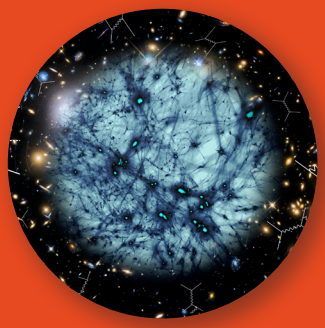
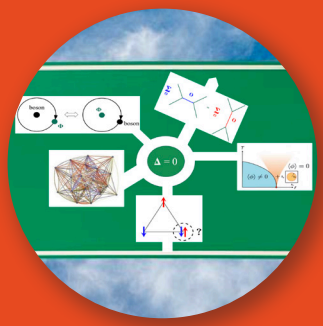


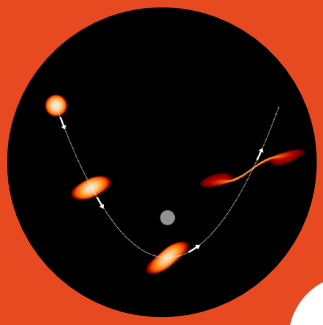
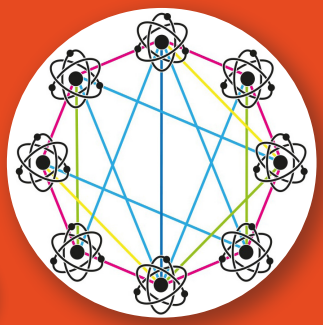
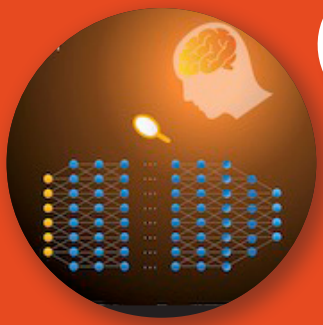
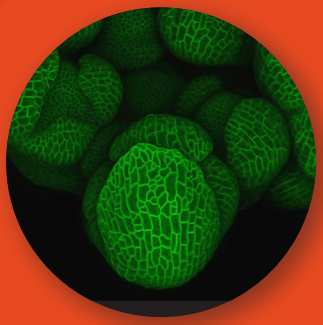
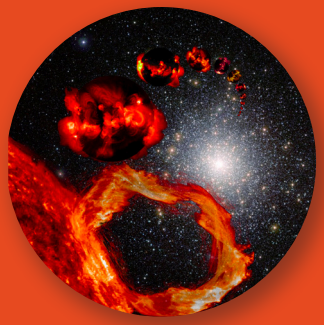
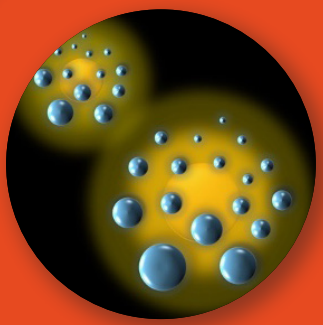

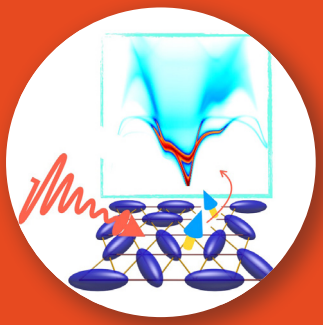

UC **SANTA BARBARA**

Kavli Institute for Theoretical Physics

Annual Report 2024

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Dear Friends,

This is our first widely distributed Annual Report for the Kavli Institute for Theoretical Physics (KITP). Established in 1979 with an originating grant from the National Science Foundation (NSF), the KITP is a facility for the theoretical physics community. Here, collaborative and transformational research, the exploration and promotion of new areas of scientific study, the training of the next generation of theorists, international collaboration, outreach to the public, and the preservation of the unity of theoretical physics are all pursued at the highest level.

Our major activity is programs, which we run 50 weeks a year and lead to over 800 visitors coming to the institute for long periods. Nearly half of these visitors come from outside the US, satisfying our goal of international collaboration. The purposes of these programs are to initiate new research, form new collaborations and pioneer new connections across the discipline. Each program also includes a four-day conference that brings another 500 people to the institute every year.

Program development and selection is accomplished with our Advisory Board and dictated by the excellence of the science, the potential for successful advances, and the timing and potential for synergy with KITP's activities. We place special attention on those programs that bring together communities which may not often interact otherwise, thereby promoting the interchange of ideas across disciplinary boundaries. The cover image shows the logos of the scientific programs we held in the 2023-2024 academic year and the programs' brief scientific summaries are included in the report.

In addition to the intellectual infrastructure we have developed, KITP has also built and maintained the physical infrastructure that enables and enhances our work. Starting 30 years ago with the construction of Kohn Hall, led by then-Director Jim Langer and expanded under the leadership of Director David Gross, Kohn Hall is an architectural gem of the UC Santa Barbara campus designed by Michael Graves.

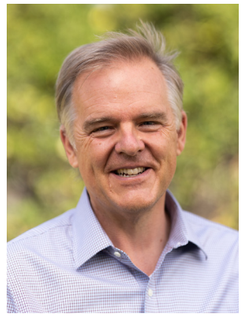
Since January 2017, our visitors have stayed at the Charles T. Munger Physics Residence. This purpose-built facility, funded by Charlie Munger, provides housing as well as many casual interaction spaces that allow our visiting physicists and their families to continue their science and social engagements across all hours! This facility has been transformative by ensuring housing commitments in advance of a visitor's arrival and relieving them and our staff of the need to search for housing in the challenging Santa Barbara market.

KITP also takes special care in identifying and mentoring early-career scientists who are with us for long periods: the Graduate Fellows and Postdoctoral Scholars. The time they spend at KITP impacts the institutions they join, collaborations they initiate, students they mentor, and industries they influence. The breadth and depth of exposure to all areas of physics and the global scientific community—via the interactions with visitors and KITP faculty—combined with the freedom and stimulating atmosphere at the institute encourages risk taking and the formation of new ideas while affording a truly unique experience.

Our outreach efforts are led by Deputy Director Mark Bowick in collaboration with Development Coordinator Demi Cain and Senior Director of Development Kristi Newton. We engage and inform the local Santa Barbara community while also providing opportunities for our early-career scientists to "try their hand" speaking at their first public-facing event. We strive to do as many of these events as possible and benefit from the excellent attendance of all of you in the community.

We have been able to stay true to our core mission due to continuous support from the NSF and UC Santa Barbara, as well as the substantially growing support from non-profit science foundations and private philanthropists. Every year we write reports to these supporting agencies, and it only seemed appropriate to now share that information with everyone via this Annual Report. I hope you enjoy learning more about the nature and impact of the work we do here at KITP.

Thanks to all of you for your support and engagement!



Lars Bildsten

Director of the Kavli Institute for Theoretical Physics

Gluck Professor of Theoretical Physics at UC Santa Barbara

The Kavli Institute for Theoretical Physics (KITP) at UC Santa Barbara is the foremost scientific research facility for theorists in physics and allied fields to explore new ideas and to work together intensely on questions at the leading edges of science.

Since its origin in 1979, KITP's driving force has been the exploration and promotion of new areas of scientific study. We foster international and cross-disciplinary networks, train the next generation of theorists, and engage the public in our collaborative, transformational research.

Kavli Institute for Theoretical Physics
Annual Report 2024

Science at KITP

KITP invites the world's leading scientists at all career stages to collaborate on the most challenging and exciting questions in theoretical physics and related fields.

These questions are addressed in an array of concurrently running programs (ranging from 1-4 months) that are developed with the KITP Advisory Board, a group of 17 scientists from all around the globe. The board works with KITP's leadership to review submitted pre-proposals, develop programs, and advise on which programs are ready to be held.

KITP designs programs by working closely with the program coordinators to achieve a balance of discussion time and presentations, in addition to unscheduled time for seeding collaborations.

