MATHEMATICS + BERKELEY

Fall 2025

IN THIS ISSUE

Letter from the Chair

Chair Martin Olsson (PhD, Berkeley, 2001) has been a member of the math faculty since 2006. His research is in algebraic geometry. He became Chair in Fall 2023.

Dear Friends of Berkeley Math,

I am pleased to share with you this latest edition of our annual newsletter. This is an extraordinary time for higher education, UC Berkeley, and the department, and you are likely familiar with all the challenges we currently face. I am pleased to report, however, that even with all the challenges mathematics at Berkeley is thriving both in terms of our research as well as our teaching. It is a daily pleasure to be part of our research mission and to interact with our many terrific students.

This past year we were delighted to welcome two new faculty, Amir Mohammadi and Ko-Woon Ohm, to our department. Amir and Ko-Woon joined us from UC San Diego. You can read more about their work on page 3. We are also currently recruiting to fill several more faculty positions with the aim of growing our faculty numbers.

Our current faculty continue to conduct world-leading research. This is reflected in our rankings in various forums and the recognitions our faculty receive. Please see page 5 for some of the awards honoring faculty from this past year.

Our graduate students and postdocs also continue to thrive. I want to especially highlight the 21 students who completed their PhD this past year (see page 9) and the 34 new students who joined our PhD program (see picture on back cover). One of my highest priorities during these uncertain times is to support these early-career mathematicians as they navigate a changing academic landscape. Our PhD students have great success both in academia and industry. I call your attention, in particular, to the piece about Professor San Ling on page 6-7

Interest in mathematics remains at record levels among our undergraduates. We currently have about 1200 math majors split across pure and applied math and many thousands of enrollments in our classes. Our undergraduates have quite varied interests pursuing later careers in a wide range of areas. We are constantly working to meet the demand at the undergraduate level including developing new courses and refining existing ones, and providing research opportunities for our students, which are highly sought after.

Looking ahead, one of the big challenges for the Department is finding a new home. Evans Hall has served us very well, but is seismically very poor and it has been known for some time that it needs to be demolished. Some departments housed in Evans are already moving out this year, but a concrete plan for a new building for math remains to be put in place, and it is a very high fundraising priority for the campus.

I want to take this opportunity to thank our amazing staff who support our department with skill and amazing dedication. Simply put, our research and teaching mission would not be possible without their work.

I also want to thank the Friends of Berkeley Math whose support is crucial for our continued success. These are very difficult times financially and every contribution to the department, no matter the size, contributes directly to our work. Thank you!

The great non-orientable white whale, Möbius Dick. This group of math PhD students won office priority in the 2025 MGSA Mathoween costume contest. Pictured left to right: John Nolan (sailor 1), Carlos Esparza (sailor 2), Yasna Aminaei (pirate), Brian Morris (Starbuck), Grace Zdeblick (Ahab), Olivine Silier (Moby Dick).

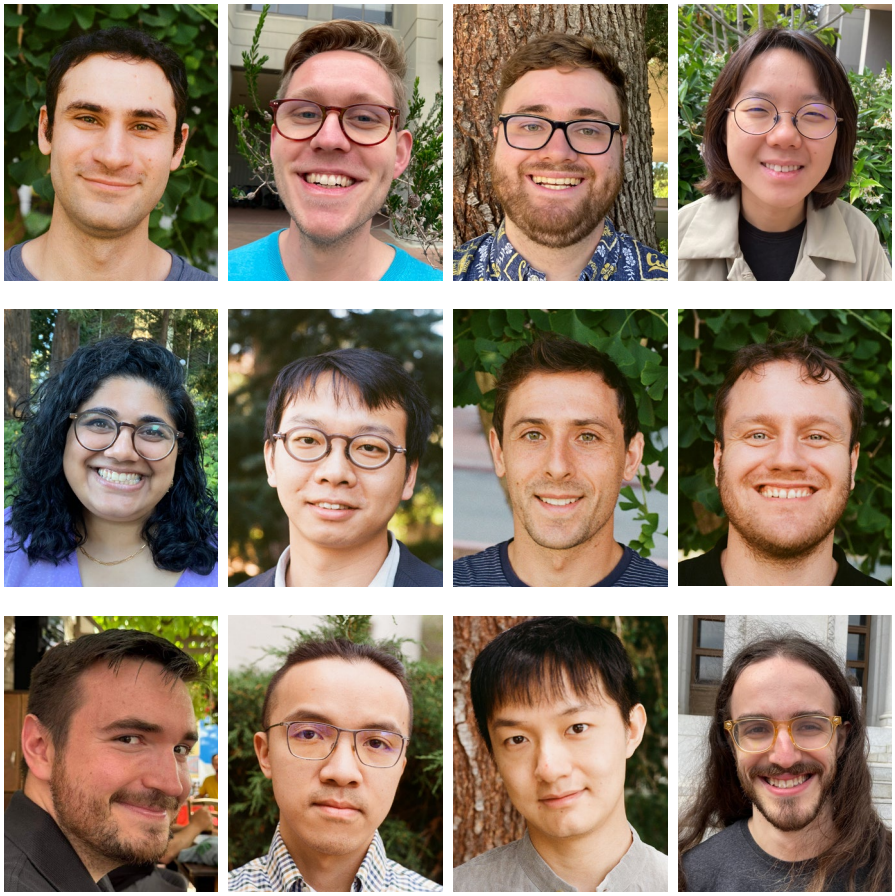




Department leadership: Fraydoun Rezakhanlou (Equity Advisor), Jon Wilkening (Vice-Chair for Faculty Affairs), Richard Bamler (Vice-Chair for Undergraduate Affairs), Sylvie Corteel (Vice-Chair for Faculty Advancement), Thomas Scanlon (Vice-Chair for Graduate Affairs)

