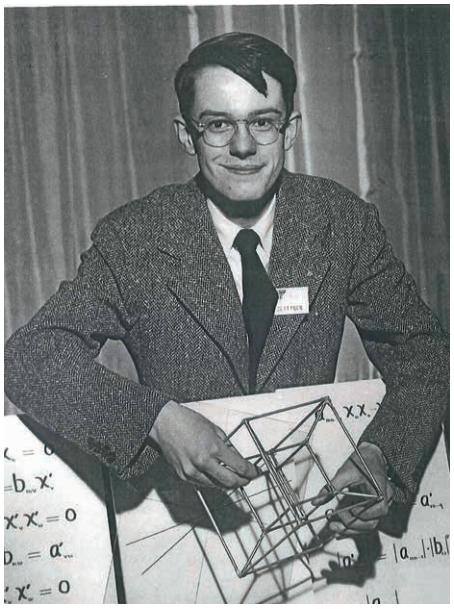

In memoriam

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Joseph Wolf, who was two years behind Bob in graduate school, remembers, "He was always willing to talk about mathematics and the world in general. I learned a lot from him then, and later. When Bob was at UCLA and I was at Berkeley, our discussions were more between equals, and we did some work together on geometric quantization."

Bob joined UCLA in 1957 and remained there until his retirement in 1992, serving as Department chair from 1981 to 1984. He had altogether six doctoral students who finished their dissertations under him. Masamichi Takesaki recalls, "The presence of Bob at UCLA gave me a tremendous sense of security throughout my career here. I studied his thesis and his subsequent work on the induced representations well before I came to the United States. He had a warm and charming personality. I was lucky that his office was not far from mine. We chatted on many, many occasions." In addition to his service to the Department, Bob was on the statewide UC Board of Admissions and Relations with Schools (BoARS) from 1990 to 1994, including serving as president. Following his retirement, Bob spent many years working for the UCLA Emeriti Center, on the board and as president. He received the Emeriti of the Year award in 2004.

Bob's work was mainly in the theory of representations of Lie groups and quantum mechanics, and his contributions earned him world-wide recognition. Within this framework his research was quite broad and spanned functional analysis, algebra, and problems of quantization. He was most widely known for a conjecture that he made, contained in the so-called Blattner formula, which suggested that a certain deep property of the discrete series of representations of a semi simple real Lie group was true. He made this conjecture in the mid-1960s. The discrete series, constructed by Harish-Chandra, which is basic to most central questions in harmonic analysis and arithmetic, was still very new and very difficult to penetrate. Bob's conjecture was later proved, and the solution was published in 1975 by Wilfried Schmid and Henryk Hecht using analytic methods, and later in 1979, by Thomas Enright, who used algebraic methods. Both proofs were quite deep, giving an indication of the insight that led Bob to this conjecture.

Bob was also interested in geometric quantization, which is essentially a way of doing quantum mechanics on manifolds and wrote several papers on the subject with J. H. Rawnsley and Joseph Wolf. As an indication of his breadth, I should mention that he was the supervisor of Mitch Rothstein (who is now a professor at the University of Georgia) and helped him write a thesis on the foundations of super manifolds.

His loss is mourned by many, but above all, by his wife Susan, his three sons, and his six grandchildren.

—V.S. Varadarajan
Distinguished Research Professor

Chen Chung (C.C.) Chang
1927 – 2014

A major figure in the field of mathematical logic, C.C. Chang died on July 17, 2014. Other than Alfred Horn, who came to UCLA before him as an analyst and did some beautiful work in logic, Chang was the first logician in the Department and founded our logic group. He was instrumental in arranging the appointment of Abraham Robinson in 1963, who only stayed at UCLA for three years but worked with Chang to establish a strong tradition of research in mathematical logic at UCLA.

C.C. earned a bachelor's degree in mathematics from Harvard in 1949 and a doctorate from the University of California Berkeley, in 1955, under the supervision of Alfred Tarski. He was one of a small group of extraordinary logicians put out by Tarski (between 1954 and 1964) who played a most significant role in laying the foundations of model theory and anchoring it at the center of research in mathematical logic. They included Robert Vaught, C.C. Chang, Solomon Feferman, Richard Montague, H. Jerome Keisler, Don Monk, Haim Gaifman and William Hanf. They truly left their mark on the field and its applications to mathematics.

He came to UCLA from the University of Southern California in 1958. Except for visiting positions — UC Berkeley in 1960 - 61, the Institute for Advanced Study in 1962 - 63 on an NSF Senior Postdoctoral Fellowship, and Oxford University in 1966-67 on a Fulbright Scholarship — he spent his entire career in the Department, retiring in 1990.

C.C. addressed many international meetings in logic, including the legendary Conference on Infinitistic Methods in Warsaw (1959). Other noted addresses include one to the annual meeting of the Association of Symbolic Logic in New Orleans (1969); three to the prestigious International Congress for Logic, Methodology and the Philosophy of Science (Stanford 1960, Jerusalem 1964, Amsterdam 1967); and two to AMS Summer Research Institutes (Cornell 1957 and UCLA 1967).