2024 In Numbers

12 programs

9 conferences

1550 in-person visitors

2-3 new collaborations

per program participant

855 new talks

publicly posted to KITP's Online Talks archive

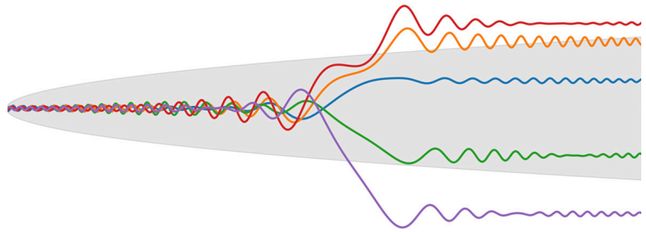
169,702 hours

of recorded talks watched online

Program Highlights

A measured approach to detecting axions

Axions are a proposed particle named after a soap. The particles 'clean up' a problem with the Standard Model. While Quantum Chromodynamics, the theory of the strong force in the Standard Model, predicts that certain symmetries are badly broken in strong interactions, this is not what is seen in experiments. The axion can be invoked to square theory and observation. So far, no one has detected an axion, but Yoni Khan—visiting KITP as a participant in Nathaniel Craig's Particle Theory Initiative—had an idea about how to go about finding one. The "axion wind" may leave a trace behind in certain materials. One material could be superfluid ^{3}He. Khan's visit overlapped with the four-week long *New Directions in Quantum Metrology* program. Quantum metrology exploits "quantum phenomena to improve parameter estimation and measurements," which are the very precise measurements needed to make the superfluid ^{3}He work. Thanks to an informal conversation with Andrew Jordan, the *Quantum Metrology* program's proposer, Khan hit upon quantum sensors and atomic clocks as a detection scheme. Khan's proposed experiment could solve several enduring mysteries in physics, since axions are also a dark matter candidate.



How physics helps us learn from the brain

While the power and utility of artificial intelligence has grown dramatically over the past few years, the mechanisms behind its ability to solve such a wide range of problems—just as with biological intelligence—remain poorly understood. The *Deep Learning from the Perspective of Physics and Neuroscience* program, as one of its goals, sought to apply statistical physics methods to these problems.

Statistical physics examines the behaviors and interactions of very large collections of very small things. For the *Deep Learning* program, the very small things are neurons or nodes in a neural network. While initially used to characterize balanced, thermodynamic systems, the methods have had success with non-equilibrium systems driven by imbalances.

The program explored what special approaches might best characterize and explain the advances in machine learning that have kicked off the recent AI boom. It also taught and discussed Dynamic mean-field theory, a technique used to describe the electronic structure of certain materials, but that seems an especially powerful way to explore deep learning.

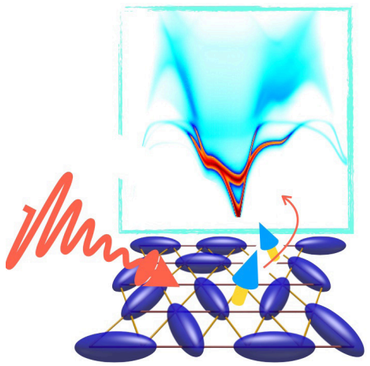
One Year of Programs

New Spin on Quantum Magnets

78 participants

40 talks

This program invited theorists and experimentalists to share the most recent developments in quantum magnetism and to connect theoretical advances in quantum dynamics and thermal transport with experimental and numerical studies. One of the most discussed topics was the Dirac quantum spin liquid, which appears in several state-of-the-art numerical studies.

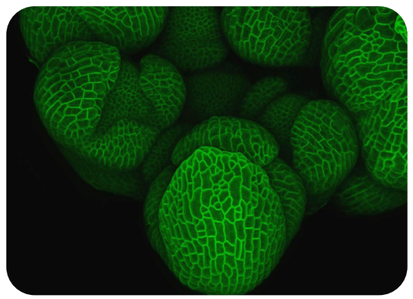


Jul 17 – Sep 8, 2023

Dynamics of Self Organization in Animal and Plant Development

53 participants

55 talks



The program brought together theoretical physicists, mathematicians, developmental and cell biologists with a broad spectrum of expertise and interests to study the mechanisms of developmental patterning and morphogenesis in complex organisms. The program ran alongside a complementary QBio summer research course on Synthetic Morphogenesis, organized by the Santa Barbara Advanced School of Quantitative Biology (more on pg. 12).

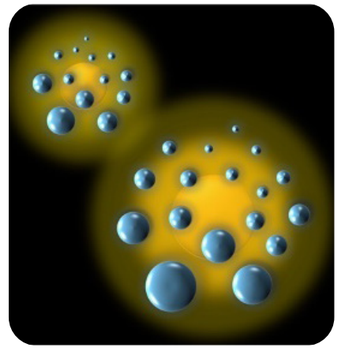
Jul 24 – Aug 25, 2023

Quantum Matter with and without Quasiparticles

76 participants

56 talks

The scope of this program was very broad and included subjects such as new states of matter in moiré systems and Kagome metals, Planckian-bound transport, superconducting pairing in non- Fermi-liquids and nearly ferroelectric Fermi liquids, phase transitions between a Fermi-liquid and Mott insulator, electron hydrodynamics, superconducting phases of heavy-fermion materials and layered perovskites, altermagnets, and many others.



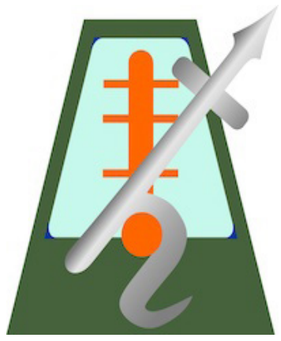
Aug 28 – Nov 10, 2023

New Directions in Quantum Metrology

37 participants

21 talks

The essence of quantum metrology (QM) is to make use of quantum phenomena to improve parameter estimation and measurements, which are at the heart of a myriad of scientific and technological applications. This program had representation from experts in several emerging areas of QM, including metrology beyond the standard quantum limit for fundamental physics applications, and the use of coherent control to boost metrological precision in time-dependent systems.



Sep 11 – Oct 13, 2023

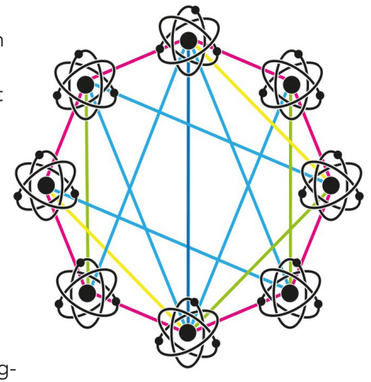
Oct 16 – Dec 22, 2023

Out-of-equilibrium Dynamics and Quantum Information of Many-body Systems with Long-range Interactions

81 particpants

55 talks

The advancement of quantum simulations has sparked substantial theoretical interest in the quantum coherent dynamics of particles interacting over long distances. This program offered the scientific community a platform for systematic and cohesive discussions on recently discovered non-equilibrium phenomena facilitated by long-range interactions.

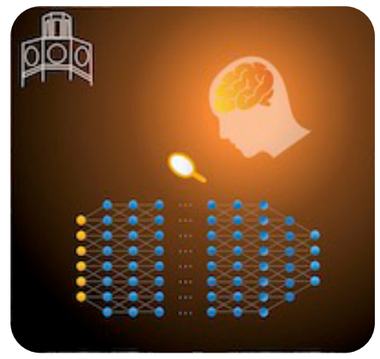


Nov 13 – Dec 22, 2023

Deep Learning from the Perspective of Physics and Neuroscience

66 participants

44 talks



The program was aimed at studying deep learning using the perspectives and tools of the sciences. The missing scientific foundation bears particular consequence for neuroscience, which shares a special relationship with deep learning due to the use of artificial neural networks as interpretable explanatory models and a common goal of uncovering the principles of learning and computation in these networks.

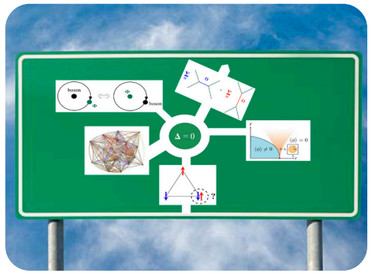
Turbulence in Astrophysical Environments

69 participants

56 talks

Turbulence is ubiquitous in astrophysical environments including the solar wind, stellar interiors, accretion disks, jets, the interstellar medium, and the circum-galactic medium. Some of its hallmarks, however, are hard to decipher from observations and simulations alike. While these different astrophysical environments can differ in their physical scales and energy levels, researchers in these sub-fields may face similar challenges in terms of the study of turbulence. The program assembled a diverse group of scientists working on turbulence using theory as well as numerical and observational approaches in various areas of astrophysical research.

Correlated Gapless Quantum Matter

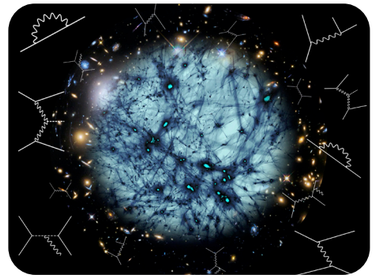


82 participants

60 talks

The program was aimed at studying quantum condensed matter systems that have gapless excitations, such as quantum critical points, quantum spin liquids and non-Fermi liquids. This exciting theme overlaps with forefront topics in theoretical and experimental condensed matter, as well as theoretical high energy physics. The activities led to many new collaborations on topics ranging from non-Fermi liquids in metals to conformal perturbation theory, quantum information, and everything in between.

