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2025 Annual Newsletter

Chair's Welcome

Greetings! It has been an eventful year in the UCSB Physics department, with many high-profile awards recognizing the research impact of our faculty and students, and with continued growth in our enrollment. The department community is thriving, with large turnouts at our recent "Physics on Ice" skating party, the Nobel colloquium, and student events such as the Summer Research Symposium. We celebrated the graduation of 146 undergrad physics majors and completion of 24 PhD degrees this year; this puts us on track for a **5th consecutive year awarding the most undergraduate physics degrees in the US**.

Our undergraduate curriculum continues to expand, with the new optics lab, which started out as a special topics course, now part of the standard course catalog. We have other new courses following that path from special topics courses, including popular courses on Quantum Information (taught by Prof. Craig), Atomic, Molecular and Optical Physics (taught by Prof. Jayich), and Mesoscopic Physics (taught by Prof. Devoret). I'm also thrilled by the growing number of undergraduate students involved in independent research projects, which was highlighted by the 2-days of talks by undergrads at the Summer Research Symposium.

To better connect with our local community, we launched a **"Labs & Lectures" program, where faculty open their labs for tours following an introductory lecture**. The first event was well-attended and well-received. The next event will be April 9th, with tours of our soft-and-living matter labs. To better connect with our alumni, we have established an annual Alumni Award which celebrates the success of an alumnus who took a non-academic career path. We look forward to welcoming the first award recipient, Joe D'Anna, back to campus for a colloquium in January! See his interview later in this newsletter.

I enjoyed meeting many alumni at events this year in NY and the Bay Area. It was thrilling to hear about the breadth of impact our alumni are having. I look forward to more opportunities to reconnect in the coming year!

David Stuart, Department Chair

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2025 Nobel Prize in Physics

UCSB Physics Professors John Martinis and Michel Devoret awarded Nobel for the discovery of macroscopic quantum effects.

Two members of our department had eventful, early morning wake-ups in October when they learned they had been awarded the prize, along with John Clarke at UC Berkeley for work they had done as a trio together in the 1980's.

"It is a great honor to be awarded the Nobel prize," Martinis said. "I am grateful to have worked with John Clarke and Michel Devoret during my PhD thesis, as they taught me how to do compelling experiments. The global physics community has also contributed greatly to the success of superconducting qubits. Next, let's build a useful quantum computer!"

The trio, who were cited "for the discovery of macroscopic quantum mechanical tunneling and energy quantization in an electric circuit," developed a series of experiments in 1984 and 1985 in which they built an electronic circuit out of superconducting components, each component separated by a thin layer of nonconductive material — a setup known as a Josephson junction. By controlling and measuring the phenomena that arose when they passed a current through it, they were able to demonstrate behaviors such as quantum tunneling, and that, true to prediction, energy in a quantum mechanical system is quantized — that is, the system absorbs or emits only certain specific amounts of energy.

Both Martinis and Devoret gave a special lecture for the UCSB community on the ground-breaking research to an audience of hundreds.

Full article from the Current.

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Gary Horowitz awarded 2025 Dirac Medal for contributions to theoretical physics

Joining the sweeping theory of general relativity to the probabilistic world of quantum mechanics is perhaps the greatest challenge in modern physics. Each has been borne out on its own scale by thousands of experiments and observations over more than a century. However, stitching these disparate frameworks together has eluded physicists for just as long, though not for want of trying.

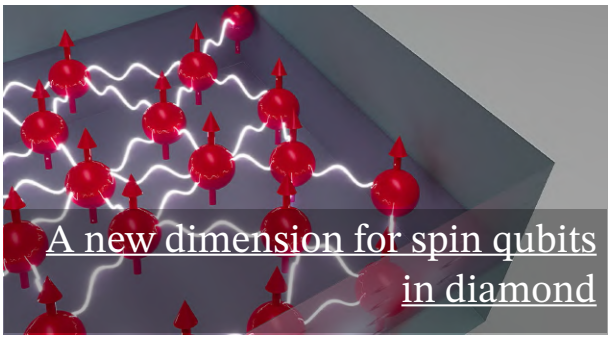
Gary Horowitz is among today's leading figures attempting to bridge this gap. His contributions to this endeavor have earned him the 2025 Dirac Medal, conferred by the International Centre for Theoretical Physics (ICTP), a prestigious honor recognizing his groundbreaking work in gravitational physics and string theory.

