Our Science
A Tradition of Scientific Discovery

Physics continues to flourish at Cal

From accelerators to atoms, achievements in a wide spectrum of scientific disciplines continue to bring distinction to the department in the form of prizes, technology transfer, impactful papers, and distinguished alumni.
2D Condensed Matter Physics

• Discovery of tunable Mott insulator, superconductivity, orbital magnetism, and Chern insulator in a single trilayer graphene/hBN moire superlattice.

• Discovery of moire excitons, Mott insulators, and generalized Wigner crystals in WS$_2$ / WSe$_3$ moire superlattices.
Quantum Computers and Simulators

Researchers at IBM Quantum in New York and their collaborators at the University of California, Berkeley, and Lawrence Berkeley National Laboratory report in the journal *Nature* that they pitted a 127-qubit quantum computer against a state-of-the-art supercomputer and, for at least one type of calculation, the quantum computer bested the supercomputer.
Brain: From Data to Model

- We can measure the neural correlates (e.g., activity of neurons) of mental activity. **Human Brain Project:** A full, digital, 3D model at the resolution of the individual cell tracing cellular connections.

- Physics, the most quantitatively accurate descriptions of natural phenomena, and physicists are needed to understand ourselves.

**Brain**
- 3 lb.
- 1000 cm$^3$

**Synapse** $10^{15}$ (1 quadrillion)
SSL: New Capabilities and Missions

Berkeley is working with private funding to study – and likely build and launch – a space telescope taking advantage of “new space” capabilities. The goal is to demonstrate the possibility of building a series of inexpensive (MidEx cost) space sciences missions, each learning from the previous, and each focusing on different science goals.
Gravity in the Quantum Information Age

- Information theory gives us a common language to approach the theories of gravity and quantum mechanics.

- New quantum tools give us table-top methods to explore fundamentally new ideas in the physics of the universe: scrambling, quantum null energy condition, ...
Our Centers
Neutral physics and astrophysics, nuclear astrophysics topics ranging from supernova and neutron star modeling to dark matter, and fundamental symmetries.

Science Mission

Research Foci

• Fundamental Symmetries
• Nucleosynthesis
• Dense Matter and Neutron Stars
• Dark Matter
• Astrophysical Simulations
Our primary research theme is quantum computing, along with connected topics in quantum simulation, sensing, and technology development, and quantum-inspired classical computing.

Science Mission

- Quantum Algorithms
- Verifiable Quantum Advantage
- Scaling Quantum Systems
Superconducting Quantum Computers for Science

Science Mission

The Advanced Quantum Testbed (AQT) is an advanced superconducting platform for full-stack quantum computing, fostering, deep collaborations with users selected through a competitive process.

Research Foci

- Quantum Processor Development
- Quantum Control
- Quantum Computation & Simulation
The most pressing scientific questions about the Universe.

Furthering our understanding of matter, spacetime and the Universe, or more specifically quantum gravity, dark matter, neutrinos, the Higgs boson, and even the multiverse, ...

Science Mission

Research Foci

- Particle Theory
- Particle Cosmology
- String Theory and Quantum Gravity
UC-wide Center Focused on the Physics of the Electron Ion Collider (EIC)

**Science Mission**

The EIC will be a particle accelerator that collides electrons with protons and nuclei to produce snapshots of those particles’ internal structure—like a CT scanner for atoms.

**Research Foci**

- How does the mass of protons and neutrons arise from the nearly massless quarks and gluons?
- How does the spin of the nucleon arise?
- What are the emergent properties of dense systems of gluons?
Every Student By Name And Need

**BUILDING NEW BRIDGES**

**Every Student By Name And Need**

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**BPIE** - The Berkeley Physics International Education (BPIE) Program partners with universities around the world to provide undergraduate international students an opportunity to study abroad at UC Berkeley for one semester or one year.

**BETA Physics** - The Berkeley Experience and Training in Advanced Physics (BETA Physics) Program is a certificate non-degree program which hosts visiting students from around the country and the world to provide them with an opportunity to study advanced graduate level physics at UC Berkeley for one or two semesters.

**The Berkeley Pre-Core Transfer Summer Program** is designed specifically to help prospective and newly admitted transfer students strengthen their skills to transition successfully into physics, astrophysics, and earth and planetary science (EPS) majors at UC Berkeley.

**REYES** - The Remote Experience for Young Engineers and Scientists (REYES) virtual STEM-H learning experience aims to increase science literacy, inspire and train the next generation of engineers and scientists. We also help increase diversity in STEM fields by lowering barriers of entry for all, including students from underrepresented backgrounds. To date, more than 11,000 learners in 135 countries have registered for REYES.

**Berkeley Connect in Physics** - The Berkeley Connect program opens up the extraordinary resources of the university to you: the extraordinary students on our campus. By joining, students will become part of a community of like-minded faculty, mentors, and students that will provide a supportive environment in which to exchange and discuss ideas and goals.