Dark Matter Theory, Simulation, and Analysis in the Era of Large Surveys



77 participants

32 talks

The nature of dark matter remains unknown, strongly implying the existence of new physics beyond the Standard Model. New volumes of observational data—including galaxy surveys, measurements of the cosmic microwave background temperature, polarization, line-intensity mapping, and strong lensing measurements—will map the distribution of matter on a broad range of scales and the thermal history of the universe with unprecedented precision, unlocking a potential for discovery of dark matter signals. The program aimed to facilitate collaboration between particle and cosmology theorists, simulators and observers that would lead to development of critical tools for dark matter discovery at the dawn of large observational surveys.

Jan 8 – Mar 15, 2024 · Jan 8 - Apr 19, 2024 · Mar 18 – May 24, 2024 · Apr 22 – May 17, 2024 · May 20 – Jul 12, 2024 · Jun 3 – Jul 26, 2024

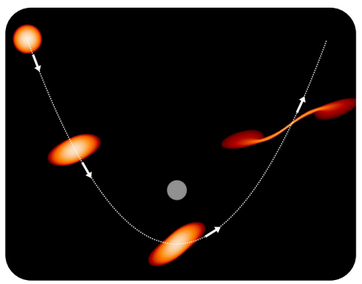
What is string theory? Weaving perspectives together

144 participants

79 talks

This program not only aimed at taking stock of recent developments on various fronts in string theory, but also to rebuild and cross-fertilize ideas across subfields. There are several directions where progress should occur in the near-future: a) deriving holographic dualities, b) technical and conceptual developments in off-shell formulations of string theory and c) new insights into string compactifications.

Towards a Physical Understanding of Tidal Disruption Events

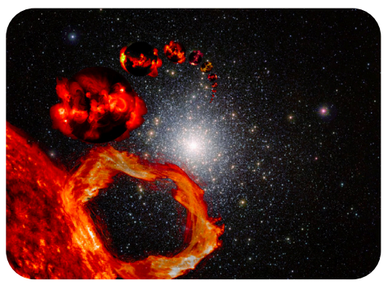


53 participants

37 talks

Tidal Disruption Events (TDEs) have the potential to unlock physical understanding of many extreme astrophysical processes and the demographics of black holes. We are now entering the era of multi-wavelength all-sky monitoring in which we are detecting tens to hundreds of TDEs per year, the accurate interpretation of which necessitates an overhaul of our modeling of TDEs. Theorists and observers formed collaborations that have led to new research efforts using theoretical models and observational data.

Interconnections between the Physics of Plasmas and Self-gravitating Systems



61 participants

46 talks

The long-range nature of the inverse square law governs the key physics of both dilute electromagnetic plasmas and self-gravitating systems. However, the research communities that study these systems have remained separate, explaining different phenomena using different languages, across different scales, from different observational data sets. This program sought to stimulate conversation between the two groups, with a particular focus on fundamental kinetic theory. The goals were to establish a common language for the kinetic theory of plasmas and self-gravitating systems, to foster a fruitful exchange of ideas and methods between our two communities, and to tackle the fundamental physics of phase-space dynamics in new and creative ways.

Teachers' Conference

When the teacher becomes the student for a day

On April 27, 2024, KITP hosted the annual Teachers' Conference for high school teachers and 2-year college instructors. This unique conference is one day jam-packed with discussions, classroom demonstrations, networking, and the opportunity for physics educators to learn about the latest developments in the field from leading researchers. This year, the conference was titled *Supermassive Black Holes and their Destructive Tidal Forces.*

The conference is coordinated by a visiting scientist who is also part of a concurrent KITP program on a similar topic. Assistant Professor Kate Alexander (University of Arizona) was this year's leader. "I've always found doing outreach to be a lot of fun," says Alexander, "and it's actually part of the way I got interested in astronomy in the first place." Her father was a member of an amateur astronomy club, so she fondly remembers attending events like star parties that grew her curiosity and passion. In her view, people who are not professional scientists often have some of the best questions and most interesting perspectives. Talking about science with people outside of the academic research community pushes her to think about her work in new ways, which is why she was happy to take on the role.

Alexander selected speakers who research a variety of topics, and who have experience giving public talks or working with planetariums, schools, or other outreach initiatives. The first presentation was from Eric Coughlin, an Assistant Professor at Syracuse University who gave an overview of the physics involved in studying black holes. It was an energizing start to the day, and set the stage for Brenna Mockler, a postdoctoral fellow at Carnegie Observatories, to discuss tidal disruption events (TDEs) in greater depth.

TDEs occur when a star is ripped apart by the tidal gravity of a black hole. A portion of the star's mass gets bound to the black hole, which essentially eats the mass through a process called accretion—Mockler compares it to the way coins would orbit a spiral wishing well and eventually fall into its center. When the mass accretes, it produces a flare of light that scientists can observe and use to study the properties of black holes.

Conference talks by Decker French (University of Illinois Urbana- Champaign) and Adelle Goodwin (Curtin University, Australia) discussed the kinds of data that emerge from these observations, how they are analyzed, and what they teach us about TDEs and black holes. French's work concerns the visible light that results from accretion, while Goodwin studies radio emissions that come from material moving away from a black hole instead of being consumed.

Most of the conference talks also demonstrated teaching tools or activities participants can take back to their students. Professor Kausik Das from University of Maryland Eastern Shore gave a mid-day demonstration with an online platform that prompted participants to use their phones to answer questions about common misconceptions in physics (top right). While a room full of students on their phones is a nightmare to most teachers, Das encouraged them to use technology in the classroom to their advantage by exploring new ways for students to interact with material.

Many educators at the conference are recurring visitors who have attended for multiple years. Maajida Murdock is a high school teacher and adjunct physics lecturer in Baltimore, Maryland who has attended so many times that she's lost count! Murdock's passion for science and education is evident. She has dedicated much of her career to advocating for STEM education that reaches all youth in her community, and she has been extensively involved in efforts to provide after-school and summer STEM programming to youth throughout Maryland.

One of the biggest obstacles Murdock has faced during her time teaching is making physics relevant to her students. She emphasizes that students at any age or educational level must be able to apply what they learn to the world around them. Murdock encourages students to "think about physics not as physics, but simply as the laws of nature. Who can't relate to nature?" However, teachers are expected to follow a predefined curriculum which can add to the challenge. Alexander remembers learning about physics from outdated textbooks in high school that didn't teach her about the latest research or modern methods scientists were using. She appreciates the impact the conference can have by providing teachers with up-to-date knowledge and resources to engage their students more effectively. Educators like Murdock continue to attend the Teacher's Conference to learn about the new frontiers in physics and, most importantly, to learn how to empower their students and demystify the process of scientific inquiry.

55 educators from across the United States

88% teach at public high schools or 2-year colleges

12% teach at private high schools

27% were first-time participants

62% traveled to KITP from outside of California

Credit: DESY, Science Communication Lab

KITP Summer Research Course in Quantitative Biology (QBio)

Bridging the divide between physics and biology

Advances at the leading edge of life sciences must deal with the extreme complexity of biological systems. Progress requires not only sophisticated measurement technologies and quantitative data analysis, but also quantitative models and concepts that interpret the data and build hypotheses so that effective new experiments can be designed. Physical sciences, with their long tradition of quantitative experimentation tightly integrated with theory, have much to offer. KITP's program and conference activities nurture, promote and facilitate the participation of physical scientists in the life science research effort and, more specifically, the integration of theory and experiment that create the theoretical core of quantitative biology.

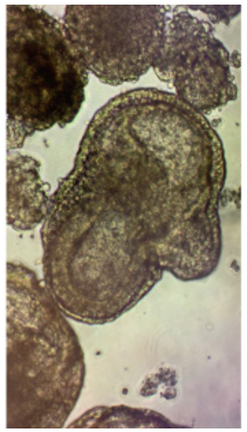
KITP hosted its 10th annual QBio course, "Synthetic Morphogenesis," from July 24 through August 25, 2023. Twenty graduate students and postdocs from around the world dove into an emerging subfield at the interface of physics and developmental biology. They used stem cell technology to decipher the mechanisms of morphogenesis, the sculpting of animal bodies in very early development.

