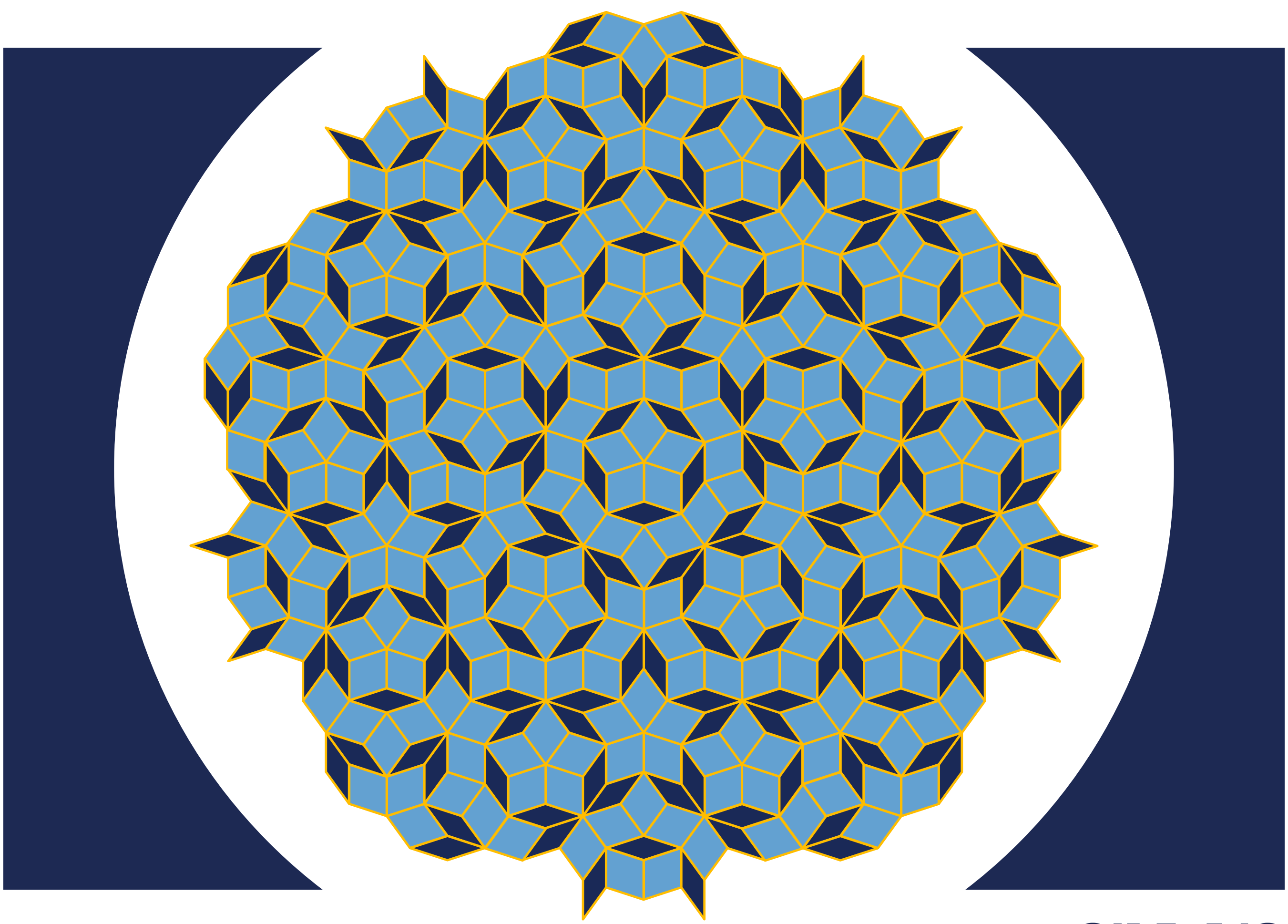
Annual Meeting
2025



Mathematics &
Physical Sciences

SIMONS FOUNDATION

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WELCOME

Dear Colleagues, Dear Friends,

We are delighted to welcome you to the 2025 Annual Meeting of the Mathematics and Physical Sciences Division.

The MPS division is firmly committed to identifying and supporting excellence in mathematics and physical sciences. We have expanded several of our programs, increasing the number of Simons Collaborations, Targeted Grants to Institutes, and Targeted Grants in MPS. We have also partnered with the American Physical Society to issue new travel awards and partnered with the Research Corporation for Science Advancement in the Scialog program.

We have awarded inaugural Simons Dissertation Fellowships to an impressive group of mathematics Ph.D. students, and we continue to support the Simons Observatory, as it has successfully entered the observations phase.

Thanks to the new presidential Empire-Simons Faculty Fellowships program, MPS is supporting the hiring of new tenure-track faculty at 18 leading institutions in New York State.

MPS continues to offer a robust conference program, with almost weekly meetings, welcoming thousands of scientists from across the globe to New York City.

In cooperation with the American Mathematical Society, the Society for Industrial and Applied Mathematics, NSF, Sloan, Moore, and other foundations, we are leading organizational efforts for the 2026 International Congress of Mathematicians, to take place in Philadelphia, July 23-30. We very much hope to see many of you there!

We wish you continued success in your work, in pursuing many new ideas and projects, and good health!

Sincerely,

YURI TSCHINKEL
Executive Vice President, MPS

GREG GABADADZE
Senior Vice President, MPS

Meeting Information

MEETING AGENDA

Thursday, October 16

8:30 AM	**CHECK-IN & BREAKFAST**
9:30 AM	**EMANUELE BERTI** Black Hole Demography and Black Hole Spectroscopy with Gravitational Waves
10:30 AM	Break
11:00 AM	**ZAHER HANI** Hilbert's Sixth Problem: From Particles to Waves
12:00 PM	Lunch
1:30 PM	**RUTH BAKER** What is Parameter Identifiability, Why Do We Need Identifiable Models, and What Can Identifiable Models Tell Us About Regulation of the Cell Cycle?
2:30 PM	Break
3:00 PM	**IVAN CORWIN** Extreme Diffusion
4:00 PM	Break
4:30 PM	**AMIT SINGER** Mathematics of Cryo-Electron Microscopy
5:30 PM	Scientific Program Concludes
5:40 PM	Walk to Altman Building
6:00 PM	**COCKTAILS @ ALTMAN BUILDING**
7:00 PM	**DINNER @ ALTMAN BUILDING**

Friday, October 17

8:30 AM	**CHECK-IN & BREAKFAST**
9:30 AM	**HEE OH** A Traveler's Journey in a Hyperbolic World
10:30 AM	Break
11:00 AM	**NORMAN YAO** A Universal Theory of Spin Squeezed Entanglement
12:00 PM	Lunch
1:00 PM	**JOHN VOIGHT** Ranks of Elliptic Curves
2:00 PM	Meeting Concludes

VENUE INFORMATION

GERALD D. FISCHBACH AUDITORIUM

Simons Foundation
160 Fifth Avenue (at 21st Street)
New York, NY 10010
T: (646) 654-0066
www.simonsfoundation.org

