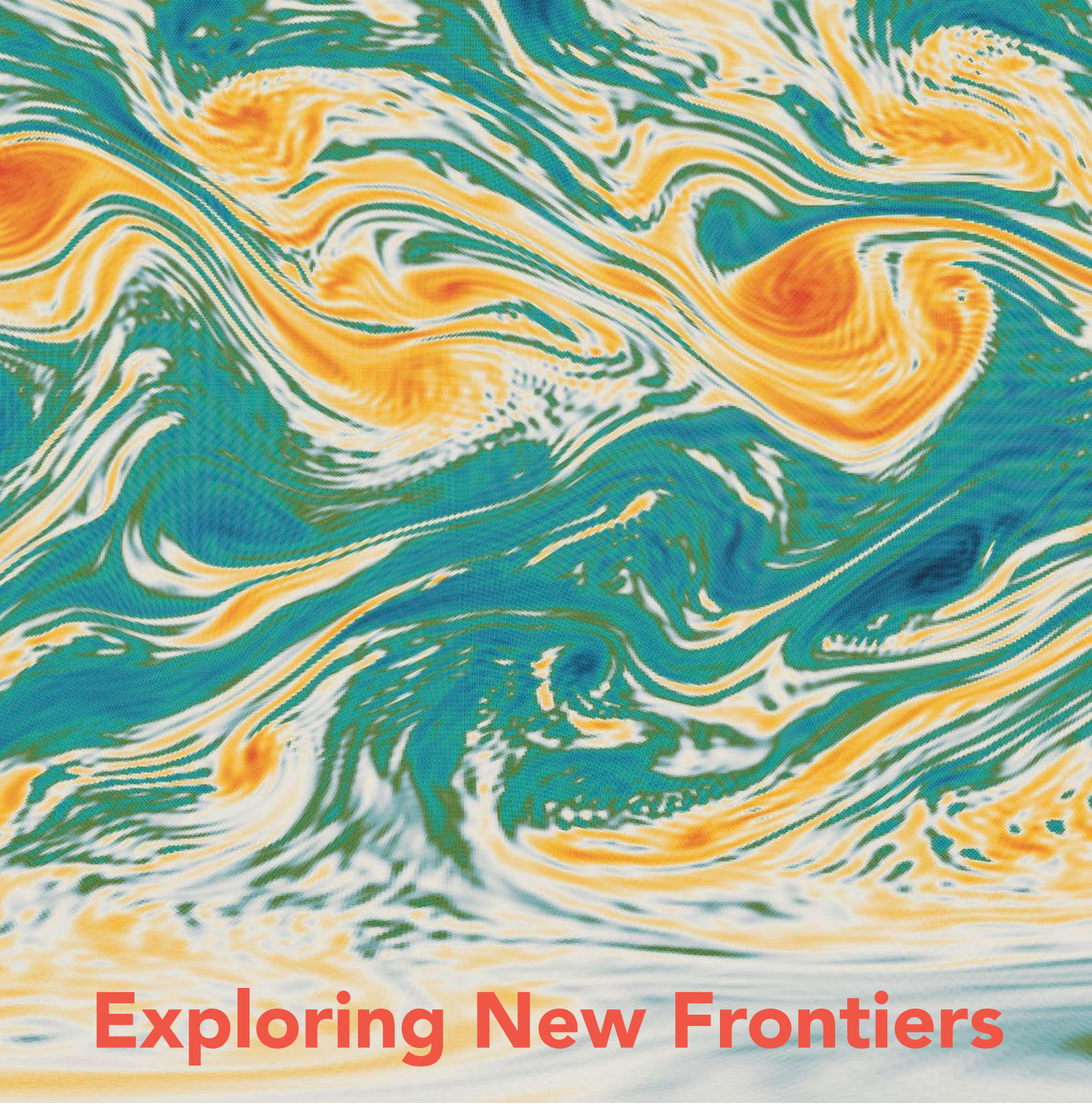

Exploring New Frontiers

UC **SANTA BARBARA**
Kavli Institute for
Theoretical Physics

Impact Report 2020

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Dear Friends,

I am delighted to share this second edition of our Impact Report, which serves to highlight KITP's scientific impact and to celebrate the essential role financial support plays in enabling our mission. Starting with the founding partnership forty years ago between the National Science Foundation and the University of California, Santa Barbara, initiated by the "Gang of Four" (see Page 6), KITP has always emphasized collaboration and the training of the next generation of theorists as central to our mission.

Our hallmark activities are long-stay, scientist-curated Programs that encompass a broad and diverse physics community and encourage cross-disciplinary and globe-spanning connections. Needless to say, these Programs have been a challenge to run in the current COVID-19 world we live in. However, I can attest that the creative efforts and commitment of KITP's staff in collaboration with the physics community have enabled us to continue to deliver on our mission to enhance discovery, even when we convene scientists from around the globe on-line rather than in-person!

This past year we hit the forty-year mark from KITP's founding in 1979, which gave us a chance to reflect on the impact the institute has had on science, as well as the accomplishments of our faculty, graduate fellows, postdoctoral scholars and visiting scientists. I encourage you to look at the resulting timeline that starts on Page 10, providing a wonderful set of entry points for learning about us.

The main joy in my job is the opportunity to work closely with talented people from all disciplines. Throughout this report, you will see the fruits of these collaborations, an example of which is the art created for the Charles T. Munger Residence. The stunning cover image is a simulation from Brown University Professor Brad Marston, a theorist who has been interacting at KITP in many ways. On page 24, he discusses KITP's support of efforts aimed at getting physicists engaged in understanding the changing climate.

The KITP continues to receive financial support from the National Science Foundation, indicative of the physics community's embrace of our fundamental value proposition of bringing scientists together to collaborate. Starting with Fred Kavli and the Kavli Foundation, the institute has also increasingly benefitted from growing support and partnerships with non-profit science-support organizations. These now include the Gordon and Betty Moore Foundation, the Heising-Simons Foundation, and the Simons Foundation. We thank them all, and of course we thank our good friend Charlie Munger for his steadfast support of all we do at KITP.

In this Impact Report, we also profile a number of generous friends who have invested in the KITP and our highest philanthropic priority, which is building a permanent endowment in support of our early-career scientists — KITP graduate fellows and postdoctoral scholars. Their careers are profoundly shaped by their experience here and we hope that you will be inspired to join our growing list of supporters helping to ensure this can go on forever!

In closing, I want to thank all of you who support KITP's mission, whether it be via your participation in our activities or generous philanthropic support. It all adds up to the creation of a very unique community of scientists, science supporters, and interested citizens that I am deeply honored to serve.

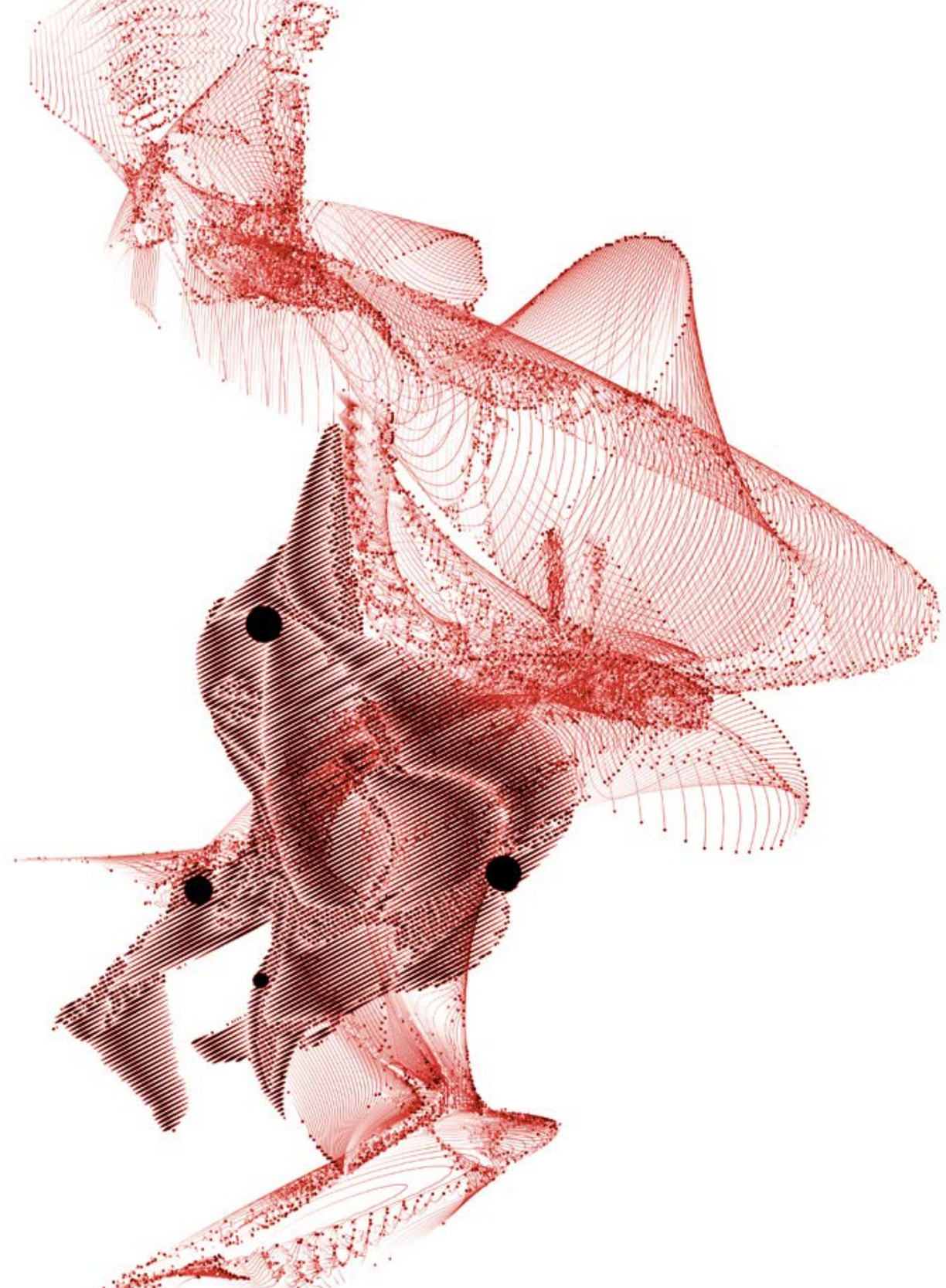
Lars Bildsten
Director of the Kavli Institute for Theoretical Physics
Gluck Professor of Theoretical Physics at UC Santa Barbara

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.

Here, we strive to stretch the limits of understanding;
Here, our institute is as dynamic as space itself.

The Kavli Institute for Theoretical Physics
Exploring New Frontiers



40 Years of Science at KITP

Who Is The Legendary Gang of Four?

How four intrepid professors established what is now known as KITP and changed physics around the world

Known at the National Science Foundation (NSF) as the "Gang of Four," UC Santa Barbara physics professors James "Jim" Hartle, Raymond "Ray" Sawyer, Douglas "Doug" Scalapino, and Robert "Bob" Sugar (pictured from right to left) developed the proposal that unexpectedly captured the NSF's attention and ultimately the $1 million-a-year grant which placed the Institute for Theoretical Physics at UC Santa Barbara. All four physicists arrived on campus in the 1960s to develop their careers. Amid the turmoil of a decade that saw an oil spill and social change, the Gang of Four each came to UC Santa Barbara to build something positive. The Institute for Theoretical Physics — later named for innovative philanthropist Fred Kavli — would become a turning point for the campus and for scientists around the world.

In the 1970s, UC Santa Barbara had a small physics department, so its few researchers were close-knit and collaborative out of necessity. Jim, Ray, Doug, and Bob found themselves working together on interdisciplinary problems in theoretical physics that ranged from condensed matter to neutron stars. Their productive partnership gave rise to a hypothesis: What if a program created this atmosphere on a much larger scale by inviting diverse, interdisciplinary scientists to tackle problems together?

"We had an idea for an institute based on visitors who would decide what programs to work on with people from all over the world for an extended period of time," said Bob. "Ray suggested we write a letter to Boris Kayser, program director for theoretical physics [from 1972-2001] at the NSF to recommend how we would organize it." On one morning bus ride to campus, Bob told an incredulous fellow commuter about their NSF letter.

"He said to me, 'You're crazy to waste your time on that, that sort of thing never comes to Santa Barbara!' It's fair to say there was no research organization on campus with national perspective, but shortly afterwards, there began to be. It was the first step in UC Santa Barbara attracting national research institutions," said Bob.

Shortly after the Gang of Four submitted their letter, the NSF called for million-dollar proposals that would fund an institute based on the gang's ideas. Jim, Ray, Doug, and Bob had mixed feelings.