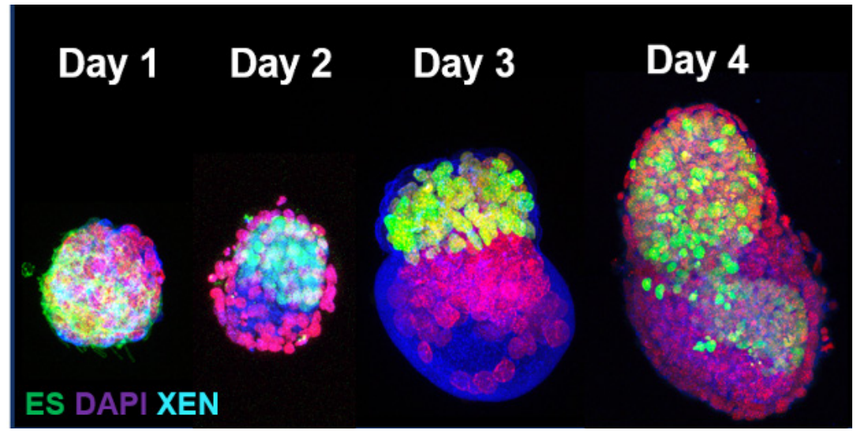
Building early animal development from scratch using stem cells provides new insights into morphogenesis, particularly in systems that cannot be manipulated for ethical reasons, such as human development.

The daily structure of the course was partitioned into morning lectures, followed by small group lab projects in the afternoon and evening. Morning lectures were given and attended by faculty participating in the concurrent KITP program *Dynamics of Self-Organization in Animal and Plant Development*. Lectures provided students with a broad overview of challenges in morphogenesis, and how physics concepts can help solve this outstanding problem of biology. Participants also gave both formal and spontaneous tutorials geared toward students. "Meet the speaker" evening sessions gave students opportunities to ask questions in a less formal setting. Students and faculty included both experimentalists and theorists, and both biologists and physicists. Thanks to their varied backgrounds, much of the teaching and learning happened among students.

At the end of the course, students presented their results to the program participants. The program coordinators reported that the course also significantly improved their KITP program. The course focus on using in vitro synthetic systems gave faculty participants a deep dive into the most current developments in a subtopic that otherwise would not have been well-represented at the program. Interestingly, several of the new collaborations initiated during the program stemmed from the new experimental approaches and tools used in the course!

"Students get a unique opportunity to learn and interact with leading experts in their field of research, as well as brilliant similar-minded colleagues, each bringing their own expertise and perspective."





"The most valuable experience was a feeling of community with people in the field, that one cannot get just by attending lectures remotely."

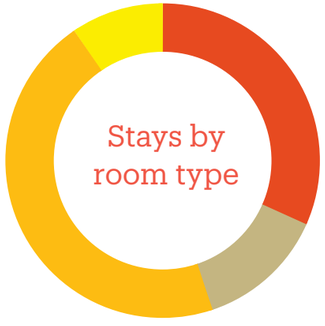
Charles T. Munger Physics Residence

Designed with physicists in mind, the Charles T. Munger Physics Residence has housed the majority of KITP's scientific visitors and their families since 2017. It provides a comfortable and intimate setting that inspires informal exchanges and extends the collaborative interactions that are the hallmark of KITP's mission. The Residence became a reality in 2012 after an avid supporter of the institute, Glen H. Mitchel Jr., introduced his longtime friend Charlie Munger to KITP—who went on to make a transformational $65M gift to fund the entire housing project. While both Glen and Charlie passed this year, they left a legacy of generosity, vision and leadership that continues to have a profound impact on KITP and physics research across the globe.

746 total visitors ●●●●● **14,151 total bed nights**

< 2 weeks	320
3-4 weeks	323
1-2 months	90
2+ months	13

240	1 bedroom
335	Multi-room suite
75	Shared 2 bedroom
96	Private 2 bedroom



Single person	425
Family	138
Couple	183

"Blackboards all around and nice common areas make it easy to have an improvised discussion."

"It was easy to meet with other scientists outside of the time we spent at KITP itself, largely because it enables my family to come with me and gives me options to meet with scientific colleagues with my family present."

What were the scientific benefits of staying at the Residence?

"I engaged in social activities with physicists I didn't know from before. Discussions were initiated during dinners in the BBQ area, which has already resulted in one paper written and another one on the go."

"It reduced the financial burden, which allows more people to benefit from programs and focus on science without thinking about the hassles of finding accommodations."

"Sustained contact with my colleagues lead to frequent informal exchanges that are intellectually invaluable."

Particle Theory Initiative

Particle physics seeks to understand the elementary constituents of matter, the forces that bind them, and the organizing principles that unite them. The 21st century has seen tremendous progress towards these goals, culminating in the discovery of the Higgs boson and the observation of gravitational waves—among other breakthroughs. Yet, many open questions remain: What is the origin of mass and the nature of electroweak symmetry breaking? What kind of unification may exist beyond the Standard Model? What is the nature of dark matter and dark energy? How was the universe born, and why did it favor matter over antimatter? What is the quantum nature of gravity, and how does it relate to the other known forces?

Answering these questions require both the energetic synthesis of existing methods from across the field and the genesis of entirely new ones. In seeking new ways to address its central questions, particle physics has built bridges to gravity, cosmology, astrophysics, nuclear physics, condensed matter physics, atomic, molecular, and optical physics, and mathematics.

To this end, KITP has initiated a new five-year activity: the Particle Theory Initiative (PTI), led by UCSB professor Nathaniel Craig (right) in consultation with an advisory group of international physicists. The intent is to accelerate work on the central questions of particle theory by both strengthening the interface with adjacent fields and building connections between formal, phenomenological, and computational theory at the core of the field. We are very grateful to longtime Friend of KITP, Carl Feinberg, for his generous support of this new initiative.

In early 2023, PTI activities began with a two-week Muon Collider workshop. Between 2023-2024, particle theorists were invited to participate for one week in three different research programs.

PTI x QMetro

The first collaboration took place September 18-21, 2023 with the *New Directions in Quantum Metrology* program. During the week, particle theorists gave talks to a combined PTI x QMetro audience and participated in the QMetro program discussions. The highlight was a talk by Yoni Kahn (University of Illinois Urbana-Champaign) outlining a proposal to use superfluid ^{3}He for axion dark matter direct detection. QMetro participants provided key insights that led to the development of a successful new measurement scheme, thereby removing a major roadblock from the proposal.

PTI x Deeplearning

The second event was with the program *Deep Learning from the Perspective of Physics and Neuroscience* the week of December 11, 2023. Theoretical particle physicists working at the interface of machine learning and theoretical physics gave six talks. Several talks touched on field theoretic and diagrammatic techniques for analyzing neural networks, while others used physical laws to devise altogether new optimization algorithms. The week's activities built on the long-running dialogue between physics and machine learning that was honored by the 2024 Nobel Prize in Physics.

PTI x Strings

Between March 11-15, 2024, the third crossover event took place with the program *What is String Theory? Weaving Perspectives Together*. Each day featured talks by particle phenomenologists and string theorists. The highlight was a discussion on the interfaces of string theory, particle theory, and cosmology, led by Hirosi Ooguri (Caltech) and involving representatives from both communities. Conversations during the week also led to a new paper by Nathaniel Craig and KITP Graduate Fellow Marius Kongsore (NYU) on generalized global symmetries in axion theories.

People at KITP

The local and international community KITP has developed to carry out our mission has been at the core of our success for over 45 years. Productivity at the institute depends on scientists to gather for long discussions, draw equations on chalkboards, and write papers together. It also relies on staff members to effectively manage the infrastructure of administration, funding, and facilities that support our scientific programming. KITP's leadership team works together to determine the goals, questions, and priorities that guide how science is facilitated at the institute.

The people at KITP are passionate about facilitating, supporting, and leading science that is transforming our understanding of the world. While they contribute as individuals, their collective efforts make them part of a larger community—and KITP's biggest strength.

KITP Postdoctoral Scholars

The KITP Postdoctoral Scholars Program provides exceptional early-career scientists with a truly unique opportunity to build an excellent foundation for their future endeavors. Our postdocs benefit from the breadth and depth of exposure to all areas of physics, in addition to the intellectual freedom and stimulating, collaborative atmosphere fostered at KITP.