Named for Nobel laureate Paul Dirac, the Dirac Medal is awarded annually on Aug. 8, Dirac's birthday, to scientists who have made "significant contributions to theoretical physics." Horowitz shares the 2025 prize with physicists Gary Gibbons, Roy Kerr and Robert Wald.

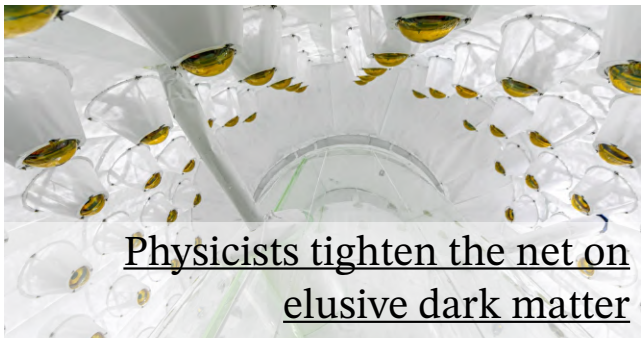
"We are incredibly proud of Professor Horowitz's many achievements, including his well-deserved recognition with the 2025 Dirac Medal," said Shelly Gable, dean of UCSB's Division of Mathematical, Life and Physical Sciences and the Susan and Bruce Worster Dean of Science. "His work embodies the depth of intellectual curiosity and ambition that characterize our scientific community at UC Santa Barbara, and we are fortunate to count him among our faculty."

Full article from the Current

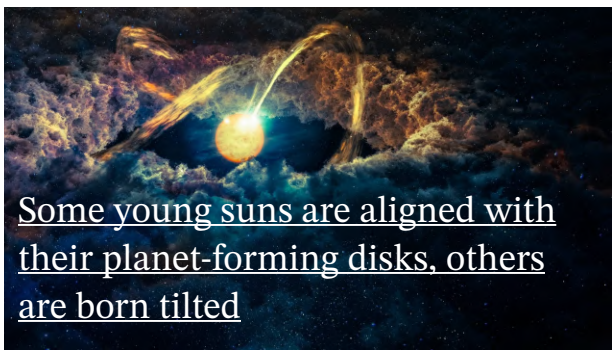
UCSB Physics in the News



A new dimension for spin qubits in diamond



Physicists tighten the net on elusive dark matter



Some young suns are aligned with their planet-forming disks, others are born tilted