New Morrey Visiting Assistant Professors and Postdocs *(pictured right)*

Adam Black (NSF Postdoc), PhD Yale 2024. Mathematical Analysis & Probability.
Felix Brandt, PhD TU Darmstadt 2024. Mathematical Analysis & Applied Mathematics.
Ethan N. Epperly (Miller Research Fellow), PhD Caltech 2025. Applied Mathematics & Probability.
Yuhan Jiang (Morrey), PhD Harvard University 2025. Algebra, Combinatorics.
Siddhi Krishna (President's Postdoctoral Fellow), PhD Boston College 2020. Geometry & Topology.
Xianzhe Li (Morrey), PhD CIM, Nankai University 2025. Mathematical Analysis & Probability.
Greg Parker (NSF Postdoc), PhD MIT 2022. Geometry & Topology.
Stefan Reppen, PhD Stockholm University 2024. Algebra & Geometry/Topology.
Ryan Unger (Miller Fellow and NSF Postdoc), PhD Princeton University 2024. Mathematical Analysis & Geometry/Topology.
Kai Xu (Morrey), PhD Duke University 2025. Geometry/Topology & Mathematical Analysis.
Yilun Yang, PhD Max Planck Institute of Quantum Optics 2025. Applied Mathematics.
Avi Zeff (RTG Postdoc), PhD Columbia 2025. Algebra.



New Faculty

Amir Mohammadi joined the department in fall 2025. He earned his PhD from Yale University in 2009 and, after a postdoctoral position at the University of Chicago, he held faculty positions at UT Austin and UC San Diego before coming to Berkeley. His research lies at the interface of dynamical systems and ergodic theory, number theory, and geometry. His recognitions include a Sloan Research Fellowship, the 2024 Brin Prize in Dynamical Systems, and an invitation to speak at the 2022 ICM.

Ko Woon Ohm joined the faculty as an Assistant Teaching Professor in Fall 2025. She earned her PhD from the University of Iowa in 2010, and after postdoctoral positions at MSRI and ETH Zürich, she held teaching positions at UT Austin and UC San Diego. Her research interests are in PDE and Fourier Analysis. In recent years, she has been actively involved in pedagogical initiatives aimed at addressing learning gaps arising from the Covid-19 pandemic, including work on an AI-FAST Challenge project. Outside of academia, Ko enjoys music-especially singing in choirs. She also likes playing card games with family and friends and trying out many diverse ethnic restaurants around Berkeley.

In Memoriam

John W. Addison (1930-2025) got his Ph.D. in 1955 at UW-Madison under the direction of Stephen Kleene, and after stints at Cornell, IAS, and the University of Michigan, joined the Berkeley mathematics department in 1962. His work includes the Kondo-Addison theorem (1958) and the First Periodicity Theorem (1967, joint with Y. Moschovakis), foundational results in effective descriptive set theory and its connections to the determinacy of infinite games that help shape the field today. Addison served as chair of the Mathematics Department in 1968-72, leading a growth that built out the department's strength across major mathematical fields, and again in 1985-89. He was chair of the Logic and Methodology Group in 1981-84, and instrumental then in establishing the Tarski fund and Tarski lecture series. He chaired the committee overseeing them for decades. John retired in 1994, but continued to chair the Tarski committee and Logic Colloquium committee long after that.

John had 13 students, and as of today, 163 descendants. Berkeley logicians remember fondly his many contributions to their social life, including the logic treasure hunts at his house, the Tarski dinners he officiated in his inimitable style, and his bi-weekly, after-colloquium invitation to join him at the Logic Tea, "in the Alfred Tarski room, on the Northwest corner of the 7th floor".

Faculty Profile: Franziska Weber on Numerical Analysis and Nonlinear PDEs

Avi Rosenzweig, Science Communications Manager, MPS Division

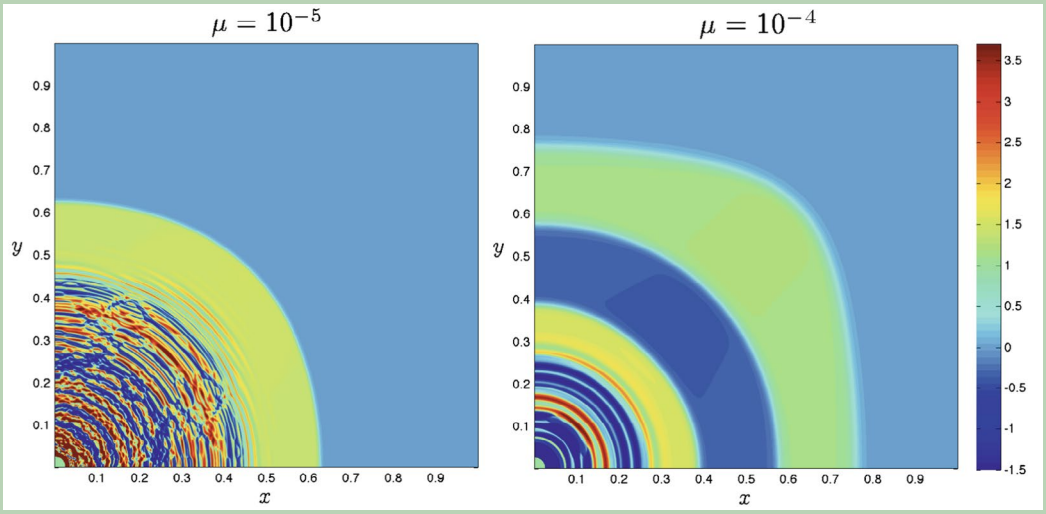
"Count me among the applied mathematicians," says Franziska Weber. "I want to use mathematics to understand an application better, or improve outcomes, or make quantitative predictions." Even functional analysis, which seems very abstract, helps evaluate the models or algorithms scientists use when working on construction problems. Her specialty is numerical analysis of nonlinear partial differential equations (PDE) in complex fluids. Is it hopeless to get that across to civilians? Not at all. Read on.