One of the institute's highest fundraising priorities is building the KITP Postdoctoral Scholar endowment, which is the primary source of support for postdocs' salary and benefits. The Mitchel Postdoctoral Scholar Career Development Fund also provides funding for computing and participation in conferences. Their efforts lead to these yearly outcomes:

3 scientific papers published by each postdoc

1/3 of papers co-authored by UCSB or KITP faculty

5 talks given by each postdoc at conferences around the world

34 UCSB graduate students mentored

6 UCSB undergraduates mentored

KITP Graduate Fellows

For 25 years, the KITP Graduate Fellows Program has offered an annual opportunity for 12-16 outstanding graduate students to spend six months at KITP broadening their understanding of physics. Fellows participate in research programs, receive mentorship from KITP Postdocs and faculty, and immerse themselves in the international scientific community.

KITP Graduate Fellows are funded by the Heising-Simons Foundation. With the help and support of many generous Friends of KITP, the institute has also built up an endowment to underwrite the program. Thanks to these collective philanthropic investments, we have nearly reached our $5M goal to fully support these emerging physicists in perpetuity.

"My time at KITP has had a huge impact on my career and future success. I built new collaborations and met interesting people in my field, which was incredibly helpful during my postdoc application process. I also learned a great deal of new physics outside of my usual research focus that opened up exciting new directions for me." **— Pavel Nosov**

Science Highlight

Fridtjof Brauns and collaborators investigated how thousands or even millions of cells coordinate their behaviors during embryonic development to sculpt tissues and organs. Combining state-of-the-art microscopy data with quantitative modeling, they showed that cells don't just rely on genetic instructions, but use mechanical cues from their surroundings to achieve this remarkable feat.

Departing Postdoctoral Scholars

Evan Anders
Member of Technical Staff, Anthropic

Wenping Cui
Postdoctoral Research Associate, Princeton University

Shang Liu
Postdoctoral Scholar Research Associate, Caltech

Izabella Lovas
Advanced Fellow, ETH Zurich (Switzerland)

Urban Seifert
Research Group Leader, University of Cologne (Germany)

Ying Zhao
Postdoctoral Researcher, MIT

Fall 2023

Shankar Balasubramanian
Massachusetts Institute of Technology

Anne-Katherine Burns
University of California, Irvine

Noam Chai
Hebrew University of Jerusalem

Margarita Gavrilova
Cornell University

Kuan-Sen Lin
University of Illinois, Urbana-Champaign

Aditya Mahadevan
Stanford University

Pavel Nosov
Stanford University

Shengqi Sang
Perimeter Institute

Spring 2024

Kasia Budzik
Perimeter Institute

Muldrow Etheredge
University of Massachusetts, Amherst

Xiaoyang Huang
University of Colorado, Boulder

Marius Kongsore
New York University

Nisarga Paul
Massachusetts Institute of Technology

Julia Speicher
Georgia Tech

Taige Wang
University of California, Berkeley

Cynthia Yan
Stanford University

KITP Scholars & KITP Fellows

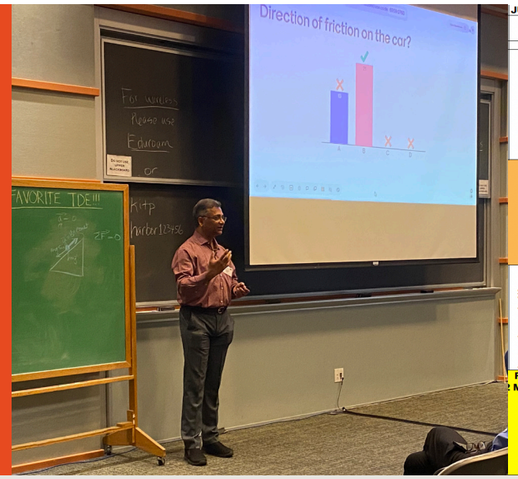
KITP offers two fellowships aimed to support physics faculty at teaching-intensive institutions. Because their teaching loads are typically high, these faculty may face challenges staying connected with the latest developments in their fields. This can also impact the opportunities they are able to provide for their students (often undergraduates) to engage in scientific research.

The KITP Scholars program began in 1998 to address these constraints by inviting faculty at teaching-intensive, non-PhD-granting institutions to stay at KITP for up to six weeks over a three-year period. Supported by the National Science Foundation, the program funds Scholars' travel and their local expenses during their visits to lessen the burden of leaving their teaching positions for multiple weeks. The success of KITP Scholars led to the development of the KITP Fellows program, which supports faculty at minority-serving institutions. Fellows come from non-R1 institutions—which may grant PhDs—and receive support from the Heising-Simons Foundation for a single visit of up to 8 weeks.

KITP Scholars and Fellows get the time and freedom to expand their professional networks, advance their own research, and take the new knowledge and opportunities they gain from their fellowship back to their classrooms to benefit their students.

"The KITP Scholars program provided me with a serene and dedicated space, free from my usual obligations, allowing me to wholly immerse myself in my research. It had a profound impact on my career and was greatly beneficial to my ongoing work." **— Maria Hamilton**

"The KITP Fellows program is a catalyst that creates pipelines of opportunity for faculty, which enriches entire institutions"
— Kausiksankar Das (right)



KITP Scholars *(who visited between 2023-2024)*

Trinanjan Datta
Augusta University

Ehsan Khatami
San Jose State University

Prabal Adhikari
Saint Olaf College

Matthew Caplan
Illinois State University

Bhubanjyoti Bhattacharya
Lawrence Technological University

Serguei Goupalov
Jackson State University

Daniel Bulmash
United States Naval Academy

Brooks Thomas
Lafayette College

Maria Hamilton
Marshall University

Peter Orland
Baruch College, CUNY

KITP Fellows

Shohreh Abdolrahimi
California Polytechnic Pomona

Chih-Chun Chien
University of California, Merced

Kausiksankar Das
University of Maryland Eastern Shore

Philip Kurian
Howard University

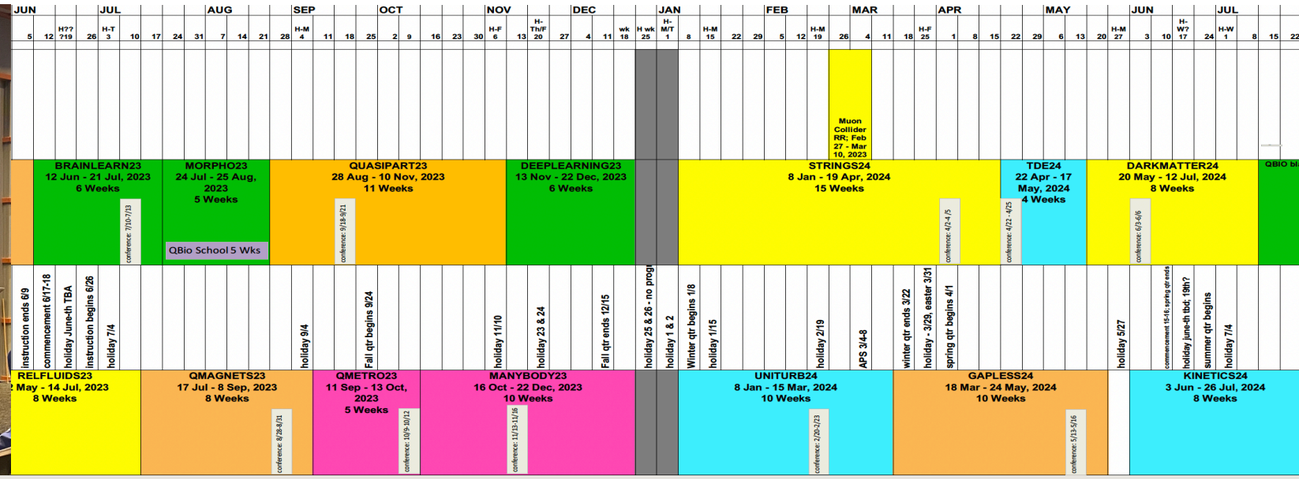
Douglas Singleton
California State University, Fresno

Scientific Leadership

At the beginning of each calendar year, the 17-member KITP Advisory Board convenes at Kohn Hall for an intensive, two-day meeting to determine scientific programming at the institute for the upcoming academic year. Scientists are invited to send proposals for programs that cover topics of particular interest in theoretical physics and related fields. It is the duty of the Advisory Board—with the Director, Deputy Director, and Permanent Members—to conduct a rigorous review of 30-40 proposals from which they identify the 10-12 programs that are shown below in the resulting planning calendar.

Members are elected to serve a three-year term and represent a wide array of backgrounds and sub-disciplines, ensuring the programs they choose also represent the diversity of research directions within physics. Because of their active roles in the international physics community, board members inform KITP of the challenges and needs of current scientific researchers.