"Bob was delighted, but I was downcast," said Doug, who began with modest expectations. "I just wanted some grad students." Doug felt their chances would fall in competition with top universities, but Jim was thrilled.

"We were upwardly mobile and this grant was a way up," said Jim. "It was time to get to work!"

With Yale and Caltech among their prestigious competitors, the Gang of Four knew UC Santa Barbara had to shine in order to win over the NSF. The wider physics community debated whether an institute was a good idea. Prominent scholars preferred to support individual principal investigators. To fortify their prospective institute, the gang had planned a rotating advisory board that would select programs overseen by a director who would be paid by the University of California. Doug was on his way east to pitch the institute when he realized that in addition to the director, it would be important to have some permanent institute members. The new UC Santa Barbara chancellor, Robert Huttenback, had not yet arrived on campus. So from the LA airport, Doug called Acting Chancellor Alex Alexander. Alexander said that the idea of having three permanent institute positions supported by UC Santa Barbara was "pretty agreeable". In his presentation the next day, Doug dropped the word "pretty," but nevertheless, the NSF committee wasn't about to accept the word of an "Acting Chancellor."

"The committee asked: 'Who made this promise and is it in writing?' We thought we had lost it," said Ray. The intense questioning shook the Gang of Four and they left the meeting downcast. They needed to talk to Chancellor Huttenback, who they had never met. Someone knew

"The group of reviewers found the physics program of the institute to be truly outstanding and of the highest quality. They were impressed by the remarkable effectiveness of the Institute in providing cross fertilization between many different areas of physics. The enthusiastic involvement of leading theorists from universities, national laboratories and industry from both the United States and abroad... testifies to the role of the ITP as a leading worldwide institute of physics."

— Report of the Reviewers of the Institute for Theoretical Physics, UC Santa Barbara, to the National Science Foundation, 1982

that the new chancellor lived in Pasadena and Doug phoned him. After Doug had introduced himself and updated him on the situation, Huttenback replied, "So they want to play hardball. You tell them that we will do what you have proposed, we will have these three positions and we will do all we can to make the institute work." Huttenback was indeed a staunch supporter of the institute and a man of his word who played an important role in the establishment of the institute.

The NSF awarded UC Santa Barbara the founding million-dollar-per-year grant for the Institute of Theoretical Physics in 1979. The newly formed ITP drew from a community of physicists to focus on critical issues. Programs would cut across the boundaries of the subfields of physics and between disciplines, like physics and chemistry, math or engineering. First, ITP tackled high energy and condensed matter physics. By the third year, there were more proposals for programs than the ITP could run. It was time for the advisory board to take over.

"There are a lot of institutes around the world that focus on one subject, run by one small group of people," said Jim. "What made the ITP distinct is that there's not one group of people who make all scientific decisions. The advisory board and subjects change all the time. It guarantees that whatever the most pressing issue is, we're doing it."

ITP's flexible model and board means that scientists can mount rapid response programs quickly for breaking topics. Subsequent institutes have replicated the ITP model, like the Mathematical Sciences Research Institute at UC Berkeley and the Newton Institute in Cambridge, England. ITP had changed scientists' approach to research collaborations worldwide, starting with the Gang of Four.

Physics inspired by biology captured Jim's imagination. A series of ITP talks probed where Earth's water came from and whether our planet was special in its ability to sustain life. At one talk, famous planetary physicist Dave Stevenson hesitated to share how many habitable planets existed in our galaxy of 11 billion stars. When the audience pushed him, he finally said: five.

"At ITP, a whole paradigm shifted from just a little bit of information," said Jim.

In the early years when punch cards still programmed computers, scientist Mike Creutz exposed Doug to a model of statistical mechanics. Excited, Doug and Bob discussed how those techniques could solve field theories in high energy and condensed matter physics. The work crossed fields and invented algorithms that are used today.

"That spun out, for me, into a great deal of what I've been doing for 40 years," said Doug. "It was the sort of project meant for the institute: It brought collaborative people together over a long period of time." As a result, Doug continues to run his condensed matter research group. Many of his core questions remain.

In a field governed by questions, the Gang of Four hesitates to speculate about the future. Walter Kohn's 1980s aspirations amuse Ray because they remain just that. How do we integrate Einstein's theory of gravitation with the rest of theoretical physics? ("Still there," his colleagues interjected with glee.) What are the implications of continued miniaturization in electronics?

"I think that's good for the next 40 years," said Ray. "These are tough questions and the more you know, the more you realize you don't know."

Over its forty-year history, the now KITP (Kavli Institute for Theoretical Physics) has incubated breakthroughs in error correction in quantum computing and founded new connections between string theory and condensed matter. Because KITP scientists are nimble and responsive, the institute is advancing fast with a core of brilliant young people. The productive collaboration of the institute's over 1,000 annual visiting scientists, graduate fellows and postdocs with UC Santa Barbara faculty drives KITP. Cumulatively, visiting scientists invest 23,500 days a year in time at KITP. In turn, KITP invests in a superlative class of graduate fellows and postdoctoral scholars who benefit from interacting with top international scientists in their fields.

"The postdoc program has been fantastic in attracting the very best young people in theoretical physics, and it's not hard to understand why," said Bob. "They come here for three years and get to meet the leading people in their field and work on a wide range of problems."

With such intellectual energy, there's a real chance of major advances at KITP. Yet as KITP matures, government support tapers, especially for postdoctoral researchers and graduate fellows. Private support now amplifies the work of KITP scientists and entices top candidates to spend time here.

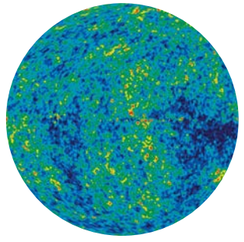
For forty years, KITP has provided a highly flexible, cost-efficient and adaptive community, running programs geared to ongoing and wide-ranging basic science research. These long programs comprise the core of the KITP model and have defined its success. Deep, real-time human interactions — true collaboration — bonds such as the one shared by the Gang of Four — take time to forge. These stimulating connections produce the breakthroughs and the high-impact research for which KITP has been recognized.

"In the future, I hope people say: this institute was always on the boundaries, but remarkably, also at the center," said Jim.

40 Years of Science at KITP

1979

With UC Santa Barbara's strong support, the "Gang of Four" — Jim Hartle, Ray Sawyer, Doug Scalapino, and Bob Sugar — applied for National Science Foundation funding to create a novel physics theory institute that would focus, in part, on scientific questions that cut across traditional subfield lines. NSF funded the proposal and the Institute for Theoretical Physics (ITP) was born and hosted its first program on the sixth floor of Ellison Hall.

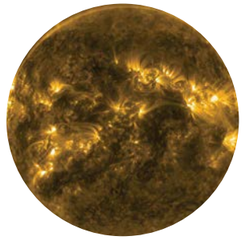


1985

The workshop on Unified String Theories took place at a time of incredible ferment in theoretical physics. It was the first multi-week meeting held after the discovery that superstring theories could provide a consistent treatment of quantum gravity, and might unify the other fundamental forces as well. Numerous approaches to superstring theory were presented, as well as first attempts to construct realistic theories in four dimensions. Participants left with a much richer understanding of superstrings and many ideas for further research. This was followed by a semester-long program in the spring of 1986, culminating in the hosting of the annual Strings '86 meeting.

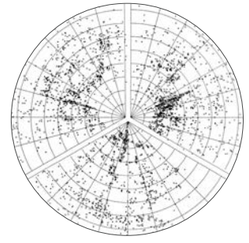
1990

A program focused on theoretically interpreting the observed pulsations of the sun solidified that the neutrinos produced by the sun were indeed three times more than observed. This propelled the development of a novel concept, neutrino oscillations, which later proved to explain the discrepancy and provide strong evidence that neutrinos have mass.



1995

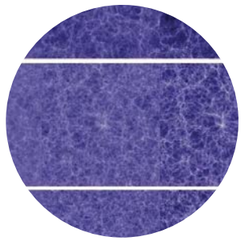
During the "Cosmic Radiation Backgrounds and the Formation of Galaxies" program, three participants wrote two papers predicting the distribution of dark matter in the halos of galaxies, unifying many models into a single, observationally testable framework.



1970's **1980's** **1990's**

1984

Participants in the "Evolution of Structure in the Universe" program pioneered the theoretical modeling that predicted the slight changes in the cosmic microwave background temperature, enabling a later reconstruction of an almost complete history of the universe that requires the presence of dark matter and a cosmological constant.

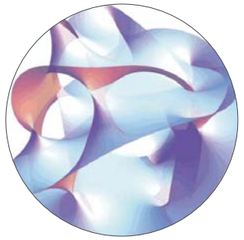


1986

During the "Strongly Interacting Fermions Systems" program, theorists realized that exchange of spin fluctuations could lead to superconductivity with higher angular momentum pairing, making this mechanism a leading contender for explaining the High T_c superconductors discovered the same year.

1994

Construction began on the new home of the ITP, Kohn Hall, at the eastern entrance to UC Santa Barbara's campus.



1995

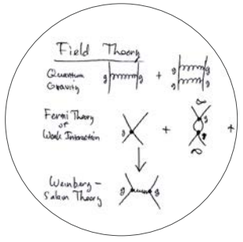
Permanent member Joe Polchinski identified D-branes with black p-brane solutions of supergravity, a discovery that triggered the Second Superstring Revolution and led to both holographic and M-theory dualities.

1995

An early program on quantum computing led to the proof-of-concept that a quantum computer would be more powerful than classical binary computing systems — envisioning, in effect, the software that would make the quest for hardware not only a worthwhile, but potentially transformative technology.

1997

Permanent member Joe Polchinski's "String Theory: What's New?" was the first ITP talk to be recorded and posted online.

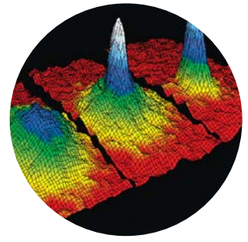


1998

The idea of controlling atomic correlations in optical lattices emerged from a program on Bose-Einstein condensation. In 2002, another group of participants published the first experimental demonstration of a Mott transition (atoms going from a localized "particle-like" state to a condensed extended "wavelike" state) controlled in an optical lattice.

1999

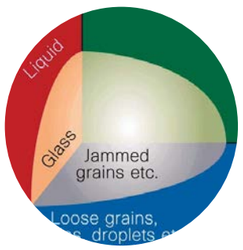
ITP hosted its first class of graduate fellows, leading graduate students from around the world who spend six months at the institute.



2001

The "Statistical Physics and Biological Information" program helped forge the intellectual agenda of the emerging community effort at the interface of Physics and Biology. The majority of the 100 physicists participating were new to the field.

1990's — **2000's**

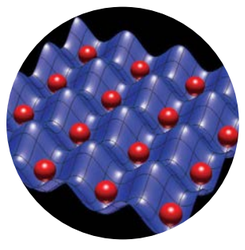


1997

Connections formed at the "Jamming and Rheology" program yielded transformative insights linking models of the glass transition to jamming.

1998

Theorists gathered at the "Dualities in String Theory" program, timed perfectly for major explorations following Juan Maldacena's profound conjecture of the AdS/CFT correspondence, which proposed an exact duality between certain quantum field theories and string theories.



1998

Along with John Pople, ITP Founding Director Walter Kohn was awarded the Nobel Prize in chemistry for his work on the electronic properties of materials, in particular the development of density functional theory.

1999

The first ITP high school physics teachers' conference, "Black Holes: Fact and Fiction," drew over 100 teachers from across the country.

2004

A program on Bose-Einstein condensates ran in parallel with one on strongly correlated electron systems. The novel interaction between the communities of those who manipulate atoms with lasers and the more conventional condensed matter physics community accelerated progress in the new emergent field of probing fundamental condensed matter concepts with experimental atomic physics.

2004

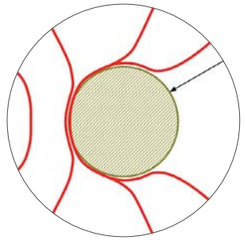
The “Collider Physics” program was intended to improve theoretical predictions for hadron colliders, Fermilab’s Tevatron and CERN’s Large Hadron Collider, by developing new methods for quantum chromodynamics. Ed Witten lectured on a novel approach, twistor string theory, which immediately attracted the attention of collider physicists and other theorists. Many further developments in understanding scattering amplitudes for collider applications, but also much more broadly, grew directly out of this program.

2005

A donation of $7,500,000 from Fred Kavli and the Kavli Foundation led to the construction of the new wing of Kohn Hall and the renaming of the institute to the Kavli Institute for Theoretical Physics (KITP). This physical growth allowed KITP to increase programming by about 35%, responding to the growth and diversity of theoretical physics and allied fields.

