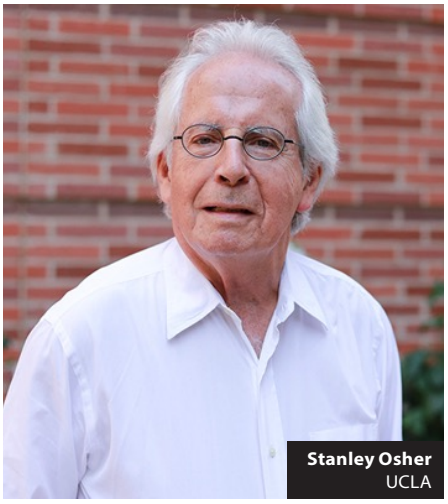
institute for pure & applied mathematics

Fall 2025

MATHMatters

OUTGOING DIRECTOR OF SPECIAL PROJECTS, STANLEY OSHER REFLECTS ON 25 YEARS AS PART OF "FANTASTIC" ENVIRONMENT



Stanley Osher
UCLA

Stanley Osher has spent nearly 50 years on the UCLA Department of Mathematics faculty — more than half of them as director of special projects for the Institute of Pure and Applied Mathematics (IPAM). Having such a prominent figure in that position for the past quarter-century has been a boon for IPAM and its ability to attract top minds from academia, government, and industry to its workshops and programs.

And yet, for all of his achievements, as Osher reflects on his time as an IPAM director, he is quick to point out that his tenure with the institute shouldn't be considered entirely altruistic.

"Being involved with IPAM has helped my own work immensely," Osher says. "It's been incredible to get to talk to and collaborate with leading experts when they come in and spend time here. Whether it's scientific computing, image processing, optimal transport, or anything else, we get the best people, and they tend to be very open to meeting and exchanging ideas. It's fantastic to be a part of such a stimulating environment."

Among other things, Osher is renowned for his contributions to level-set methods for computing moving fronts involving topological changes; the development of

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GREEN FAMILY LECTURE

In May of this year, Alessio Figalli, Professor in the Department of Mathematics and Forschungsinstitut für Mathematik (FIM) Director at ETH Zürich, gave two lectures as part of the Green Family Lecture Series (GFL). During his introduction to his scientific lecture, Figalli celebrated the IPAM programs and workshops he participated in that allowed him to form the connections that would ultimately shape his career. He is widely regarded for his specialization in the wide-ranging fields of Calculus of Variations and Partial Differential Equations, focusing especially on optimal transport, functional and geometric inequalities,

Alessio Figalli
ETH Zürich

(continued on page 4)

LATMATH

IPAM hosted the triennial Mathematical Sciences Conference (LatMath) on the UCLA campus on March 6-8, 2025 at the Luskin Conference Center. LatMath showcases the achievements of researchers in the mathematical sciences. The goal of the conference is to encourage participants to pursue careers in the mathematical sciences, promote the advancement of junior participants currently in the discipline, showcase research being conducted by those at the forefront of their fields, and build a community around shared academic interests. The conference included research talks, a poster session, professional development and mentoring activities, panel discussions, interactive storytelling, and opportunities for networking. This conference was sponsored by the Mathematical Sciences Institutes Diversity Initiative (MSIDI), and

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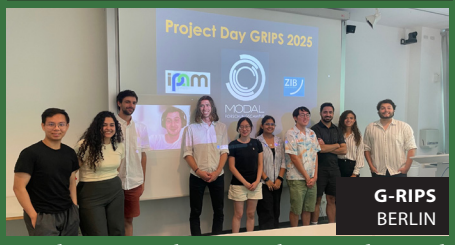
GRIPS: BERLIN & SENDAI



G-RIPS
BERLIN

Graduate-Level Research in Industrial Projects for Students (G-RIPS)-Berlin & Sendai offer graduate students in mathematics and related disciplines the opportunity to work on industry sponsored research problems for 8 weeks during the summer.