KITP Permanent Members are also a critical part of the institute's scientific leadership. Permanent members are tenured faculty in UCSB's physics department who primarily work at Kohn Hall as active researchers, program participants, and mentors for our early-career scientists while also helping the Director and Deputy Director make key decisions about the institute's activities.



Permanent Members

Leon Balents

Lars Bildsten (Director)

David Gross

Boris Shraiman

Deputy Director

Mark Bowick

Advisory Board

Nima Arkani-Hamed
Institute for Advanced Study

Asimina Arvanitaki
Perimeter Institute for Theoretical Physics

Rajesh Gopakumar
International Centre for Theoretical Sciences

Eun-Ah Kim
Cornell University

Kaitlin Kratter
University of Arizona

Gudrun Magnusdottir
UC Irvine

Eliot Quataert
Princeton University

Dima Rinberg
New York University

Dam Son
University of Chicago

Monika Schleier-Smith
Stanford University

Rachel Somerville
Flatiron Institute

Ashvin Vishwanath, Co-Chair
Harvard University

Vincenzo Vitelli
University of Chicago

Anastasia Volovich
Brown University

Aleksandra Walczak
École Normale Supérieure

Laure Zanna
New York University

Alexandra Zidovska, Chair
New York University

KITP Staff Members

The dedication of KITP staff to keeping the institute operating at the highest level enables it to have a lasting, global impact on science. Since the opening of the Charles T. Munger Physics Residence in 2017, visitors and their families who have stayed at the facility have had many of the same helpful staff greeting them, answering their questions, and working long hours behind the scenes to make their stay comfortable and productive. Two of those staff received promotions to other areas of UCSB this year, but they left an impact as integral parts of the ongoing success of the Residence.

Arlene Contreras was hired during construction when hardhats and closed-toed shoes were still required to enter the premises. For seven years, she was part of and later led the custodial team responsible for setting and maintaining impeccable standards of cleanliness, beauty, and functionality at the Residence. Her role also required her to interact with and assist guests directly, and meeting people from around the world was one of her favorite parts of the job. She learned how to communicate better, observing that "we're all speaking different languages and from different cultures, but at the same time we find a way to understand each other."

Arlene's positivity and love of helping others, no matter the task, made her a natural fit at the Residence and KITP. Working closely with Residence Manager Carlos Marquez, she was always looking for proactive ways to make operations smoother and systems more organized. This led Arlene to create a preventative maintenance manual, a key document that has proven to be a hugely valuable resource. The manual details the location and function of essentially every valve, switch, and button of the many complex systems on site—plumbing, heating, electricity, and appliances, to name a few. The project also relied another essential staff member, Guillermo Iturralde, who can be seen demonstrating his deep knowledge of the building throughout the images in the manual (below right).

Guillermo was a custodian at campus housing and was recruited to help furnish the Residence when construction was completed. Eventually, he took up an opportunity to become a part-time building maintenance worker (BMW) with the Residence, which progressed into a full-time role. As a BMW, Guillermo handled a variety of repairs, routine building and equipment maintenance, and many other projects to keep the Residence in pristine condition despite year-round use. Everything in the building was brand new and many features were custom-built, and Guillermo enjoyed learning the intricacies of all the building's equipment. When he wanted to know more about the structure of the building, he even took on the challenge of learning how to read blueprints.

Aside from the work itself, both Guillermo and Arlene are deeply appreciative of the guidance, support, and respect they received from other staff and especially KITP's leadership. Guillermo recalls how nervous he was when he started because English is not his first language, and he was worried about communicating. When he saw that Director Lars Bildsten and Chief Administrative Officer Lisa Stewart visited the Residence on a regular basis, took time to talk with him and the other staff—even that they remembered his name each time—his nerves eased. Guillermo got the impression that, regardless of a person's position, "at KITP, we go by our names, not our titles."

Guillermo and Arlene knew that they were valued, trusted members of a team. The care they received as employees made it easy for them to treat the Residence "as my house that I need to take care of," according to Guillermo, who still sometimes accidentally introduces himself as "Guillermo, KITP." They are grateful for their time with KITP, and KITP remains grateful to them.

Giving to KITP

Generous contributions and sustained support from philantrhopists, the National Science Foundation, UC Santa Barbara and other non-profit foundations are key to the institute's long-term sustainability. Our highest fundraising priority is to grow the institute's endowment through inspired investments, with the goal of supporting KITP's early-career scientists and scientific programming in perpetuity.

We are grateful to our loyal Friends of KITP, our community of supporters whose generosity, advocacy, and engagement ensures KITP's continued impact on the future of scientific exploration.

To learn more about giving to KITP, please contact:
Kristi Newton, Senior Director of Development
kristi@kitp.ucsb.edu or 805.893.6307

Financial Highlights

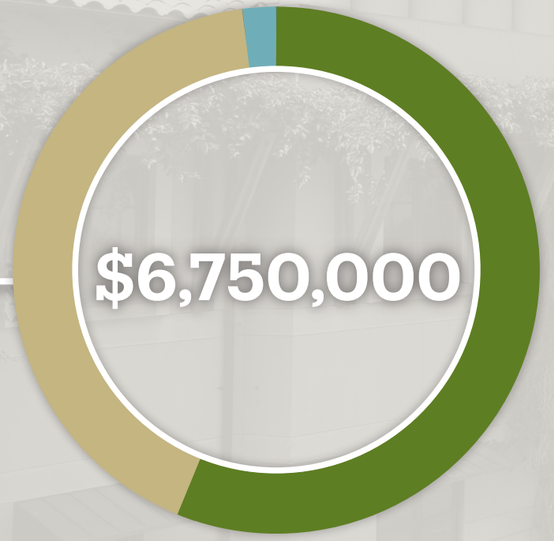
Support for KITP Activities
2023-2024 Operating Income and Expenses

National Science Foundation **$3.8 M**

Private Foundations
(Chan Zuckerberg, Heising-Simons, Moore, Simons) **$2.8 M**

Private Philanthropy **$150 K**

Operating Income



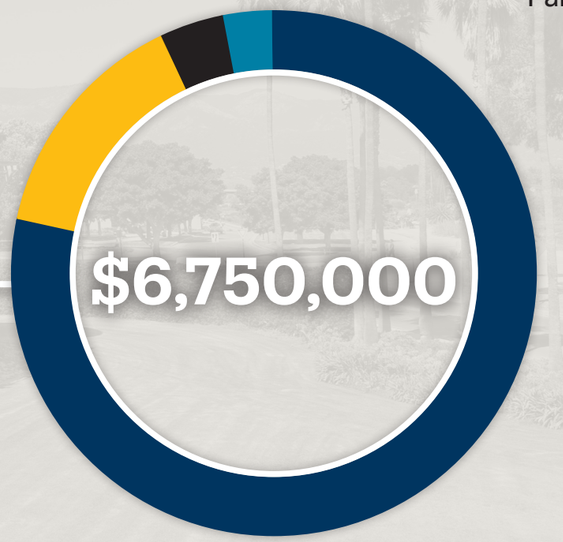
Programs, Conferences, & Support Staff **$5.3 M**

Postdoctoral Scholars **$980 K**

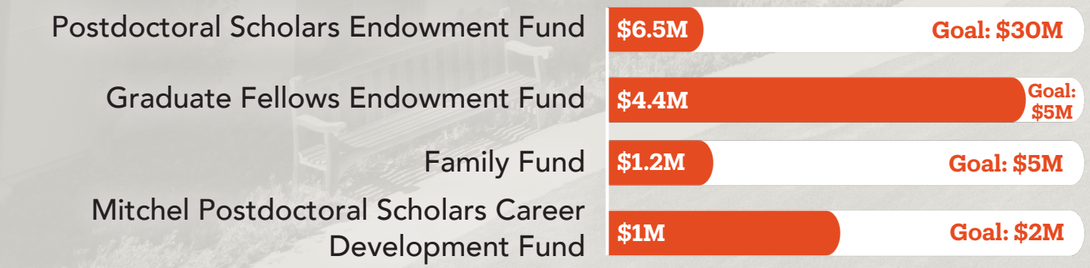
Graduate Fellows **$270 K**

Family Fund **$200 K**

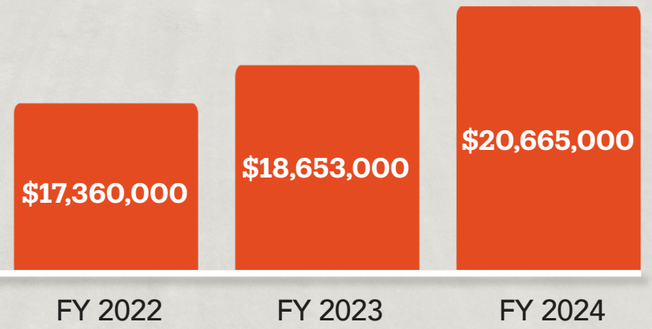
Expenses



Priority Endowment Totals (cash & gift commitments):



General Endowment Totals



KITP Legacy Society

KITP was founded with the idea that extended collaboration around the most pressing questions in physics—free from distractions or funding restrictions—yields innovation and leads to breakthroughs. Providing scientists with the freedom to explore the boundaries of our universe is crucial, even if the results of such explorations only become visible to the next generation.