2006

KITP postdoctoral scholars Shinsei Ryu and Tadashi Takayanagi presented their formula “entropy = area,” revealing a deep connection between spacetime geometry and quantum information theory. Further study of this connection has given theorists a new perspective on gravity and shed light on entanglement, quantum error correction, quantum teleportation, and the black hole information problem.



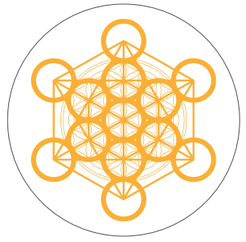
2011

KITP Director Lars Bildsten, KITP senior fellow Bill Paxton, and collaborators released their “Modules for Experiments in Stellar Astrophysics (MESA)” software. Over 1,000 scientists worldwide now use this open-source software to model stellar evolution, and subsequent releases have expanded its capabilities to realistically model a wider range of stellar properties, types of stars, and stellar explosions.

2000’s **2010’s**

2004

Director David Gross is awarded the Nobel Prize in Physics, along with former ITP permanent member Frank Wilzcek and Caltech Professor David Politzer, for the discovery of asymptotic freedom.

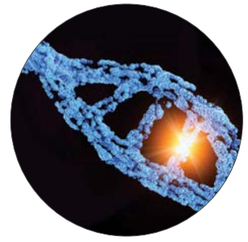


2006

KITP hosted its first Kavli Foundation funded Rapid Response program, “The Supersolid State of Matter,” gathering scientists in response to a startling experimental discovery. Subsequent events have spanned topics from black holes to twisted graphene, always triggered by a new breakthrough that could benefit from immediate, concentrated attention.

2008

The “Population Genetics and Genomics” program connected statistical physicists, many of whom were making their first forays into evolutionary questions, with biologists working in those fields. The exchange solidified the nascent view that most genetic variation is adaptive, rather than selectively neutral.



2011

A. A. Burkov and permanent member Leon Balents’s 2011 paper “Weyl Semimetal in a Topological Insulator Multilayer” proposed a simple material structure for the most elemental Weyl semimetals, one which could be synthesized and probed experimentally. Weyl fermions were first introduced in high-energy physics to describe fundamental particles and can be modeled in ways similar to certain “quasiparticles,” or excitations of the many interacting particles comprising solid materials. Materials hosting such behavior are called Weyl semimetals and are predicted to show a number of exotic behaviors.

2012

Interactions during the “Bits, Branes, and Black Holes” program led to the “firewall” proposal as a possible solution to an apparent inconsistency in the black hole complementarity problem. This result triggered so much enthusiasm in the community that a Rapid Response program was held in August 2013.

2014

Conversations between participants in the “Active Matter: Cytoskeleton, Cells, Tissues and Flocks” program sparked interest in the concept of pressure within active systems consisting of self-propelled particles. These particles accumulate around the boundaries of their container, and their behavior is influenced by the material properties of the container itself.

2015

Alexei Kitaev introduced what is now called the “SYK” model in two seminars at the “Entanglement in Strongly-Correlated Quantum Matter” program, sparking intense study worldwide and raising questions about the nature of holography and its relationship to quantum chaos, transport, and hydrodynamics.

2019

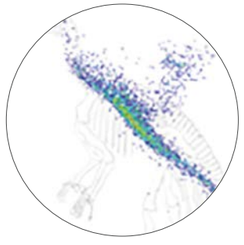
KITP’s online talks archive reached 20,000 talks. It has received well over two million page visits.

2020

Motivated by the coronavirus pandemic, KITP launched its first virtual program, “Symmetry, Thermodynamics and Topology in Active Matter.” Over 100 participants from four continents pursued collaborations that would have otherwise been disrupted. Even when face-to-face interaction was impossible, KITP remained a venue for “interacting entities that are individually self-driven.”

2013

Led by permanent member Boris Shraiman, the first KITP Santa Barbara Advanced School of Quantitative Biology Summer Research Course titled, “New Approaches to Morphogenesis: Live Imaging and Quantitative Modeling” took place, bringing together physicists and biologists for over a month of experiments at UC Santa Barbara.



2015

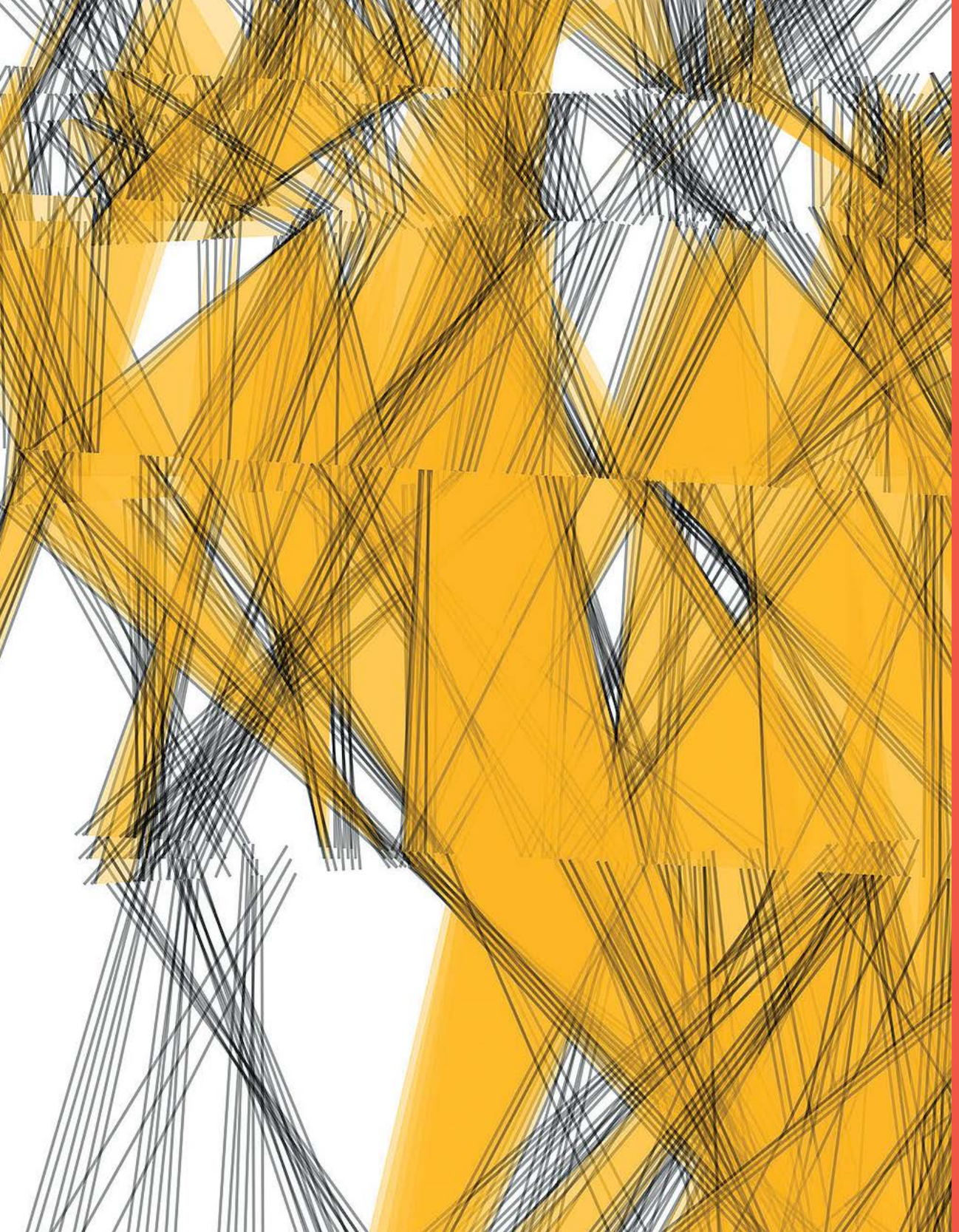
The “Galactic Archaeology and Precision Stellar Astrophysics” program brought together scientists studying stars at all scales, from those characterizing the internal physical properties of stars to those modeling the history of the galaxy. The ability to measure the properties and ages of individual stars and map them throughout the Milky Way allowed for a probe of galactic history.

2017

The Charles T. Munger Physics Residence, named for Charlie Munger following his transformative $65M gift to KITP, hosts its first guests. The Munger Physics Residence allows KITP visitors to make prolonged stays in a shared facility purpose-built for physicists and their families.

2019

Cosmologists gather at the “Tensions Between the Early and Late Universe” conference to discuss growing discrepancies between observations of the universe’s expansion rate at early and late cosmological time. If confirmed, this discrepancy would require a substantial revision of our theory of cosmology.



Far-reaching Impact

Opportunity for Good Accidents

Eun-Ah Kim and Frank Zhang take an unexpected leap

Eun-Ah Kim, a professor of physics at Cornell University, spent the fall of 2016 on sabbatical at KITP. She and Frank Zhang, a former KITP Graduate Fellow who was then her postdoc, spent the time making their first efforts at applying machine learning to quantum matter. In less than three months at KITP, they developed Quantum Loop Topography (QLT).

Topological insulators are materials that allow conduction on their surfaces but not their interiors. They are a topic of intense interest in both theoretical and experimental physics. QLT was a new method for training neural network algorithms to recognize novel topological insulators, a problem that had proven extremely difficult to crack both experimentally and with conventional machine learning algorithms. Eun-Ah attributes their ability to make such rapid progress — "a big leap that was kind of unexpected" — to KITP's unique environment and the opportunity it provides for unexpected scientific encounters.

"I think being in this pool of ideas that KITP allows helps you think in more flexible, open-minded, and creative ways," said Eun-Ah.

Eun-Ah and Frank arrived at KITP in September of 2016 knowing that Roger Melko, a computational physicist at the University of Waterloo, hadn't been able to train neural networks to recognize topological phases at that point. Eun-Ah thought that machine learning was a sensible approach to the problem, but experimenting with it was a bold move for two theorists with a more analytical bent. Their ambitious goal was to finish a manuscript by November, when Frank would return to Cornell.

"Being away from my usual obligations encouraged me to be really bold," Eun-Ah said.

The day after Frank arrived at UC Santa Barbara, they heard that Simon Trebst of the University of Cologne would be speaking about his research on the subject at Station Q, a Microsoft research lab on campus. They went to the talk and learned something they never would have in the scientific literature: where Trebst had gotten stuck.

"In publications you only see the success stories," Eun-Ah said. "The really valuable information of 'I've tried something for one full year and got nowhere,' you only hear when you meet people in person."

She and Frank began brainstorming, discussing, and "doodling" on Kohn Hall's many blackboards.

"I felt bold that fall, like never before," Eun-Ah admitted. "I set an ambitious goal and thought, 'I'll try to do something that other people might not think I can do, something that doesn't seem to be a natural extension of what I have always been doing.'"

They posted the manuscript, titled "Quantum Loop Topography for Machine Learning," to the arXiv online repository in November, and by March it had been published in the prominent journal Physical Review Letters. Eun-Ah credits KITP for this, but it wasn't an organized program that allowed it to happen.

"Organized programs lead to a lot of good results and focused discussions and so on, but I also really value the atmosphere, the less tangible things about KITP, and the large cross-section of scientists you get," said Eun-Ah.

"It gives ample opportunity for good accidents to happen."

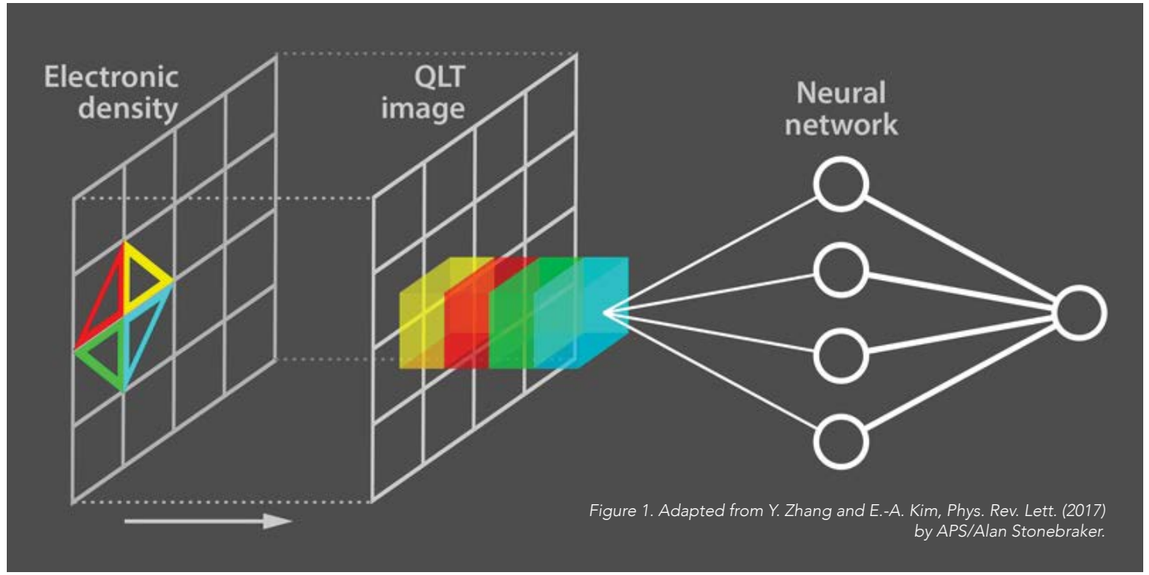


Figure 1. Adapted from Y. Zhang and E.-A. Kim, Phys. Rev. Lett. (2017) by APS/Alan Stonebraker.