Weber joined Berkeley Mathematics in 2022, after short stints at Carnegie Mellon and University of Maryland. She likes the rigor of math, in contrast to the intuition that many physicists seem to follow. "Perhaps it takes me longer, using formal language, to get a description right, but the quantitative predictions benefit." Mathematicians want to start with axioms as a foundation and build systematically from there, while physicists will see the same methods as tools for describing and predicting real-world situations. One side looks ahead to the destination and figures out how to get there, while the other carefully proceeds step by step getting every move right. Practical decisions often involve complex calculations where many of the variables involved have not been pinned down. Weber brings up old oil fields. Is it worth trying to squeeze more oil out of used wells, or will you just pull out watery dregs? To figure this out, you need to know about the porousness of the ground, the properties of the oil and water that is left down there, how they all interact, and how well the recovery methods perform using different recipes under different situations. Is that too many unknowns? Not if you're handy with nonlinear PDEs.

Prof. Franziska Weber

Every flower in the field and bird in the sky matters. Some. Taking a good guess at how many of each there are is much easier than actually counting them. The estimates won't be exact, but they could be good enough to decide if there's enough duck salad to feed the wedding party. Recall the Butterfly Effect: speakers bring it up when they want to show that tiny actions can have giant effects, but it also illustrates how every contribution makes some difference. Include the wings flapping in your modeling, and the edges and wind speeds of the future tornado will be a little better defined. Nonlinear PDEs are tools for making good guesses when there are plenty of unknowns. Apply numerical analysis as Professor Weber does, and you can see which guesses are indeed good ones and which ones not so much. For problems like old oil wells, we can actually double-check the scores by comparing what comes out of the ground with what the models predict should come out of the ground, and adjust the models accordingly. Analysis makes guessing better.

This kind of explanation will get you some distance in many physical science situations. Simplify the real-world conditions without becoming too simplistic, and you can come up with useful models. STEM people love a quote from statistician George Box: "All models are wrong, some are useful." Fair enough, but one person's clarification is another's oversimplification. Mathematicians may read the PDE description above and object that it doesn't convey how various variables vary in different ways, nor how complex dynamic fluid behavior becomes, nor how systematically the samples are selected, etc. But if a general reader now understands that PDEs are mathematical tools for situations that have a lot of unknowns, that is at least a good



A visualization of the 'quarter five-spot problem,' a standard model for water flooding in oil reservoirs. Water injected at the bottom-left (0,0) displaces oil toward a production well at (1,1). The panels illustrate how varying the parameter μ shifts the flow from chaotic, complex instability to a smooth, stable wavefront.

(continued) start. Is reducing an oil field to a bunch of nonlinear partial differential equations so much different?

Switzerland, where Weber was raised, employs an educational policy that puts sixteen-year-olds into vocational apprenticeships or on a college track. Teenager Franziska "wanted to work in a zoo, but I was good at school, and didn't like the prep for zoo work, so I eventually signed up for college. Environmental science starts with biology, and those intro courses just repeated what I had already learned. Computer science wanted to recruit more girls, so I checked it out and found that I loved the computer nerds and the math puzzles. So maybe bioinformatics? I had to pick a Bachelor's degree major first, though, so math it was." She liked it well enough to go on to "cold and dark" Norway for a PhD, and then to Maryland for a postdoc. A PDE textbook by Berkeley mathematician Craig Evans inspired Weber's interest in them. She was fascinated by the physics, and drawn to the descriptive power of the math. Fluid dynamics is especially well-suited for one who likes visualizations.

Professor Weber knows that many people are put off by math. Do you care about tsunamis? counters Franziska. The work she does in numerical analysis can help determine whether a model for tsunamis spreading out from an undersea earthquake is accurate. Math can validate a model, or see that it isn't working, before your apartment floods. A well-made model never lies.

Life is turbulent and uncertain, but don't be daunted. Franziska Weber is contributing to the work of fixing a small part using numerical analysis to improve models, getting a better handle on its ups and downs. She won't repair it all, but she can point proudly to times when her efforts make things clearer. After all, it really is hard to make anything simpler.

Faculty Honors

Ian Agol was elected to the American Academy of Arts and Sciences

Mina Aganagic, Richard Bamler, Edward Frenkel, Patrick Lutz, David Nadler, and Yunqing Tang received the 2025 Frontiers of Science Award

Tony Feng was a 2025 Sloan Fellow

Alberto Grünbaum received the IOP (Institute of Physics, England) Distinguished Scientist Award

Olga Holtz received a UC Multicampus Research Program Award

Svetlana Jitomirskaya was the JMM 2025 Colloquium lecturer

Lin Lin, David Nadler, Sung-Jin Oh, Yunqing Tang, and Ruixiang Zhang are 2026 International Congress of Mathematicians (ICM) speakers

Rohil Prasad won the 2024 Brin Prize for Young Mathematicians

Nicolai Reshetikhin received the Chinese Government's Friendship Award

Kenneth Ribet received the 2025 Leroy P. Steele Prize for Seminal Contribution to Research

Sug-Woo Shin received the 2025 Samsung Ho-Am Prize and was named a 2026 Fellow of the AMS

Yunqing Tang was awarded the 2026 AMS Frank Nelson Cole Prize in Number Theory

Maciej Zworski was awarded the 2026 Joseph L. Doob Prize

Graduate Student Honors

The 2024–25 Herb Alexander Prize for outstanding dissertations in pure mathematics was awarded to Ovidiu-Neculai Avadanei and Zhongkai Tao.