IPAM held G-RIPS Berlin for the 10th time this summer in partnership with MODAL (Mathematical Optimization and Data Analysis Laboratories) Research Campus. MODAL promotes exchange and collaboration between public institutions and

(continued on page 4)

FEATURES

HIGHLIGHTS

INFORMATION

NOTE FROM DIRECTOR DIMA SHLYAKHTENKO


Dima Shlyakhtenko
IPAM Director

IPAM's scientific reach has significantly expanded in the last year. Our Fall 2024 Mathematics of Intelligences program used mathematics to find common themes in studies of animal intelligence, human intelligence, and the latest newcomer, AI. Our Winter workshops explored topics ranging from free entropy and random matrices to computational interactions between algebra, combinatorics, and geometry, to turbulence. The workshop on sampling, inference, and data-driven physical modeling was disrupted by the Palisades fires and moved to summer, joining a workshop on randomized numerical linear algebra. The LatMath conference brought together nearly 300 researchers united by their passion for mathematics. Our Spring program focused on optimal transport in non-commutative probability and quantum information. And we ran a very successful quartet of Research in Industrial Projects for Students programs, in Los Angeles, Germany, Japan, and Singapore. We are always looking to take IPAM in new scientific directions—please reach out to us if you have an idea for an IPAM program!

I want to thank Stan Osher for his many years of service at IPAM, and to Terry Tao, who recently started as our new Director of Special Projects, and the rest of the IPAM staff who make IPAM the special place it is.

As an NSF-funded Mathematics Institute, IPAM continues to offer innovative programs in all areas related to mathematics. We cannot do it alone. As we enter a period of budgetary uncertainties, we have received numerous pledges of support, from new scientific ideas for programs to gifts that will help us continue our record of scientific successes. I would like to express our deepest gratitude to our many friends and supporters for all their help. And remember: Math Changes Everything! ■

FOR ERIC CARLEN, INTERACTING ACROSS DISCIPLINES AT IPAM PROVES FRUITFUL

Eric Carlen, distinguished professor of mathematics at Rutgers University, has found his experiences at the Institute for Pure and Applied Mathematics (IPAM), where he frequently interacts with individuals outside his area of expertise, to be especially fruitful.

Carlen studies functional analysis and probability, primarily problems arising in mathematical physics. "A lot of what goes on in my branch of mathematical physics is trying to understand how the random behavior of many interacting particles somehow leads to deterministic, orderly behavior on a large scale," he says. "If there isn't an existing explanation, often one of the reasons is that you need some new mathematics."

Over the last two decades, Carlen's focus has increasingly involved quantum mechanics. It's an interest that began during his time as a graduate student and junior faculty member, ultimately leading Carlen to work on the quantum aspects of the Boltzmann equation — a fundamental physics equation that describes the movement and interactions of molecules and atoms over time. "The nice part about mathematical physics problems is that there are many built-in connections," Carlen notes. "But essentially, my interest has been in the longtime behavior of large numbers of atoms or molecules and how fast such systems relax to a steady state or equilibrium, as described in terms of entropy."

That interest led to Carlen becoming involved in the spring 2009 IPAM long program Quantum and Kinetic Transport: Analysis, Computations, and New Applications as a co-organizer and core participant. The program brought in leading figures and young researchers to present and exchange ideas on mathematical analysis, computational challenges, and then-new applications of quantum and kinetic transport theory.

Although Carlen had previously attended IPAM meetings — participating in a one-week workshop in the winter of 2002, and then as a speaker in the Optimal Transport long program in 2008 — this was his first experience helping to put together an IPAM meeting. "I had always found the IPAM events to be stimulating and very productive, and I realized in co-organizing the 2009 meeting that everyone else felt the same way," he recalls. "The acceptance rate for our invitations was very high — we were able to get lots of interesting people, and it was a great program."


Eric Carlen
Rutgers University

The 2009 meeting was also productive for Carlen personally. The previous year, he had started working with two colleagues, Jose Antonio Carrillo and Adrien Blanchet, on the Keller-Segel model — a mathematical biology equation describing the movement of bacteria across a petri dish — applying methods coming from kinetic theory and optimal mass transport. The long program on quantum and kinetic transport provided an ideal environment for advancing that work.