In his active years between graduate school and 1975, C.C. published two monographs jointly with H. Jerome Keisler and more than 35 research articles, some with collaborators, many of which made substantial contributions to logic. He supervised nine doctoral dissertations, including, most prominently, Dave Kueker's in 1967.

Perhaps his most influential work is the Chang-Keisler "textbook," *Model Theory*, first published in 1973. Some indication of its immediate acceptance as the bible of the field is the oft-quoted quip by a logician attending the 1974 International Congress of Mathematicians in Vancouver upon seeing a colleague at a neighboring clothes-optional beach "wearing nothing but Chang and Keisler." The book included a wealth of unpublished results and shaped permanently

the teaching of model theory. It is still extensively used today.

Chang's research in classical model theory has had a lasting impact on the field. His doctoral thesis, "Cardinal and Ordinal Factorization of Relation Types," was followed by several papers concerning such products. His many significant results in pure model theory include Chang's preservation theorem (which characterizes first order theories that are preserved under unions of chains), Chang's two-cardinal theorem (which concerns theories that admit pairs of distinct cardinals), and the Chang-Makkai theorem (concerning definability of predicates). He also proposed Chang's conjecture, a hypothesis about pairs of cardinals in model theory that has strong implications about large cardinals and has inspired much research by set theorists.

His seminal work on the foundations of many-valued logic led to two major current areas of research. First, this work spawned the monograph, *Continuous Model Theory*, by Chang and Keisler, that forms the basis for the currently active research on the model theory of structures that arise in analysis rather than algebra (such as Banach spaces and probability spaces). Second, he introduced the analogue of Boolean algebras for many-valued logic, called MV algebras, which has long been an active research subject. He also developed a form of axiomatic set theory based on many-valued logic.

C.C. made significant model-theoretic contributions to infinitary logic. One interesting idea of his was to look at the sets constructible using infinitary formulas. He also introduced an approach to the model theory of modal logic.

His work in infinite combinatorics in the early 1970s culminated in the solution of a problem on partitions for which Erdös offered a $250 prize. In celebration, he announced that he would use the prize money to buy himself a motorcycle.

For his substantial contributions to the field of logic, the mathematics community owes C.C. a great debt of gratitude.

We are grateful to H. Jerome Keisler for his brief description of Chang's research in paragraphs 7 – 10.

John "Ernie" Esser

1980 – 2015

UCLA math alumnus John "Ernie" Esser died Sunday, March 8, 2015, at a hospital in Reykjavik, Iceland, of complications from the flu and pneumonia, which he suffered on a flight home from Europe. His death was a huge loss for everyone who had the pleasure of knowing him. Throughout his life, Ernie dedicated himself to family, to mathematics, and to exuberant celebrations of life with his many friends and colleagues.

Ernie was born and grew up in Seattle, where his family still resides. Following graduation from the University of Washington in 2003 with degrees in mathematics, applied mathematics, and Italian — the native language of his mother — Ernie pursued doctoral studies at UCLA, focusing on optimization algorithms for convex minimization problems with applications in variational image processing. He made truly remarkable contributions. His thesis, "Primal Dual Algorithms for Convex Models and Applications to Image Restoration, Registration and Nonlocal Inpainting," is one of the most important and extensive surveys on non-smooth minimization algorithms. His groundbreaking work, "A General Framework for a Class of First Order Primal-Dual Algorithms for Convex Optimization" in *The Imaging Science Journal*, was one of the earliest publications on primal-dual iterative methods, and has led to a huge number of subsequent papers by other researchers around the world.

Tony Chan, Ernie's PhD advisor recollects, "Ernie was one of the most mature PhD students I have had at UCLA, not only in the technical sense, but also in the manner in which he approached research, his taste of problems, and the high quality standard he set for himself. He was very independent, which was fortunate because during his time as my student, I was mostly on leave at the National Science Foundation and could only return to UCLA for a few days every month. But during those visits, we had intense discussions, and he brought to our joint efforts, intelligence, knowledge, and insight."

Following his doctoral degree in 2010, Ernie was recruited by the University of California Irvine. There he was supported by the NSF PRISM (Proactive Recruitment in Introductory Science and Mathematics) Program, locally known as iCAMP. As part of the grant (joint with information and computer science), 20 undergraduate students attended a summer program of supervised research each year. Ernie's expertise and personality meshed perfectly with iCAMP. He was a leading expert in convex optimization and image processing applications, and his work inspired several subsequent projects and publications. In addition to research, Ernie's position involved advising undergraduate students about STEM research and careers. In this, he was equally original and creative. Thanks to his tireless efforts, two groups of iCAMP students published their works in *SIAM Undergraduate Research Online* (SIURO), and many other students gave presentations at regional and national conferences. Ernie's iCAMP colleague, postdoc Anna Konstorum, remembers, "Ernie was the best type of person to work with, incredibly intelligent and creative, but also kind, humble, and always ready to help. There was always a great collaborative energy, percolated with much humor, so that the many hours we spent on the projects with the students were truly fun and educational in the best possible way." While a postdoc at UC Irvine, Ernie also organized and played mid-fielder for the math department's Mathlete soccer team.