The 2024–25 Bernard Friedman Memorial Prize in Applied Mathematics was awarded to Ahmad Abassi, Zhen Huang, and Yulong (Lewis) Pan.

Jeremy Taylor received the Kenneth Ribet & Lisa Goldberg Award in Algebra.

The Nikki Kose Memorial Teaching Prize was awarded to Dun Tang.

Emma Boniface, Ethan Ebbighausen, Will Fisher, Jonathan Guo, Joseph Hlavinka, Theo Keller, Lukas Krause, Wanzhou Lei, Galen Liang, Jacob Parish, Tejas Rao, Sterling Saint Rain, Olivine Silier, Luke Triplett, and Jason Zhao received 2024–25 Outstanding Graduate Student Instructor Awards.

Undergraduate Student Honors

Asher Cohen received the 2024–25 University Medal (awarded to UC Berkeley's most distinguished graduating senior).

The 2024–25 Departmental Citation (Valedictorian) was awarded to Benjamin Eisley.

The 2024–25 Paul Chernoff Memorial Prize in Mathematics was awarded to Benjamin Eisley.

Jad Damaj, Vihaan Dheer, Nir Elber, Kishan Jani, Aren Martinian, Ishaan Patkar, Carl Sun, Harry Wang, Jianzhi Wang, and Henry Zeng received the Dorothea Klumpke Roberts Prize in Mathematics.

Aditya Baireddy, Michelle Dong, Andrew Huang, Joshua Jones, Aditya Ramabadran, Shreyas Ramamurthy, and Justin Wu received the Percy Lionel Davis Award for Excellence in Scholarship in Mathematics.

Student Group: Berkeley Math Tournament at Cal Day 2025 (Photo: Vicky Lee)

From Evans Hall to National Service: Professor San Ling (PhD '90) Wins Haas International Award

The UC Berkeley Math Department is proud to announce that one of its own, Professor San Ling (PhD '90), has been named the 2025 recipient of the prestigious Elise and Walter A. Haas International Award. The award honors an international alum with a distinguished record of service to their home country, a description that perfectly describes Professor Ling's multifaceted career. He has served as Deputy President and Provost of Nanyang Technological University (NTU), Singapore, and as Chief Scientific Advisor for Singapore's National Research Foundation.

Though his work now blends high-level academic administration with national science policy, he still identifies as a mathematician at heart. He jokes that his former advisor, Professor Ken Ribet, might disagree: "I don't think Ken regards me as a pure mathematician anymore." But he is quick to add that the lines between fields are "artificial". "There's a lot of value in actually not splitting things too fine".

It's a perspective he has cultivated over a remarkable journey that began, in earnest, right here in Evans Hall.

The "Half Hearted" Journey to Berkeley

In the mid-1980s, San Ling was a top student at Cambridge, finishing his undergraduate degree, and was "quite bent on just staying on". But a mentor in Singapore, the logician C.T. Chong, intervened.

"He wrote a very long letter to me," Ling recalls, "and he said, 'You spent three years in Cambridge. That's enough. Go to the U.S. and see the rest of the world'". This was before the internet, so Chong's letter was incredibly detailed, listing the top 10 U.S. departments and the number theorists at each. "For Berkeley, he listed, I think, Ken Ribet and Robert Coleman".

Even after Berkeley made an offer, Ling was "still half hearted". His mentor's response was firm. "He basically stood his feet and said, 'Look, OK, stop being half hearted, just go. That's a very good offer'".

Arriving at Berkeley was "an eye opener". "I think one of the most interesting recollections is really the realization of how brilliant people can be," he says. He recounts meeting a young Korean woman in his entering class of 60 students who seemed "extremely intense" about math. "To my amazement, I found out that her undergrad was in French literature," he says. "She had only taken a few math classes in a community college... But she was just very intense".

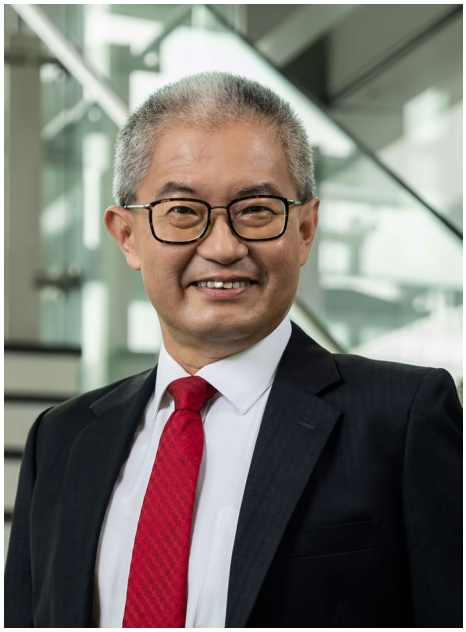
That semester, Ling—who had already taken many advanced classes at Cambridge—audited Math 250A. The woman with the French literature degree, however, enrolled. "And she topped the class," Ling says, still amazed. "It was an eye opener for me. How brilliant people could be".

His time at Berkeley provided another lesson, this one in adapting to the unexpected. At the end of his second year, just as he was ready to start his dissertation, his advisor, Professor Ken Ribet, "dropped a bombshell".

