



Caltech Associates

discovering
tomorrow
today

winter | spring
2025

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On the cover. The sparkling green waters of Vietnam's Ha Long Bay, which translates as "descending dragon," are studded with thousands of limestone karsts. Legend holds that the islands and islets were formed as a defense against invaders by protector dragons, who manifested them to destroy approaching ships.

In May, we depart with Professor of Visual Culture **Brian Jacobson** for Vietnam—a crossroads of ancient traditions, *pusaka* craftsmanship, and international trade in the heart of Southeast Asia. Our tour includes UNESCO World Heritage Sites, an overnight cruise of Ha Long Bay, restored palaces of the Nguyen dynasty, the "Temple of Literature" dedicated to Confucius, the iconic Thien Mu pagoda, and Hoi An Ancient Town.



Dear Associates members and friends,

The Caltech community and our neighbors across Southern California began the new year facing an unprecedented disaster. Historic fires caused devastation that is hard to comprehend fully, as thousands in our region lost their homes or were displaced under mandatory evacuation orders. Despite this tragedy, the Caltech community united to support

and relieve one another, and I am so proud of our faculty, staff, and friends like you who came together in a time of crisis.

As we begin recovery, I look forward to spending time together and focusing our attention on the hopeful possibilities of innovative, world-changing research. Due to the fires, our event with **Paul Sternberg** and his investigations into the mysteries of DNA had to be rescheduled. I'm happy to report that we have confirmed Tuesday, April 22, as the new date.

Our first event of the season will be virtual via Zoom in February, presenting the work of **Lulu Qian**, who is developing molecular "machines" that can be programmed to perform tasks or even act autonomously.

In March, **Harry Atwater** will moderate a panel discussion with **Michael Alvarez**, **Frederick Eberhardt**, and **Daniel O'Dowd** (BS '76) on the ethical and policy implications of artificial intelligence. In April, **Nick Hutzler** will describe a novel method employing quantum science to examine atomic nuclei and better understand the most basic ingredients of the universe. And in June, **Sergio Pellegrino** will update us on the progress he is making along with Harry Atwater and Ali Hajimiri toward realizing the dream of generating solar power in space.

A highlight of our spring calendar is a day trip with Nobel Laureate **Barry Barish** to Brookhaven National Laboratory in New York, a leading global center for energy, physics, environmental science, and nanotechnology discovery. This is a rare opportunity you won't want to miss!

We are grateful for your support of Caltech. Your generous membership gifts have a powerful impact, providing funds to invest in promising research and to attract and retain the most talented faculty and scholars in their respective fields. On behalf of the Institute, thank you!

Catherine E. Reeves
Executive Director



PASADENA

Dinner with the Provost

Tuesday, March 11, 2025, 6:00 pm • The Athenaeum

As provost, **David A. Tirrell**, the Ross McCollum-William H. Corcoran Professor of Chemistry and Chemical Engineering and Carl and Shirley Larson Provostial Chair, helps to secure Caltech's future as a source of discovery and innovation. We will hear from Provost Tirrell about the latest Institute developments.

The evening will also feature a presentation from **Niles A. Pierce**, the John D. and Catherine T. MacArthur Professor of Applied and Computational Mathematics and Bioengineering and executive officer for Biology and Biological Engineering.

VIRTUAL

Molecular Robots

Tuesday, February 25, 2025, 11:30 am • Via Zoom

Emerging technology has the potential to endow nonliving physical systems with intelligent behaviors similar to biological systems. **Lulu Qian**, professor of bioengineering, will explain how her research takes inspiration from principles in biology and conceptual frameworks in computer science to develop methods for constructing artificial molecular machines. She will discuss DNA-based neural networks that classify complex and noisy molecular information, proving that rudimentary brain-like behavior can exist in test tube chemistry.

Her presentation will examine simple ways to create nanostructures with programmable patterns comparable to the smallest living cells. She will also describe the creation of swarm molecular robots, demonstrating that nanomechanical tasks can be carried out autonomously by simple molecules following energy-efficient algorithms.