continued on page 10

In memoriam

continued from page 9

From 2013 until his tragic passing, Ernie worked as a postdoctoral fellow at the University of British Columbia's Seismic Laboratory for Imaging and Modelling (SLIM), where he continued to excel as a researcher. SLIM lab director Felix J. Herrmann recalled that Ernie "was a fantastic researcher working on a wide variety of problems ranging from full-waveform inversion to blind-deconvolution. He was an extremely enthusiastic and extremely talented researcher who was, above all, immensely generous with his time and ideas. We miss his talent and leadership tremendously."

Ernie's interest in boomerangs — he built his own — led to an annual lecture, "Why Boomerangs Come Back," at his alma mater, the University of Washington, during the annual Math Day Program. Last, but not least, Ernie was well-known for his home-made wine and mead. To honor his memory and love of biking, a group of friends organized the Ernie Esser Memorial Bike Ride on Memorial Day weekend, 2015, a 175-mile bike trip through San Francisco and Napa Valley. It provided an opportunity to celebrate Ernie's life, share stories and memories, and grieve together.

Ernie is survived by his parents Doug and Rita Esser, his brother Mike, and many, many friends.

Tributes to Ernie

Paul Jones: *"He had a motor that just wouldn't quit. He never got upset at losing … the guy you could count on for being up for a 20-mile hike or an impossible 130-mile winter bike ride through rain and sleet."*

Fred Park: *"He gave me valuable tips on writing that I still use to this day and influenced me to look deeper into mathematical problems. I'll miss many things – his funny t-shirts, his incredible espresso made to Italian standards in his office … I am truly grateful to have known Ernie and to be able to call him a friend."*

Jim Ralston: *"Ernie saved me from heat exhaustion (or worse) on a very hot day in the San Gabriels. We were on a fairly long hike, and I had not brought enough water. Ernie was carrying about two gallons.*

Xiaoqun Zhang: *"He was always full of new ideas, passionate about the beauty of mathematical modeling, theory and applications in imaging. He had a good heart, and was always willing to share and talk about his thoughts and his work selflessly. I treasure those moments when he stepped into my office ..."*

In memory of Ernie, the University of Washington Mathematics Department, along with generous funds from Ernie's family and friends, and Sub Salt Solution, have created the Ernie Esser Undergraduate Award.

Gifts to the fund will support undergraduate students who are assisting faculty with research. The University of Washington math department hopes to continue to grow the fund with further contributions from friends, peers, community, and others who share Ernie's passion for growing and enriching the mathematics community.

For more information about supporting the award, contact **Alexandra Haslam** *at alexeck3@uw.edu, 206.616.1989, or to make your gift online, please visit www.washington.edu/giving and search for "Ernie Esser Undergraduate Award."*

graduate news

Special Awards Ceremony

Honoring our Graduate Students

Every year the Department honors outstanding faculty and students. Here are this year's awards and recipients:

■ **Departmental Distinguished Teaching Award** (for faculty): Professor Alexander Merkurjev ■ **Departmental Distinguished Teaching Award** (for students): Kristen Hendricks, Keith Ouellette, George Schaffer, Alexander Azzam, David Clyde, Sudesh Kalyanswamy, Melissa Lynn ■ **Richard Arens Putnam Scholars Undergraduate Award**: Tudor Padurariu, Emre Girgin ■ **Horn-Moez Prize for Excellence in First-Year Graduate Studies:** Kevin Carlson, Stephen Miller ■ **Beckenbach & Dissertation Year Fellowship:** Andrew Soffer, Scoot Garrabrant, Casey Jao, Kaitlyn Hood ■ **Girsky Student Award:** Nicholas Cook, Joseph Woodworth ■ **Heaviside Wealth Management Award:** Christopher Scaduto ■ **Basil Gordon Prize:** Tudor Padurariu ■ **O'Neill Travel Stipend Award:** Yajing Liu, Ian Zemke

Math Student Awarded Charles E. and Sue K. Young Graduate Student Award

Math graduate student Jaclyn Lang, studying under Harudo Hida, has been awarded the 2014 – 2015 Charles E. and Sue K. Young Graduate Student Award. This honor is given by UCLA's College of Letters and Sciences to three graduate and three undergraduate students annually to acknowledge academic achievement, research, and service to the university and community. Jaclyn's work in number theory encompasses all of these qualities. She is specifically interested in generalizing the work of Ribet and Momose who determined the image of certain classical Galois representation in the 1970s and 1980s.

Jaclyn's academic honors include an NSF Graduate Research Fellowship in 2010, allowing her three years to focus on research without teaching responsibilities. She has been inducted into UCLA's chapter of the Edward A. Bouchet Graduate Honor Society, which recognizes outstanding scholarly achievement and promotes diversity and excellence in doctoral education and the professoriate.