"I really value the atmosphere, less tangible things about KITP, and the large cross-section of scientists you get. It gives ample opportunity for good accidents to happen."

An Open Archive

Doug Eardley and KITP Online share 20,000+ talks

KITP hosts about 1,400 scientists each year for timely, community-driven programming. Program visits result in hundreds of scientific papers and collaborations each year, but through a unique resource, even people who never visit KITP benefit from its activities. Since 1999, nearly every science and outreach talk given at KITP has been recorded and made available to the world, for free, through its website. The project was conceived by professor and then-ITP permanent member Doug Eardley.

"I was sitting in a talk one day in 1997, and all of a sudden a little voice in my head said, 'we should be recording all this.' The vision came: we would make these recordings and we'd propagate them so that scholars all over the world could enjoy these wonderful talks, not just the scientists who were in the building already," said Doug.

Doug had no experience with video recording or production, but he just went for it. In September of that year, Doug recorded his first talk, "String Theory: What's New?" by permanent member Joe Polchinski. For the archive's first year, Doug did everything from sourcing equipment to miking speakers to collecting supporting visual materials.

In late 1998, then-director David Gross came back from a trip to CERN and reported that scientists there were regularly checking the KITP website for new talks. David, already supportive, was convinced that KITP Online was becoming recognized by the international scientific community, and KITP's computing staff soon took on a major role in production.

While the resource's utility was evident, Doug wasn't sure whether most scientists would want their talks recorded and distributed publicly. With citation rates the primary metric of academic achievement, scientists justifiably feel the need to be credited with their own discoveries. The system for doing this in print is long-established, but these open-source talks were uncharted territory, and maintaining the community's trust has always been forefront in Doug's decision-making. He has been heartened by the consistent support he has received.

"[Visitors] want to have their talks recorded, and people have accepted it as something they want to do to provide more distribution for their own work and their own views," Doug said.

"It leverages the support for research provided by KITP by sharing cutting-edge talks and discussions with the world at large," said Ted Jacobson, University of Maryland theoretical physicist. "This promotes scientific progress and training, and is highly open and equitable."

The archive has grown to 20,000+ talks and has received well over two million page visits. While much of the material eventually becomes available in another form, usually an academic publication, some of it is utterly unique. In May 2011, Jonathan Widom delivered a talk at the KITP conference "Soft Matter Physics Approaches to Biology." He died, unexpectedly, less than two months later. Helmut Schiessel (Lorentz Institute, Leiden) poignantly described how the recordings of that and another talk have impacted his research: "[They remain] the only recordings that are available. My main work of the last two to three years has started out by listening again and again to that last talk… Without the recording, most of these beautiful ideas would have been lost forever."

A Decade of Climate Physics at KITP

Brad Marston reflects on uniting traditional climate scientists and physicists

A personal essay in Brad's words:
"Physicists, your planet needs you" declared a 2015 essay in Nature magazine. It went on to discuss some possible ways that physicists could contribute to a better understanding of the Earth climate system. Over the past decade, KITP has led the way by bringing physicists, geophysicists, applied mathematicians, ecologists, and others to Kohn Hall to work together on climate physics.

In spring 2018, KITP hosted a program on "Planetary Boundary Layers in Atmospheres, Oceans, and Ice on Earth and Moons" over a three-month period to tackle the tough problem of the nature of turbulence in the near surface oceans and in the lower atmosphere. In these locations, dynamics on length scales of less than 10 kilometers are the sources of the largest uncertainties in climate modeling because global-scale climate models cannot resolve these processes.

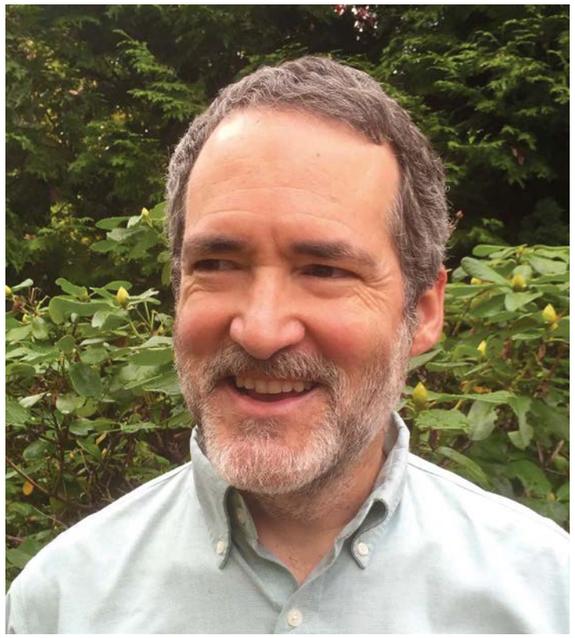
The boundary layer program was the third to focus on aspects of climate physics. Thanks to farsighted support from former KITP director David Gross, KITP hosted its first program on the "Physics of Climate Change" in 2008, and I was privileged to lead the coordination of that initial effort. The program ran alongside another program on "Dynamo Theory" led by Steve Tobias (University of Leeds). This turned out to be fortuitous, as Steve attended some of our talks and realized that tools that I had been developing to directly study the statistics of simple climate models could also find application to astrophysics problems that he studied. We began a close collaboration that continues to this day.

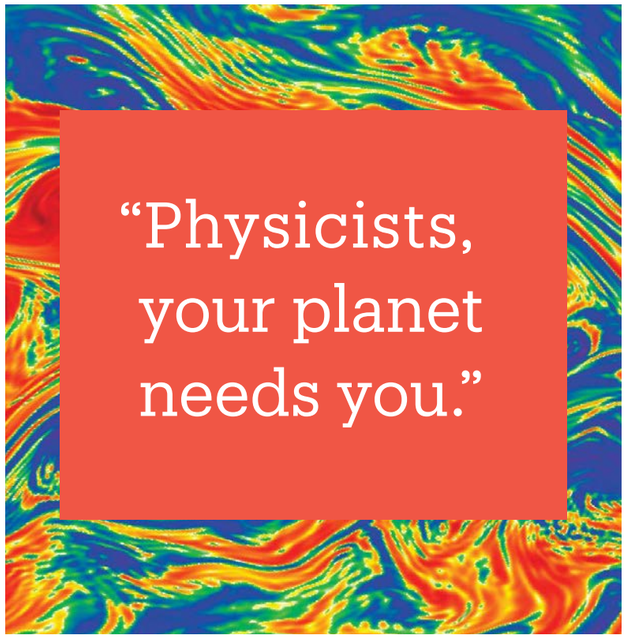
Learning how to best organize programs that bring together traditional climate scientists and physicists from other fields has been a continuing process. I served on the KITP Advisory Board from 2010-2014, and from that vantage gained a much better understanding of what works, and what doesn't, at KITP. Paul Kushner, a widely respected climate scientist from the University of Toronto, currently sits on the advisory board.

James Cho (Queen Mary University of London) led the next climate-focused program, on "Wave-Flow Interaction in Geophysics, Climate, Astrophysics, and Plasmas," in 2014. The physics of waves interacting with currents has been a rich source of insights, and this program brought together researchers in a range of related fields. A highlight for me was giving a public talk on "The Quantum Physics of Global Warming" with a terrific turnout and great questions from the audience.

As an example of the kind of breakthrough that can happen when researchers in other fields such as condensed matter physics turn their attention to the climate system, I'd like to point to a discovery that Pierre Delplace and Antoine Venaille (both at ENS de Lyon) and I recently made. We showed that, as a consequence of the rotation of the Earth that breaks time reversal symmetry, equatorially trapped Kelvin and Yanai waves emerge as topologically protected edge modes. Amazingly, the oceans and atmosphere of Earth naturally share basic physics with the quantum Hall effect! As equatorially trapped Kelvin waves in the Pacific ocean are an important component of El Niño Southern, these new results demonstrate that topology plays a surprising role in Earth's climate system. I first spoke about our discovery during the 2017 program on "Recurrent Flows: The Clockwork Behind Turbulence," receiving extremely helpful feedback that helped inform my thinking.

I'd like to thank David Gross and the current KITP Director Lars Bildsten for their generous long-term support for climate physics at KITP. I also want to thank the KITP staff for their great work at making all of this happen!





Open Knowledge

“Unofficial scholar” Bill Paxton makes astro-computing accessible to all

Once, not long ago, astrophysicists needed to live and work at one of a few academic institutions if they wanted to create computational models of the stars. Thanks to Bill Paxton and his irreverent programming style, the walls of those fiefdoms have fallen. Modules for Experiments in Stellar Astrophysics (MESA) is an open and adaptive computer program with wide applications across stellar astrophysics. Bill says it takes a particular kind of crazy person to invent a program like MESA — one who found a home at the Kavli Institute of Theoretical Physics.

Computer scientist and Stanford alumnus Bill Paxton arrived at UC Santa Barbara in June 2000, ten years after retiring from Adobe. He began to attend UCSB classes as a community member. Greek history, political science, math... and “Stars with Lars” taught by Lars Bildsten, the course that drew Bill into the orbit of KITP. What began as regular meetings led to an office and then a challenge: could Bill create a computational tool for stellar evolution that would take advantage of modern processor architectures, algorithms and community engagement?

“From the beginning, we described MESA as open knowledge rather than open source,” Bill said. “If you use MESA, you’re committed to helping other people learn the program.” Astrophysicists share code modifications, control files and everything used to generate their results.

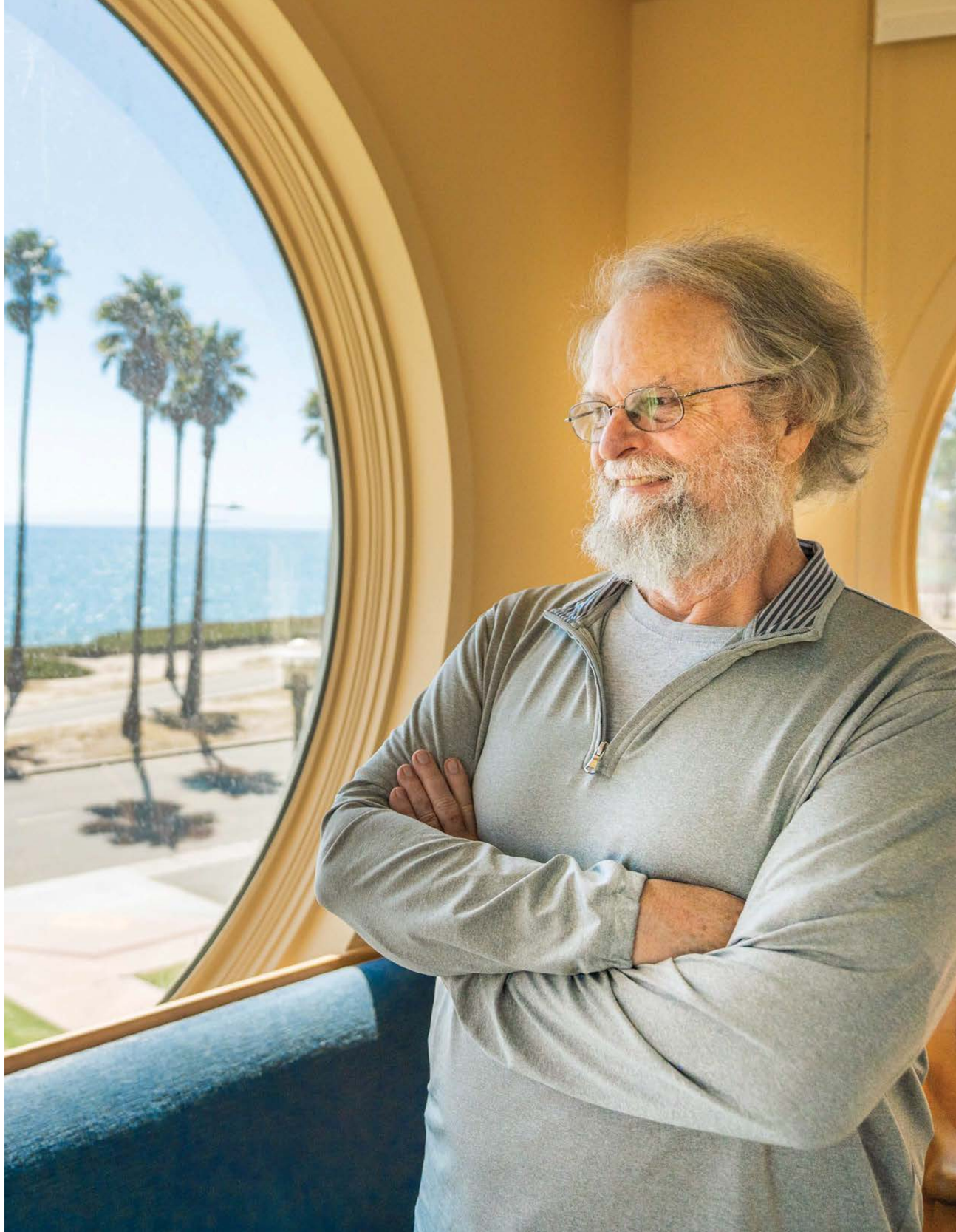
Fueled by coffee and inspiring colleagues from around the globe, Bill stitched together and rewrote code that incorporated information from different parts of physics, including nuclear reactions, thermodynamics and radiation. By focusing on tools that an individual could operate instead of supercomputers, and by committing to a distributed online network as well as summer schools held at UC Santa Barbara, Bill and his colleagues established a community that will expand MESA long after he steps back.