**Pi2** - The Physics Innovators Initiative is our vision for modernizing, streamlining, and strengthening the path students follow as they pursue their undergraduate careers. The Pi2 Summer Scholars Program is designed to create funded summer research opportunities for undergraduates and rewards graduate students and postdocs for their mentorship.
Our Community
Creating A Community Of Life-Long Learners
“My research largely focuses on understanding the emergence of low-energy nuclear physics directly from the fundamental theory of quark and gluons, namely quantum chromodynamics (QCD).”

A Wilson Award winner whose work has expanded different subfields of nuclear and particle physics, including QCD spectroscopy, lattice QCD, scattering theory, hadron structure, nuclear structure, and quantum computing.
“Using AMO and precision measurement techniques we can perform new tests of fundamental physics on a table-top, with real-world applications in fields such as navigation and medicine.”

A world-leading experimentalist having developed advanced methods where the frequencies of two highly precise atomic clocks are compared to one part in $10^{20}$, the highest precision of any measurement to date.
The Miller Institute is "dedicated to the encouragement of creative thought and the conduct of research and investigation in the field of pure science and investigation in the field of applied science in so far as such research and investigation are deemed by the Advisory Board to offer a promising approach to fundamental problems."

Visiting Professors

Philip Kim, Harvard University
Vahid Sandoghdar, Max Planck Institute for the Science of Light
Michael Turner, Rauner Distinguished Service Professor, Kavli Institute for Cosmological Physics
Jure Zupan, University of Cincinnati

Fellows

Augusto Ghiotto, Columbia University
Ethan Lake, MIT
Calvin Leung, MIT
Xueyue (Sherry) Zhang, Caltech
Faculty Awards

• Ehud Altman
  Simons Foundation Investigator

• Stuart Bale
  American Geophysical Union Fellowship

• Mike Crommie
  Department of Defense Vannevar Bush Faculty Fellow

• Hernan Garcia
  Chan-Zuckerberg Biohub Investigator

• Alessandra Lanzara
  UC Berkeley Bakar Fellow Prize

• Dunghai Lee
  American Academy of Arts and Sciences Fellow

• Chung-Pei Ma
  American Astronomical Society Fellow

• Eric Ma
  Amazon Physical Science Fellowship

• Geoff Pennington
  DOE Early Career Award

• Matt Pyle
  DOE Early Career Award

• Ben Safdi
  Alfred P. Sloan Research Fellowship

• Dan Stamper-Kurn
  American Association for the Advancement of Science Fellow

• Michael Zaletel
  L&S Faculty Award

  DOE Early Career Award
Marjani previously worked at the University of Illinois Chicago (UIC) as an academic advisor for the occupational therapy department. At UIC, she was a primary resource for prospective and enrolled students. She was chair of the Applied Health Sciences staff council committee.

“I hope to contribute to the mission, vision, and goals of the Department by supporting student success and satisfaction, and by partnering with other academic staff/departments.”
“My dad is a mathematician and a physicist, so an appreciation for science runs deep in my family! My goal is to promote the continuing growth of our programs and create a fun and memorable experience for all of our visiting Physics students.”

A consultant and strategist with ample experience in marketing, advertising, website creation, digital storytelling and campaigns, content curation and social media strategy. Alex is from the Bay Area and a UC Santa Cruz graduate.
• **Collaboration** - Enhances individual work by soliciting contributions from others and enhances others’ work by contributing to their success to more effectively meet unit goals.

• **Goal Accomplishment** - Achieves individual goals that contribute to unit priorities.

• **Inclusion & Belonging** - Demonstrates respect for people and their differences, and understands the benefits of a diverse workforce, is trusted and respected by others, includes and welcomes others, and works to understand the perspective of others.

• **Innovation** - Uses knowledge, skills, and professional experience to seek efficiencies and improve work outcomes.

• **Job Mastery** - Demonstrates the knowledge, skills, and abilities that result in high performance and contributions within the scope of the employee’s job description.

**SPOT Awards**

Anna Hilke  
Laura Fantone  
Elizabeth Nakahama-Ryan  
Joelle Miles  
Kathleen Cooney  
Carlos Bustamante  
Isabella Mariano  
Simon Leaver-Appelman  
Mari Royer  
Beth McCleary  
Anthony Vitan
Where Students Are Achievers

Graduate Student Incoming Class

Abdalla, Ahmed Ibrahim
Adhidewata, Jyesta Mahayu
Afifa, Umaima
Alcott, Samuel David
Alsallom, Faisal
Bariuan, Luis Gabriel Carlos
Bartlett, Alexa
Bear, Soren Jorgensen
Blackburn, Albany Eve
Carrel, Dashiell
Castro, Juan Antonio
Cui, Jeffery
D’Ambrosia, Samuel Hewitt (Sam)
David, Marco
Derrico (Abby), Abigail
Devereaux, Kyle
Duim, Rowan
Fahs, Adam
Fultineer, Aaron Timothy
Gong, Xiaoxun
Hong, Vi Thanh