Jaclyn devoted some of her graduate career to teaching, specifically as a teaching assistant for calculus 2, abstract algebra, and discrete math. In the fall of 2013, she became a teaching assistant consultant, helping to train new TAs in the Department. In this role, she instituted a diversity training day with a talk by Jenessa Shapiro, associate professor of management and organizations at UCLA's Anderson School of Management.

Jaclyn's participation in Department activities included a turn as president of the Graduate Student Organization (GSO) in 2014. GSO is dedicated to cultivating camaraderie and professional development by providing opportunities to socialize via social events and outings and to grow professionally through student-organized seminars. A weekly seminar enables students to give talks on mathematical topics of their choice. Jaclyn also co-founded the (unofficial) Women in Mathematics group as a way to facilitate connections and support for women in STEM fields.

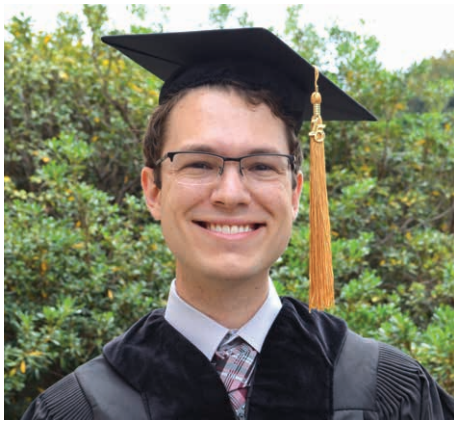
graduate news

2015 Graduate Students Take Flight

Ashay Burungale *to the University of Arizona and L'Université Paris 13*

Ashay developed his mathematical talent and interest during the eighth grade in his native India. The variety of challenging problems and the possibilities for solving them were revelations. Math contests, especially the Olympiads, played a key role in his academic growth. There he was exposed to elementary number theory; Diophantine equations mystified him. Hoping to get a better feel for equations, Ashay entered the Indian Statistical Institute Bangalore after high school where he began to understand math as an expanding landscape. Reading projects exposed him to topics in modern number theory, and further motivated, he decided on graduate school. At UCLA, Ashay studied with Haruzo Hida and Chandrashekhar Khare, who introduced him to the rich world of modular forms. Ashay came to appreciate Haruzo's comment that modular forms are like a black hole and began to study topics in the non-triviality of arithmetic invariants based on geometric aspects of modular forms. His investigations were an enriching experience with a few surprises along the way. In his upcoming postdoc positions in Arizona and France, he plans to further explore this black hole.

Damek Davis *to UCLA*



Damek Davis works in the field of mathematical optimization, solving problems with non-smooth calculus tools. Says Damek, "Calculus is like a magic wand that converts optimization problems (which have many parts) into equations that can be fed into a computer." During his doctoral program at UCLA, Damek created new ways of using multiple computers to better solve optimization problems. In his thesis, Damek split the parts of optimization problems across many computers in order to solve the problems faster; he also showed that there are fundamental limits to the speed that can be gained by apportioning the work this way. In recognition of his results, Damek was awarded the 2014 INFORMS Optimization Society Student Paper Prize for his paper, "Convergence Rate Analysis of Several Splitting Schemes." The prize-winning work analyzed the speed of several operator-splitting algorithms. He will continue his research at UCLA as a postdoctoral fellow, mentored by Wotao Yin and funded by the NSF Mathematical Sciences Postdoctoral Research Fellowship Program. Following this one-year postdoc, he will join the faculty of Cornell University's School of Operations Research and Information Engineering as an assistant professor.

Will Feldman *to the University of Chicago*

Will's interest in mathematics evolved through his love of physics; in order to take upper division physics courses in college, he had to learn more math. As a result, his interests shifted, and he began enrolling in as many math classes as he could fit into his schedule. Ben decided to pursue applied mathematics in his graduate studies as it encapsulated all of his favorite aspects of math and physics. At UCLA he became very interested in the analysis of partial differential equations after taking a course with Inwon Kim, who later became his advisor. His research in the areas of homogenization and free boundary problems reflect a combination of his interests: physical application, intuition, and deep connections within analysis and probability theory. While at UCLA, Will served the graduate student government as a member of the MPSC (Math and Physical Sciences Council) for four years. Ever curious, he is looking forward to taking some language classes during his postdoc at the University of Chicago.

