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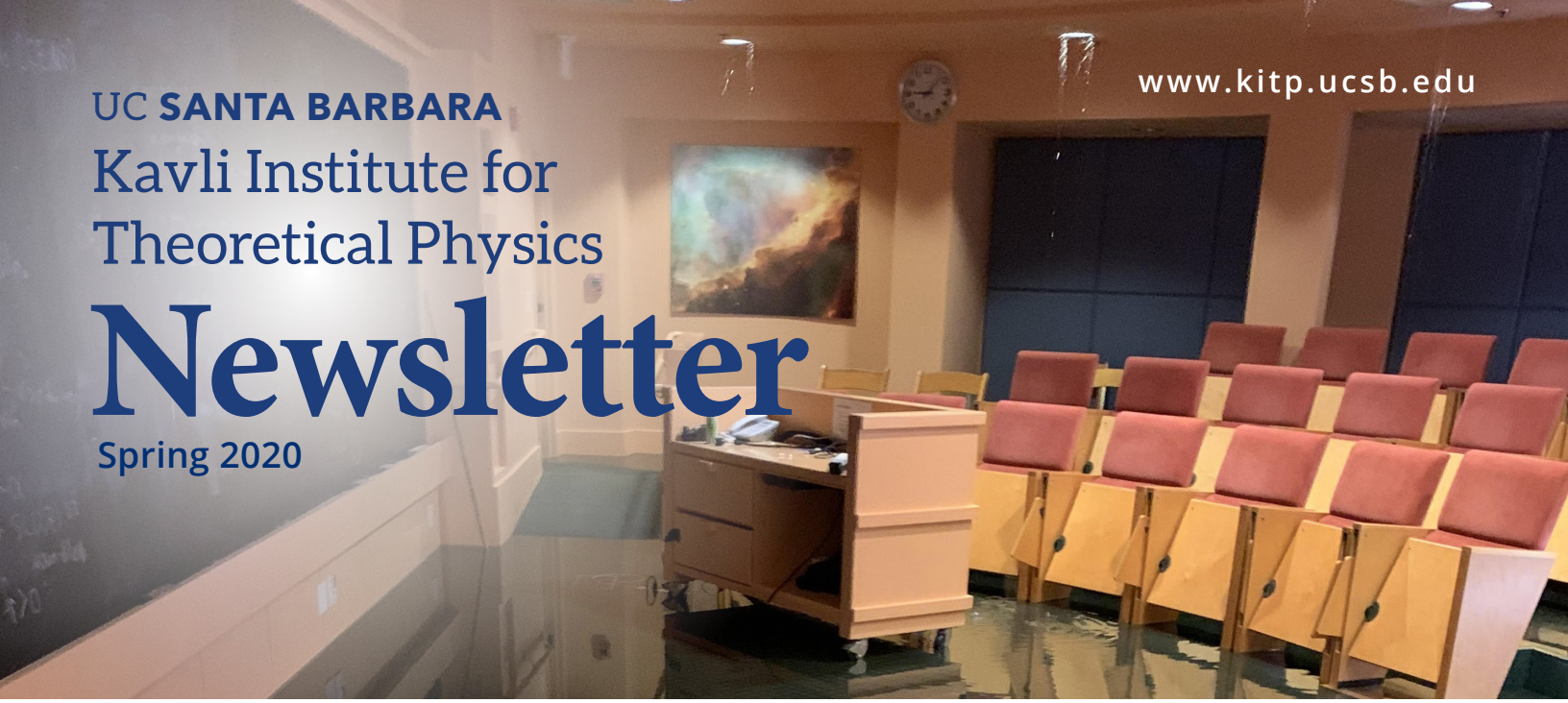
Newsletter

Spring 2020



LISA STEWART

CARTER HYAMA

Lars Bildsten

On Sunday, March 8, 2020 I arrived at Kohn Hall at 9:30 AM to see water flowing out the door and down the steps! Unfortunately, Kohn Hall was experiencing a 10,000-gallon flood originating from the water heater on the second floor above the Auditorium (see image above). We lost the use of our Auditorium, Lobby and about 20 offices for our postdocs, graduate fellows, staff and visitors. Roughly 1/4 of Kohn Hall. This is an insured loss, so KITP's burden is solely the stress, time and effort to reconstruct. KITP's Chief Administrative Officer Lisa Stewart and I have been coordinating with the Campus and the many contractors to achieve the rebuild. We expect that reconstruction will be accomplished by late September. The silver lining is that we are adding new features (e.g. new cameras and microphones) that will enhance our in-person program activities through remote participation when we return to working in Kohn Hall.

As Covid-19 emerged in early March, we decided to continue to engage with our international physics community via "remote" interactions using the Zoom platform. We made the decision early enough so that nearly all of the participants for the "Symmetry, Thermodynamics and Topology in Active Matter" (ACTIVE20) and "Globular Clusters at the Nexus of Star and Galaxy Formation" (CLUSTERS20) programs could avoid traveling to Santa Barbara. Those few who were already on their way made the most of their prolonged stay with us, as you can see from reading the article they wrote on Page 3.

KITP's Deputy Director Mark Bowick was one of the Coordinators for the ACTIVE20 program and was able to work closely with the other Coordinators Mike Cates (Cambridge), Nikta Fakhri (MIT), Cristina Marchetti (UCSB) and Sriram Ramaswamy (IISc Bangalore) to create something new for KITP: A fully remote program! This required remarkable planning, persistence and teamwork with our very able IT Staff of Alina Gutierrez (read about her on Page 6) and Craig Kunimoto to achieve nine weeks of nearly two-hour events almost every day.