Hwang, Minyoung Chris (Tucker)
Jahanbani, Shahin
Lee (Tsaichen Lee), Tsai-Chen
Lim, Hyungbin
Louie, Garrett
Naumov, Kirill
Pan, Shuaimei
Pope, Isaac Matteo
Raman, Kailash Anirudh
Sewalls, Harper Clay
Shiferaw, Abel Misikir
Shtov, Alexander Sergeevich
Singh, Roshni
Suryanarayanan, Aswath
Tabor, Elisa
Turnbull, Joey
Wang, Yi-Cheng
Xiang, Tai
Yousuf, Fatima
Zhu, Tong
Meet the new graduate class

- 1195 Applicants; 42 acceptances
- 6 Major Fields of Physics
- Applicants from Across the Globe

<table>
<thead>
<tr>
<th>Research Type</th>
<th>Applied</th>
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<tr>
<td>Nuclear</td>
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</table>
A Community Of Researchers

Incoming Postdoctoral Scholars

Andrews, Bartholomew
Bhattacharyya, Prabudhya
Bloch, Itai
Bonnefoy, Quentin
Chang, Yen-Yung
Chen, Lebing
Cheong, Patrick Chi Kit
Colin-Ellerin, Sean J
Feggeler, Thomas
Freschi, Marco
Froustey, Julien
Ge, Zhehao
Hashim, Akel
Hodgkinson, Danielle Louise
Jackura, Andrew
Ji, Lingyuan
Karamanis, Minas
Lin, Yu-Ping
Liu, Chuanhong
Lopez-Collado, Elena de la Hoz

Luo, Hailan
Mitscherling, Johannes
Mukhopadhyay, Payel
Myles, Justin
Paterson, Jessy
Pritchard Cairns, Luke
Ray, Anupam
Saez, Maria Manuela
Salazar Wong, Farid
Schneider, Lucas
Wang, Ke
Wu, Qiming
Zhang, Fang
Zhang, Jessie T
Physics Student Organizations

Student Org activities include: mentoring, social events, faculty/student lunches, community outreach, BBQs, study halls, guest speakers, undergraduate student seminars, physics tournaments, workshops, research lecture series, poster sessions, research support,...

A Vibrant Community

Physics major Ana Lyons has created a series of 12 posters in response to renewed conversations about equity and justice in the Physics Department.

“I’ve always loved drawing and painting”, she says, “and creating a series of portraits of influential Black physicists seemed a fun way to contribute.

Willie Hobbs Moore
First Black Woman To Earn a PhD in Physics

A First Generation Student, Dr. Moore studied physics and electrical engineering at the University of Michigan, where she earned her PhD in 1972. Her thesis analyzed the structure of PVC plastics. As a researcher at the University of Michigan, she studied protein spectroscopy. In just 5 years, she published over 30 papers.

In 1977, she left the University for Ford Motors, where she worked on improving manufacturing and engineering methods. Dr. Moore was a passionate advocate for minority students in STEM.

Philosophy major Philip W. Phillips is a theoretical condensed matter physicist who works on disordered, strongly correlated electron systems, and problems on the border with high-energy physics. He received his PhD in 1982 from the University of Washington and then was a Miller Fellow at UC Berkeley. After a faculty position at MIT from 1984-1993, he joined the physics faculty at University of Illinois at Urbana-Champaign.

He has received numerous awards for this work including the Edward A. Bouchet Award from the APS, Fellowship in the APS, a Guggenheim and membership in the American Academy of Arts and Sciences in 2020.
Our Undergraduate Class

’22–’23 AY: 110 Graduates

Post-Graduate Plans

<table>
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<th>Graduate School</th>
<th>Technology Fields</th>
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<td>0%</td>
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- research assistant/specialist
- software engineer
- STEM teacher
- data scientist
- quantitative analyst
- quantum device test engineer
Faculty Retirements

Frances Hellman  
Steve Louie  
Marjorie Shapiro
IN MEMORIAM

Remembering Allan Kaufman

Allan Nathan Kaufman, Professor of Physics at UC Berkeley, passed away peacefully on December 2, 2022 in Moraga, California. He was 95.

Professor Kaufman made seminal contributions in plasma physics, specifically in the areas of wave chaos, wave kinetic equations, ponderomotive effects, quasilinear diffusion and mode conversion in nonuniform plasmas.
Our Vision
"I came to UCB as an undergrad from Berkeley High School in 1959. My maternal and paternal grandmothers, my mother and all of my aunts on both sides of my family preceded me, one of my grandmothers graduating from UCB in 1897, the other in 1908. I served in Physics as Facilities and Operations Manager for 24 years. Though now retired, I still love supporting the Physics Department.