Mapping space: Largest map of the universe announced

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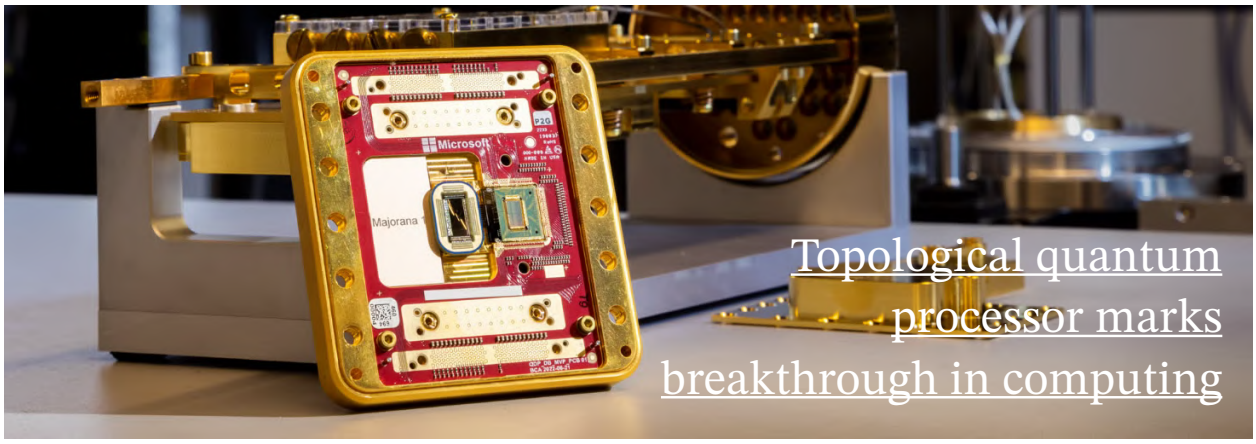
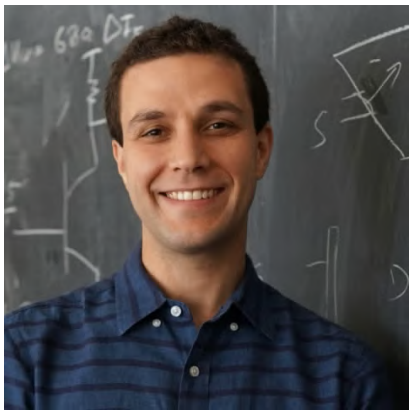
UCSB Physics in the News



Congratulations!

Physics faculty **Sebastian Streichan**, **David Patterson** and **Andrea Young** were all named Gordon and Betty Moore Foundation Experimental Physics Investigators. They were named along 19 other mid-career researchers nationwide who will receive $1.3 million in support over the next five years for their innovative work to advance the frontier of fundamental research in experimental physics. Congratulations on becoming Moore Investigators!





New faculty: Prateek Agrawal

This year we welcomed Prateek Agrawal on the faculty, joining the High Energy Theory and Astrophysics groups. He did his PhD at the University of Maryland, postdoctoral positions at Fermilab and Harvard, and has been on the faculty at the University of Oxford (UK) before moving to UCSB. His work lies at the interface between cosmology and physics beyond the standard model. Welcome to Broida, Prateek!

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Boris Shraiman points a physicist's eye on biological quandaries

Physicist Boris Shraiman has led an intellectually peripatetic career, to great satisfaction, success and acclaim. The UCSB theoretician was recently awarded the American Physical Society's Max Delbrück Prize in Biological Physics for "contributions to morphogenesis, evolution, and biological information processing."

The APS cited Shraiman's "mastery of biological knowledge, innovative analysis of biological data, and rigorous theoretical reasoning" which he combines to "uncover deep insights into the underlying principles of biological processes."

Make no mistake, though, Shraiman is a theoretical physicist by training, and that is still how he sees himself. He's just a physicist who works on problems in biology. "I find it fascinating that simple ideas, simple theories, can be predictive even in a field as complex as biology," he said.

"I am greatly honoured by the prize but it would not have happened without the fabulous cohort of my collaborators and without the benefit of the exceptional intellectual ferment of our institute and the department," said Shraiman, the Susan F. Gurley Professor of Theoretical Physics and Biology at the Kavli Institute for Theoretical Physics (KITP) and in the UCSB Physics Department. "It feels good to have your past work recognized," he added. "But to tell the truth, I'm more focused on the excitement of my current work. And I feel that the best work is still to come."

Shraiman's work has been a boon to his field and helped shape the character of KITP. "It's wonderful that Boris has been appreciated for his groundbreaking theoretical insights into biology," said KITP Director Lars Bildsten. "Through his curation of the yearly Santa Barbara Advanced School of Quantitative Biology, Boris has also created an international community of scientists who deeply engage in experiment and theoretical dialog every summer with early-career researchers. His contributions are profound and lasting."

Full article from the Current

Onward and Upward: congratulations graduates!