"He said he was going to Paris for his sabbatical for a year". In the pre-internet, pre-Zoom era, this was a crisis. "I said, 'Yeah, then what am I supposed to do?' And he said, 'Well, we would write letters'". Knowing a three-week mail delay each way wasn't feasible, Ling made a decision: "I think I need to go to Paris with you".

There was just one condition. "You can come to Paris," Ribet told him, "but on one condition: that you speak enough French to take some classes and be able to manage your day to day life".

"I was so motivated," Ling laughs. "I dropped everything, no math for that summer, 10 weeks, just French... at the end of the 10 weeks, I think I managed enough French to check the box". The semester in Paris, attending lectures at the Collège de France, became "one of those unintended outcomes, but something tremendously useful for the rest of my life".



A Pivot from Pure Math

After graduating from Berkeley in 1990, Ling returned to Singapore and began his career in "hardcore arithmetic geometry, Galois representations". But he soon faced an intellectual isolation familiar to many researchers.

"We were all very young and working in very different areas," he says of the number theory group at the National University of Singapore (NUS). "It was extremely difficult to have intellectual discussion". His only option was traveling overseas every summer.

"As the years went by, I started to realize that I was actually falling further and further behind how fast the field was moving internationally," he admits with striking candor. "That being a very difficult and deep field, I realized that there will come a point when I will probably become totally irrelevant".

This coincided with a new opportunity. He began talking with computer science colleagues working on error-correcting codes and cryptography. "I realized that it would be interesting to see if... my mathematical tools could be used".

He was soon asked to help teach an undergraduate course in error-correcting codes. "For the first time, I learned that topic properly myself," he says. "And after that semester, I realized that, OK, I think this is a new area for me". After a

sabbatical, he "moved on wholeheartedly into the new areas".

His research became focused on designing new coding schemes for data integrity. He explains the core mathematical problem beautifully:

"In mathematical terms... you can think of the space in which all the data would live as just an enormous vector space over a finite field," he says. "There is a dimension and then there is this notion of a distance... the smallest number of coordinates where two distinct vectors differ".

The challenge, he explains, is a "tension" between three key parameters. You want low cost, which means a small *length* and *dimension*. But you want high performance, which means a large *distance* (for correcting more errors). "For any given length and dimension, you cannot increase the distance in an arbitrary manner," he says. It is not merely that the limit is finite; it is governed by nontrivial bounds.

"So what interests me is to find ways to design new codes that come as close to these known bounds as possible".

Prof. Ken Ribet and Dr. San Ling, UC Berkeley, 1990

For Ling, this pivot was not a departure from mathematics but an expression of it. "That is the beautiful part," he says, "just bringing this amazingly brilliant math into some useful things".

The Accidental Administrator

The shift to applied research was the first major "accident" of his career. The second, which would come to define the "service" honored by the Haas Award, was his move into administration.

In 2004, he was happily working as Deputy Head of Mathematics at NUS. But NTU, then primarily an engineering school, had decided to become a comprehensive university and build a new School of Physical and Mathematical Sciences from scratch. His former dean, who was recruited to lead the new school, approached Ling with a "very interesting proposition": would he come and found the new math department?

The timeline was "compressed". The first students were set to matriculate in July 2005, less than a year away.

"I essentially decided that, OK, if I were to continue my life in the National University of Singapore, the impact I would have would probably be, well, a few more papers," he reflects. "But if I were to take up this challenge... if it is done right, the impact will be very different". "Not everyone gets a chance of a lifetime to set up a math department".

He took the leap. This role eventually led to others: Dean, Provost, and even a two-year post as Chief Scientific Advisor at Singapore's National Research Foundation (NRF).

"I had planned for none of these career moves," he says. But the motivation was the same: "If there is something I can do to make a difference that is not purely academic, but nonetheless has a lasting impact—why not?".

He found his Berkeley training "very, very logical in our thinking"—was a tremendous asset. Importantly, he served as a crucial advocate for mathematical culture in a multidisciplinary environment.

"Very often... colleagues who publish 10, 15 papers a year... they don't understand our culture," he explains. "When it comes to review committees, people look at it and say, 'Come on, these mathematicians, they need to work much harder'".

"Having a mathematician in a leadership role like that has helped to educate some people," he says. "It gave me the opportunity to explain to people that not all disciplines are like yours".

The First Love

Now on sabbatical, Professor Ling is enjoying a return to his "first love," research, and is aiming to "do a bit of catch up on post-quantum crypto".

Looking back, he offers powerful advice for Berkeley's current PhD students. He admits he regrets not embracing the breadth of his Berkeley education at the time. "I already knew what I wanted to do," he says. "But if I were to do it again now, I would actually embrace a lot of these non-algebra courses... You don't really know when that perspective or even tools in some other field might actually become very useful".

For students who see his career and want to emulate it, his advice is clear.

"I would advise them to make sure, first and foremost, that they excel in the bread and butter of a faculty's job. In other words, research and teaching".

But after that, "Keep an open mind," he urges. "If you keep an open mind and see impact in a broader perspective, sure, if it turns out to be the right thing".

From his unexpected journey to Evans Hall to his pivot into error-correcting codes and cryptography, and his "accidental" career building one of Asia's top science schools, Professor San Ling has embodied that broad perspective. His career of service is a testament to the Berkeley values of excellence and impact, and the department warmly congratulates him on this well-deserved honor.

Our 2026 ICM Speakers: Five Invited Talks

The International Congress of Mathematicians (ICM) will convene in Philadelphia in July 2026. With five members of our department speaking at this prestigious event, we asked them to provide brief reports on their talks.