This work, however, requires long-term investment. Legacy gifts are a powerful tool for building KITP's endowment, which supports our early-career scientists as well as ongoing operational costs for scientific programs and community outreach. You can join the KITP Legacy Society by including KITP in your will or living trust, naming KITP as the beneficiary of your Individual Retirement Account (IRA) or life insurance policy, or establishing a charitable bequest.

Supporting KITP with a planned or estate gift commitment offers the opportunity for significant tax benefits, the possibility of additional lifetime income, and most importantly, the chance to help enable scientific discovery for years to come.

We are grateful to longtime Friends of KITP Larry and Dee Franks, who have chosen to include KITP in their estate as a testament to their support for sustaining transformative science research:

"We were inspired to leave a legacy for KITP because we believe in the mission of the institute and know that our planned gift contribution is really an investment in the future."

— Larry and Dee Franks

How we celebrate our Legacy Society members:

- A KITP Legacy Society gold pin that identifies you as an investor in the future of KITP
- Acknowledgement on our website and in our Annual Report
- Acknowledgment for gifts over $100,000 on a donor recognition wall in Kohn Hall
- The opportunity to name a space in the Charles T. Munger Residence for gifts over $250,000

KITP Legacy Society Members

Anonymous
David Brown
Neal Carron
Chad Comerdinger
Carl and Toby Feinberg
Larry and Dee Franks
Jerg Jergenson
James and Elinor Langer
Tina Hansen McEnroe
Dr. Ann Rice

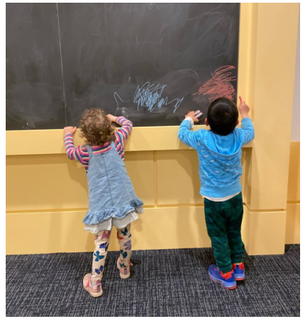
Family Fund

Family responsibilities can be a barrier to participation in scientific programming, particularly for women. To address this constraint, KITP has undertaken several initiatives to make our scientific programs and conferences more family-friendly.

The Family Fund was established in 2008 with a gift from Drs. Ann and Myron Rice to help offset the additional expenses scientists incur when bringing their families with them to KITP. Recipients most often use family fund awards to cover childcare and travel costs for their children, partners, or accompanying caregivers. Securing local childcare can be a major logistical burden, so KITP partners with UC Santa Barbara's daycare centers to ensure there are a handful of spots available for our visitors' children.

KITP also provides comfortable and welcoming accommodations for visiting families at no additional expense to them. The Charles T. Munger Physics Residence houses most visitors just over a mile away from Kohn Hall and has two-bedroom units, an indoor children's play area, and an outdoor playground.

We are grateful to the Heising-Simons Foundation and Alec and Claudia Webster who have generously supported the Family Fund, which has enabled us to provide funding to all eligible scientists who apply.



"The support provided by KITP and the Family Fund turned an impossible time commitment for a mom with a young child into an affordable family adventure. With this support, I was able to fulfill my role as a program organizer, and attend the entire two month workshop."

— Kaitlin Kratter

90 visiting scientists received awards this year

Women made up **30%** of Family Fund recipients, while only **18%** of U.S. physics faculty are women.

The average award was **$1875 per family**

Generosity to KITP

••• Friends of KITP

Gifts made between July 1, 2023 - June 30, 2024

$500,000+

Tina Hansen McEnroe

$100,000 to $500,000

Anderson Stewart Family Foundation
Mani Bhaumik
Heising-Simons Foundation
Chan Zuckerberg Initiative

$10,000 to $100,000

Muthiyaliah and Rani Babu
Shurl and Kay Curci Foundation, James Mitchell and Judy Wainwright
Len DeBenedictis
Carl and Toby Feinberg
Glen H. Mitchel, Jr.*

$5,000 to $10,000

James Brous and Mary Lane Scherer
Daniel Nash and Maia Kikerpill
Alex Trebby and Ludivine Souhaut
Lindsey Wilde and Jonah Stowe
Susan and Bruce Worster

$2,000 to $5,000

Lars and Ellen Bildsten
David Brown
Frederic and Nancy Golden
James and Elinor Langer
Bruce and Kay McFadden

$1,000 to $2,000

Trudy and Jim Chiddix
Michael Douglas
Norman and Jane Habermann
Daniel Malinow
Clark and Katie Porter
Sandy and Eric Seale
Steven Senesac and Ann Steinmetz
Anne Smith Towbes
Kathy Weber
Ron Winston

$500 to $1,000

Anonymous
Coffee Pot Lodge Inc.
Cary and Elizabeth Conyers
Karen Bedrosian Coyne and Ted Coyne
Michael Freedman and Sam Howland
Margaret Gordon
Alan and Ruth Heeger
Sharyn Johnson, The Goodman Family Foundation
David Gross and Jacquelyn Savani
Daniel and Donna Hone
Jerg Jergenson
Robert Johnson and Lisa Reich
Robert Kvaas
Barbara Levi
Chelcie and Katherine Liu
Franco Nori

$200 to $500

Anonymous
Robert Bernstein and Merlie Samonte
Neal Carron
Eldon Chapman
Charles and Beatrice Curatalo
Yvonne DeGraw and Craig Prater
Rodney Durham
Michael Enright
Thomas and Doris Everhart
Pamela and Russell Lombardo
Eugene (Rick) Hibbs and Karin Nelson
Eric and Karna Hirschmann
Doug and Meg Pearson
Robert Ramey
Raymond and Curry Sawyer
Suzanne Spillman
Beverly and Michael Steinfeld
Paul Tonkin
John and Betsy Watson
Lawrence Westbury
Alan and Cary Wexlar

$50 to $200

Arnold Adams and Page Hiller-Adams
James Balter
Julia Bryce and Per Berglund
Kum-Kum Bhavnani
David and Teresa Bothman
Ashley Bradbury and John Turnham
Skona Brittain
James and Emma Brinkman
Roland and Joyce Bryan
R. Sekhar Chivukula and Elizabeth Simmons
Dennis Clougherty
Jerome and Betty Compton
Nathaniel Craig
Brette Delahoussaye
Dale Dunlap and Steven Silbaugh
Naomi Greene
Joseph Hickey
Harold Hill
Phillip Ho
Cheri Jasinski
James and Elaine Keenan
Dennis and Sandra Kuttler
David Lacy
Peter Lada
John Langan and Linda Elliott
Jonathan Lipsitz
Christopher Martin
Doug and Sharon McKenzie
Jonathan and Mahela Morrow-Jones
Jim Melillo
Kristi Newton and Joseph Beban
Alan and Lisa Piltz
Kathy Rayburn
Barbara Rosenblum
Bernard Roth
Al Sladek
Lisa Stewart and Mark Maynard
Deborah and William Storm
William and Diana Thomas
Sharon Wilson
Dale Van Mill
Eddie Zeitler