Ben Krauss *to the University of British Colombia*

Growing up in Canada, Ben was (briefly) as interested in the humanities as he was in mathematics. The balance was permanently tipped with his first analysis course at Amherst College. Ben's early mathematical interests leaned toward the algebraic side, in particular, arithmetic dynamics. However, early into his first-year analysis course, taught by future adviser Terence Tao, he came across an ergodic-theoretic proof that almost every number, say between 0 and 1, will have an asymptotically equal number of zeros and ones in its binary expansion. The ability to study a number theory problem from an analytic/dynamical perspective drew Ben quickly to analysis. Several of his research projects reflect an interplay between number theory and ergodic theory. Ben also became interested in a wide range of topics in harmonic analysis, and a major theme of his research has been the interplay between harmonic analysis and pointwise ergodic theory. Ben is returning to his native Vancouver as a University of British Columbia-PIMS Distinguished Postdoctoral Fellow under the mentorship of Izabella Laba. He is very happy to be teaching at the same university as his parents.

Ekaterina Merkurjev *to the University of California San Diego*

During her childhood in Russia, Ekaterina's parents, who both had math backgrounds, gave her and her twin sister extra lessons and organized contests to further stimulate their budding interest. Following high school, Ekaterina attended UCLA as an undergrad with a focus on applied math. She seized the opportunity to participate in UCLA's REU (Research Experience for Undergraduates) and IPAM's RIPS (Research in Industrial Projects for Students) summer programs. Further inspired, Ekaterina elected to pursue doctoral studies in applied mathematics at UCLA under Andrea Bertozzi, with whom she has already established a strong working relationship. In her dissertation, Ekaterina worked on variational and PDE-based methods for machine learning, data analysis, and image processing using a graphical framework. Applications of the work include classification of high-dimensional data, image segmentation and image inpainting. She is very grateful to the UCLA applied math division for support and camaraderie throughout her academic career and is looking forward to attending the University of California San Diego as a UC President's Postdoctoral Scholar.

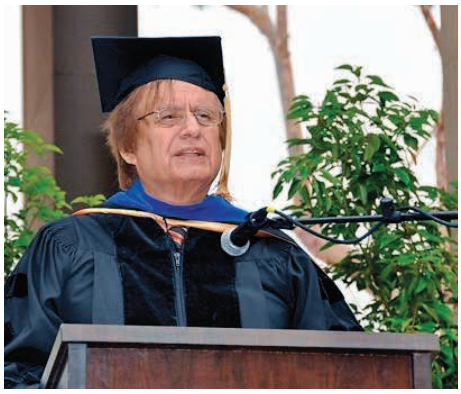
Brent Nelson *to the University of California Berkeley*

With a high school mathematics teacher as grandfather and coach, Brent excelled in the subject as a youngster, but it wasn't until middle school that he began to stand out as a nascent mathematician. Brent chose the University of Illinois at Urbana-Champaign for his undergraduate work, majoring in math with a minor in physics, and graduating in three years. Brent took several graduate level courses there and discovered his love for analysis. At UCLA, he took a course with Jim Ralston that sealed his decision to pursue functional analysis. He focused on von Neumann algebras, in particular, Type III or non-tracial von Neumann algebras, with his advisor, Dima Shlyakhtenko. Says Brent, "My interest was well timed because I was able to prove a non-tracial analogue of a result of Dima's on 'free transport,' itself a non-commutative analogue of transport from probability theory." Brent received an NSF Mathematical Sciences Postdoctoral Research Fellowship and is excited to be headed to the University of California Berkeley.

Chris Scaduto *to Brandeis University*

As a result of his mentored high school math experience, Chris went to college knowing he wanted be a mathematician. At Columbia University, he enjoyed courses in analysis, number theory and algebra, but was most captivated by topology and geometry. From his inspiring and encouraging instructor, Chiu-Chu Melissa Liu, he learned differential geometry and complex algebraic curves. Having established an appetite for low-dimensional topology, Chris headed to UCLA for his doctorate, working with Ciprian Manolescu. The study of Simon Donaldson's book, *Floer Homology Groups in Yang-Mills Theory*, under Ciprian's guidance, was a key part of his development. Soon after, Chris began research on a problem related to combinatorial constructions in knot theory to Yang-Mills instanton theory, an area of mathematical physics. Funded by the NSF Mathematical Sciences Postdoctoral Research Program, Chris begins a postdoctoral position at Brandeis University in Boston, working with Danny Ruberman, an expert in gauge theory and its applications to low-dimensional topology.

undergraduate news



UCLA Math Welcomes Back Alumnus Richard A. Tapia

This year's commencement ceremony featured keynote speaker and UCLA math alumnus, Richard A. Tapia, an international scholar in computational and mathematical sciences and a national leader in education and outreach. He was a 2010 awardee of the National Medal of Science, the highest honor bestowed by the United States government on scientists and engineers. More recently, he was awarded the 2014 National Science Foundation prestigious Vannevar Bush Award. Richard was also the first Hispanic elected to the National Academy of Engineering. Two professional conferences have been named in his honor, recognizing his contributions to diversity: Richard Tapia Celebration of Diversity in Computing Conference and the Blackwell-Tapia Conference. To view his commencement address, please visit: https://www.math.ucla.edu/news/2015-ucla-commencement-keynote-speaker-address.