Bill revolutionized stellar modeling with MESA. Proprietary code was once the default for a select few. Now, more than 1,000 scientists use MESA worldwide and its instrument papers have thousands of citations. Graduate students have credited Bill for their Ph.D. studies; without MESA, they would not even have access to the code. Today, a group of 15 astrophysicists are dedicated to continue the development of MESA and its use for science and education around the world.

“The field understands being a theoretical or observational astrophysicist who brings back telescope images,” said Bill. “Turns out the way to make the connection between those is through computer programs that can embody the theory and spell out the consequences in a way that can be compared to the observations.” Computational astrophysics is a long-term need, and Bill cautions that institutions cannot expect someone like him to stumble in. The field of physics needs to support inventive computer scientists.

“Sometimes being creative is as frustrating as hell,” said Bill when asked if working on MESA was enjoyable. “Imagine Chihuly when he breaks a glass sculpture at the last second. What makes it worthwhile is when the glass doesn’t break, when you’ve created something cool that other people like and use. I’ve had that in spades at KITP.”

Bill made his immense contribution to physics entirely as a volunteer. “I get compensated by having great friends here at KITP, an office, a computer and all the caffeine I can consume,” said Bill. He and his wife, Kathlyn, have also been loyal physics graduate student fellowship supporters and Friends of KITP for 20 years.



Opposing the Tribal Tendency at KITP

An excerpt of a KITP's 71st Public Lecture, entitled "Chaos, Black Holes and Quantum Mechanics" presented by Stanford University's Richard Herschel Weiland Professor of Physics and former KITP Postdoctoral Scholar, Stephen Shenker

You've seen that in this talk, many different parts of physics are sort of swirled together. It often happens that ideas that you thought of as separate are joined, and that joining often leads to rapid progress. Roughly, if you find some areas that are connected with yours, you can take advantage of all the hard work other people did very quickly.

It's a powerful route to progress.

But there are powerful opposing forces to this kind of joining of different fields. They go back, I think, to the idea that human beings are tribal creatures. We have seen this to our regret in the current political scene.

This means that people like me who work on quantum gravity and string theory like to talk to other people who are working on quantum gravity and string theory. We share a language, we share common goals, we think the same problems are important. And more prosaically, we often sit in the same part of physics buildings.

People who work on classical mechanics, which is a subject where people still think about chaos — they like to talk to each other, they declare that the same problems are important. They might sit in another building.

The theory of random matrices is highly developed in math departments. They are in a whole different department. Universities are these medieval institutions that codify the tribal features of intellectual inquiry.

It's not that we dislike each other, but rather that we are just naturally led to people we're familiar with.

Well I have to tell you that this place is, I believe, the most powerful force in the world in theoretical physics opposing that tribal tendency. This place, since it was founded, has deliberately pursued a strategy of bringing together people interested in different things.

You organize programs on rather different subjects you might think have an overlap, and have them happen at the same time. You have talks from one group to another. And more prosaically, even more importantly, office mates are chosen from different programs. You have to sit next to these people!

And now, with the Charles T. Munger Physics Residence, you have to live next to these people. And this is a very powerful force that has dissolved lots of boundaries. Some of my work started here, and it wouldn't have started without the kind of fluidity that this place enforces. I first came here almost 40 years ago, when I was a post-doc, and I come back every chance I get.

So the final thing I want to say is this: I understand that this Lecture Series is underwritten by the Friends of KITP, and that you provide lots of other support and encouragement to this place. So I want to thank you on behalf of myself and the other people in my field for the support you have given this place. It's very important for the development of physics.

Shenker, Stephen
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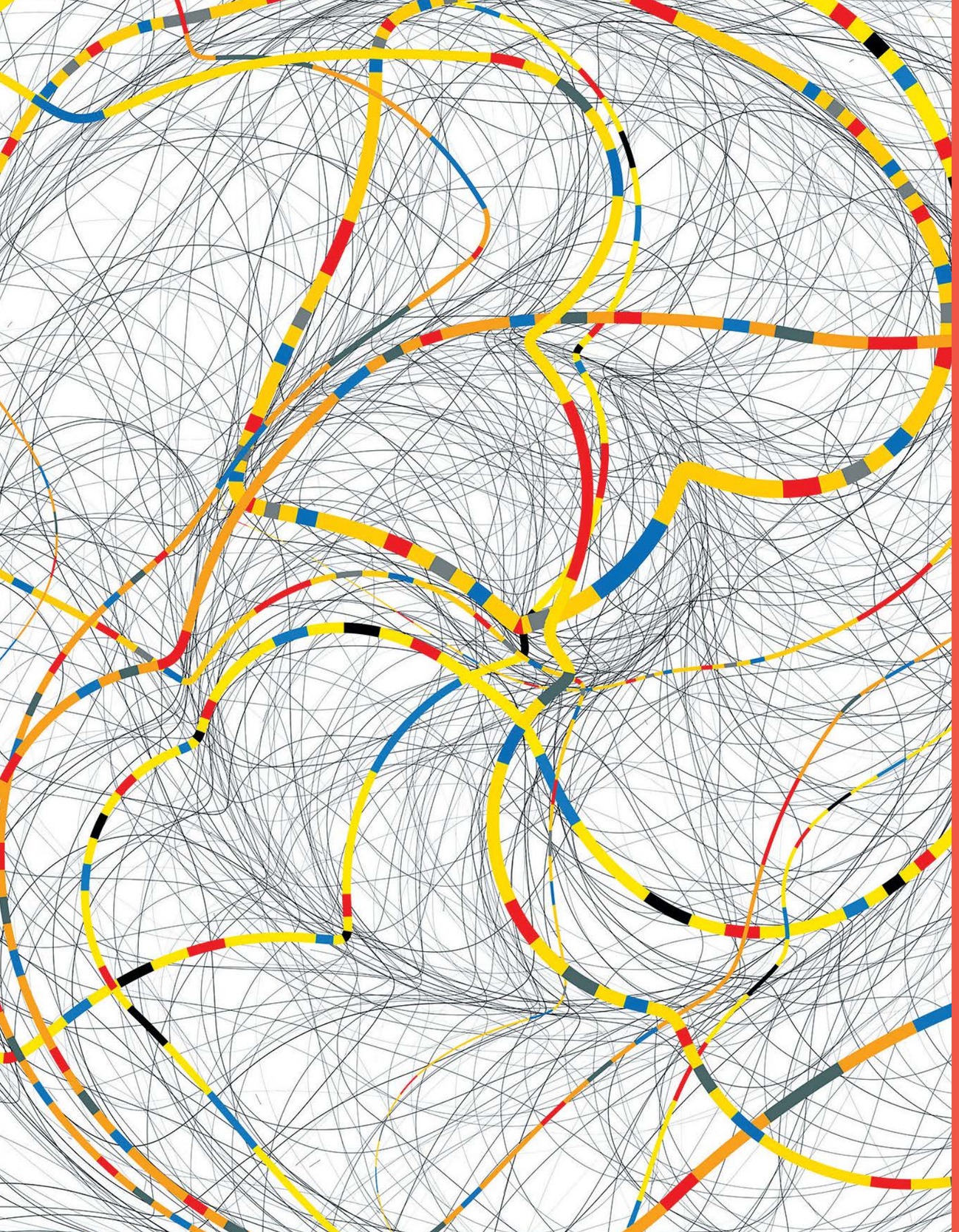
Office Number: 2327



Visionary Investments

All One Field

Dr. Muthiyaliah Babu and his wife, Rani, support KITP's postdoctoral scholars

When you lay down in a field in remote India with no light pollution and look at a sky, that's astrophysics. When Dr. Babu's four-year-old grand-daughter asks him how far the sky goes, it's biology. Dr. Muthiyaliah Babu has always been curious about what's out there, a universal yearning for the unknown. He and his wife, Rani, (pictured below) have chosen to support postdoctoral scholars at KITP for the future of science and the future of their grandchildren.

When Dr. Babu first moved to Santa Maria, California, from Michigan, he would drive 150 miles to UCLA to attend conferences. Thankfully for him, a patient introduced him to KITP's frequent public lectures. At his first one, Dr. Babu thought he had stumbled into a high-level physics lecture and was impressed with the intense cross-pollination of ideas.

"Medicine is a benefactor of curiosity," said Dr. Babu, who sees medicine and physics as intertwined. "If not for NASA, we wouldn't have telemetry. Radiotherapy drives the cancer field. These advances came out of curiosity."

Over 600 curious scholars from the international physics community apply for just a few postdoctoral scholar positions at KITP each year. Scholars choose KITP because they know they'll benefit from broad exposure to new ideas, expert mentorship and rare opportunities. Cross-pollination provides perspective and respect for other fields. As a result of their work at KITP, postdoctoral scholars often switch the focus of their research efforts.

Dr. Babu can relate with physicists who find new specialties at KITP. In 1972, Dr. Babu traveled from India to New York to become a thoracic surgeon. He left as a nephrologist, a kidney specialist. The transformative moment was a pie chart that showed the composition of ocean water and extracellular fluids. Dr. Babu was amazed to see they were the same.

"The ocean represents the primordial soup that we all came from as single-celled organisms," said Dr. Babu. "Our body cannot survive without it. The kidney is responsible for maintaining its chemical content."

Chemistry, engineering, even the quantum physics of Positron Emission Tomography (PET) scans: There is enormous interaction among all sciences. Next, Dr. Babu would like KITP to expand collaboration with the humanities.

"It's all one field," he said.

Such Great Heights

Lady Leslie Ridley-Tree encourages young physicists to take flight

The KITP Graduate Fellows Program combines talent with mentorship and access to a global scientific community. Since 1999, over 75 graduate students from around the world have arrived at KITP for a six-month research experience and returned to their universities with a broader understanding of physics. Over half of KITP graduate fellows now serve in esteemed faculty positions. Others reside at leading research organizations such as the Los Alamos National Lab and CERN. Over 20% of recent KITP graduate fellows are women, nearly double the national average of women pursuing graduate degrees in theoretical physics. All this is possible through the generosity of supporters like Lady Leslie Ridley-Tree, who helps visiting scholars soar beyond the realm of their experience at KITP.

Lady Leslie is not constrained by the expectations of others. She defied convention in 2005 by taking over her late husband's business manufacturing airplane parts as chief executive officer and chair of Pacific Air Industries in Santa Monica. The company is not the only organization that has risen under her leadership; Lady Leslie is a trustee and former board chair of the UC Santa Barbara Foundation. She dismisses those who expect her to support exclusively "feminine" causes like art and theater.

"People don't see that you can have wide interests," said Lady Leslie, who has a 20-year legacy of student support at UC Santa Barbara.

"Science is the beginning of the world, the beginning of us all, and if you start with that, it's simple. I find that very exciting."

That sense of wonder and exploration is encouraged in graduate fellows. While at KITP, each fellow is mentored, encouraged to participate in KITP programs and invited to give talks to the local KITP community. Fellows receive invaluable experience and exposure.

"As a student supported through the Graduate Fellows Program at KITP, I'm grateful for receiving what I truly believe is a unique opportunity for young scientists to witness how science progresses through productive collaborations, inspiring discussions and the subtle exchange of ideas that only occurs under special circumstances," said Gautam Reddy, a 2019 graduate fellow who is now an NSF-Simons Postdoctoral Fellow at Harvard. "I believe KITP does indeed nurture such an environment, and I'm very thankful for the opportunity to experience it."