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Eric Carlen at IPAM

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There was also a serendipitous development while Carlen was at UCLA for the meeting: Jan Maas, a PhD student at Delft University of Technology in the Netherlands, had completed his PhD earlier than anticipated, had extra funding, and wanted to use it to travel to IPAM to work with Carlen and other colleagues in applying kinetic theory methods to problems of quantum mechanics and optimal mass transportation. "Being at IPAM there were no distractions, and we were able to really brainstorm," Carlen recalls. Those discussions began a process that led Carlen and Maas, now a professor at the Institute of Science and Technology Austria, to publish three influential papers over the next five years.

That meeting also served as a precursor to IPAM's spring 2025 long program, Non-commutative Optimal Transport, where Carlen was a participant. The program brought together researchers from various mathematical communities to tackle ongoing challenges in a fertile area of inquiry that has applications in many fields beyond mathematics. One of the approaches to quantum mass transport developed out of the work Carlen and Maas had started at the 2009 meeting. "It was a real pleasure to come back to IPAM years later to discuss where we've gone with this," Carlen says.

Carlen believes that IPAM is unique in its ability to bring together experts from disparate but complementary fields in an environment that encourages the types of informal interaction that can spark new ideas and collaborations. "The IPAM building, designed by Frank Gehry, functions beautifully, with lots of natural light and the offices ringed around common space," he says. "Attendees spend long periods of time there, so you see people again and again — you'll bump into someone at a coffee break and it's, 'I had another thought about something you were saying yesterday…' "

IPAM is also distinguished by its follow-up meetings at Lake Arrowhead, which typically occur 1.5-2.5 years after a meeting. "It's a great opportunity to get together with the same people and see where participants have gone with the ideas and collaborations that started at the original meeting," Carlen says. "I don't know of another example where that's done." ■

KATERINA GRATSEA EXPERIENCES FIRST-HAND HOW MATH CHANGES EVERYTHING

My name is Katerina Gratsea and I am a researcher passionate about connecting quantum algorithms to real-world applications with a positive impact for our society. Currently, I am a Post-Doctoral Research Associate at University Wisconsin-Madison, but when I was first invited to IPAM I was a Marie Skłodowska-Curie PhD fellow. During the last year of my PhD program, I attended the Fall 2023 long program on "Mathematical and Computational challenges in Quantum Computing" and experienced IPAM's mission on "Math Changes Everything".

During the long program, I took every opportunity to converse with leading experts that attended the workshops. For example, I had inspiring discussions with Peter Shor who shared stories of the father of quantum computation, Richard Feynman. All the discussions with leading experts gave me a better perspective on the challenges and the promising directions of quantum computation. This helped me identify impactful research directions for my next career steps and shaped the focus of my Post-Doctoral Fellowship.

Moreover, while at IPAM I identified a disconnect between the scientific communities working on the near-term and long-term goals of quantum computation and proposed a workshop on "Bridging the Gap between NISQ and FTQC". This program is organized in collaboration with other participants of the long program (Andrew Bazsewski and Peter Johnson) and will take place at IPAM in early 2026. It's exciting how many leading experts in the field have already committed to attend.

Ever since the long program, I have stayed connected with IPAM by participating in other impactful workshops on Quantum Computing for Quantum Chemistry in 2024, Quantum Error Correction in 2025 and the reunion of the long program on Mathematical and Computational Challenges of Quantum Computing in 2025. All these programs have greatly helped my research on Quantum Resource Estimations that incorporate all aspects of quantum computing (hardware, software, algorithmic and application).

During the long program, I contributed to the efforts of mitigating the stray cat population at Los Angeles by fostering two cats and it was then when I carefully started observing the struggles of shelters in resolving the overpopulation situation of stray animals. Now, I still actively volunteer at shelters and apply my research skills to study stray overpopulation through statistical and data analysis. I believe that through research, concrete steps can be identified that could be taken to start resolving the animal shelter crisis.