Lin Lin: The advent of error-corrected quantum computers is anticipated to usher in a new era of computing. At its core, quantum computing explores whether certain computational tasks can be performed efficiently through the multiplication of unitary matrices. Quantum signal processing is such an example: it asks whether certain classes of polynomials can be represented by a sequence of SU(2) matrices, and this leads to one of the most significant quantum algorithms developed in the past decade. My ICM lecture, "Mathematical and numerical analysis of quantum signal processing," surveys recent advances in this fascinating area and its connections to mathematical ideas both old and new. I am grateful to the ICM for the opportunity to share this work.

David Nadler: My talk, joint with David Ben-Zvi of UT Austin, is about our work in representation theory with Germán Stefanich of Max Plank in Bonn (and a former Berkeley PhD student). In the 20th century, representation theory received impetus from quantum mechanics: phase spaces with symmetry lead to representations on vector spaces of states. Now in the 21st century, we would like to apply these ideas to two-dimensional quantum field theories: here phase spaces with symmetry should lead to representations on categories, or other higher structures, organizing boundary conditions. Our work uses the technology of sheaf theory, a now ubiquitous tool that connects local and global phenomena, to make sense of these notions, and arrives at a new conjectural Fourier transform relating such representations for dual groups. In thinking about this direction, and preparing the talk, I have been struck by how many recent Berkeley PhD students, including Ben Gammage of Toronto, Joel Kamnitzer of McGill, Nick Proudfoot of Oregon, Jeremy Taylor of UCLA, Ben Webster of Waterloo, and Harold Williams of USC, have made key contributions to the subject.

Sung-Jin Oh: Wave phenomena are ubiquitous in nature; they are described by nonlinear hyperbolic partial differential equations. My ICM talk, "Long-term behavior of linear and nonlinear waves," surveys recent progress in understanding the long-term behavior of their solutions, emphasizing robust physical space techniques. These methods are well-suited for problems with variable coefficients and nonlinearities, such as waves on black hole spacetimes or interacting with solitons. The talk highlights a general method (with J. Luk) for determining "late-time tails" for waves in odd spatial dimensions, which plays an important role in the bigger program of understanding singularities inside black holes (the Strong Cosmic Censorship conjecture). This work also revealed new phenomena in nonstationary and nonlinear cases that went beyond the standard physical conjecture, Price's law. Finally, the talk introduces a new physical space method (with F. Pasqualotto and N. Tang) for the long-term asymptotics of Klein-Gordon equations in three spatial dimensions. This method yields new global nonlinear stability results with precise asymptotics and is hoped to aid in studying the stability of solitons in relativistic field theories with mass.

Yunqing Tang: There is a long history of studying power series that have both nice arithmetic properties (the coefficients are integers or rational numbers with controlled denominators) and nice analytic properties (they have analytic continuations to large domains). For instance, Dwork generalized Borel's rationality criterion on power series and proved the rationality of zeta functions of varieties over finite fields. Later, the work of André, Bost, Charles and many others generalized the rationality criterion of Dwork and deduced many applications in the arithmetic of differential equations and elliptic curves. The joint ICM talk by Frank Calegari, Vesselin Dimitrov, and myself, "Holonomy bounds and Diophantine approximation", will discuss our arithmetic holonomicity theorems, which includes a generalization and refinement of the above-mentioned work, as well as several threads of applications, including new applications to effective Diophantine approximation. Our original motivation for the arithmetic holonomicity theorem includes our earlier work on the unbounded denominators conjecture, as well as on our new irrationality results based on a method first used by Apéry to prove the irrationality of $\zeta(3)$. We are grateful to the opportunity to share our work at the ICM.

Ruixiang Zhang: Waves are ubiquitous in our daily life, modeled by dispersive equations such as the wave equation and the Schrödinger equation. The free versions of these equations are very amenable to Fourier analysis, which is the main field I work in. Despite their simple appearance, a basic question—how large can a solution of a free dispersive equation be, and where can it be large?—is surprisingly subtle and only partly understood, especially in higher dimensions. This question is fundamental and also useful in solving nonlinear equations, and has nice connections to nearby areas such as number theory, geometry and combinatorics. Over decades, it transpired that in order to answer this question, one often needs to understand whether and how much the solution can concentrate on important subsets of $\mathbf{R}^n$. In my ICM lecture, I will discuss three kinds of such subsets (convex sets, semialgebraic sets and lattices) and their importance based on some problems I have experience with.

Congratulations to our 2025 Graduating MAs and PhDs!

Ahmad Alkadri "A Quantum Algorithm for the Finite Element Method" under Lin Lin

Ovidiu-Neculai Avadanei "On Gallery Waves in Free Boundary Problems and Low Regularity Well-posedness for Quasilinear Dispersive Equations" under Professor Daniel Tataru

Diego Bejarano "Definability and Scott rank in Separable Metric Structures" under Thomas Scanlon

Alois Cerbu "Compressed Sensing and Optimal Control of Musical Signals" under Ian Agol and Carmine Cella

Fei Yu Chen "On Coconnective Coalgebras" under David Nadler

Yifan Chen "On Calabi-Yau metrics of Calabi type" under Song Sun

Ahmee Christensen "Semantic Studies of Modal and Intuitionistic Modal Logics" under Wes Holliday

Adam Dhillon "Integrable Highest Weight Representations of Non-Symmetrizable Kac-Moody Superalgebras of Finite Growth" under Vera Serganova

Matthew Duvalier "Definibilitas Minimaximi" under Ted Slaman

David Gonzalez "Countable Structures, Isomorphism, and Complexity" under Antonio Montalban