Physics is special because of the people and their values: amazing faculty, extraordinary staff, awesome students who enjoy working together and supporting one another in achieving shared goals."

Strengthening Community
With the devastating effects of COVID mostly behind us, revive and grow the inclusive and vibrant community that has made the Physics Department so special—the joy of contributing collectively to the success of our Department.

Infrastructure
Reorganize and refresh appropriate spaces and upgrade infrastructure to attract and retain top-notch faculty, staff, and students and support cutting-edge research and teaching programs.
INFRASTRUCTURE

Math & Physics Master Plan

- Master Plan commissioned by MPS Dean Steve Kahn late 2022
- Payette and LMS selected as architects to develop Master Plan
- Explore options and pathways to meet Physics’ evolving space needs and Math’s vacating of Evans and future space needs
- Two scenarios being presented to Campus and UCOP leadership
We should develop a realistic, workable, actionable plan for recruitment and retention of a diverse faculty and students. We also need to have a mechanism to properly support our new members when they are here.

“...I arrived at Berkeley in 1990 to begin my undergraduate studies at Cal. During my undergraduate years, I worked as a student assistant in the Physics Library. I joined the Physics Department in 1995 and have now been here nearly 28 years, all in our incredible Physics Student Services Unit.

Berkeley Physics is like no other. I have been in Berkeley Physics for a number of years now and have seen our department experience incredible achievements and also many challenges/hardships. We have made it through them all because I choose to believe that we all care and we all want to contribute to a positive and thriving community.”

**Strengthening Community**

As a Department (faculty, students, staff, postdocs, visitors, lecturers, etc.) and in partnership with all its members, we all need to rebuild the sense of community and collaboration in all areas.

**Support**

We should develop a realistic, workable, actionable plan for recruitment and retention of a diverse faculty and students. We also need to have a mechanism to properly support our new members when they are here.
Building A Welcoming and Vibrant Community

Honoring all Traditions

An E&I plan for Berkeley Physics needs to foster a sense of belonging through all steps in the intellectual pathway.
“I joined UC Berkeley on July 23, 2013 as the Director of Instructional Support. When I arrived from the east coast, I knew no one in the bay area, and I had to leave my family behind. My first impression of Berkeley was that I was now part of a second family - my family at Berkeley.

Berkeley Physics is special to me because of the people, both faculty/staff and students, who embrace you into the community.”

Transparency
A transparent community contributes to better retention and a stronger bond among its constituents. It allows individuals within the community to openly express their views and share their thoughts. It enhances the quality of work and life for community members.

Shared Governance
Shared governance in our community ensures a culture of trust, and mutual accountability. It promotes collaboration, a diversity of ideas, shared responsibility, collegiality, and institutional excellence.
New Physics Department Vice Chairs

Dan McKinsey
Faculty Affairs

Yury Kolomensky
Instruction

Martin White
Faculty Appointments
New Head Undergraduate Faculty Advisors

Na Ji

Gabriel Orebi-Gann
"I've been at Berkeley since 2006, after five years working at Mills College, but I am a Bay Area native and UCB was always close by. The reputation of Berkeley Physics as a great place to work was well known before I applied to work here. This has absolutely been the case for me - I have found the staff and faculty to be excellent (whip smart, experienced, devoted, caring) and I immediately felt at home.

Berkeley Physics is special to me because of the people, both faculty/staff and students, who embrace you into the community."

**Strengthening Community**
I also want to amplify our efforts to strengthen equity, inclusion and belonging for all individuals in our community: students, staff, faculty, postdocs, lecturers, researchers and so on. I want to be a part of a community that sees diversity as its strength and celebrates the contribution each of us makes on a daily basis.

**Undergraduate Experience**
I am very focused on the undergraduate experience - mentoring, belonging, academic support, resources. There is so much we can do to strengthen the experience for pre-majors and majors, and inspire more students to choose, and stay, with physics at Berkeley, regardless of their eventual career path.
Joint Anti Racism Workshop Series with LBNL

EQUITY & INCLUSION

Be Educated, Be A Good Achiever

2022

- How to Hold Civil Discussions about Racism
- Othering and Belonging
- Expanding our Cultural Lens

A Partnership In Discovery

2023

Exploring ways to improve mentoring.
A process was started during the Physics First Friday workshop in November 2020 to create a set of unique principles for the Physics Department, a set of agreements rooted in our own community values, beliefs and interests.

https://physics.berkeley.edu/equity-inclusion/physics-department-community-principles
Our Events
10•30•23
John Clauser
Experimental proof that nonlocal quantum entanglement is real
Thank you!
Join us for refreshments outside the Campanile