IPAM is a unique institute that shapes the future of early career researchers as it brings together professionals from all over the world on topics that are at the heart of most impactful and interesting R&D efforts. IPAM's professional talk recordings are available on YouTube, but I strongly recommend taking part in a long program that they host. I believe that IPAM's efforts stress the importance of math in all scientific fields and I can strongly testify through my own experience at IPAM that "Math Does Change Everything". ■

Katerina Gratsea
University Wisconsin-Madison

NEWS STORIES

GREEN FAMILY LECTURE

(continued from page 1) differential equations, and free boundary problems. He has received many awards, including the Peccot-Vimont Prize and the Peccot Lectures in 2012, the EMS Prize in 2012, the Stampacchia Medal in 2015, the Feltrinelli Prize in 2017, and the Fields Medal in 2018. His GFL lectures were part of the Non-commutative Optimal Transport Long Program's third workshop Statistical and Numerical Methods for Non-commutative Optimal Transport.

LATMATH

(continued from page 1) (MSIDI), with sponsorship from Analog Devices, American Mathematical Society, UCLA Mathematics Department, Lawrence Livermore National Laboratory, and the UCLA Division of Physical Sciences.

G-RIPS: BERLIN & SENDAI

(continued from page 1) partners of MODAL are the Free University of Berlin (FU Berlin) and the Konrad-Zuse Zentrum für Informationstechnik Berlin (ZIB). Six students from the U.S. and six from Europe have worked on cross-cultural teams on three research problems designed by the industrial sponsor. At the end of the program, the teams present the results of their work and prepare a final report.

G-RIPS Sendai

IPAM also partners with Tohoku University in Sendai, Japan and Tohoku Forum for Creativity (TFC) and the Advanced Institute for Materials Research (AIMR) to sponsor six U.S. students and two U.S. mentors to form cross-cultural teams working on research problems designed by industrial sponsors. At the end of the program, the teams present the results of their work and prepare a final report.

2025 QUANTUM WINTER SCHOOL

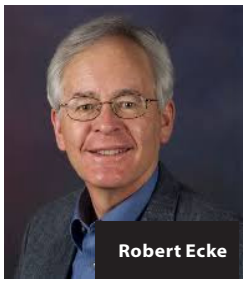
IPAM will again collaborate with the Challenge Institute for Quantum Computation (CIQC), to host the 2026 Quantum Winter School in January of next year. The school is aimed at experimentalists and new theory students working in quantum information science and related fields. It works to convene a multidisciplinary group of students and researchers who will disseminate and accelerate developments in the field, and to draw on their own research to help inspire new approaches and application domains. Applications are now being accepted for 2026. Financial support will be offered to young researchers subject to demonstrated need and availability. For more information, please visit IPAM's webpage under Special Events and Conferences.

MODERN MATH WORKSHOP

The Modern Math Workshop (MMW) was a two-day workshop which took take place in conjunction with the 2024 NDiSTEM Conference of the Society for the Advancement of Chicanos and Native Americans in Science (SACNAS). It grew out of a similarly named yearly event originally organized by MSRI and first held at Howard University in 2002. It became a collaboration with SACNAS in 2006 and has been jointly organized by the Mathematical Sciences Institutes since 2008. Since 2011 this event has been funded by the NSF through the Mathematical Sciences Institute Diversity Initiative (MSIDI). In the fall of 2024, IPAM was the lead organizer for the MMW, which consisted of research sessions, undergraduate mini-courses, and keynote speakers. The MMW encourages participants to pursue careers in the mathematical sciences, and builds research and networking opportunities among undergraduates, graduate students and recent PhDs. This conference was sponsored by the MSIDI, with additional funding from the National Science Foundation Division of Mathematical Sciences.