We would like to offer our heartfelt congratulations to the UCSB Physics PhD students who successfully defended their PhDs in 2025:

Fall 2024
Jacob Bargemann
Megan Newsome
Wayne Weng

Winter 2025
Yubi Chen
Brad Price

Spring 2025
Eve Bodnia
Nikolas Claussen
David Grabovsky
Paarth Gulati
Vishank Jain-Sharma
Robinson Mancilla
Nayan Myerson-Jain
Taka Park
Ben Xie
Daipeng Yang

Summer 2025
Remi Boros
Jessie Held
Austin Hopkins
Henry Leung
Xiaoyi Liu
Cian Reeves
Ray Sattvic
Ryan Schmitz
Zihang Wang
Sunny Wong

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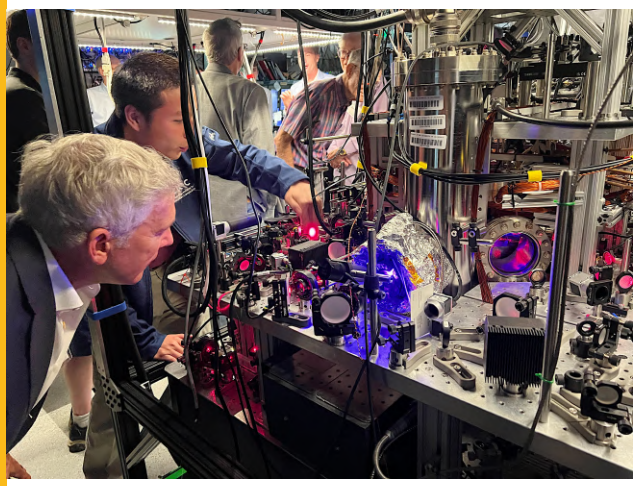
Labs & Lectures Series

Frontiers of Quantum Science

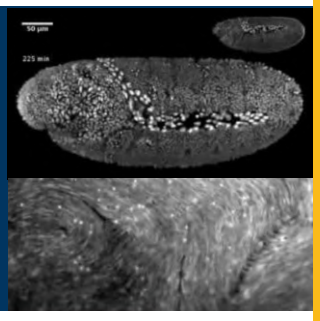
October 2025 — This fall featured our inaugural Labs & Lectures community biannual event. Welcoming members of the public to campus, Professor David Weld gave a riveting lecture on harnessing quantum science to pioneer new technologies, and he also described the physics behind the 2025 Nobel Prize, also dealing with quantum phenomena. A wine and cheese reception followed the lecture, then guests were invited to tour Prof. Weld's lab to see how ultracold atomic physics experiments are carried out. Professor Mark Sherwin also brought the public into his lab, demonstrating Free-Electron Lasers that operate in a unique THz portion of the electromagnetic spectrum and can be used to investigate unique properties of quantum condensed matter.

The department is looking forward to its second Labs & Lectures event this coming spring.



Next Labs & Lectures? Save the Date: April 9, 2026

Join us for a tour of soft & living matter, at the interface of biology and physics, with Prof. Sebastian Streichan, with tours of Streichan and Dogic labs.



Alumni Spotlight: Joe D'Anna, UCSB PhD 1996

Moving from the world of physics to finance in the '90s, Joe D'Anna has had a successful career applying his love of mathematical puzzles to one of the world's most complex industries. After completing his PhD with Tony Zee on random matrix theory in 1996, he transitioned to a career as a financial engineer, creating new financial products, managing risk and developing systematic hedging and investment strategies at banks, insurance companies and startups. D'Anna is the inaugural recipient of the UCSB Physics Alumni Award. Professor Caitlin Casey recently chatted with Dr. D'Anna to learn more about his time at UCSB, his career, and advice for the next generation.

Casey: Congratulations on your alumni award! Tell me a bit about your experience as a UCSB Physics Grad student.