Siqi Huang "Applications of Group Actions in Coloring Problems and Wallpaper Groups" under Richard Borcherds

Tegan Lakshmanan under Jon Wilkening

Catherine Lee "A Verlinde Formula for Families of Curves" under Constantin Teleman

Mingyang Li "Gravitational instantons with conformally Kähler geometry" under Song Sun

Yixuan Li "Geometric Interpretation of Donkin's Tensor Product Theorem" under David Nadler

Yixiang Luo "Advances in Multiple Testing and Variable Selection" under William Fithian and Steven Evans

Mark Macerato "The derived Satake category of a real reductive group" under David Nadler

Rikhav Shah "Hermitian Eigenproblems and Regularization of Nonnormal Eigenproblems" under Nikhil Srivastava

Dun Tang "Ancestor-Descendant correspondence and $g=1$ permutation-equivariant quantum K-theory for symplectic target spaces" under Alexander Givental

Zhongkai Tao "Scattering resonances in hyperbolic dynamical systems" under Maciej Zworski

Jeremy Taylor "Universal monodromic Hecke categories" under David Nadler

Edric Wang "Functional inequalities and the Central Limit Theorem" under Steven Evans and Thomas Courtade

Jiasu Wang "Mathematical Aspects of Quantum Signal Processing" under Lin Lin

Tianrui Xu "Enhancing Auction Market Design through Stochastic Bilevel Control: A Proposal for Fees and Rebates" under Steven Evans and Thibaut Mastrolia

Department of Mathematics Commencement, May 2025 (Photo: Vicky Lee)

My Journey to Belonging in the Math Department

Third-year math major and department Peer Advisor, Nicholas Ballesteros, writes about their experiences as a Latine student in the math department, navigating underrepresentation, and the active search for community and belonging.

Latine/Chicane students make up about 21% of the university's undergraduate population, but in the math department it feels we are nearly negligible. Many of my Latine math major friends have switched majors, or dropped out of the university entirely. Going to a Latine identity club's event and meeting a fellow math major always came as a surprise. I am not sure what I expected when I started at Berkeley, but looking around at a class of five hundred students, and seeing only a handful of people that looked like me was not it. When I started taking upper division classes, it became normal to be the only Latino in the room. That constant underrepresentation has made it easy to question whether I am in a space where I truly belong. I am certain that I am not the only student of an underrepresented background in math that feels this way. It can be incredibly difficult to find community when you feel so set apart from your peers. Since my first semester here I have been grappling with what it means to feel like I truly belong in this department. I have learned that for me being confident in my mathematical abilities is something completely distinct from answering the deeper and more complex question of what it truly means to belong in math.

Last semester I took a Chicano Studies course, and I had a wonderful experience. It was the first time, in a classroom setting, that I felt surrounded by so many people who looked like me and felt like me. Our discussion sections made me feel like I am not the only one navigating a system that is often alienating. Seeing yourself in your instructors, in your department's staff, in the students around you, changes the way that you participate in the space. The course not only gave me a deeper understanding of my own cultural identity, but also reminded me that our presence in academia matters. I felt like progress was truly something that I held in my own hands. My academic journey, while a personal journey, is not just about me, it is also about being a part of something bigger, something that can really bring about change. My presence is a push for greater representation, equity, and belonging in spaces where we have been historically overlooked.

Latines are experiencing an incredible upsurge in college attendance. I believe that being visible and vocal about our experiences is an important way to not only find each other, but also to pave a way for future Latine scholars. I hope to one day be a role model for those who come after me, for those who feel like they do not always belong. I hope that Berkeley's imminent Hispanic Serving Institution status coincides with a feeling of belonging for all Latines across the vast assemblage of departments at this university. However, if we do not look out for each other then who will? As historically underrepresented minorities at an institution like Berkeley the future is in our hands.

Math major Nicholas Ballesteros

Finding community has been one of the most important parts of my journey at Berkeley. Finding community is not just something that happens, it is an active process that we partake in. It requires intentionality, vulnerability, and the courage to reach out, especially when you feel isolated. It means showing up to meetings, starting conversations, and building networks of support with people who understand the particular challenges that we face. These networks have sustained me throughout my time here, especially in moments where feelings of alienation felt overwhelming.

It is not always easy to feel like we belong in the spaces that we occupy, but it is always important to remember that we are here and we deserve to be here. Mathematics is a better, stronger, more creative space because it includes every single one of us. So go find your community. Take a class about your cultural identity. Go find the spaces where you feel at home, or create them if they do not exist yet. Work to turn this place into the institution you wish it was. Turn it into a place where you feel supported. Pave the way for those who will follow. Belonging isn't always something that finds you, sometimes we have to search for it. I hope that we can all find a way to feel at home in this department.

Building Community: Resources for Support & Belonging

Math Peer Advisors Peer Advisors (like Nicholas!) are current majors available to provide friendly, peer-to-peer guidance on how to thrive in the department. They offer a first point of contact for advice on course selection, study strategies, and navigating university resources to ensure students feel supported in their major.

MPS Scholars Designed to help students from all backgrounds thrive, MPS Scholars offers structured mentoring from faculty, alumni, and peers to build influential networks. The program provides funded research experiences, career development, and social events specifically aimed at increasing students' sense of belonging in the sciences.

Berkeley Connect in Mathematics This program pairs undergraduates with graduate student mentors to foster a close-knit intellectual community within the large university setting. Through small-group discussions and one-on-one advising (with no exams or homework!), students build meaningful connections with peers and mentors who share their passion for math.