ROBERT ECKE PUBLIC LECTURE

In January of this year, Robert Ecke gave the public lecture, Tales of Rotating Thermal Convection: How rapid rotation drives heat transport, creates novel vortex structures, and relates laboratory experiments to the motions of the Earth's outer core, as part of IPAM's Rotating Turbulence: Interplay and Separability of Bulk and Boundary Dynamics winter workshop. Ecke is an American experimental physicist specializing in nonlinear dynamics, turbulence, and granular materials. He is a Laboratory Fellow and Director Emeritus of the Center for Nonlinear Studies at Los Alamos National Laboratory and an Affiliate Professor of Physics at the University of Washington. A Fellow of the APS and AAAS, Ecke has held leadership roles in both organizations.



Robert Ecke

PUMA

PUMA, The Practicum for Undergraduate MAthematicians, is a series of workshops for rising sophomores, including community college students transitioning to upper-division mathematics. It is designed to support and encourage participation in specific mathematical sciences research areas, particularly among diverse cohorts of students from the Los Angeles area. IPAM has hosted two PUMA weekend events this past academic year with topics focusing on Inverse Problems and Data Simulation (Fall 2024), and Topology (Spring 2025). The goal is to motivate students and expose them to various directions of modern-day mathematics. To date, 107 students have participated in the PUMA program.

IPAM FRONTIERS SOCIETY

Whether one is seeking algorithms to locate disease genes, designing and predicting the properties of new materials, exploring new frontiers in open quantum systems, or discovering new methods for modeling cancer, the need for cutting-edge, innovative mathematics is critical in many fields. Fostering new mathematical techniques and training a new generation of mathematical scientists who will develop and use them lies at the heart of IPAM's mission. You can help by donating to IPAM's Frontiers Society! Any donation amount is appreciated.

DONOR RECOGNITION

IPAM wishes to thank everyone who gave to the Frontiers Society in the past year:

SPECIAL RECOGNITION
Dolores and John Garnett
Katherine and Mark Green
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JOIN NOW!

To learn more about IPAM's Frontiers society, fundraising priorties, or to make a contribution, please go to: ipam.ucla.edu/frontiers-society/donate/.

MEMBERSHIP LEVELS

IPAM offers 3 distinct elevated Frontiers Society membership levels. These membership levels are valid from the day of the donation until December 31 of the following calendar year. Couples may join with a single membership.

Innovator ($200+): Benefits include: An IPAM gift (T-shirt, mug, or other), mention of your name in the annual newsletter and on the IPAM webpage, regular updates about IPAM, and a print copy of the annual newsletter.

Visionary ($1000+): Benefits include: All the benefits of the Innovator level membership, an invitation to at least one special (annual) IPAM event, and reserved seating at all public (general audience) IPAM events.

Champion ($2000+): Benefits include: All the benefits of the Visionary level membership, and the naming of a seat in the IPAM lecture hall.

There are additional naming opportunities for larger donations.

The core participants of the Spring 2025 Long Program Non-commutative Optimal Transport donated funds to name a lecture room chair in honor of their program "NOT2025".

FUNDING PRIORITIES

Programmatic Activities. IPAM hold over 20 academic programs per year, including long programs, workshops, undergraduate and graduate summer schools, public lectures, large and small scale conferences, and outreach events. Your gift will help support these activities.

Facilities Improvement. Upkeep and enhancement of IPAM's space is essential in ensuring a healthy and safe workplace. Your gift will help create and maintain a welcoming place for our participants and the math community.

Dependent Care Fund. Help IPAM support participants with depedent care needs.

Belonging. Help IPAM improve in all of its activities. Last year this fund supported two PUMA events and a graduate summer school.

Directors Endowment. Donations to this fund will allow the director to fund activities and programs that cannot easily be funded by other sources. It will also support the research activities of the director, and thus help with the recruitment of future directors.