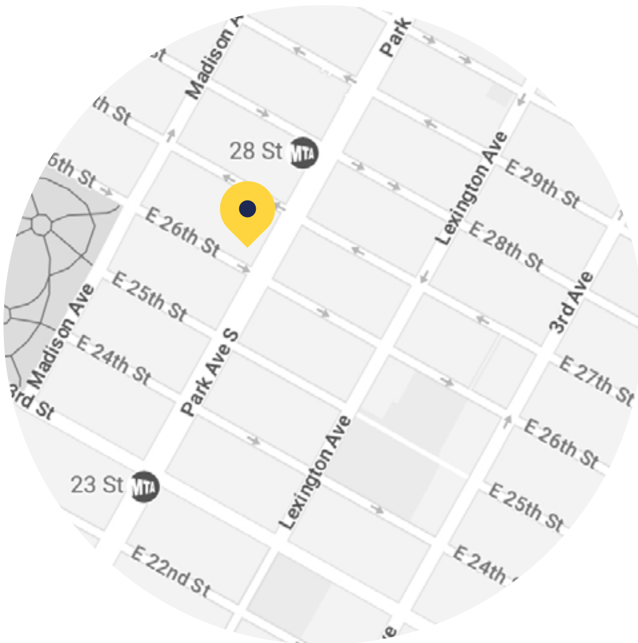
AUDITORIUM

The Gerald D. Fischbach Auditorium is ADA accessible with a microphone and AC power connection located at each seat. Food and beverages are not allowed in the auditorium.

Wi-Fi at the auditorium

Network name: SimonsGuests
Password: simonsnyc

HOTEL & TRAVEL INFORMATION



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Check-in: 4:00 PM
Check-out: 12:00 PM

SERVICE AND FACILITIES

Wi-fi is complimentary in each guest room and throughout the hotel.
Fitness center is open 24 hours a day.

GROUND TRANSPORTATION

Return transportation to NY-area airports will be coordinated for participants departing on Friday, October 17. A reminder of your departure itinerary as well as ground transportation information will emailed to you on Thursday, October 16.

LUGGAGE

Those departing from the Gerald D. Fischbach Auditorium after the conclusion of the annual meeting should bring their luggage to the meeting.

CONTACT INFORMATION

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mfazzi@simonsfoundation.org

Ground Transportation Inquiries:
Michelle Pantaleon
Coordinator, MPS
mpantaleon@simonsfoundation.org

Hotel and Travel Information:
FCM Travel Meetings & Events
SimonsFoundationEventTravel@us.fcm.travel

ANNUAL MEETING DINNER

THE ALTMAN BUILDING

135 West 18th Street
New York, NY 10011
Between 6th Ave and 7th Ave
https://www.altmanbldg.com/

Cocktails: 6:00–7:00 p.m.
Dinner: 7:00–9:30 p.m.

Speaker Profiles

RUTH BAKER

University of Oxford

What Is Parameter Identifiability, Why Do We Need Identifiable Models, and What Can Identifiable Models Tell Us About Regulation of the Cell Cycle?

Mathematical modelling is increasingly integral to the interpretation of experimental data across applied mathematics, particularly in the life sciences where complex dynamical systems are prevalent. Accurate parameter estimation is central to this endeavor: model parameters are used not only to fit observed data but also to infer latent biological processes and generate predictive simulations. A fundamental issue is parameter identifiability—the extent to which model parameters can be uniquely or reliably estimated given the available data. This becomes especially challenging in the context of nonlinear, high-dimensional models that are common in systems biology because many existing identifiability tools are either underutilized or not well-adapted to such models. In this talk, I will outline recent progress in developing methods to assess parameter identifiability. I will illustrate these approaches using models of cell cycle regulation and demonstrate how identifiability analysis can shed light on the influence of regulatory mechanisms on collective cell migration.

Ruth E. Baker is a professor of applied mathematics and an affiliated principal investigator at the Institute of Developmental and Regenerative Medicine at the University of Oxford. She holds a D.Phil. in mathematics from Oxford and has developed a research program at the interface of applied mathematics, statistical inference, and the life sciences. Her work focuses on the development of mathematical and computational tools to extract biological insights from complex models and data, with particular emphasis on parameter identifiability and the integration of models with experimental observations. Her contributions have been recognized through numerous awards, including the Whitehead Prize of the London Mathematical Society and a Royal Society Wolfson Research Merit Award. Beyond her research, she plays a leading role in the international mathematical biology community, having served on the Board of Directors of the Society for Mathematical Biology and currently chairing the SIAM Life Sciences Activity Group.

EMANUELE BERTI

Johns Hopkins University

Black Hole Demography and Black Hole Spectroscopy with Gravitational Waves

As the LIGO-Virgo-KAGRA gravitational-wave detector network improves in sensitivity, observations of binary black hole mergers are growing in number and quality. With each new observation, we are building a census of black hole masses, spins, and redshifts. In the first part of the talk, Emanuele Berti will discuss our current understanding of the population of astrophysical black holes and of their formation channels, and how future detectors (the Einstein Telescope, Cosmic Explorer, and the space-based interferometer LISA) will extend this “black hole demography” program to a whole new mass and redshift range.

Gravitational-wave observations are also testing general relativity in the strong gravity regime. According to Einstein’s theory, as the remnant of a binary black hole merger settles to the stationary, rotating solution found by Roy Kerr, it emits characteristic “ringdown” waves—a superposition of damped exponentials with frequencies and damping times that depend only on the mass and spin of the black hole. In the second part of their talk, Berti will explain how these measurements can be used to do “black hole spectroscopy” and provide direct evidence of black holes, just like the 21-cm line identifies interstellar hydrogen.

Emanuele Berti’s research focuses on black holes, neutron stars, gravitational-wave astronomy, and tests of general relativity. After his Ph.D. from the University of Rome, he held postdoctoral positions at the Aristotle University of Thessaloniki, the Institut d’Astrophysique de Paris, Washington University in Saint Louis, and JPL/Caltech. He joined the faculty at the University of Mississippi in 2009, and he moved to Johns Hopkins University in 2018. Berti served as chair of the American Physical Society’s Division of Gravitational Physics and as president of the International Society on General Relativity and Gravitation. His research has been supported by awards from the National Science Foundation, NASA, the Templeton Foundation, and the Simons Foundation.

IVAN CORWIN

Columbia University

Extreme Diffusion

Two hundred years ago, Robert Brown observed the statistics of the motion of grains of pollen in water. It took almost one hundred years for Einstein and others to develop an effective theory describing this motion as that of a random walker. In this talk, Ivan Corwin challenges a key implication of this well-established theory. When studying systems with very large numbers of particles diffusing together, Corwin will argue that the Einstein random walk theory breaks down when it comes to predicting the statistical behavior of extreme particles—those that move the fastest and furthest in the system. In its place, Ivan will describe a new theory of extreme diffusion which captures the effect of the hidden environment in which particles diffuse together and allows us to interrogate that environment by studying extreme particles. He will highlight one piece of mathematics that led us to develop this theory—a non-commutative binomial theorem—and hint at other connections to integrable probability, quantum integrable systems and stochastic PDEs.