Awards for Outstanding Undergraduate Achievement

Daus Prize – Yunbai Cao; Yudong Qiu

Sherwood Prize – Tudor Padurariu

Outstanding Actuarial Science Student Award – Qianwen Bai

Girsky Student Award – Nine undergraduate students each received a $2,500 award toward their summer research projects.

Undergraduate Star to MIT

Tudor Padurariu has distinguished himself as an accomplished scholar throughout his years at UCLA, resulting in acceptance to doctoral programs at all the top universities in the U.S. He has chosen to attend MIT, where he plans to study algebraic geometry.

Prior to his undergraduate career in the Department, Tudor was already prominent as a math Olympiad in his native Romania, earning two bronze medals and one silver medal in 2009, 2010 and 2011, respectively. Sorin Popa (Department chair from 2009 – 2012) saw the potential for Tudor to do great things at UCLA and recruited him in the fall of 2010 as a recipient of the Department's Math Undergraduate Merit Scholarship (MUMS). Says Sorin, "We had a lot of exceptional applicants, but Tudor stood out as a clear front-runner; the members of the selection committee all placed him at the top of the list."

Says Tudor about his UCLA experience, "One of the great advantages was the ability to choose all of the classes I wanted to take and skip the material I had learned in high school. After taking classes in most of the foundational subjects in my first two years, I focused on algebraic geometry and related topics. Another advantage was the possibility to take as many individual reading classes as I pleased, an opportunity I used in my last two years to learn more algebraic geometry and representation theory."

His talent and hard work on the Putnam exam contributed to UCLA's higher standing in the competition. His performances earned him two honorable mentions (in 2011 and 2014, when he ranked in the top 40 students in North America) and one special prize (in 2012 when he ranked 11th overall) from the Putnam committee.

Over the past four years, math faculty who worked closely with Tudor have heralded him on numerous occasions. In addition to meeting his undergraduate course requirements, Tudor signed up for graduate level classes and learned a great deal on his own time. He took one of Ciprian's advanced graduate courses on gauge theory and wrote a final paper on its connections to algebraic geometry.

Beginning in his junior year, Tudor did research on algebraic geometry and representation theory with Burt Totaro and Raphaël Rouquier. The resulting paper, "Groups of order p^3 are mixed Tate," has been submitted for publication. According to Burt, "Tudor already knew a lot of graduate level math, and he was eager to start doing research. In just a few months, he answered the open question I asked him. I'm proud of him, and I'm looking forward to reading his future work." Tudor described his experience studying with Burt and Raphael as "eye-opening," a glimpse into "what a real mathematician's life is really like." He is sure that his time with the faculty will facilitate his transition to graduate school. His impressive scholarship has earned him the Richard Arens Putnam Scholar Award, the Basil Gordon Prize, and the Sherwood Prize.

UCLA Putnam Team Ranks 10th

The UCLA Putnam team (Tudor Padurariu, Peihao Sun and Dillon Zhi) was ranked first among U.S. public universities and 10th overall. A total of 431 institutions competed. Individually, Tudor Padurariu was ranked 30th in North America, receiving an honorable mention. Other high scorers from UCLA were Emre Girgin, Peihao Sun, Iris Cong, Ufuk Kanat, Dillon Zhi, Man Cheung Tsui, and Yue Zhou. A total of 29 UCLA students participated in the 2014 competition.

math education

Curtis Center Awarded $1.4 Million Contract

A collaborative writing team of K-12 math experts, including Chris Anderson and Jim Ralston (UCLA), Fields Medalist David Mumford (Harvard & Brown), and Roger Howe (Yale), will manage the writing of the "long answer" portion of the end-of-year mathematics exam given to 3rd – 11th graders in 20 U.S. states. This portion of the exam aims to assess student ability to engage in mathematical modeling and justification.

Online Map of Common Core State Standards for Mathematics

http://curtiscenter.math.ucla.edu/math-teachers/math-resoce-mapper

Initially created as part of a Gates Foundation Grant, this online map was further developed by the Curtis Center as a resource for over 94 countries. Educators can click on any standard and see a list of curated resources (lesson plans, problem sets, articles) from reliable sources on the topic.

UCLA Logic Center Summer School for Undergraduates

With primary support from NSF, the 2015 summer school series enrolled 16 students from universities around the world. The intensive courses are designed to assume little, if any, prior experience with logic, yet reach highly advanced, graduate level material within three weeks. The goal is to introduce future mathematicians to central results and techniques of mathematical logic. Courses this year covered the Goedel completeness and incompleteness theorems, and determinacy.

Ongoing Professional Development

To strengthen the mathematics knowledge of K-12 teachers, the Curtis Center hosted:

- three summer institutes
- three Saturday workshops
- individualized training to 10+ local school districts
- 9th annual Curtis Center Annual Math and Teaching Conference

Introducing Caline Smith

The Curtis Center welcomes UCLA math alumna Caline Smith as professional development director, overseeing the Saturday math workshops, summer institutes, and the Center's math education work with local school districts.