UPCOMING PROGRAMS

LONG PROGRAMS

Bridging the Gap: Transitioning from Deterministic to Stochastic Interaction Modeling in Electrochemistry
September 3 – December 12, 2025

Multi-Fidelity Methods for Fusion Energy
March 9 – June 12, 2026

Quantum Topology, Character Varieties and Low-Dimensional Geometry
September 14 – December 18, 2026

Numerical Algebraic Geometry and Correlated Electrons: Generalized Grassmannians, Repsonse Functions and Excited States
March 8 – June 11, 2027

WINTER WORKSHOPS

New Frontiers in Quantum Algorithms for Open Quantum Systems
January 12 – 16, 2026

Quantum Winter School
January 21 – 23, 2026

New Interactions between Probability and Geometry
January 26 – 30, 2026

Mathematics and Machine Learning for Earth System Simulation
February 2 – 6, 2026

Bridging the Gap Between NISQ and FTQC
February 17 – 20, 2026

Mathematics of Cancer: Open Mathematical Problems
February 23 – 27, 2026

SUMMER RESEARCH PROGRAMS

RIPS Los Angeles 2026
June 22 – August 21, 2026

RIPS Singapore 2026
May 18– July 17, 2026

G–RIPS Berlin 2026
June 22 – August 14, 2026

G–RIPS Sendai 2026
June 16 – August 6, 2026

CALL FOR PROPOSALS

IPAM seeks proposals from the mathematical, statistical, and scientific communities for its long programs, winter workshops, summer schools, and exploratory workshops. Programs are selected on the basis of their scientific impact Please send your proposals by September 30th to the IPAM Director at director@ipam.ucla.edu.

WINTER WORKSHOPS

Winter workshops are typically five days in length, with 20–25 presentations. The proposal should include a short description of the mathematical and scientific content, names of individuals to serve on the organizing commit tee, and names of potential speakers and participants, and a statement of broader impacts of the workshop.

EXPLORATORY PROGRAMS

Exploratory workshops address urgent problems that mathematics may help solve. They are two or three days long, and can be organized in less than a year. The proposal should follow the guidelines for winter workshops.

LONG PROGRAMS

Long Programs generally have two complementary streams: one mathematical and one (or more) from other related scientific disciplines where there is the potential for a fruitful and exciting interaction. The proposal should include a brief description of the topic, names of individuals to serve on the organizing committee, and a preliminary list of senior researchers and representatives of industry and government you would like to invite. In addition, a statement of broader impacts should be included.

SUMMER SCHOOLS

Summer schools are one to three weeks in length and incorporate both tutorials (a series of 3–4 talks) and research talks illustrating applications. They are directed toward graduate students and postdocs. The proposal should follow the guidelines for winter workshops.

MARK YOUR CALENDARS

March 5 – 6, 2026. Industrial Short Course: Generative AI Algorithms by Lecturer: Xavier Bresson, National University of Singapore.

May 18, 2026. Green Family Lecture Series: Karen Wilcox will give a general audience public lecture as part of the "Algebraic Varieties and Electronic Structure" workshop.

May 19, 2026. Green Family Lecture Series: Karen Wilcox will give a scientific audience public lecture as part of the "Algebraic Varieties and Electronic Structure" workshop.

IMPORTANT DEADLINES

February 3, 2026. Application deadline for IPAM's Research in Industrial Projects for Students (RIPS) Programs in Singapore and Los Angeles.

February 23, 2026. Application deadline for IPAM's Graduate-level Research in Industrial Projects for Students (G-RIPS) Programs in Berlin and Sendai.

For more information, go to **www.ipam.ucla.edu.**

Stanley Osher reflects on 25 years of "Fantastic" environment

(continued from page 1)

methods for approximating hyperbolic conservation laws and Hamilton-Jacobi equations; and total variation and other partial differential equation-based image-processing techniques. He surpassed a significant milestone in 2023: Osher's 150,000-plus citations on Google Scholar since 1988, with an h-index of 130, makeing him one of the most cited researchers in the history of UCLA.

Not long after IPAM was co-founded in 2000 by Mark Green, Tony Chan and Eitan Tadmor, the leadership approached Osher about becoming director of special projects — charged with identifying and developing programs with an applied hook. "They wanted a presence in applied math, so I was a likely candidate," Osher says. "And in all modesty, it's worked out quite well for IPAM as well as for me."