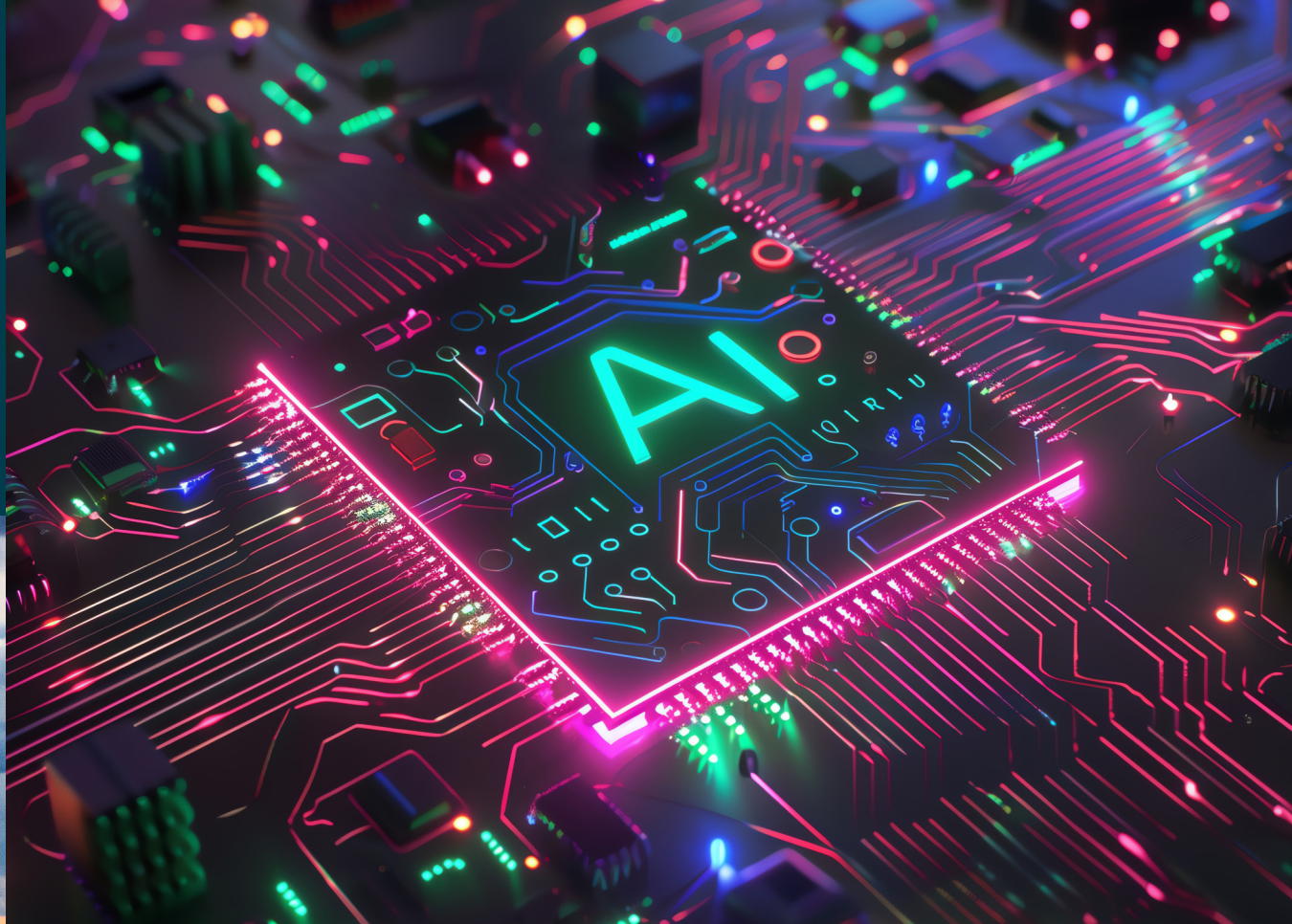


EAST COAST

President's Circle Dinner

Thursday, March 13, 2025, 6:00 pm • New York City

Thomas F. Rosenbaum, president and the Sonja and William Davidow Presidential Chair and professor of physics, will visit New York City for an intimate dinner with President's Circle members. He will also share Institute updates.