D'Anna: Thank you! I'm honored and proud to receive this. I've always valued staying connected with UCSB, and this means a great deal. I arrived at UCSB having finished my undergraduate work at the University of Redlands. My UCSB classmates and I all shared an office and eventually became close, lifelong friends, but they had graduated from elite research schools like Princeton, Caltech and Harvard, and I came from Redlands. Some of them initially wondered what I was doing there, so it took a bit of time to earn their respect. We all got right to work starting the PhD; it was quite a shock. Santa Barbara is beautiful, but I can say with confidence that I don't think I visited the beach or went anywhere fun or interesting probably for the first nine months. I am really grateful for the broad education, faculty mentoring and research experience I gained from attending a small, liberal arts college, but my classmates were all a year ahead of me in physics coursework and I had to catch up. Once we had all bonded, we would do our homework sets together; studying together was a great experience for me and why many of us are still close friends.

Casey: What drew you to the financial world and investing?

D'Anna: I always loved games, mathematics and puzzles (including physics, of course). I was in an investing club in high school. I grew up in Carson City, Nevada, and I remember that my grandfather was interested in the fairness of some of the games in the casino and I played around by writing some programs to test the statistical properties of gambling results. When I arrived at UCSB, I was establishing my financial independence, filing taxes, etc. Another classmate of mine from Redlands happened to also move to Santa Barbara in the math department. We decided we wanted to learn how to invest, so we started an investment club with some classmates and friends; I went to mathematical finance journals to try and learn how I could use my computational mathematical skills to get an edge. This investment club became something run like a mutual fund, and all of this happened while I was a physics graduate student.

The more I learned about finance, the more tangible it seemed. Portfolio management can be understood in the framework of linear algebra and nonlinear optimization problems. I sometimes would spend spare time applying portfolio theory to horse bets at the race tracks.

The investment club is still going by the way, 30 years later. When we started it was hard to convince everyone in the club to get an email address so we could all communicate. They'd say, "email, why do I need that?" It's funny. Everyone would transfer in $30 a month, and we'd buy stock in different companies. We'd argue over what to do, but rarely ever sold anything. We were there to

buy stock when Apple was a “beleaguered computer company” on the verge of collapse, and when Amazon and Google got started. By the 2010s, the club’s portfolio had become big enough to qualify us as an institutional investor.

Casey: Do you have any reflections on how finance problems are similar to physics problems?

D’Anna: When I told Tony I was going to Bank of America, we discussed how there were actually random matrix theory applications in finance. Even now, there was recently a large meeting in Paris on the topic. When I made the transition I was always looking for ways to make discoveries. For example, one of my projects was to evaluate the risk in foreign exchange trading. There’s a trillion dollar market of banks doing this; traders everywhere are completing transactions in foreign currencies, and each transaction comes with some risk. There are policies that individual traders need to follow in order to limit how much risk a bank can take on. I looked at the policy limits. I quickly realized that they analyzed risk along nine dimensions and put just three linear constraints on it. But there were six other degrees of freedom where risk could go to infinity. I went to my boss and pointed this out, and the first reaction was that it couldn’t be true. I drew up some example high-risk transactions, and he admitted I was right. But then he concluded that ‘traders aren’t smart enough to figure this out, so don’t worry about it.’ It was one of the first indications I got that my skillset could be very useful, even if in practice it wasn’t used here.

Casey: What advice would you give PhD students potentially interested in heading into finance?

D’Anna: My basic advice is to seek out informational interviews with professionals in the field who started from STEM degrees or backgrounds. Be respectful, and ask for 15 minutes with them. Ask them if they were you at your stage now, what would they do? Use this approach to build your network and make connections. That’s how industry works — you build personal and professional connections, and one job leads to the next sometimes. You never know what will come from those relationships, but you have to show up. It’s something younger folks might struggle with because they’ve faced some real challenges lately, especially COVID, and the influence of social media. Don’t underestimate the power of a telephone call or meeting in person. Talking to people and growing your network can sometimes be uncomfortable, but you should spend some time building those skills. Even right now — your classmates and professors — you have relationships with these people, and you will be surprised at how those relationships will still be important in 10, 20 or 30 years.