Ivan Corwin is a professor of mathematics at Columbia University. Prior to arriving there in 2013, he did a postdoc at MIT and Microsoft Research and received his Ph.D. in 2011 from the Courant Institute. His research is at the interface of probability, integrable systems, and mathematical physics. He is currently a Simons Investigator in mathematics, a fellow of the American Mathematical Society and of the Institute for Mathematical Statistics; has held fellowships or chairs from the Simons Foundation, Packard Foundation, Clay Mathematics Institute, Institut Henri Poincaré, and Miller Institute; and is a recipient of the Loève prize, Alexanderson award, Rollo Davidson prize, and a Blavatnik National Award finalist.

ZAHER HANI

University of Michigan

Hilbert's Sixth Problem: From Particles to Waves

In his sixth problem, Hilbert called for the derivation of the equations of fluid mechanics—such as the Euler and Navier-Stokes equations—by way of rigorously justifying Boltzmann's kinetic theory for particle systems. The scope of this program, now known as Hilbert's program, was precisely framed in the mid-20th century through the works of Grad and Cercignani, who identified the correct limiting process involved: the Boltzmann-Grad limit. In his celebrated work, Lanford (1975) gave the first rigorous derivation of Boltzmann's equations, albeit only valid for short times. However, Hilbert's sixth problem requires a long-time extension of Lanford's result, which remained open for decades. In recent joint work with Yu Deng (University of Chicago) and Xiao Ma (University of Michigan), we extend Lanford's theorem to long times—specifically for as long as the solution of Boltzmann's equation exists. This allows for the full execution of Hilbert's program and the derivation of the fluid equations in the Boltzmann-Grad limit. The underlying strategy follows an earlier joint work with Yu Deng that resolved a parallel problem, in which colliding particles are replaced by nonlinear waves; thus, establishing the mathematical foundations of wave turbulence theory. In this talk, we will review this progress and discuss some future directions.

Zaher Hani is the Frederick W. and Lois B. Gehring Professor of Mathematics at the University of Michigan, Ann Arbor. He works in the field of nonlinear PDE and mathematical physics. Before moving to Michigan in 2018, Hani held positions at Georgia Tech (2014–2018), and the Courant Institute of Mathematical Sciences, NYU (2011–2014). He graduated with a Ph.D. from the University of California, Los Angeles in 2011 under the supervision of Terence Tao.

HEE OH

Yale University

A Traveler’s Journey in a Hyperbolic World

In this lecture, we will explore the journey of a traveler moving along a straight (Euclidean) path in a variety of geometric worlds. In a Euclidean torus world, she enjoys the sights of a subtorus, a phenomenon explained by Kronecker’s 1884 theorem showing that the closure of any line in the Euclidean torus is always a subtorus. But what happens when she ventures into closed hyperbolic manifolds or even hyperbolic manifolds of infinite volume? We will describe what she encounters, accompanied by numerous illustrations to bring these geometric concepts to life.

Hee Oh is the Abraham Robinson Professor of Mathematics at Yale University. Her work bridges dynamics, Lie groups, geometry, and number theory, showing how symmetry and motion of shapes in curved spaces uncovers hidden patterns—even when those spaces stretch out endlessly. After earning her Ph.D. from Yale in 1997, she held faculty appointments at Princeton, Caltech, and Brown before returning to Yale in 2013. Her contributions have been recognized with the AMS Satter Prize (2015), a Guggenheim Fellowship (2017), the Ho-Am Prize in Science (2018), and election to the American Academy of Arts and Sciences (2024). She previously served as a vice president of the American Mathematical Society.

AMIT SINGER

Princeton University

Mathematics of Cryo-Electron Microscopy

Single particle cryo-EM is an increasingly popular technique for determining 3-D molecular structures at high resolution. The 2017 Nobel Prize in Chemistry was awarded to three of the pioneers of cryo-EM, and already in the early stages of the global pandemic, cryo-EM was successfully applied to image the SARS-CoV-2 spike protein. We will discuss the mathematical principles and computational methods for reconstruction using cryo-EM, focusing on the challenges of reconstructing small size molecules and the reconstruction of flexible molecules.

Amit Singer is a professor of mathematics, the director of the Program in Applied and Computational Mathematics (PACM), and a member of the Executive Committee for the Center for Statistics and Machine Learning (CSML) at Princeton University. He joined Princeton as an assistant professor in 2008. From 2005 to 2008, he was a Gibbs Assistant Professor in Applied Mathematics at the Department of Mathematics, Yale University. Singer received the B.Sc. degree in physics and mathematics and the Ph.D. degree in Applied Mathematics from Tel Aviv University (Israel), in 1997 and 2005, respectively. His list of awards includes a SIAM Fellowship (2022), Simons Math+X Investigator Award (2017), National Finalist Blavatnik Award for Young Scientists (2016), Moore Investigator in Data-Driven Discovery (2014), Simons Investigator Award (2012), Presidential Early Career Award for Scientists and Engineers (2010), an Alfred P. Sloan Research Fellowship (2010), and the Haim Nessyahu Prize for Best Ph.D. in Mathematics in Israel (2007). His current research in applied mathematics focuses on theoretical and computational aspects of data science, and on developing computational methods for structural biology.

JOHN VOIGHT

University of Sydney

Ranks of Elliptic Curves

Elliptic curves lie at the intersection of many areas of mathematics and remain central to modern number theory. The rank of an elliptic curve over the rational numbers measures the size of its group of rational points; intuitively, it counts the number of independent points needed to generate all rational solutions up to torsion. A fundamental question, going back to Poincaré, remains unresolved: can the rank be arbitrarily large? In this talk, we present computations and data, a statistical model and heuristic framework to guide our expectations, and outliers that challenge these assumptions. This is joint work with Jennifer Park, Bjorn Poonen, and Melanie Matchett Wood.

John Voight is professor of mathematics at the University of Sydney, where he leads the Magma Computational Algebra group and works in arithmetic geometry. He earned his Ph.D. from the University of California, Berkeley in 2005 and then held faculty positions at the University of Vermont and Dartmouth College. He is a recipient of an NSF CAREER award and in 2025 was named a fellow of the American Mathematical Society. Voight's research aims to make structures in algebra and number theory explicit.

Motivated by the Langlands program, he develops algorithms that bring abstract objects—such as modular forms, elliptic curves, Galois representations, and L-functions—within computational reach. His work enables large-scale computations and new experimental approaches in number theory, with a view to solve concrete problems as well as reveal patterns and conjectures that illuminate the landscape of modern arithmetic.