As a KITP graduate fellow, Gautam researched how creatures navigate complex and turbulent environments. He presented a Café KITP talk on the ways that gliders and birds soar using thermal currents. These fundamental insights can be applied to machine learning and the physics of turbulent transport to model decision-making in noisy conditions. Donors like Lady Leslie gave Gautam the lift he needed to take his research to new heights.

"It's unusual for graduate students to have access to such a large group of leading scholars and have that freedom to explore," said Lady Leslie. "For me, it's about breaking barriers." Lady Leslie has high expectations for KITP scientists.

"I hope they will discover the formula for peace," she laughed. Then seriously, she added: "Science can help us realize we are all connected."

Game Theory

The Duval family ignites scientists' imaginations

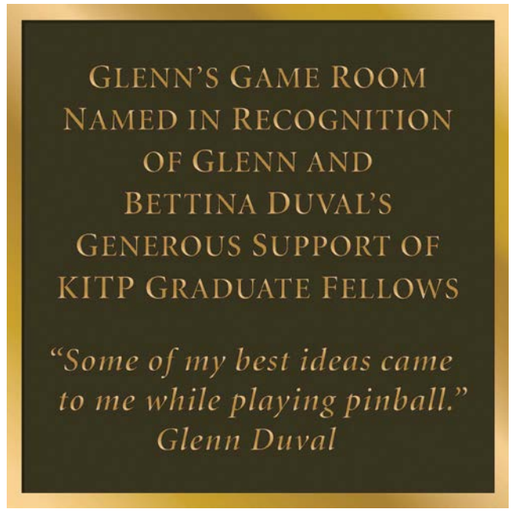
Few universities invite scientists to step outside their routines and home campuses in a way that inspires sharing. KITP pioneers new ways to empower and train the next generation of scientists to pursue groundbreaking research and foster collaborative networks. Designed with physicists and their loved ones in mind, the Charles T. Munger Physics Residence supports this mission by housing the majority of the thousand or more yearly KITP visitors and their families. Within the Munger Physics Residence, Glenn Duval encourages creative serendipity in an unusual way: through spending time having fun playing pinball or one of the many other games in what is now known as Glenn's Game Room.

"We need more people with active imaginations," said Glenn. "This stuff is so esoteric that you need to encourage sharing so all these crazy thoughts do not get lost."

Glenn, a UC Santa Barbara Foundation trustee who earned his bachelor's degree on campus in 1980, also supports adventurous initiatives like the Institute for Energy Efficiency and deep-sea explorer Bob Ballard's Nautilus expedition. In 2014, Glenn made the first gift to the KITP Endowment Campaign to help graduate students achieve their dream of living among the stars. This thrill of the unknown is what first drew Glenn to the KITP and to the Munger Physics Residence, where he and his family (which includes a family pet pig named Hamlet) give scientists a place to gather and play.

In Glenn's Game Room, physicists can bond over a friendly game of chess while their kids play foosball. The game room is furnished with pinball machines, table tennis and other games that help scientists relax. Glenn loves that KITP brings scientists together and he wants to help them make lasting friendships that lead to lifelong collaboration. Last year, he celebrated "Glenn's Stellar 60th" in the game room with his family, friends and KITP scientists.

"I am proud to be a KITP supporter because all who are involved share a pure love of science and the dream of impacting the future," said Glenn. "KITP is the place where a better future goes from the theoretical to the practical."



Family Physics

Claudia and Alec Webster help early-career scientists balance work and life

An associate professor earns an opportunity that could change the course of her research, and possibly her career: an invitation to participate for months in a program at KITP. Here, she'll have time to collaborate and share ideas with leaders in her field, connect with colleagues and gain exposure, all without the pressing responsibilities of her home institution. There's no question that KITP will accelerate her career. There's just one catch: how can she afford to bring her two small children?

Early-career scientists, especially women, can be held back when the formative years of their family and scientific career coincide. In a field where only 14% of faculty members are female, KITP is committed to supporting the whole scientist, including their families. UC Santa Barbara Foundation Trustee Claudia Webster and her husband, Alec, support the KITP Family Fund to encourage scientists to stay at the institute for as long as possible by offsetting child care and travel costs. Resources are also available for those caring for an elderly parent and additional family needs. This is essential for program success.

"Having support for key expenses like child care ensures KITP can bring the very best to participate in programs without financial barriers," said Claudia.

This holistic support means that women are more represented at KITP than in the wider field of physics. In the 2018-19 academic year, over 20% of KITP program participants were women, 30% of whom were funded by the Family Fund. Thanks in part to support from the Websters, 40 scientists — both men and women — received an average grant of $2,500 to make their transition to the institute easier. The youngest child to visit KITP last year was just eight weeks old!

Families find a welcoming home in the furnished apartments of the Charles T. Munger Physics Residence, where a children's playroom, game room, barbecues, communal spaces and ample chalkboards foster a neighborly environment. New mothers can access a private nursing room while working in Kohn Hall, a resource open to others on campus. Along with these measures, the Family Fund is part of KITP's commitment to alleviating the financial hardship that may prevent early-career scientists like Dr. Agnese Seminara (pictured far right) from participating in the institute's world-class programs.

Dr. Seminara visited KITP from the University of Nice, France, in August 2018 to join an institute program called "Neural computations for sensory navigation: mechanisms, models, and biomimetic applications sensory navigation" (SNAV18). SNAV18 brought scientists in different disciplines together to study how animals interpret environmental cues to travel. Visual, olfactory, thermal and mechanosensory cues change with space and time. Mapping neural circuits critical for sensory navigation in different sensory modalities and organisms informs development of models for the computations these circuits may perform. The models in turn suggest experiments to test how these circuits direct elementary behavioral responses that form robust orientation strategies.

Dr. Seminara first came to UC Santa Barbara when she presented a study on olfactory navigation in mice at a 2015 KITP conference. By returning for a month-long stay, she bonded with colleagues and got a "crash course" in advising students in KITP's UC Santa Barbara Advanced School of Quantitative Biology Summer Research Course, a quantitative biology school that is held yearly.

"This would not have been possible without the Family Fund," said Dr. Seminara, who struggled to cover the mounting costs of travel and daycare for her spouse and two-year-old child. "We could not afford it, and I could not have come the entire time without it. This kind of experience is crucial for people's career and for building community."

The Websters are determined to aid great women scientists. Claudia and Alec met at UC Santa Barbara, where they earned bachelor's degrees in 1975 and 1976, respectively. Alec earned a second bachelor's degree from the UC Santa Cruz environmental college formerly known as "College 8." In 2016, he and Claudia made a generous gift that renamed the college for Rachel Carson, the writer and conservationist whose 1962 book "Silent Spring" launched the modern environmental movement. Together, the Websters hope to support scientists who advance biomimicry, energy science, geophysics and sustainability.

"We need to support curiosity-driven science and the inquisitive minds who move knowledge forward," said Claudia. "It's exciting to support the KITP Family Fund. We love the emphasis on diversity and ensuring that all viewpoints are represented in the room — especially women."

The Quandaries of Nature

Together, Glen and Clark Mitchel ’78, MFA ’81 help scientists imagine the unseen

Without hesitation, Glen Mitchel can tell you that there are exactly 22 chalkboards in KITP’s Charles T. Munger Physics Residence. Glen enjoys the image of physicists from around the world housed comfortably on campus with their families and plenty of chalk as opposed to scattered around town in sublets as before. The residence exists in its current form in part through Glen’s leadership, recognized by a sculpture his son donated to KITP in his honor.

In 2012, Glen made a connection that accelerated KITP Director Lars Bildsten’s vision for a space that embraced visiting physicists. A regular participant in institute events and public talks, Glen first heard about the housing project from Lars in summer 2012 and shared it with philanthropist Charlie Munger, a good friend of 60 years. Charlie was sold. Glen helped oversee the project and was often spotted on-site for surprise inspections during construction.

“KITP has a mission to solve some of the quandaries of nature which have yet to be answered,” said Glen. “And it attracts leading scientists from around the globe who are enthusiastically anxious to get to UC Santa Barbara to work together on resolving these unanswered questions.”

Once here, scientists find the Munger Physics Residence an inspiring place to seek answers to questions such as the age of the universe. The Hubble Constant is the unit of measurement that describes the expansion of the universe. Its currently contested value is a subject of intense observational scrutiny and possible profound theoretical significance.

“Problems like the Hubble Constant conundrum have got to be solved, and KITP is the only forum capable of a conclusion,” said Glen.

“KITP is among the world’s finest centers for symposia and it tackles the most challenging problems in physics.”

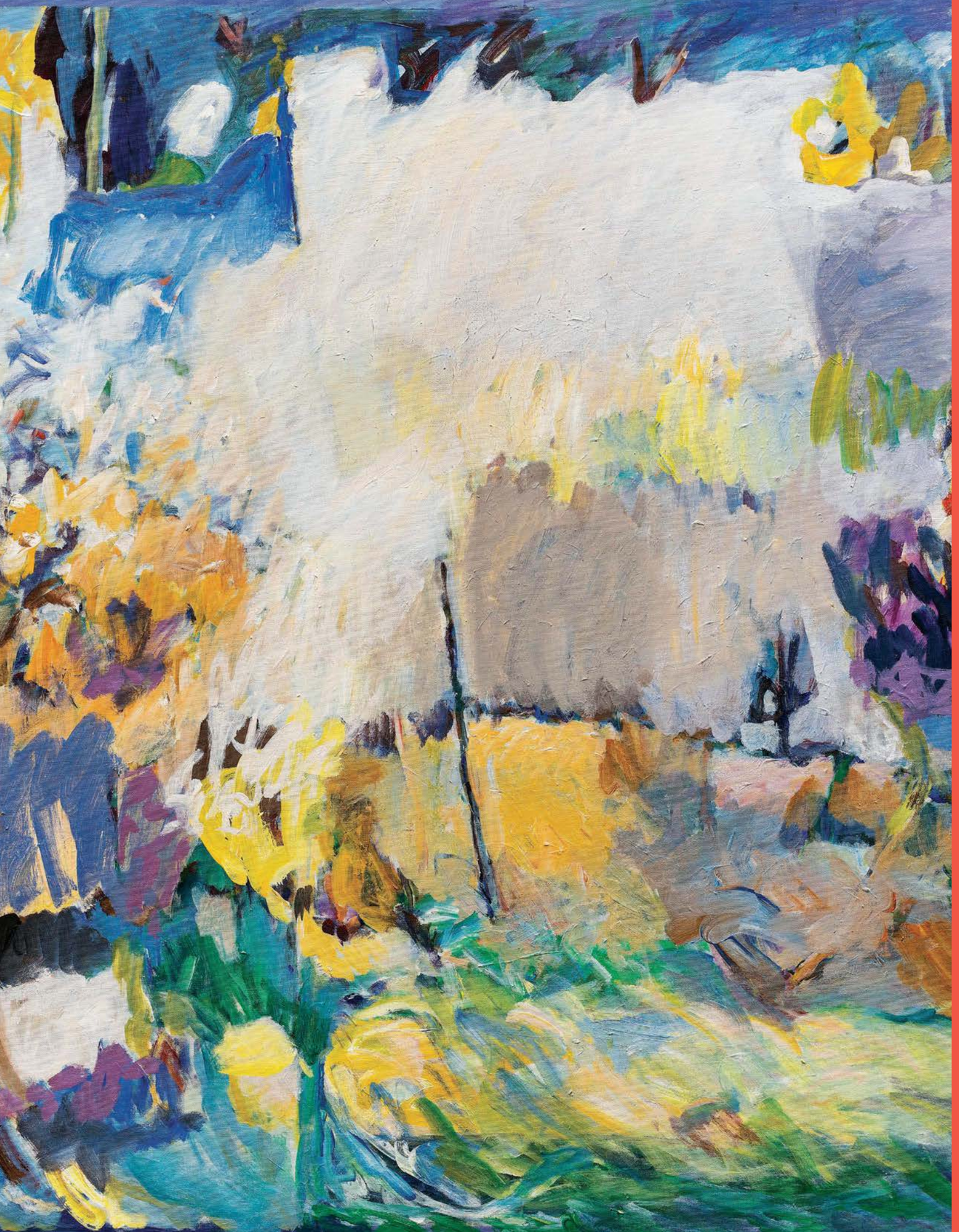
In 1979, the same year that what was then the ITP began, Glen’s son Clark also found himself intrigued by unknown variables. As a student in UC Santa Barbara’s MFA program for studio art, Clark encountered an artist’s rendering of astronomical formulations. Clark wondered at the creative intelligence required to develop these ideas based on math and speculation. He reinterpreted the image by casting it in bronze and called it “Expanding Sphere.”