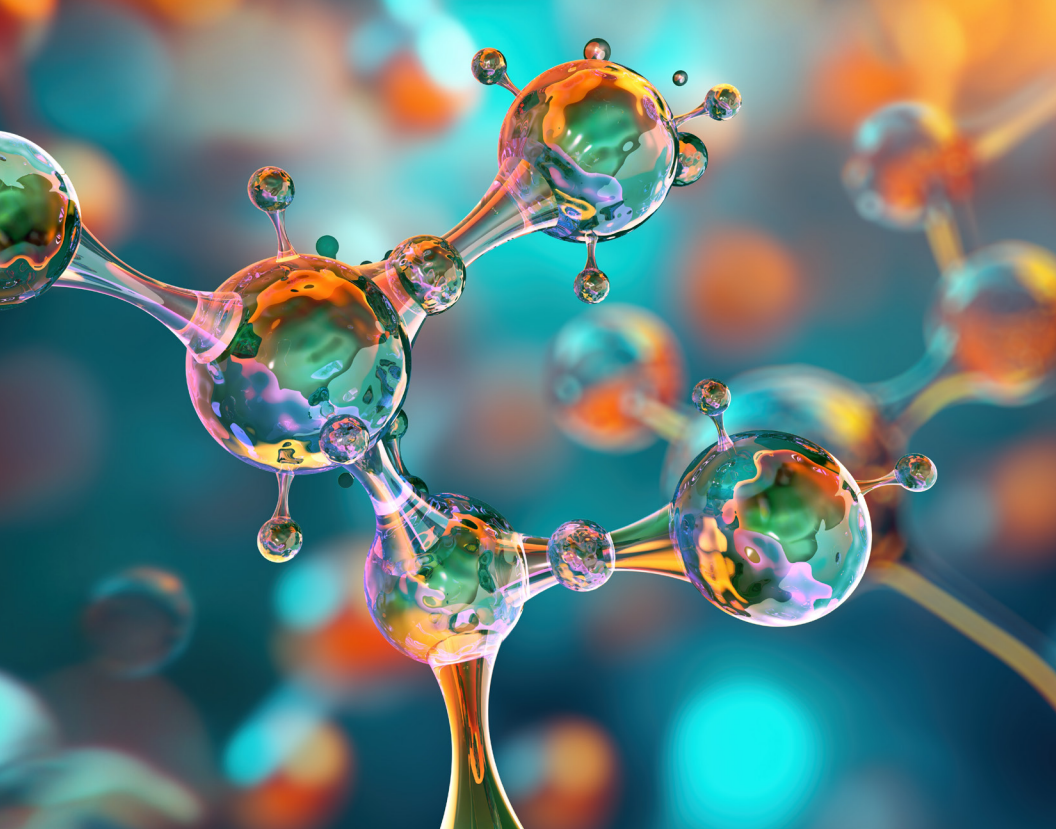
MONTECITO

AI Ethics and Policy

Saturday, March 29, 2025, 11:30 am • Private residence

A panel discussion moderated by **Harry Atwater**, the Otis Booth Leadership Chair in the Division of Engineering and Applied Science and the Howard Hughes Professor of Applied Physics and Materials Science, will examine the ethical perplexities of artificial intelligence and its public policy implications.

Panel participants include **Michael Alvarez**, the Flintridge Foundation Professor of Political and Computational Social Science; **Frederick Eberhardt**, professor of philosophy; and **Daniel O'Dowd** (BS '76), a 2020 Caltech Distinguished Alumni Award winner and founder and CEO of Green Hills Software.



ORANGE COUNTY

Reading the Genome

Tuesday, April 22, 2025, 6:00 pm • Avenue of the Arts, Costa Mesa

A fundamental goal of genetics is the ability to look at the sequence of a genome—the DNA instructions found in cells—and understand the differences between species and individuals. The better we become at reading the genome, the better we can understand fundamental biology, address genetic diseases to improve human, animal, and plant health, and ultimately write genomes for biotechnology applications.

Paul Sternberg, the Bren Professor of Biology and the William K. Bowes Jr. Leadership Chair in the Division of Biology and Biological Engineering, will share his view of the state of the art in genetics. He will discuss how genome analysis, systematic genome editing, and data science, such as artificial intelligence, coupled with conceptual understanding (the old-fashioned “feel for the organism”), work together to allow unprecedented progress in genetics and its applications.

NORTHERN CALIFORNIA

Exotic Nuclei

Saturday, April 5, 2025, 6:00 pm • The Sea by Alexander’s Steakhouse, Palo Alto

Many of the basic ingredients and phenomena of the universe—including how matter was formed after the big bang—are not understood. Quantum-controlled molecules can provide sensitive probes of atomic nuclei and undiscovered particles that might be hiding inside them.

Assistant Professor of Physics **Nick Hutzler** will discuss how studying nuclei with deformed shapes can help us gain understanding and reveal fundamental properties of the nucleus. These investigations are typically conducted at large facilities, but a new class of approaches uses small-scale experiments that leverage advances in quantum science. Professor Hutzler will describe how his lab combines ideas from nuclear physics, quantum science, and physical chemistry to design molecules that can be controlled down to the quantum level and examine them to reveal the properties of exotic nuclei.





EAST COAST

Brookhaven National Laboratory

Friday, April 25, 2025, 7:00 am • Departing from New York City

A leading center for energy, physics, environmental science, and nanotechnology research, Brookhaven National Laboratory (BNL) investigates scientific questions of national and global importance. Work conducted at BNL has been awarded seven Nobel Prizes in physics and chemistry, five of which resulted from work with the facility's particle accelerators. The lab is supervised by the United States Department of Energy's Office of Science.

We'll tour this fascinating facility with Nobel laureate **Barry Barish**, the Ronald and Maxine Linde Professor of Physics, Emeritus. Barish shared the 2017 Nobel Prize in Physics with fellow Caltech faculty Kip S. Thorne, the Richard P. Feynman Professor of Theoretical Physics, Emeritus, and Rainer Weiss of the Massachusetts Institute of Technology for contributions to LIGO.