NORMAN YAO

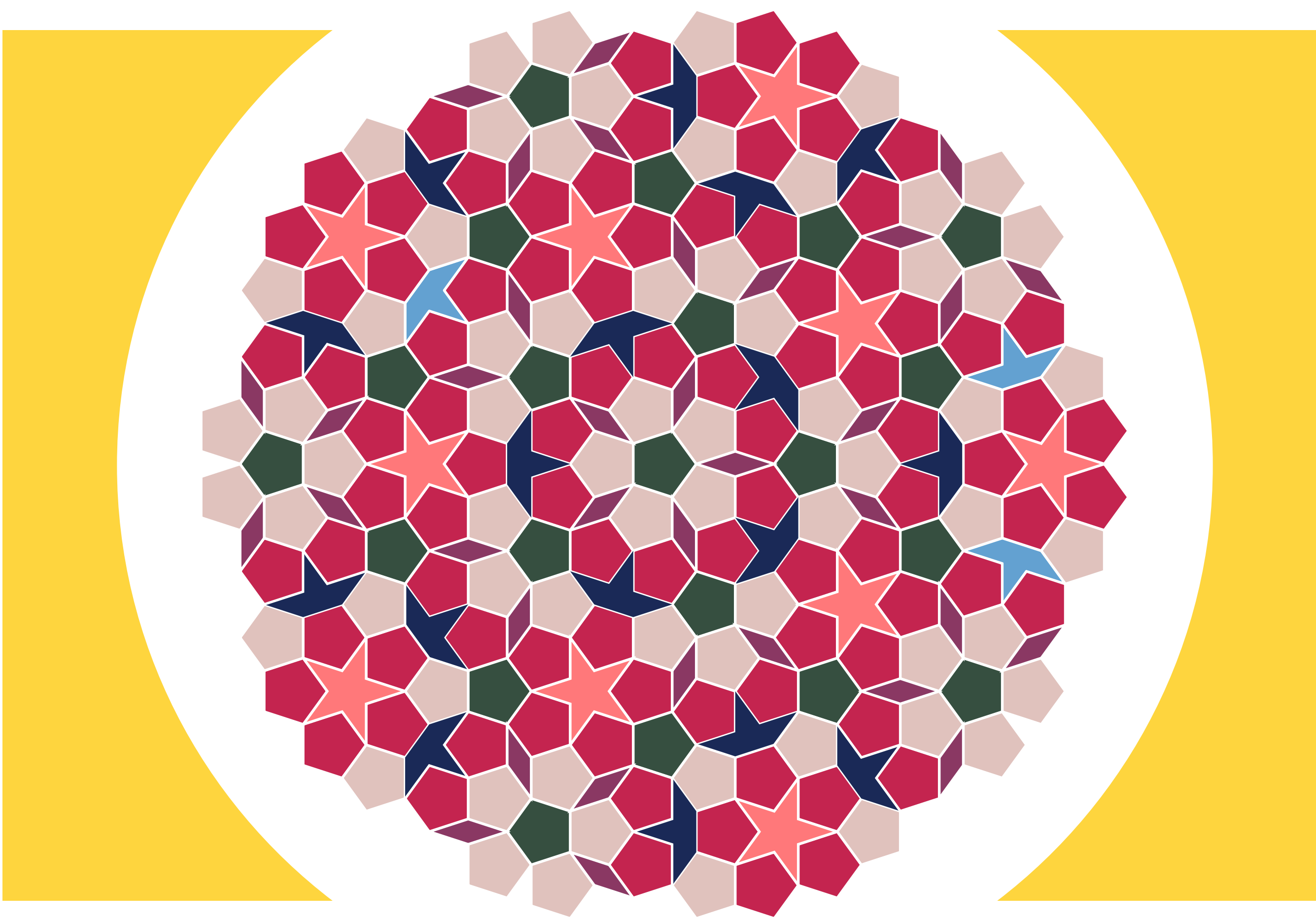
Harvard University

A Universal Theory of Spin Squeezed Entanglement

Quantum metrology makes use of structured entanglement to perform measurements with greater precision than would be possible with only classically correlated particles. One of the most paradigmatic examples of such entanglement is known as “spin squeezing”, which is known to arise in bespoke systems exhibiting all-to-all interactions. In this talk, Norman Yao will provide evidence for the following conjecture: that there exists a one-to-one correspondence between spin squeezing and a particular type of magnetic order (i.e. an easy-plane ferromagnet). If true, this would suggest that spin squeezed entanglement can naturally be generated in a wide variety of physical systems, including quantum dipoles.

Norman Yao is Professor of Physics at Harvard University. His research interests lie at the interface between AMO physics, condensed matter, and quantum information science. A recurring theme in his research program is that much of the power of quantum mechanics remains concealed if one focuses solely on systems in thermal equilibrium. Norm earned both his undergraduate degree (2009) and his Ph.D. (2014) from Harvard. Following a Miller postdoctoral fellowship, he joined the UC Berkeley physics faculty in 2017 and returned to Harvard in 2022. He is a recipient of the Breakthrough Foundation’s New Horizons Prize, a Simons Investigator (2023-2028), a Brown Investigator and has been awarded the I. I. Rabi Prize and the George E. Valley Prize from the American Physical Society.

About MPS



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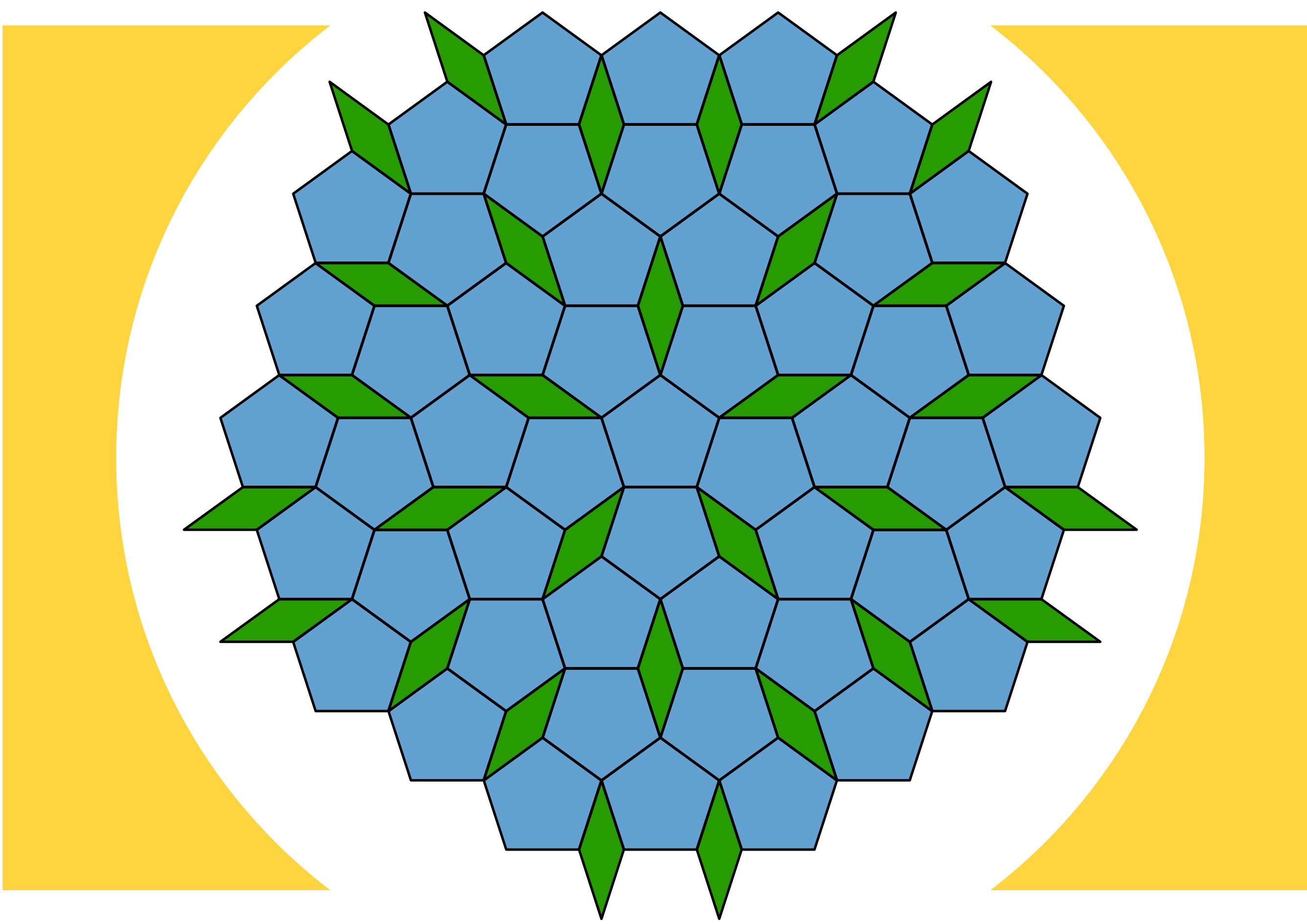