Los Angeles Math Circle

An enrichment program for elementary to high school students

This year's activities culminated in the Math Festival for 7th –10th graders, organized jointly by the Math Circle and the Center for Talented Youths at Johns Hopkins University. Over 150 students attended, taking part in breakout sessions on topics from cryptography to the mathematics of moviemaking.

Benchmarks:

- **220 students** enrolled in the Math Circle for the 2014 – 2015 school year.
- **24 students** were national and state winners in the Math Kangaroo International Competition in Mathematics, which attracts 21,000 students nationwide.
- **8 middle school students** received $1,000 MathMovesU scholarships from Raytheon.
- High school freshman **Megan Joshi**, one of 230 students in the country to qualify for the USA Junior Math Olympiad, was selected to participate in the Mathematical Olympiad Summer Program.

ipam

IPAM commemorated its 15th anniversary with a celebratory event featuring three speakers whose careers were significantly influenced by their involvement in IPAM programs: Roja Bandari (Twitter), Raanan Schul (SUNY Stony Brook), and Maryam Fazel (University of Washington). IPAM's anniversary also marked renewal of a major, long-standing NSF grant for another five years (2015 – 2020). This award is nontrivial as not all of the NSF institutes were renewed.

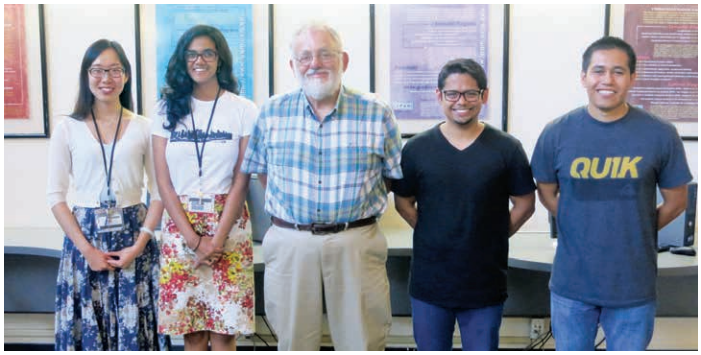
Another special event from 2014 – 2015, Latina/os in the Mathematical Sciences Conference (or lat@math for short), featured talks by Stanford Professor of Genetics Carlos Bustamante, University of Washington President Ana Mari Cauce, and actor Edward James Olmos. In addition to the talks, the conference hosted panel discussions on career development and opportunities and organized special activities for high school students.

IPAM's 2015 – 2016 academic year includes two long programs. The fall 2015 program, Mathematical Approaches for Traffic Flow Management, is particularly relevant to Los Angeles. It features lectures and workshops on traffic modeling, predictions, and management. The one-day event marks the initiation of the I-210 Pilot Project led by Caltrans with assistance from LA Metro and California Partners for Advanced Transportation Technology (PATH) at UC Berkeley. The project is part of the Connected Corridors Program, a multi-agency project to address the state's many transportation challenges.

The spring 2016 program, Culture Analytics, brings together leading scholars in the social sciences and humanities with their counterparts in applied mathematics, engineering, and computer science. The event addresses opportunities that are emerging in the cultural information space – an exploration of the range of possible values and meanings under given rules and circumstances within cultural paradigms. The program includes a series of public lectures by Ingrid Daubechies (Duke University) as part of IPAM's Green Family Lecture Series.

(L to R) Al Hales, Juan Meza, Russ Caflish, and Steve Ashby.

(L to R) Mark Green, Joel Tropp, Tim Tangherlini and Lieven Vandenberghe



Cleve Moler with four RIPS students

Russ Caflish and Mike Raugh

alumni news

Geotagging Tweets

Geospatially-indexed Twitter data is valuable for several emerging research directions. However, when only publicly visible data can be accessed, researchers quickly find that social media users rarely publish their locations. While working for HRL (Hughes Research Laboratories), UCLA math alumnus Ryan Compton, along with David Jurgens and David Allen, developed a method to geolocate the overwhelming majority of active Twitter users, independent of their location sharing preferences.

Ryan reports, "We inferred unknown locations of Twitter users by examining the locations of their friends. Then we framed the geotagging problem as an optimization over a social network with a total variation-based objective and solved it at scale. Our final results contained home locations for 101 million Twitter users at a median error of 6.38 km. This allowed us to geotag 30.6 billion public tweets. By comparison, GPS-based geolocation can only provide locations for 12 million users and 584 million tweets."

Career Week 2015

In collaboration with the UCLA Career Center, the Department showcased math alumni careers through a panel that included Elizabeth Corral (commercial product manager at UPC Insurance), Nima Shayeg (analyst for PIMCO), Ivelina Yorgova (senior underwriter for American International Group), Jeff Patterson (founder and owner of Gaggle), and Jason Sorger (director of strategy and product for digital networks at Sony Pictures Television).

Participating in a panel is a great way to give back to the Department and highlight math for today's UCLA students. If you are interested in participating on our 2016 alumni panel, contact Anna Ramos at anna@math.ucla.edu.