Casey: Do you think entering finance now looks different than when you started out?

D’Anna: One big difference is artificial intelligence and machine learning. Until recently, however impressive the models were, you still had to do tremendous work acquiring and cleaning data before fitting. With LLMs, the models are powerful enough to even help with that preparation. But here's the concern: even the experts don't fully understand how any particular model works, yet people are blindly using them to extrapolate knowledge despite well-documented hallucination problems. Physicists and engineers who rely on models know you have to understand the system, and can't extrapolate. The rest of the world is barreling ahead without that discipline—and with LLMs, the consequences aren't just unreliable results, they're potentially dangerous.

And in the era of realistic, hard-to-detect avatars, there’s going to be a much greater premium put on meeting people, knowing them, and trusting that they're a person that can be relied upon. I would say it's even more important now to do that kind of old-fashioned networking and showing up.

For example, I’ve been on the other end of the table running the recruitment for a summer internship program at Goldman Sachs. I would get a file of 100 applicants that were graduating with a master’s degree in mathematical finance, or computer science, or physics at Harvard. They all had perfect grades and all indistinguishable, like electrons. What are you supposed to do if you can only interview five? But the kid that actually called me up or the young person that I met or who was able to hold a conversation… suddenly they’re ahead of the pack, even if they’re not from a top school. So my best advice is to keep showing up.

Read the full interview with Joe D’Anna here.

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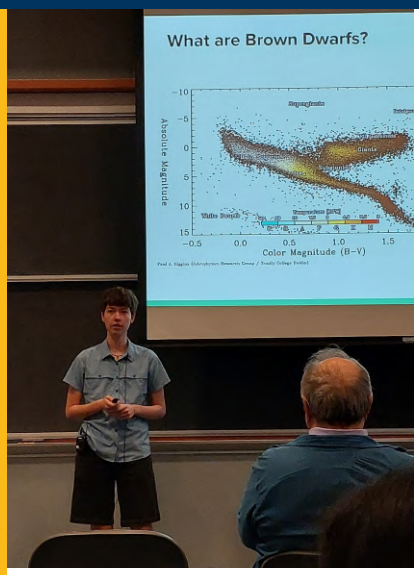


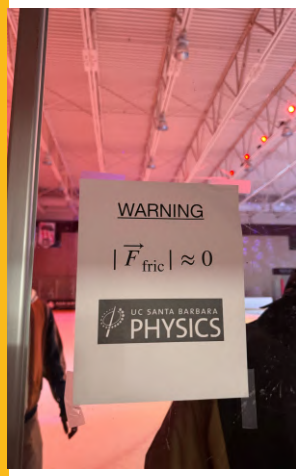
2025 Undergraduate Research Symposium

September 2025 — At the start of the fall quarter, KITP hosted an annual presentation of undergraduate research. It's a great opportunity for students who spent the summer learning the ropes to present what they have been working on. An impressive 46 undergraduates presented their work in a series of 10 minute talks, followed by a reception for members of the department to get to know the growing undergraduate physics community. Congratulations on your presentations!

Left: Cee McClave, 2nd year, presents their work on observational astrophysics.

Physics on Ice!

November 2025 — Did you know that an unusual number of physicists can ice skate? The physics department hosted an impressive gathering of physicists and their family members at "Paradise on Ice" in Goleta this past November to celebrate the end of a phenomenal year for the department. Staff, faculty, graduate and undergraduate students all gathered on the NHL-scale rink for a fun time gliding frictionless. Non-skaters gathered to watch the skaters and eat pizza. It was a great place to be on one of the rare rainy, drizzly days in Santa Barbara. Thanks to everyone who came, and thanks to the UCSB Climate Committee for organizing the event for our community!