GRANTEE HONORS AND AWARDS

AMERICAN ACADEMY OF ARTS AND SCIENCES

IAN AGOL
Simons Investigator and Simons Fellow, Math

JONATHAN MATTINGLY
Simons Fellow, Math

CHRISTOPHER SKINNER
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LAUREN WILLIAMS
Simons Fellow, Math

SALIL VADHAN
Simons Investigator, Computer Science

MICHAEL WEINSTEIN
Simons Society of Fellows, Math

BILL BIALEK
Simons Society of Fellows, Physics

BASIC SCIENCE LIFETIME AWARD

GEORGE LUSZTIG
Simons Fellow, Math

NATIONAL ACADEMY OF SCIENCES

INGRID DAUBECHIES
Simons Investigator, Math and Computer Science

CYNTHIA DWORK
Simons Investigator, Computer Science

GARNET CHAN
Simons Investigator, Physics

MARK DEVLIN
Simons Observatory PI, Astronomy

SHANHUI FAN
Simons Investigator, Physics

RUSSELL IMPAGLIAZZO
Simons Investigator, Computer Science

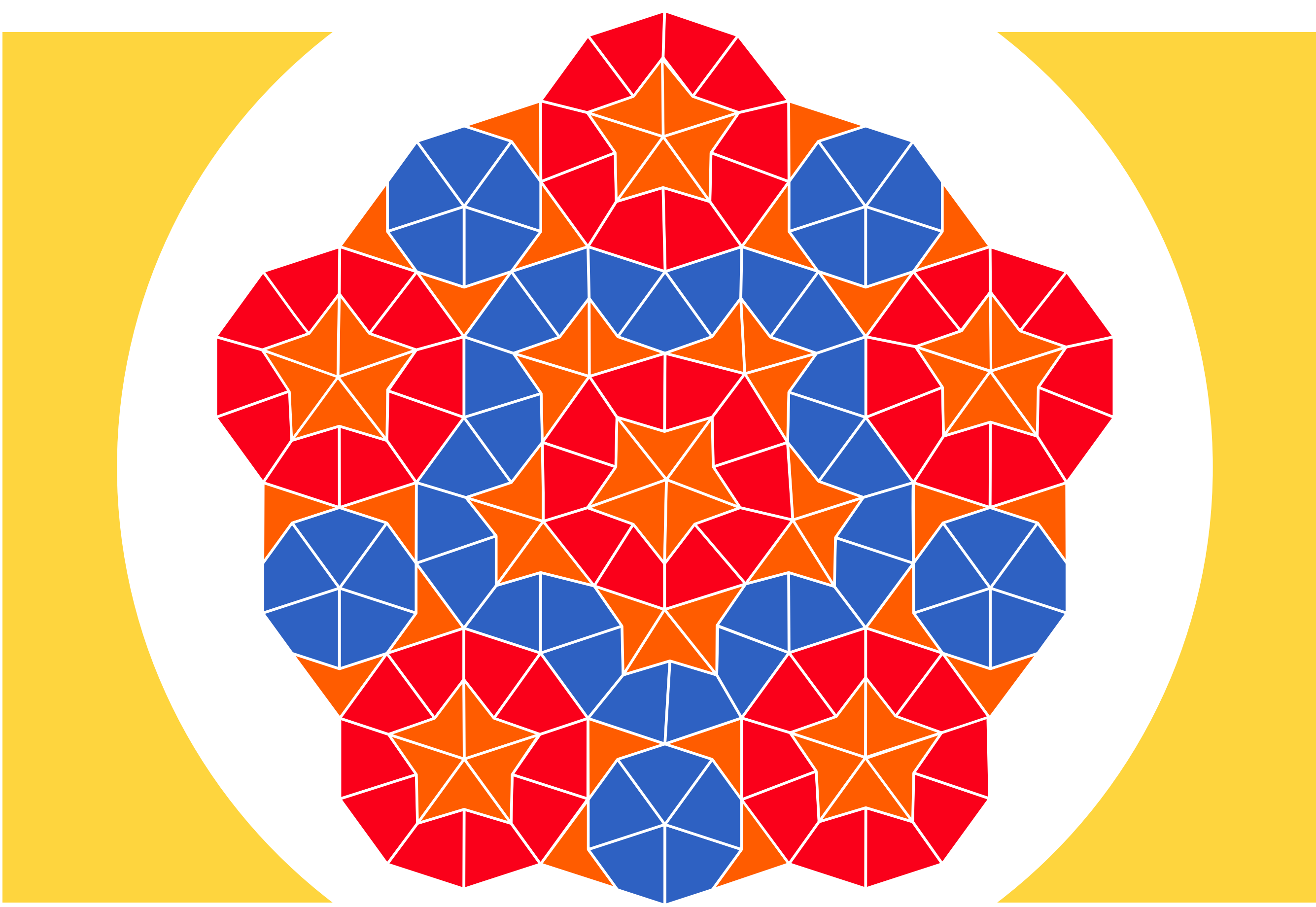
SORIN POPA
Simons Society of Fellows, Math

DAVID REICHMAN
Simons Collaboration in MPS, Physics

SCOTT SHEFFIELD
Simons Collaboration in MPS, Math

RAVINDRAN KANNAN
Simons Institute for the Theory of Computing, Computer Science

Summary of MPS Programs



GRANTS TO INDIVIDUALS

SIMONS INVESTIGATORS

An additional five years of funding has been provided to a number of our current Investigators, as outlined below, via new grants from Simons Foundation International (SFI). Simons Investigators are outstanding theoretical scientists who receive a stable base of research support from the foundation, enabling them to undertake the long-term study of fundamental questions.