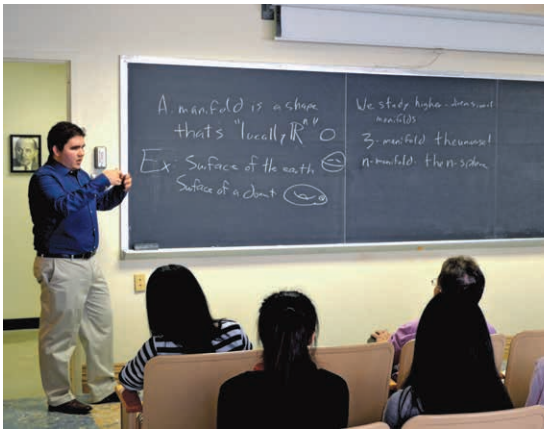
If you have news to share with the Department, please contact Anna Ramos at anna@math.ucla.edu .

And the Oscar goes to ...

UCLA math alumnus Ron Fedkiw (left) won an Academy Award for developing software that helped "Hollywood's bad guys destroy things." Known as PhysBAM Destruction System, the software was one of the earliest toolsets capable of depicting large-scale destruction with a high degree of design control. Ron earned his doctorate in applied math under Stan Osher and served as PhD advisor to Joey Teran. He is now a professor of computer science at Stanford University.

Math Alumni & Friends Mixer

The Department's second Alumni & Friends Mixer included a presentation by current grad student Stephen Miller. Held during Alumni Weekend, the event provides a stimulating but casual venue for chats and reunions among UCLA math students, friends and alumni. Be on the lookout for more activities throughout the year!



our donors

Why We Donate

Terry and I support UCLA, UC Irvine and UCLA's Department of Mathematics because we want to assist these institutions in their missions of growing human knowledge and training the next generation of leaders.

We both studied undergraduate math, and this education profoundly shaped the way we approach the world and think about problems. And these aren't just math or science problems. Our careers have been spent in finance and banking where many decisions are made with imperfect information and can often rely on forecasts, with large error margins, of future events.

While many branches of mathematics, such as statistics and game theory, provide models to help analyze these situations, we've found its most beneficial contribution may be the logical framework it can provide decision-makers. Even in the face of imperfect information and seeming randomness, a structured and logical framework is invaluable for making sound decisions and deciding how to alter course once more is known. We've also seen the benefit of mathematical thinking in tackling complex business issues by providing tools to dissect large and complex challenges into smaller, more manageable components.

Drawing on these logical principles has been important to our contributions at work, in the community and even at home, and we're happy to support leaders such as UCLA in the development, enrichment and teaching of this critical discipline. We believe it's important to not only build the mathematics knowledge base through original research but also to teach future practitioners, educators, and of course, mathematicians in the theory and application of these concepts.

Steve and Terry Godfrey have two teenage children and live in Palo Alto, CA. Terry is a member of the Palo Alto Unified School District Board of Education and provides financial consulting to non-profit entities and initiatives. Steve is Head of foreign exchange ecommerce at Wells Fargo.

We are pleased to thank and acknowledge our many supporters.

Gifts made after June 30, 2015, will appear in our fall 2016 newsletter. This listing does not include payments made on existing pledges.

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The Simons Foundation

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Dear Friends, Colleagues, Students, and Alumni:

It is a great privilege to assume the position of Department chair this fall. Having been a professor here (a pure mathematician, a number theorist) since 2000, I have had the pleasure of getting to know the faculty and staff and have always been impressed by their high level of mutual support and cooperation. This is especially true given their varied specialties, backgrounds and goals.

I step into some very large shoes. The outgoing chair, Dimitri Shlyakhtenko, has been supremely effective. I will not attempt to list all of his accomplishments, but I would like to mention just a few. His leadership was characterized by a high level of communication and responsiveness to the faculty's diverse and sometimes conflicting concerns, and he worked with great success within the university, modernizing and streamlining administrative procedures and promoting Departmental priorities. Dima was always analyzing problems and looking for ways to make improvements; he was not one to fall into complacency. As a result, our Department has continued to excel on multiple fronts. I will rely heavily on his experience and expertise as well as that of other previous chairs as I learn the ropes.

My goal is to maintain our upward trajectory as the Department fulfills its many roles in teaching, research, community service, and academic leadership. We must continue to recruit the best faculty in order to meet our obligations. I also want to increase our responsiveness and willingness to the evolving needs of those in other fields in which mathematics is an intrinsic component. I feel strongly that in addition to contributing to students' general education, we must serve students in all of the sciences that are dependent on mathematics. It is critical to have an open dialogue with the faculty of affiliated departments and with university administration about how this can be best accomplished. It is also crucial that we remain responsive to the challenge of promoting inclusion by educating and mentoring students of all backgrounds.

I look forward to my term as Department chair and hope you enjoy the latest issue of *The Common Denominator*.

Sincerely,

Sincerely,

William Duke

UCLA Department of Mathematics
Fall 2015 Newsletter

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