“Those images advanced our knowledge of what’s out there in the universe,” Clark said of the drawing that inspired him. “Now, we’re getting pictures of black holes, but back in the 1970s they said we’d never see one.”

Art was a way to imagine what was out there. When he saw Glen’s dedication to building a home for scientists, Clark felt moved to donate the sculpture to KITP in honor of his father. “Expanding Sphere” now greets visitors in the Mitchel Foyer, which was recently named in honor of Glen’s leadership support of KITP and essential role in helping to create the Munger Physics Residence.

“I’m looking at KITP to be a permanent part of the world,” said Glen, a dedicated supporter for over ten years.

“Discoveries here help the entire scientific community. In order to do that, you’ve got to have an adequate endowment that ensures its continuity.”



Endowment Campaign

KITP Endowment Campaign

Ensuring in perpetuity there are no barriers to discovery

In 2019, KITP embarked on an ambitious endowment campaign to celebrate its 40th year of operation and sustain the future of the institute. Over the next several years, we intend to raise $30M in new endowment funds that will be used to support the research and career development of KITP graduate fellows and postdoctoral scholars, who are the future of the institute, and more broadly, of scientific discovery.

KITP is pioneering new ways to empower and train the next generation of scientists from a diverse range of backgrounds to pursue groundbreaking research and foster collaborative networks. KITP's Endowment Campaign will ensure in perpetuity that for scientists at the KITP there are no barriers to discovery.

The KITP Endowment Campaign Committee is a group of distinguished supporters who have led by example investing in KITP at a leadership level — helping to elevate the institute's reputation and ensure its lasting impact.

The newest member of KITP's Endowment Campaign Committee is Jim Simons, Founder of Renaissance Technologies and the Simons Foundation. Jim and his wife, Marilyn Simons (who is president and co-founder of the Simons Foundation), graciously participated in an exclusive KITP Salon sponsored by UC Santa Barbara alumnus and UC Santa Barbara Foundation Trustee Michael Stewart '91, which featured a reception and dynamic conversation with Jim facilitated by KITP Director Lars Bildsten.

The event, held at the Arader Gallery in New York City, was attended by UC Santa Barbara alumni and Friends of KITP, and alumna and UC Santa Barbara Foundation Trustee Karen Coyne '91 introduced the speakers.

Jim shared with attendees what inspires him to invest in science, and why it continues to be so important in our world today and in the future. Guests heard more about his Flatiron Institute, and his personal passion for funding young people in science.

KITP holds salons twice a year for Friends in the New York Metropolitan area, which create educational and entertaining opportunities for inquisitive members of the community to engage with renowned scientists in an intimate setting. Featured scientists have included A. James Hudspeth (Rockefeller), Ramamurti Shankar (Yale), Matteo Cantiello (Flatiron Institute), and Joel Moore (Berkeley).

"Basic science is a key pillar of human civilization, and KITP facilitates important contributions to that pillar"

Jim Simons

Campaign Committee

David Brown
Virginia Castagnola-Hunter
Glenn Duval
Carl Feinberg
Frederick Gluck
Gus Gurley
Glen H. Mitchel, Jr.
Charles T. Munger
Jim Simons
Lady Leslie Ridley-Tree
Douglas Troxel

KITP Postdoctoral Scholars

Philanthropic support helps recruit bright, independent young scientists...

Postdoctoral scholars add vitality to all aspects of KITP and contribute greatly to the intellectual atmosphere of Kohn Hall. In turn, the unique experience of being at KITP provides early career scientists with an excellent foundation for their future endeavors. Over 70% of KITP postdoctoral scholars are now in academic faculty positions across the world.

Annually, four to five postdoctoral scholars are selected from an exceptionally competitive applicant pool to join a cohort of 12-15 postdoctoral scholars in residence at a given time. Our scholars take full intellectual advantage of being at KITP and UC Santa Barbara and find ample opportunity to collaborate with other postdoctoral scholars, faculty members, and visiting scientists.

Chiara Toldo | Postdoctoral Researcher at Ecole Polytechnique (Paris) and CEA Saclay | 2017-2018

"I really enjoyed my experience at KITP. **The Postdoctoral Program at KITP gave me the unique opportunity to carry on my research among the best scientists in the world.** It allowed me to collaborate with the researchers at KITP and those at UC Santa Barbara, and diversify my research to include topics such as supersymmetric localization and properties of black hole horizons.

KITP's very diverse long-term scientific programs gave me the opportunity to broaden my knowledge and to keep up-to-date with the latest developments in other fields of physics. All this will help in becoming a mature well-rounded researcher, and my permanence at KITP was invaluable in this respect."

If you share our passion for making it possible for the brightest young minds to pursue unfettered, curiosity-driven science, please consider making a difference by investing in our KITP Postdoctoral Scholars Program.

KITP Graduate Fellows

...and invites graduate students to join an international scientific community

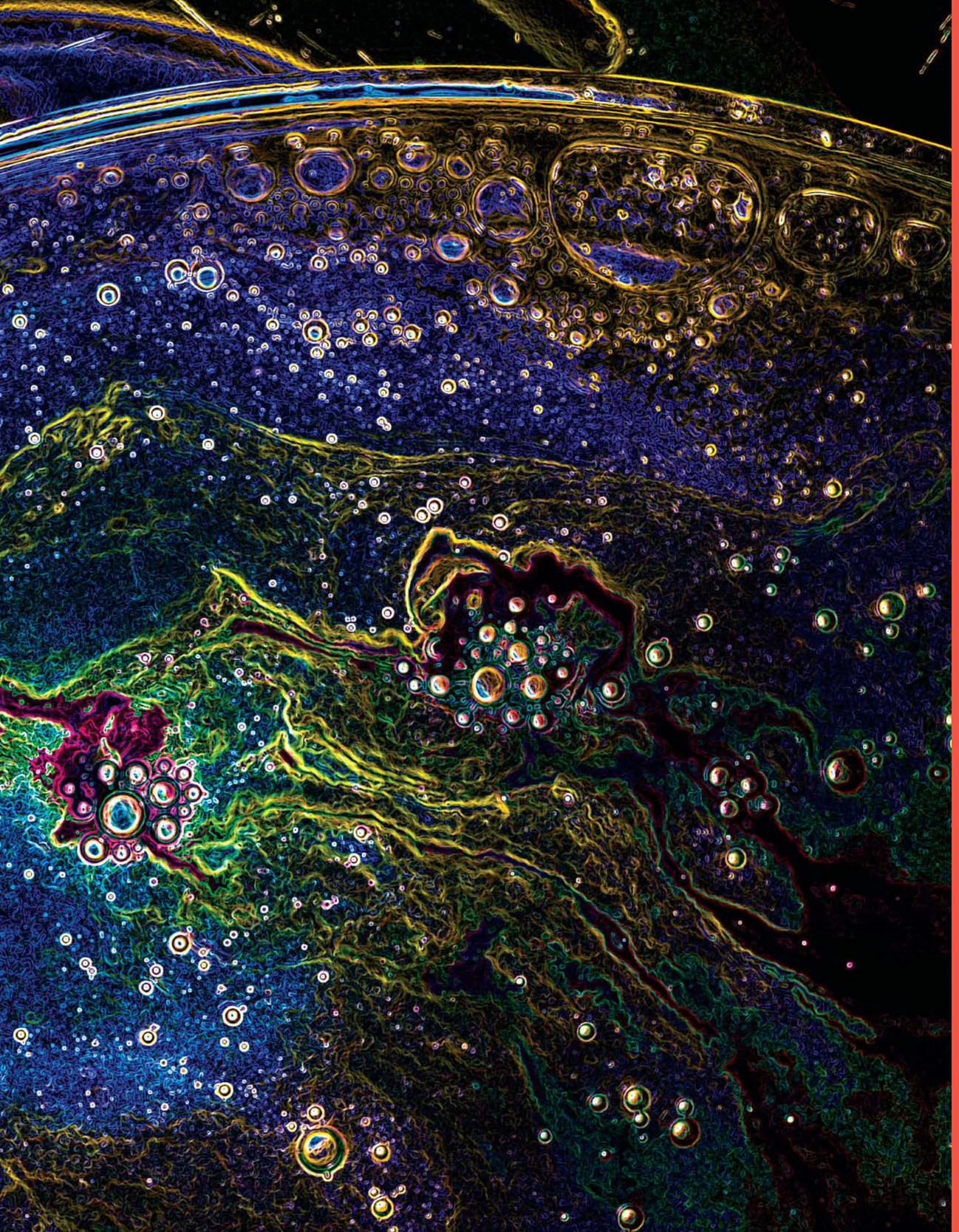
Every year the KITP Graduate Fellows Program offers a unique, highly competitive opportunity for a dozen outstanding graduate students to spend six months at KITP to participate in research programs and broaden their understanding of physics. The first KITP Graduate Fellows arrived in 1999.

The talent of these phenomenal students, coupled with the mentoring and access to the world-class, international scientific community at KITP, has produced impressive results.

Ashvin Vishwanath | Professor of Physics, Harvard University | Fall 1999

"The KITP Graduate Fellows Program had a huge impact on me. Mine was the first cohort of the program. I was the fourth year of my Ph.D., and I had a lot of interactions with scientists at KITP, including Professor Matthew Fisher, postdocs T. Senthil and David Carpentier, and Professor Leon Balents, who is now a Permanent Member. I had spent a lot of time during my Ph.D. learning, and I got to apply it to research when I was at KITP. **It was one of the most productive times of my Ph.D. I attribute this to the remarkable research atmosphere at the KITP, which was friendly, open and intellectually stimulating.** As a professor, I have tried to foster a similar atmosphere in my own group. The research areas I was exposed to as a graduate fellow was the application of Gauge Theories, traditionally applied to Elementary Particle Physics, to Condensed Matter Physics. That has been a recurring theme in my research ever since."

More than ever before, private support of our KITP Graduate Fellows Program is essential to ensure that we are able to continue to empower this next generation of theorists to connect, collaborate, and grow our collective knowledge with no barriers to their scientific discovery.



Legacy

The KITP Legacy Society

Leaving a legacy of exploration

Planned gifts support the core of KITP: the people. These gifts sustain the institute by adding to the endowment that supports KITP's post-doctoral scholars and graduate fellows as well as ongoing operational support for scientific programs, high school teachers' conferences, and community outreach. In perpetuity, planned gifts help to ensure that there are no barriers to discovery at the KITP.

We invite you to make a planned gift and become a member of the KITP Legacy Society. Special recognition and naming opportunities are available for irrevocable planned gift commitments to our KITP endowment.

To learn more about the KITP Legacy Society and opportunities for making a planned gift to benefit the institute, please contact Kristi Newton, Senior Director of Development, at kristi@kitp.ucsb.edu or 805.893.6307.

Supporting the Kavli Institute for Theoretical Physics through a planned gift offers the opportunity for significant tax benefits, the possibility of additional lifetime income, and — most importantly — the chance to help enable scientists' discoveries at KITP for years to come.

From Earth to the Stars

NASA engineer and finance entrepreneur David Brown has big dreams for KITP

"Going where no one's gone before is fun," said David Brown. He could be talking about putting a man on the moon… or about the Kavli Institute for Theoretical Physics, the first-of-its-kind research phenomenon that he champions. David's support of the KITP endowment helps theorists in physics and allied fields collaborate on the questions that arise from investigations at the leading edges of science.

David knows a leading edge when he sees one. When he entered the University of Pittsburgh computer science program in 1959, there were not many like it in the country. He was a student when the university received a grant to create lab simulations, an opportunity that David seized with excitement. NASA hired him right out of school. Fifty years ago, mentored by Carl Sagan, David helped build the models that put the first man on the moon.