MATH

NETS KATZ

CIPRIAN MANOLESCU

FERNANDO CODÁ MARQUES

ALEXEI BORODIN

ZHIWEI YUN

COMPUTER SCIENCE

OMER REINGOLD

DAVID WOODRUFF

PHYSICS

MOHAMMAD HAFEZI

LEONARDO RASTELLI

KATHRYN ZUREK

AASHISH CLERK

CLAUDIA DE RHAM

JANE KONDEV

ASTROPHYSICS

KARIN ÖBERG

2024 SIMONS FELLOWS IN MATHEMATICS

The Simons Fellows program enables the extension of sabbatical leaves from a semester or quarter to a full year, allowing awardees to spend substantial time away from teaching and administrative duties, focusing only on their research.

In 2025, MPS received 154 applications and made 50 awards, funded by SFI.
Read More

TRAVEL SUPPORT FOR MATHEMATICIANS

The ability to work with colleagues both near and far is an essential ingredient for the advancement of ideas and research in mathematics. The Travel Support for Mathematicians program provides funds for travel to facilitate collaboration opportunities for mathematicians who do not have access to significant funding from other grants.

MPS received 560 applications for the Travel Support for Mathematicians program in 2025 and made 179 awards. The program began in 2011 and has since supported around 2,000 mathematicians. It is one of the MPS division's most popular programs, with over 5,000 applications received since 2011.
Read More

GRANTS TO INDIVIDUALS

SCIENTIFIC SOFTWARE RESEARCH FACULTY AWARD

This program supports new research professor positions in existing academic departments to be filled by scientific software-focused researchers. The aim of this program is to stimulate the development and maintenance of core scientific software infrastructure in academic environments through creating a new, long-term, faculty-level career path.

To date, SFI has made the following awards.

The second call for proposals resulted in 13 letters of intent; 6 were selected for full proposals, for awards to start between September 1, 2025, and September 1, 2026.

SOLAR RADIATION MANAGEMENT

The objective of the Solar Radiation Management (SRM) program is to fill fundamental scientific knowledge gaps relevant to solar radiation management. The SRM steering committee has selected an additional 5 proposals to fund in 2025.

Click here to learn more about current awardees.

GRANTS TO INSTITUTIONS

TARGETED GRANTS TO INSTITUTES

Currently, the Simons Foundation and SFI supports over 30 institutes worldwide, including six new awards in 2025.
Read More

Instituto Balseiro

SFI will provide funding for international schools and research workshops, with the primary goal of international collaboration and career development of students and young researchers.

Alfréd Rényi Institute of Mathematics

Funding from SFI will support the participation of young researchers, particularly from disadvantaged backgrounds, in the thematic semesters held at the Erdős Center.

Abdus Salam International Centre for Theoretical Physics

SF and SFI will continue their support of ICTP via funding for the successful Simons Associates program, a new sabbatical program, and a global science portal to connect all ICTP activities across their community of researchers.

Dark Universe Science Center at the University of Washington

The SFI grant will support a mentorship-focused postdoctoral program, an anchor postdoctoral fellow, and a postdoctoral program conference in the third year of the program.

Institute of Mathematics of the Polish Academy of Sciences

SFI will provide additional funding to support the Simons Semesters at the Banach Center.

Centre International de Mathématiques Pures et Appliquées

Funding from the SFI will support fellowships and collaborative workshops for young mathematicians in developing countries.

TARGETED GRANTS IN MPS

Targeted Grants support high-risk projects of exceptional promise and scientific importance for up to five years.

NEW IN 2025

Central American-Caribbean Bridge in Astrophysics

Anthony Beasley, Associated Universities for the National Radio Astronomy Observatory

The Central American-Caribbean Bridge in Astrophysics (Cenca Bridge), an international award-winning nonprofit organization, provides opportunities to students from Central America and the Caribbean, where scientific research is inaccessible or completely absent. Cenca Bridge builds capacity in astronomy in the region and raises awareness among local government funding agencies about the importance of supporting astronomy research. The director of the National Radio Astronomy Observatory (NRAO), Dr. Anthony Beasley, represents NRAO's role in this partnership.

Cenca Bridge has brought together 100 undergraduate and early graduate students from Central America and the Caribbean with a common goal: to contribute to the scientific community and improve access to astronomy education. Cenca Bridge's current primary focus is the 3-month-long remote internship program, in which students are paired with research advisors from across the globe and mentors from the student's country. Additionally, programming and professional development workshops are presented, as well as a webinar series in which invited speakers give presentations about their research and academic journey.

In June 2024, the Cenca Bridge team was awarded the 2024 IAU Development Prize, for development of astronomy research opportunities in Central America and the Caribbean. In August 2024, the team traveled to the IAU General Assembly in Cape Town, South Africa to give a prize talk.

Cenca Bridge is led by three co-directors. Dr. Gloria Fonseca Alvarez is a Nicaraguan astronomer currently working as a postdoctoral researcher at NSF NOIRLab. Yahira Mendoza Moncada is a Honduran physicist and a graduate student in astronomy at the Observatório do Valongo at the Universidade Federal do Rio de Janeiro (OV-UFRJ). Dr. Antonio J. Porras-Valverde is a Costa Rican astronomer currently working as a Heising-Simons Foundation postdoctoral fellow at Yale University.

TARGETED GRANTS IN MPS

Muon Colliders: A New Direction in High Energy Physics

Isobel Ojalvo, Princeton University

In particle physics, the 10 TeV scale has emerged as the next target in the exploration of the energy frontier. A collider with this center of mass energy is essential to unravel mysteries surrounding the Higgs mechanism, unambiguously discover or exclude long-favored dark matter scenarios, and search for new phenomena in completely new territory. A muon collider is the machine with a chance of reaching this scale in the next few decades and would represent a paradigm shift for the field. This project seizes a window of opportunity to drive informed decision-making in next-generation particle accelerator technology.

This effort aims to advance the experimental design of a muon collider experiment while also fostering interdisciplinary collaboration between accelerator physicists and collider experimentalists. By establishing a model for direct engagement between experimental particle physicists and accelerator experts, it will help strengthen the accelerator physics pipeline. Efforts will focus on addressing key challenges in muon collider experiment development, including improving beam-induced background simulations through alternative approaches and hardware acceleration, as well as developing AI-driven techniques for background rejection in collider experiments. Additionally, we will collaborate with accelerator physicists to tackle fundamental issues in muon production and cooling using advanced simulation methods. By integrating expertise in artificial intelligence, high-energy physics, and accelerator science, this initiative will lay the groundwork for transformative discoveries in particle physics and the next generation of collider technology.

Click here to learn more about other active projects.

SIMONS OBSERVATORY & ARRAY

In 2024, SFI made a $20 million commitment to the observation phase of the telescope over a four-year period. Also, SFI made two new commitments to the Simons Array project totaling $1.1 million over 1 year to support site restoration and a CMB polarization map of large-scale structure, measurement of neutrino masses, and a deep search for the signature of inflation.

The Simons Observatory (SO) project has made impressive progress and passed a number of milestones since the advisory committee last met in early June 2024: two small aperture telescopes (SATs) have recently passed from commissioning into initial science operations (ISO), with one of them operating well above specifications and the other to be upgraded early next year, and the third is undergoing commissioning; the large aperture telescope (LAT) receiver has undergone testing on-site, and the LAT mirrors are on the way to Chile. The data management system is being used to routinely process commissioning and ISO data and has produced early temperature and polarization maps that appear to have excellent sensitivity. The construction project is close to completion, and the remaining project budget appears sufficient to complete it.