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New NSF-funded Graduate Research Fellows

Congratulations to six UCSB Physics majors who were awarded **2025 Graduate Resesarch Fellowships from the National Science Foundation**! This includes Andrew Fee, Samyuktha Ramanan, Filippo Delzanno, Alan Hartsell-White, Asahi Jige, and Xuanwei Lian. Congratulations as well to the two NSF GRFP honorable mentions, Montu Ganesh and Katherine Larina. This is the most GRFP awards given in one year to UCSB physics undergraduates. Congratulations fellows!

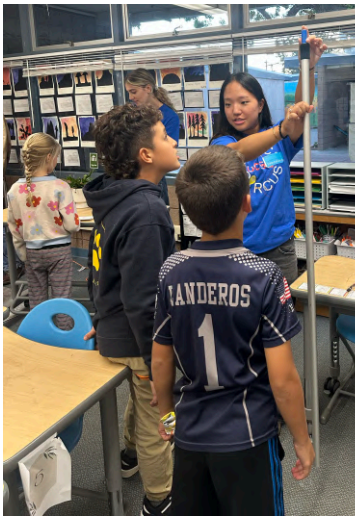
Physics Circus!

Pictures courtesy of Sylvia Greene

The UCSB Physics Circus is a long-standing K–12 outreach program that brings hands-on physics demonstrations to schools and community events, generating curiosity and excitement for science. This fall, our team of graduate and undergraduate volunteers participated in science nights at local elementary schools, shared demos during Parents & Family Weekend, supported EAOP events on campus, and visited classrooms at the UCSB preschool!

Since its founding in 1997, the Physics Circus has brought the excitement of physics to more than 200,000 local K–12 students, while providing UCSB students with valuable experience in science communication and teaching. Alumni support ensures that we can continue working toward our goals of promoting STEM education and maximizing our impact in the community.

To learn more, visit our website, or contact Coordinator Sylvia Greene (*sylviagreene@ucsb.edu*) or Faculty Advisor Professor Jean Carlson (*carlson@ucsb.edu*).



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Thanking our Donors

Donor List includes gifts from June 1, 2024 through October 31, 2025

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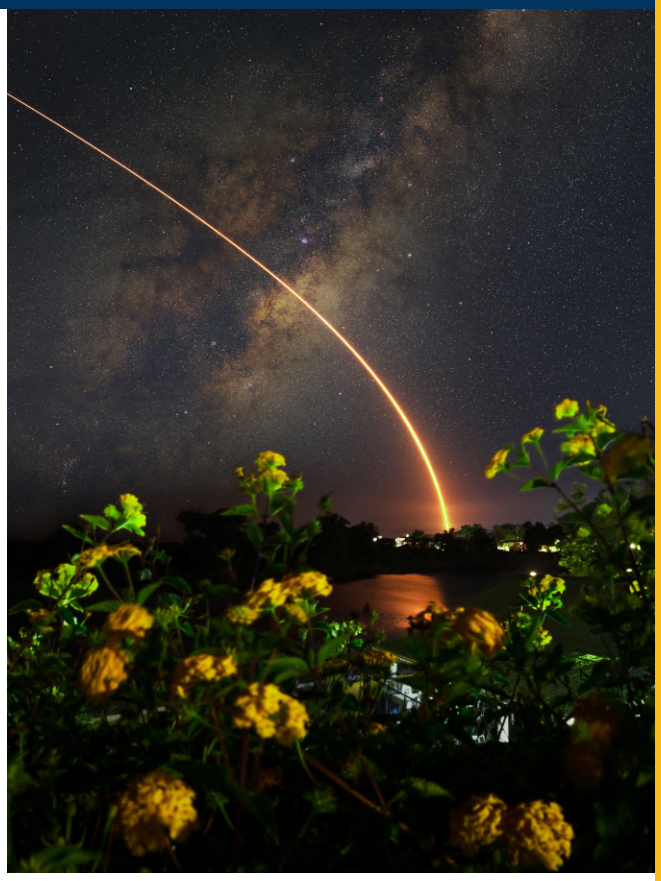

Undergraduate physics major Tomas Forney photographs a Starlink launch over the UCSB lagoon, summer 2025

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