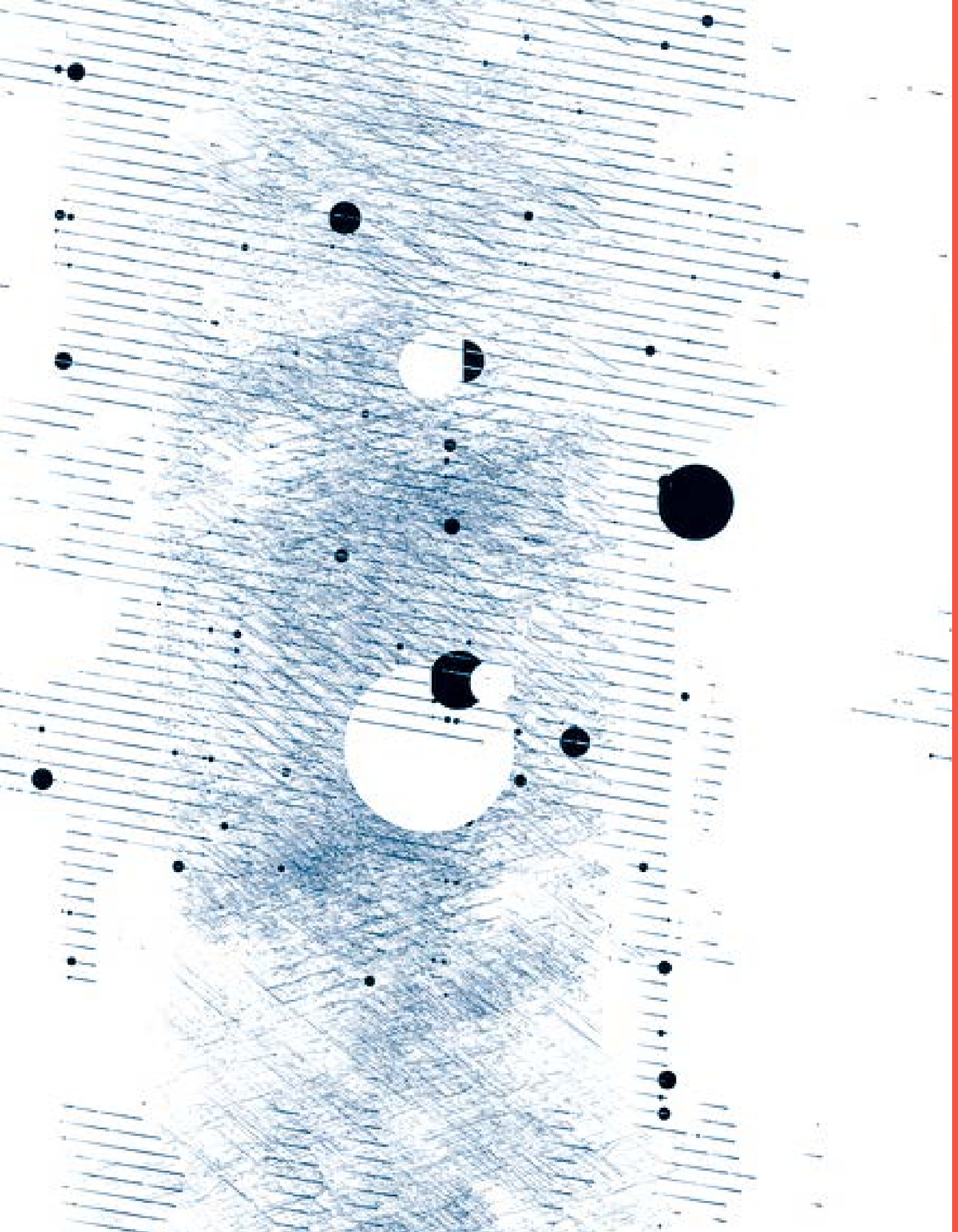
Today, a cell phone has more power than the entire room full of computers that David used to model the lunar landing at NASA. He would daydream about hundred-kilobyte chips; now, he marvels at terabyte chips with mind-blowing speed. For David, KITP captures the thrill of learning to build things we have never before seen.

"From my background in the space program, I know what it takes to do great things: you need lots of great people with the time to get to know each other," said David. "KITP has Nobel Prize winners; one of the greatest residence halls in the world funded by a famous fellow and good man, Charlie Munger; and tremendous scientists from across the globe."

At KITP, where even casual encounters lead to new ideas, scientists advance our understanding of the world. David prioritizes science funding because of his strong belief that knowing how things work will enable us to survive as a species. From his childhood lessons in a one-room schoolhouse to his lifelong pursuit of knowledge, David believes in the power of education. He and his late wife, Carolyn, have helped to make education possible by funding college scholarships in their hometown. When former KITP Director David Gross foresaw the importance of an endowment 20 years ago, David and Carolyn were proud to support the pursuit of knowledge as early and steadfast donors and are also founding members of the KITP Legacy Society.

"If KITP was good enough for Stephen Hawking, it's good enough for me," he said with a laugh. "If you're serious about the science being done here — if you care — you should donate and be a part of it."

Through his work at NASA, his work-in-progress novels, and his support of KITP, David hopes to reach people all over the world with the power of science.



Recognition

Generosity to KITP

Gifts made between July 1, 2018 - December 31, 2019

$1,000,000 and above

Gordon and Betty Moore Foundation
Alfred C. Munger Foundation
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$500,000 to $999,999

Virginia Castagnola-Hunter
Lady Leslie Ridley-Tree H'12

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Deborah '79, '86 and John Mackall
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Consecutive annual giving to KITP for 10 years or more

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Frederick and Linda Gluck
Frederic and Nancy Golden
Colin and Barbara Gordon
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Cheryl Hahn
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Cumulative giving to KITP as of December 31, 2019

$30M and above
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Fred Kavli* H’05, The Kavli Foundation

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Gordon and Betty Moore Foundation
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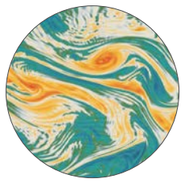
Alec ‘76 and Claudia ‘75 Webster, The Helen & Will Webster Foundation

**Deceased*
H = Honorary Alumni

Note: Every effort has been made to provide a complete and accurate listing of KITP donors. We apologize for any omissions or errors that may have accidentally occurred. Please contact Kristi Newton, Senior Director of Development for KITP, at 805-893-6307 or kristi@kitp.ucsb.edu regarding corrections or other feedback.

Featured Artwork

Interpretations of discovery



Macroturbulence
Brad Marston
Cover Image

City of Light
Meg Torbert
Charles T. Munger Physics Residence
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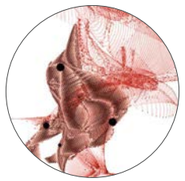

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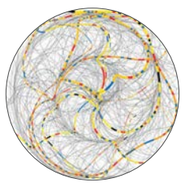

Vortex Boogie Woogie
Jean-Pierre Hébert
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Benjamin Franklin Bust
George Lundeen
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Financial Highlights

Support for KITP Activities
2019-2020 Projected Income and Expense

Income $5,950,000

National Science Foundation	$3.2 M
Private Foundations (Heising-Simons, Simons, Kavli, Moore)	$1.75 M
Private Philanthropy	$800 K
National Institutes of Health	$200 K

Expenses $5,845,000

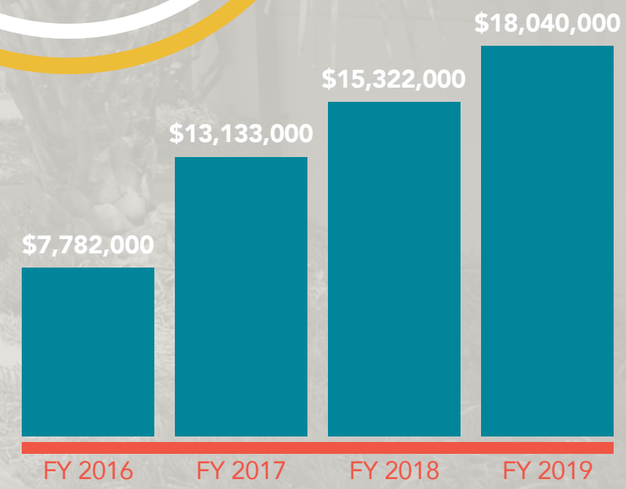
Programs, Conferences, & Support Staff	$4.5 M
Postdoctoral Scholars	$700 K
Equipment & Materials	$275 K
Graduate Fellows	$220 K
Family Fund	$150 K

Endowment Campaign Commitments

$6M Postdoctoral Scholars Endowment Fund (Goal: $25M)

$2M Graduate Fellows Endowment Fund (Goal: $5M)

General Endowment Totals



Totals are for KITP's general endowment and do not include endowed chair funds, which are restricted to support faculty member research.

Permanent Faculty Members (pictured)

Leon Balents · Boris Shraiman · Lars Bildsten · David Gross

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SLAC National Accelerator Laboratory

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Tim Tait
UC Irvine

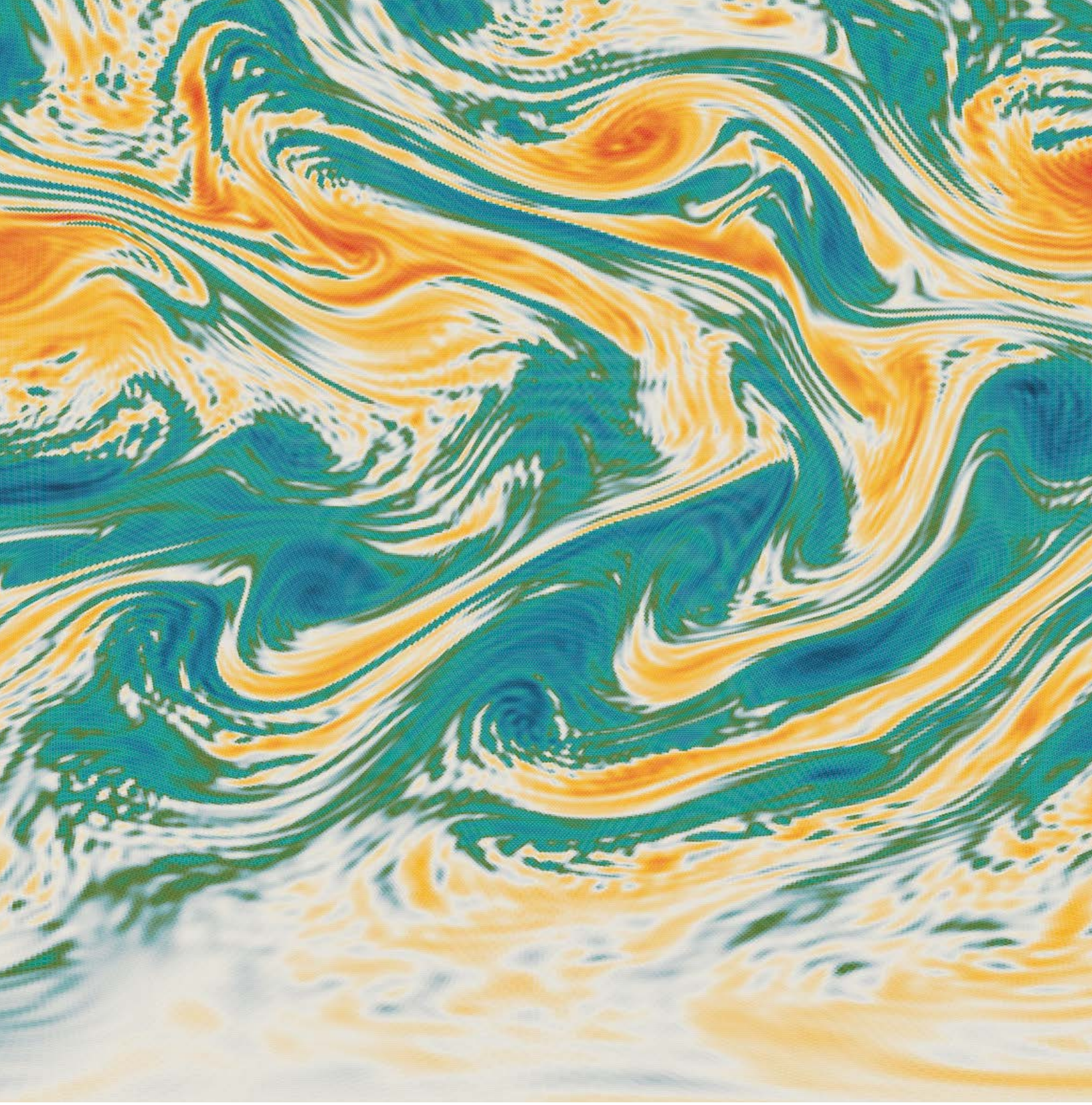
Mark Trodden
University of Pennsylvania

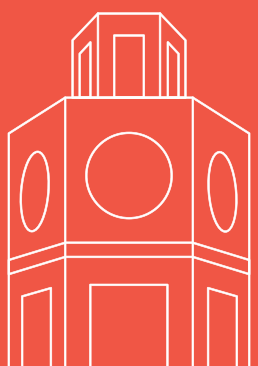
Roser Valenti
Goethe University Frankfurt

Steven White
UC Irvine

"Physics has enormously helped me in life — the logic and power of it. Once you see what a combination of calculus and Newton's laws will do and the things you can work out, you get an awesome appreciation for the power of getting things in science right. It has collateral benefits for people. And I don't think you get a feeling for the power of science — not with the same strength — anywhere else than you do in physics."

Charles T. Munger





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Cover by Brad Marston

Vorticity in an idealized model of an atmospheric jet that displays macroturbulence — a mixture of random chaotic eddies and larger coherent structures.