Many of the hottest topics in math and related disciplines, from theoretical to applied, were jump-started at IPAM, Osher notes. He points to Deep Learning, Feature Learning, an IPAM graduate summer school program held in 2012, as a turning point in the field of artificial intelligence. "It was a perfect storm where you had reached the point of having enough data and strong enough computers, and all of the leaders in the field came," Osher says. "We had mathematics and computer-oriented people working together, and practically everything you see today, with people using AI on a daily basis, germinated at that meeting."

Osher brings up compressive sensing and optimal transport as two other topics, among many, for which critical early work took place at IPAM. "There has been a tremendous amount of good judgment in the people and topics IPAM's Science Advisory Board picks," he says. "We are trendsetters, not followers. It's challenging because we have to plan our long programs almost two years ahead of time, and yet we tend to be very timely." He credits the ability of IPAM to attract some of the world's best mathematicians, as well as experts from related scientific fields, to serve on its Science Advisory Board. "I always wonder how we're going to get these great programs organized, and it always seems to happen," he says, laughing.

Osher believes one of the keys to the institute's success is its location on the UCLA campus. "In the time that I've been here we have grown to become one of the top math departments," he notes. "It's California, so people come and they're happy to be here. And we have a very unpretentious department, which promotes an environment where everyone is encouraged to interact, both in the sessions and informally. There are always top faculty here, working with each other and with students and postdocs. And it's very interdisciplinary: We have experts in an applied field who are doing incredibly clever things without realizing it's mathematics, and often it turns out to be something that can be generalized. That's the way science should be done."

Osher says he feels fortunate to have partnered with leaders at IPAM who have worked so hard to ensure that the institute fulfills its intended mission of advancing the field — often at the cost of their own research, given the time it takes. These include Mark Green, Russ Caflisch, and IPAM's current director, Dima Shlyakhtenko. "They have all been highly dedicated, along with the staff," he says.

"IPAM wasn't designed to improve our research at UCLA; it was designed for the mathematical community," Osher concludes. "But I have been happy to grab whatever I could, whatever was available, and it's been fantastic. Going to IPAM every week for many years, I learned a lot. We say, 'Math Changes Everything,' and when you walk into IPAM, you can see that. The excitement is crackling." ■

Institute for Pure and Applied Mathematics

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math changes everything.

2026 LONG PROGRAMS

SPRING 2026

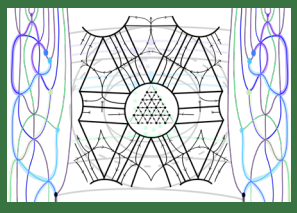
MULTI-FIDELITY METHODS FOR FUSION ENGERY

The pursuit of fusion energy as a clean and virtually limitless power source has gained renewed momentum, particularly following significant advancements in inertial confinement fusion and magnetic fusion energy technologies. Recent experiments have demonstrated the potential for producing more energy than consumed through nuclear fusion, prompting substantial investments from the U.S. federal government and the private sector. However, the realization of commercially viable fusion power faces substantial mathematical and computational challenges.

This IPAM Long Program aims to unite mathematicians, physicists, computer scientists, and engineers to collaboratively tackle the challenges and opportunities presented by multi-fidelity modeling in fusion energy research. The program will provide a platform for sharing knowledge and innovations, ultimately striving to build a multidisciplinary community capable of advancing fusion energy towards practical implementation.

FALL 2026

QUANTUM TOPOLOGY, CHARACTER VARIETIES AND LOW-DIMENSIONAL GEOMETRY



Quantum topology studies manifolds using invariants coming from quantum field theory. This program focuses on quantum invariants and their application to questions in geometry and low-dimensional topology such mapping class group representations, hyperbolic structures on three-manifolds, and smooth structures on four-manifolds.

The program will be centered around four streams: 1) character varieties and their quantum deformations 2) hyperbolic geometry and quantum invariants 3) contact geometry and cluster algebras 4) categorification in quantum topology.

The streams all involve hands-on geometric and combinatorial constructions, cutting/gluing/TQFT-like properties, and computation via diagrams, which we hope will facilitate Rosetta-stone like translations between previously disjoint fields.