The Simons Array (SA) has been focused on science return since mid-2023, as articulated in the recent contingency request for science operations. The site operations program for the SA is driven by the science goals articulated in the April 2023 SA face-to-face meeting and relayed in the 2023 annual report. The SA program is uniquely positioned with continuous rotating half-wave plates (HWPs) at higher angular resolution than any other operating or planned CMB experiment. The PB2A and PB2B instruments have key advantages in polarization measurement fidelity and systematic control at fine angular scales. Data reduction has been an ongoing activity and is expected to continue into 2025 with a recently hired graduate student under the direction of Professor Brian Keating at the University of California, San Diego.

Read More

SIMONS COLLABORATIONS IN MPS

The aim of the Simons Collaborations in MPS program is to stimulate progress on the fundamental scientific questions of major importance in the broad areas of mathematics, theoretical physics, and theoretical computer science. Supported collaborations address questions both concrete and conceptual with the hope that with answers come major scientific milestones. Among research activities of these collaborations are small workshops and annual meetings held at the foundation. Collaborations are supported initially for four years.

IN 2025, THE FOUNDATION AWARDED THREE NEW COLLABORATIONS:

Simons Collaboration on Black Holes and Strong Gravity

Director: Nicolas Yunes, University of Illinois Urbana-Champaign

Our most successful theory of gravity—Einstein's theory of general relativity—is inherently non-linear, and this property leads to one of its most astonishing predictions: black holes. The strong gravity of black holes prevents everything even light—from escaping their interior. Inside black holes, Einstein's theory predicts that the curvature of spacetime diverges, forming singularities that signal the potential breakdown of spacetime itself and delineate the edge of our physical understanding. The cataclysmic collision of black holes shakes the fabric of the universe, generating vibrations in spacetime that Einstein dubbed "gravitational waves." These vibrations travel through the cosmos almost unimpeded, carrying secrets about the cosmos that we can now decode by listening to gravitational waves.

No longer a purely theoretical enterprise in the landscape of ideas, strong gravity has become a mature discipline with real observations that can be interpreted thanks to breakthroughs in theoretical modeling and data analysis. But unless a collaborative effort is established to bring together physicists, mathematicians, computer scientists, and observers, we are bound to miss groundbreaking discoveries. This Simons collaboration is designed to ensure strong gravity discoveries are not lost in the recent explosion of gravitational observations.

The unifying thread of this Simons Collaboration is the non-linear and dynamical nature of strong gravity and black holes, which we will explore through mathematics, physics, and numerical computations, and which we will directly confront through observations. Our major goal is to reveal deep insights about our cosmos that lie at the intersection of strong gravity in general relativity, strong gravity beyond Einstein, and gravitational observations. The combined progress in these interconnected themes will allow us to develop accurate models, interpret gravitational observations and make new discoveries. This Simons Collaboration creates the multidisciplinary community needed to transform strong-gravity science and catalyze a radical paradigm shift in our understanding of the cosmos.

Simons Collaboration on Probabilistic Paths to Quantum Field Theory

Director: Scott Sheffield, Massachusetts Institute of Technology

Quantum Field Theory (QFT) underpins both high-energy and condensed matter physics and has profoundly influenced diverse areas of mathematics, including analysis, geometry, topology, and algebra.

In recent decades, substantial advances in stochastic analysis and random geometry have introduced powerful probabilistic tools for rigorously addressing non-perturbative aspects of QFT. Conformally invariant processes like the Schramm–Loewner evolution allow analysis of the fractal structure of field theories, the theory of regularity structures offers insights into field singularities, and multiplicative chaos provides a mathematical foundation for Liouville quantum gravity. Frameworks such as the mating-of-trees approach

SIMONS COLLABORATIONS IN MPS

exemplify how these tools can be fruitfully combined, yielding deep rigorous results in statistical physics.

This collaboration brings together experts in probability, analysis, and mathematical physics to develop a unified probabilistic foundation for Euclidean QFT, with the goal of enabling non- perturbative analysis of central models and advancing the interface between QFT and mathematics.

Simons Collaboration on Physics of Learning and Neural Computation

Director: Surya Ganguli, Stanford University

Throughout the history of machine learning, physicists have made groundbreaking contributions: the Hopfield model, the Boltzmann machine, and simulated annealing are just a few of the many ideas which laid the foundations for today's deep learning and artificial intelligence.

Progress in machine learning and artificial intelligence continues to accelerate, but to date it is largely empirical. Today's AI is a black box. We believe the time has come for a concerted effort to discover the principles which make it work. We will draw on physics, computer science, neuroscience, mathematics, and statistics, to understand the structure of data, the representations and architectures which encode it, and the dynamics of learning.

This collaboration aims to elucidate fundamental scientific principles of learning and neural computation underlying modern AI. To achieve these aims we treat AI as a complex physical system and we employ and develop powerful techniques from physics and mathematics, in concert with computer science and theoretical neuroscience, to understand and improve how large neural networks learn, compute, scale, reason and imagine.

Learn more about other Simons Collaborations in MPS here.

INFRASTRUCTURE

arXiv

The foundation continues to support the arXiv as part of a multi-year operations grant. Once the current modernization grant period is over the foundation will be continuing a large commitment as part of an arXiv spinout, with a planned launch in 2026.

Magma

The Simons Foundation has played a key role in supporting Magma for over a decade, providing free access to Magma for researchers based at institutions in the United States. Six new sites were enrolled between August 1, 2024, and January 31, 2025, bringing the total number of participating entities (sites) to 276. None of the six sites that joined the scheme in the six months prior to February 1, 2025, have previously held a Magma subscription. So, of the 276 sites, 213 are new sites (ones not using Magma at the time of joining the scheme) and 63 are sites that had been using Magma at the time they joined the Simons scheme. There were 39,189 MAC addresses registered as of January 31, 2025, compared with 34,921 on July 31, 2024.

In 2024, Simons Foundation International made two new grant commitments to support the long-term plan for sustaining Magma via long-term hires, visitor support, research fellows, Magma meetings and development conferences. The grants were made to Andrew Sutherland at MIT and John Voight at the University of Sydney.

CONFERENCES AND SYMPOSIA

Symposia

Simons Symposia are meetings on exciting developments in mathematics, theoretical physics, and theoretical computer science. For one week, top researchers are brought together for discussions and collaborations in a relaxed yet scientifically stimulating atmosphere. Symposia are normally a series of three meetings held every second year.

In 2025, MPS hosted four symposia:

New Frontiers in Combinatorics & Computer Science

Solvable Lattice Models & Interacting Particle Systems

Multi-Scale Physics

Illuminating Dark Matter

Simons Symposia to date are available here.

Conferences

MPS Conferences take place over two, three or five days and are meant to facilitate new scientific directions for MPS engagement and promote interaction and collaboration across disciplines. Information on 2025 conferences can be found on our website.