PASADENA

President's Circle Garden Party

Saturday, May 3, 2025, 6:00 pm • President's residence

Thomas F. Rosenbaum, president and the Sonja and William Davidow Presidential Chair and professor of physics, and **Katherine T. Faber**, Simon Ramo Professor of Materials Science, welcome President's Circle members to their home for an elegant evening to celebrate members' generosity to Caltech.



Watson Lectures 2025

Presented in the elegant Beckman Auditorium on campus, the Earnest C. Watson Lecture Series has brought the wonder of Caltech research and discovery to the public for more than 100 years. Caltech Associates members receive complimentary preferred seating. To reserve tickets, call (626) 395-4652.

Wednesday, January 29, 2025, 7:30 pm

Post-Wildfire Debris Flows

Michael Lamb, professor of geology, discussed research on debris flows and ways to forecast their impact.

Wednesday, February 26, 2025, 7:30 pm

Investigating DNA

Rob Phillips, the Fred and Nancy Morris Professor of Biophysics, Biology, and Physics, will discuss the challenges in understanding what the DNA of different organisms mean.

Wednesday, March 26, 2025, 7:30 pm

Movies & Technology

Brian Jacobson, professor of visual culture, will explore the relationship between cinema and technology.

Wednesday, April 23, 2025, 7:30 pm

The Power of Microbes

Smruthi Karthikeyan, the Gordon and Carol Treweek Assistant Professor of Environmental Science and Engineering and William H. Hurt Scholar, will discuss how we can harness microbes for health and sustainability.

Wednesday, May 28, 2025, 7:30 pm

Mission to Europa

Tracy Drain, lead flight systems engineer at Jet Propulsion Laboratory, will discuss the Europa Clipper mission to explore that tantalizing moon of Jupiter.



ORANGE COUNTY

Space Solar Power

Thursday, June 5, 2025, 6:00 pm • Private residence

The elusive dream of large satellites in space that beam electric power to Earth around the clock is now closer than ever. For more than ten years, three Caltech professors, Harry Atwater, Ali Hajimiri, and **Sergio Pellegrino**, the Joyce and Kent Kresa Professor of Aerospace and Civil Engineering, and their students and collaborators have been developing new technologies that will make it possible to provide power to Earth from space at an economically affordable cost.

Professor Pellegrino will talk about Caltech's scalable system architecture, which consists of identical modular spacecraft that fly in formation. The development and demonstration of these modules have involved a series of conceptual and technological breakthroughs. He will also discuss a recently completed space demonstration of the three main technologies developed at Caltech and the techno-economic analysis that underpins the team's claim that affordable power from space is within our reach.

Travel



CERN 2026

May 2026 dates to be announced

Join us in spectacular Switzerland with **Maria Spiropulu**, the Shang-Yi Ch'en Professor of Physics, as we visit CERN, where physicists and engineers are probing the fundamental structure of the universe in the world's biggest physics laboratory. We will see the Compact Muon Solenoid detector, which is built around a massive solenoid magnet capable of generating approximately 100,000 times the magnetic field of Earth.

Our itinerary includes Geneva and a tour of the Patek Philippe Museum to learn about the art and science of watchmaking. We will also explore the wonderfully preserved medieval Old Town of the federal capital and university city of Bern, a UNESCO World Heritage Site, and visit Bern's 15th-century Gothic cathedral. In Basel, we'll sample the world of Swiss chocolate and learn from a master chocolatier. Then, we will wander the banks of the River Limmat in Zurich before making a short journey to the vineyard in Zurich-Höngg, where the Zweifel family have been active as winegrowers since 1440. This trip will be an unparalleled opportunity to experience the pinnacles of Swiss technology, art, and culture.

LIGO 2025

Monday to Thursday, November 3–6, 2025

On September 14, 2015, the twin LIGO detectors in Livingston, Louisiana, and Hanford, Washington, made an incredible breakthrough. They both detected gravitational waves produced by the merger of two black holes.

In 2017, Rainer Weiss of the Massachusetts Institute of Technology and Caltech's Barry C. Barish, the Ronald and Maxine Linde Professor of Physics, Emeritus, and Kip S. Thorne, the Richard P. Feynman Professor of Theoretical Physics, Emeritus, jointly received the Nobel Prize in Physics "for decisive contributions to the LIGO detector and the observation of gravitational waves."

Join **Rana Adhikari**, professor of physics, and **Yanbei Chen**, professor of physics, for a tour of this historic facility. Professors Adhikari and Chen are expanding upon the legacy of Weiss, Barish, and Thorne by combining theoretical and experimental techniques to peer deeper into the most mysterious phenomena in nature, using quantum measurement to understand the nature of black holes and space-time.





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