Staff News

Brian Underwood, Department Manager

As we bring 2025 to a close, it is important to recognize the exceptional dedication and professionalism demonstrated by every member of the department's staff. This past year has presented many unforeseen challenges which required our staff to balance compassion and care in their daily work while also supporting one another and maintaining their own personal well-being.

We have been extremely fortunate to experience little turnover during the past year. Brandon Eltiste, Information Systems Manager, left in November after eight years in our department. We are extremely grateful for the assistance of Cecilia Coca who has stepped in as Interim-Information Systems Manager. Her support and leadership have been exceptional.

This year we were excited to celebrate several remarkable UC Berkeley service milestones: Jacqueline Frias, Math Diagnostic Testing Project Site Coordinator, celebrated 10 years of service in 2024. In 2025, Thomas Brown, Lead Undergraduate Advisor, and Emiliano Gomez, Math Diagnostic Testing Project Site Director, celebrated 25 years of service.

Additionally, several members of our highly talented staff were nominated by students, faculty and peers within our Math Community this year to receive SPOT Awards for individual contributions taking place during the 2024-25 academic year. This year's SPOT awardees include Arryanna Mendoza, Brandon Eltiste, Christian Natividad, Clay Calder, Kathryn Mills, Loryn Briscoe, Marsha Snow, Stephen Hernandez, Thomas Brown, Vicky Lee, and Zhanara Gallegos.

Staff members Jacqueline Frias, Thomas Brown, and Emiliano Gomez

Uniquely positioned to interact with nearly every member of the Mathematics community at UC Berkeley, our staff take tremendous pride in celebrating the accomplishments and fostering the success of each person in our department while continuing to approach every new challenge with the same kindness, understanding, and diligence that define their work. Looking to 2026, we are deeply grateful for the commitment, resilience, and passion of our staff as they support every member of our academic community at each step of their journey.

New Math Scholarship Named for Marco Troper

Every year since 1999, math undergraduates have gathered for the Serge Lang Undergraduate Lecture. This year, Professor Federico Ardila-Mantilla from San Francisco State University gave a lecture entitled, "Inequalities for trees and matroids." Ardila-Mantilla is a Colombian-American mathematician, educator, DJ, and musician. He has received the NSF CAREER Award and the Simons Fellowship for his research, the MAA National Haimo Award for his teaching, and the AMS "Mathematics Programs that Make a Difference" Award for his service. He is also known for his work to increase access to mathematics education and for making the experience of math both meaningful and fun.

Following the lecture, Chair Martin Olsson announced the creation of a new scholarship in honor of Marco Troper, "Today we are excited to announce the establishment of the Marco Troper Undergraduate Scholarship, which will be awarded to an incoming freshman with an intended major in Math or Applied Math. Marco Troper entered Cal as a freshman in 2023, and unfortunately left us too soon, passing away in 2024. His parents and extended family created the Marco Troper math scholarship in his memory. Marco was a mathematician. He was part of our mathematical community. Like so many of us here, mathematics was Marco's passion, much more than just a subject in school. Marco will be remembered for his enthusiastic and inquisitive mind, and the joy of his interactions with fellow students, professors, and family members - I understand especially his grandfather Stanley."

The scholarship that carries Marco's name will be part of the university's Regents' and Chancellor's Scholarship program, which provides support for the most promising incoming students to do their best work at Berkeley. Olsson concluded, "We are proud that Marco chose to attend Berkeley and take part in our mathematics program. We are honored to celebrate his life through the awarding of this scholarship to outstanding mathematics students in perpetuity."

Marco Troper outside the UC Berkeley Letters & Sciences Advising Office

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FALL 2025 NEWSLETTER

Entering class of graduate students 2025 (Photo: Clay Calder)

A Note on Strategic Priorities

The Department of Mathematics is working hard to maintain its excellence in all aspects of research and education and to bridge the resource gap that separates us from our better-funded peers. For this we continue to rely on donations from alumni and friends of the department. Here are some of the department's current top priorities:

- Graduate Student Fellowships are needed to enable the department to make competitive, attractive offers to the very strongest applicants to our graduate program, who are often being lured by our private peers with offers of higher stipends and lower teaching loads.
- Endowed Faculty Chairs and Endowed Postdocs are needed in order to improve the department's ability to make competitive offers for the recruitment and retention of world-class faculty and postdocs.
- Research Visitor Funds make it easier to invite high-profile visitors to come to Berkeley to deliver lectures in our department or collaborate with our faculty. These intellectual exchanges are of tremendous value to our research and education.

Besides these specific goals, we welcome gifts to the department's discretionary fund, which give the Chair of the department much-needed flexibility in funding graduate student recruitment, parts of the faculty recruitment process, research travel for graduate students, and many other initiatives that make our program competitive and rewarding. Undergraduate Research Fellowships are needed to enable undergraduate students to participate in summer research groups with faculty, postdocs, and graduate students.

We invite you to join us in keeping UC Berkeley Mathematics strong through your gifts to the department. All donations, large or small, are greatly valued. You may choose whether to direct your gift toward a specific goal of your choice or to have your donation used for our most pressing needs at the department's discretion.

For further information, please contact the Mathematical & Physical Sciences Division, email: mpsgiving@berkeley.edu or Department of Mathematics Chair Prof. Martin Olsson, e-mail: chair@math.berkeley.edu.

Newsletter Contributors: *Editors:* Martin Olsson and Per-Olof Persson. Thanks to Melanie VandenBerghe, Vicky Lee, and Brian Underwood. *Photography:* George Bergman, Vicky Lee. Cover: Per-Olof Persson.

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The Department of Mathematics wishes to thank all alumni, parents, students, faculty, staff and friends who support the department.

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