SIMONS SOCIETY OF FELLOWS

Founded in 2014, the Simons Society of Fellows is a community of scholars that encourages intellectual interactions across disciplines and across research centers in the New York City area.

Composed of both senior and junior fellows, the society organizes weekly dinners, annual retreats, alumni conferences and career development workshops. It also encourages its fellows to participate in regular lectures and conferences organized by the Simons Foundation.

SENIOR FELLOWS

Michael L. Overton

Michael L. Overton is a Silver Professor of Computer Science and Mathematics at the Courant Institute of Mathematical Sciences, New York University. His research interests are at the interface of optimization and linear algebra, especially nonsmooth optimization problems involving eigenvalues, pseudospectra, stability and robust control.

Glennys R. Farrar

Glennys R. Farrar is a Collegiate Professor of Physics and Julius Silver, Rosalind S. Silver and Enid Silver Winslow Professor at New York University. Farrar's primary research goal is discovering the identity of dark matter.

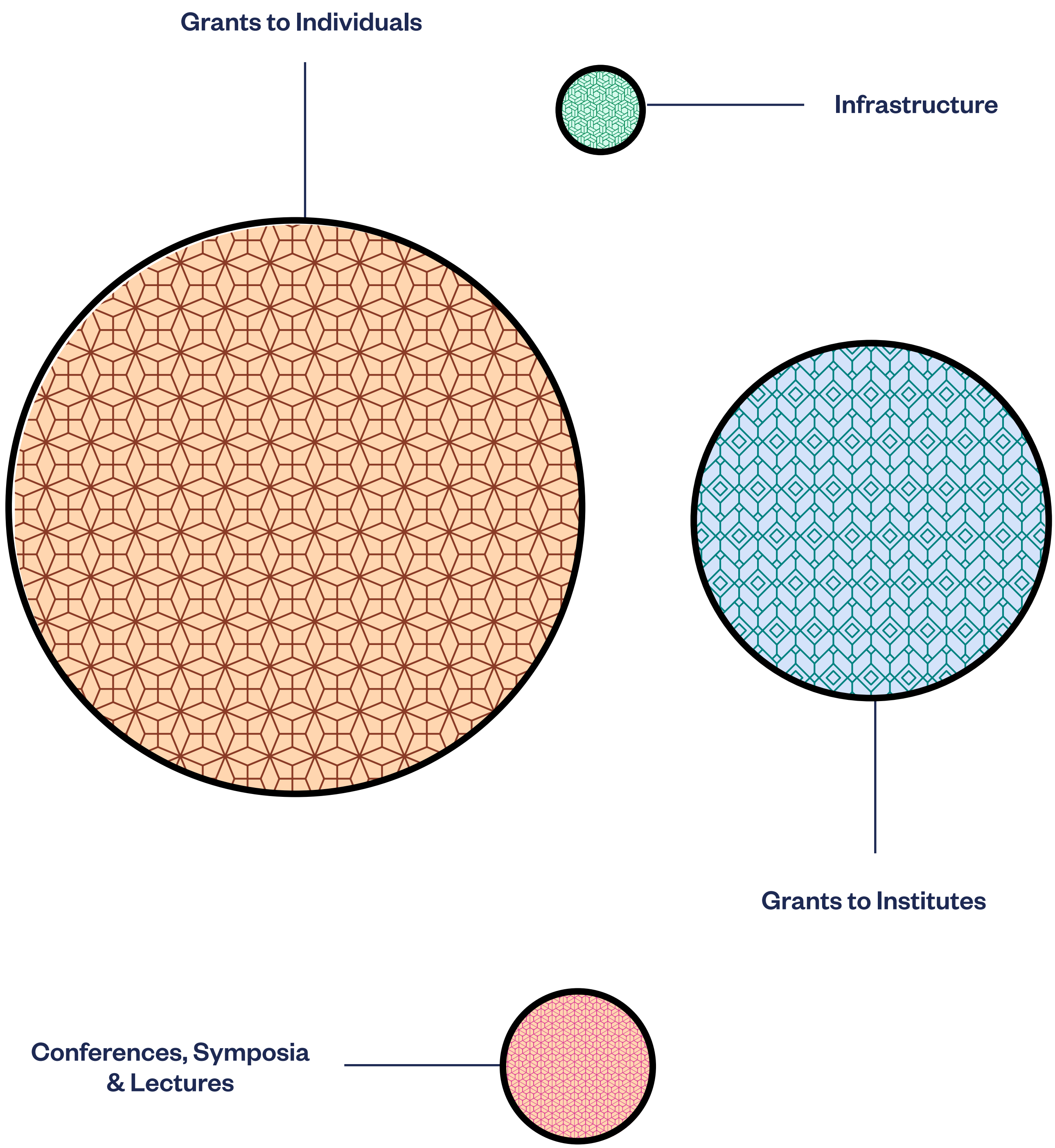
Andrea Alù

Andrea Alù is a Distinguished Professor at the City University of New York (CUNY), the Einstein Professor of Physics at the CUNY Graduate Center, the founding director of the Photonics Initiative at the CUNY Advanced Science Research Center, and a Professor of Electrical Engineering at the City College of New York. His research interests span over applied electromagnetics, nano-optics, polaritonics, and acoustics.

JUNIOR FELLOWS

In 2025, the society made 15 Junior Fellowship awards via Simons Foundation International.
Read More

MPS BUDGET


Grants to Individuals
Infrastructure
Grants to Institutes
Conferences, Symposia & Lectures

2026 International Congress of Mathematicians

The International Congress of Mathematicians (ICM) is among the largest mathematical conferences worldwide. Held once every four years, it is a showcase of contemporary mathematics and an opportunity for outstanding mathematicians from different regions of the world to present the best work covering all mathematical subfields, thus, setting future directions for the field, which it has been doing since the first congress was held in 1897 in Zurich, Switzerland. The last three ICMs, in 2022, 2018, and 2016, took place in Helsinki, Finland, Rio de Janeiro, Brazil and Seoul, South Korea, respectively.

In addition to prestigious scientific talks given at the ICM, scientific prizes are awarded by the congress' governing body, the International Mathematical Union (IMU), which are the highest distinctions in the mathematical world. Presented at the Opening Ceremony are Fields Medals, the IMU Abacus Medal, the Carl Friedrich Gauss Prize, the Chern Medal Award, Leelavati Prize and the Emmy Noether Lecture.

The last US-hosted ICM took place in 1986 in Berkeley, CA. Allyn Jackson writes in *An Inspirational Mix: ICM2026 in Philadelphia* of the 1986 congress, "Many of the greatest advances in mathematics research of that period were made by mathematicians working in the US—many of whom were born elsewhere. A true "melting pot" of nationalities and ethnicities, the American mathematical community is a compelling example of how much can be achieved when people set aside differences to focus on great intellectual aspirations. This spirit of cooperation and collaboration makes the US an ideal site for an ICM." After 40 years, we have the distinct honor of welcoming the congress to Philadelphia, PA, July 23-30 at Pennsylvania Convention Center.

Register for the 2026 ICM.

Click here to view the full list of speakers.