••• Loyal Friends

Consecutive annual giving for 10 years or more, as of June 30, 2024

Muthiyaliah and Rani Babu
Robert Bernstein and Merlie Samonte
Lars and Ellen Bildsten
Skona Brittain
David Brown
Marcia Burtt
Sammi Butler
Neal Carron
Virginia Castagnola-Hunter
R. Sekhar Chivukula and Elizabeth Simmons
Peter Chua and Celia Blanchet
Cary and Elizabeth Conyers
Marianne Dalton
Leonard Danczyk
Len DeBenedictis
Yvonne DeGraw and Craig Prater
Bill DePriest and Muriel Slevin
Roger and Keiko Dunham
Rodney Durham
Martin Einhorn
JC Elliott
Thomas and Doris Everhart
Larry and Dee Franks
Michael Freedman and Sam Howland
Michael and Nancy Gifford
Frederick and Linda Gluck
Frederic and Nancy Golden
Margaret Gordon
Naomi Greene
David Gross and Jacquelyn Savani
John "Gus" and Meg Gurley
Alan and Ruth Heeger
Eugene (Rick) Hibbs and Karin Nelson
Harold Hill
Daniel and Donna Hone
Cheri Jasinski
Jerg Jergenson
Sharyn Johnson
James and Elaine Keenan
James and Janice Knight
Dennis and Sandra Kuttler
Robert Kvaas
James Brous and Mary Lane Scherer
John Langan and Linda Elliott
James and Elinor Langer
Dorothy Largay and Wayne Rosing
Barbara Levi
Pamela and Russell Lombardo
John and Deborah Mackall
Bruce and Kay McFadden
Marlin and Ginger Miller
James Mitchell and Judy Wainwright
Daniel Nash and Maia Kikerpill
Chetan Nayak and Shelly Gable
Desmond O'Neill
Rose Marie Otey
Bill and Kathlyn Paxton
Alan and Lisa Piltz
Simon and Diana Raab
Sandy Russell
Raymond and Curry Sawyer
Sandy and Eric Seale
Al Sladek
Suzanne Spillman
Beverly and Michael Steinfeld
Louise Stewart and Craig Mally
Deborah and William Storm
William Theeringer
Deborah and Douglas Troxel
John and Betsy Watson
Kathy Weber
Lawrence Westbury
Derek and Elizabeth Westen
Alan and Cary Wexlar
Ron Winston

••• Lifetime Investors

Cumulative giving to KITP as of June 30, 2024

$30M and above

Charles T. Munger*

$10M to $30M

Fred Kavli*, The Kavli Foundation
Gordon and Betty Moore Foundation
Simons Foundation

$3M to $10M

John "Gus" and Meg Gurley
Alfred C. Munger Foundation

$1M to $3M

Anonymous
David and Carolyn* Brown
Carl and Toby Feinberg
Frederick and Linda Gluck
Heising-Simons Foundation
Christine and Jordan Kaplan
Ann* and Myron* Rice
Michael Stewart
Deborah and Douglas Troxel
Joe* and Patricia Yzurdiaga

$300,000 to $1M

Muthiyaliah and Rani Babu
Mani Bhaumik
Burroughs Wellcome Fund
Virginia Castagnola-Hunter
Glenn and Bettina Duval
Tina Hansen McEnroe and Paul McEnroe
Dorothy Largay and Wayne Rosing
Simon and Diana Raab
Lady Leslie Ridley-Tree*
Helen and Will Webster Foundation
Philip and Carolyn* Wyatt, Wyatt Family Foundation

$100,000 to $300,000

Joseph and Lambertha Alibrandi
American Committee for the Weizmann Institute of Science
Anderson Stewart Family Foundation
Michael Brinkenhoff
Chan Zuckerberg Initiative
Culler Scientific Systems Corporation
Len DeBenedictis
Larry and Dee Franks
IBM Corporation
The Institute for Advanced Study
Jerg Jergenson
James and Janice Knight
James and Elinor Langer
Stuart and Hannelore Mabon
Glen H. Mitchel, Jr.*
James Mitchell and Judy Wainwright
Joseph Polchinski* and Dorothy Chun
Schlinger Chrisman Foundation
Shurl and Kay Curci Foundation
John* and Betty* Stephens

**Deceased*

Note: Every effort has been made to provide a complete and accurate listing of donors. We apologize for any omissions or errors. For corrections, please contact Kristi Newton, Senior Director of Development at KITP: 805-893-6307 or kristi@kitp.ucsb.edu

Outreach Events

Café KITP

Café KITP is a unique series of talks given exclusively by KITP Postdoctoral Scholars about their field(s) of interest and related research. It is hosted at SOhO Restaurant & Music Club in downtown Santa Barbara, where guests can enjoy the event over dinner and drinks in a casual, comfortable atmosphere. Café KITP is a valuable opportunity for our early-career scientists to hone their science communication skills and, for many, give their first talk to the public. Postdocs receive guidance from the Deputy Director while developing their presentation as well as ample time to practice to ensure their talk is fit for a general audience, and that they are confident and well-prepared.

KITP Public Lectures

The KITP Public Lecture series was established with an inaugural talk by Stephen Hawking in 1996. Since then, KITP has brought the world's leading researchers to our community to present discoveries at the forefront of physics and other fields like biology, computer science, chemistry, neuroscience, and many more. KITP's Deputy Director identifies speakers from the pool of scientists already visiting the institute for programs, fellowships, and other activities. Scientists are chosen for exceptional public speaking or outreach experience in addition to their scientific contributions within a field of notable public interest.

Friends of KITP Chalk Talks

Like our Public Lectures, KITP makes the most out of the abundance of top-tier scientists working in Kohn Hall throughout the year by also offering Chalk Talks. Visiting researchers are asked to give these special talks as a benefit for our Friends of KITP—the network of supporters whose generosity and advocacy on behalf of the institute play an important role in our success. Multiple times per year, we invite Friends to join us for an evening learning about the most exciting developments in theoretical physics.

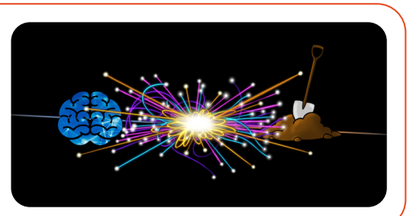
Chalk Talks are designed to be more intimate and informal than larger-scale Public Lectures. Receptions before the talk allow more time for guests to meet the speaker and each other, fostering a community of curious individuals with diverse backgrounds and a shared passion for science. The smaller audience size also allows for more a dynamic format in which in-depth questions and insightful exchanges with the speaker throughout the talk are encouraged.

July 20, 2023

Café KITP

Playing Dirty: Excavating new particles

Jessica Howard
KITP Postdoctoral Scholar

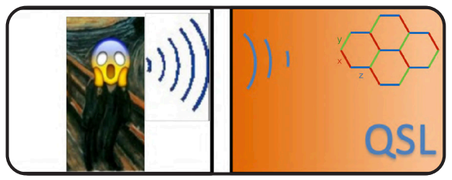


August 23, 2023

Chalk Talk

Why are we excited about the Kitaev model?

Natalia Perkins
Professor, University of Minnesota

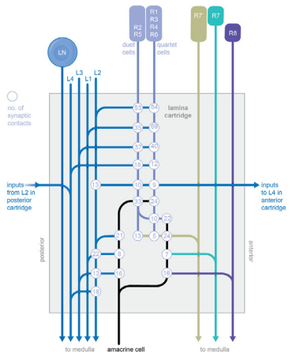


November 29, 2023

Chalk Talk

Can Brain Science Help Advance Artificial Intelligence?

Dmitri "Mitya" Chlovskii
Group Leader, Flatiron Institute / Research Associate Professor, NYU



March 5, 2024

Chalk Talk

Mapping Cosmic Magnetism between the Stars

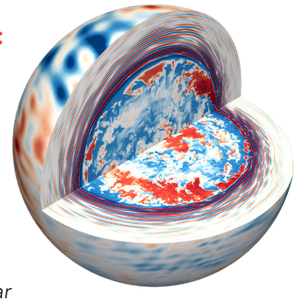
Susan Clark
Assistant Professor, Stanford University

March 19, 2024

Café KITP

Stellar sleuthing: How scientists learn from lights in the sky

Evan Anders
Member of Technical Staff, Anthropic / Recent KITP Postdoctoral Scholar

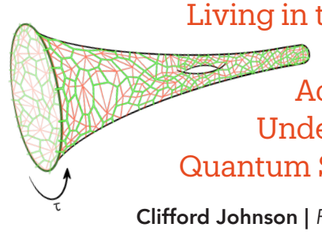


April 19, 2024

Public Lecture

Living in the Matrix: Recent Advances in Understanding Quantum Spacetime

Clifford Johnson | *Professor, UCSB*

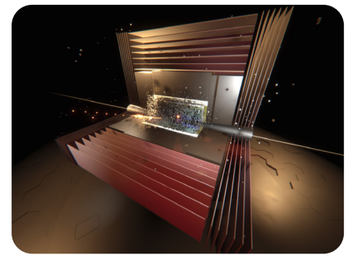


May 29, 2024

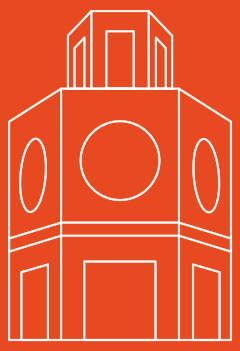
Chalk Talk

The Muon Shot & The Future of Particle Physics

Nathaniel Craig
Associate Professor, UCSB



Welcome



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