All of the meetings were recorded and are now available online. This endeavor allowed KITP to continue our important mission of ensuring that collaborative science is always happening! Indeed, there is no better time than now for us to work even harder on that mission. The success of the ACTIVE20 program allowed for the CLUSTERS20 program to proceed in a similar manner. Each program brought nearly 100 people together at each event, allowing the participants to learn what others are working on and thereby define new intellectual streams. We will continue to support the explorations of the frontiers of science in this way, even during these difficult times. And, most importantly, all the lessons we have learned about the value of remote participation will stay with us, allowing for an expanded impact of KITP when in-person visits are again possible.

We have three science stories in this Newsletter that involve long-term participants at KITP. On Page 2, we highlight recent work by Professor Jørgen Christensen-Dalsgaard of Aarhus University. He is a frequent KITP visitor, starting decades ago in a program aimed at understanding how the Sun oscillates. This article highlights recent work done with his collaborators on just how stars further along in their evolution are ringing in a manner detectable by space-based telescopes. Brandeis Professor Bulbul Chakraborty's long association with the KITP is described on Page 5, where you can read how the KITP has impacted the evolution of her research program. And lastly, for many years, KITP has been bringing biologists to the KITP for extended interactions. Harvard Professor Andrew Murray is a frequent guest and shares his views of the benefits of these deep engagements with physicists on the back page.

On page 7 we share a story about the Tower Room Lunch Series for women that was initiated in 2017 by Cornell Professor Eun-Ah Kim during her 2017 visit. These weekly gatherings are held in the iconic second-floor Castagnola-Hunter Tower Room at Kohn Hall, which was recently named in honor of KITP's longtime friend and legacy donor Virginia Castagnola-Hunter. Her gift to the Postdoctoral Scholars Endowment Fund helps ensure support for early career scientists at KITP.

The last three months have been a very challenging time for the international physics community we serve, as well as all the KITP scientists and staff as we adjusted to working from home while still achieving our important mission. However, the shocking death of George Floyd has caused many of us here to reflect on what more KITP can do.

In closing, I quote from KITP's Statement of Solidarity: "To pursue physics as both a passion and a vocation is truly a privilege and obliges us to root out racism in all its many forms."

- Lars Bildsten, KITP Director

A Flash and a Shudder

Theoretical Work Predicts Unusual Oscillations

JØRGEN CHRISTENSEN-DALSGAARD

In five billion years or so, when the sun has used up the hydrogen in its core, it will inflate and turn into a red giant. This phase of its life — and that of other stars up to twice its mass — is relatively short compared with the more than 10 billion-year life of the sun. The red giant will shine 1,000 times brighter than the sun, and suddenly the helium deep in its core will begin fusing to carbon in a process called the "helium core flash." After this, the star settles into 100 million years of quiet helium fusion.

Astrophysicists have predicted these flashes in theory and in models for 50 years, but none has ever been observed. However, a paper in Nature Astronomy Letters suggests this may soon change.

"The effects of helium core flash are clearly predicted by the models, but we have found no observations that directly reflect them," said coauthor Jørgen Christensen-Dalsgaard, a Simons Distinguished Visiting Scholar at KITP and professor at Aarhus University in Denmark.

A star like the sun is powered by fusing hydrogen into helium at temperatures around 15 million K. Helium, however, requires a much higher temperature than hydrogen, around 100 million K, to begin fusing into carbon, so it simply accumulates in the core while a shell of hydrogen continues to burn around it. All the while, the star expands to a size comparable to the Earth's orbit. Eventually, the star's core reaches the perfect conditions, triggering a violent ignition of the helium: the helium core flash. The core undergoes several flashes over the next 2 million years, and then settles into a more static state where it proceeds to burn all of the helium in the core to carbon and oxygen over the course of around 100 million years.

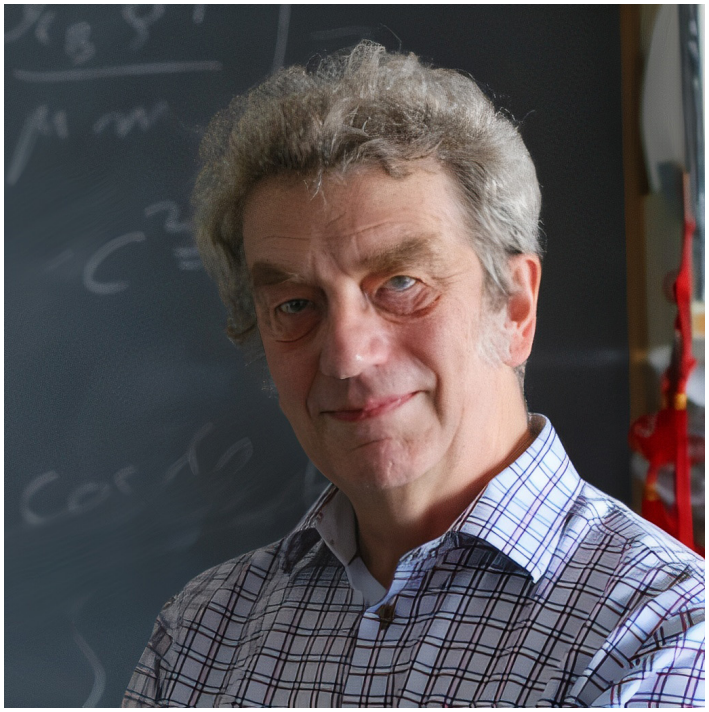
The Helium core flash plays an integral role in our understanding of the life cycles of low-mass stars. Unfortunately, gathering data from the cores of distant stars is incredibly difficult, so scientists have been unable to observe this phenomenon.

The power of modern space-based observatories like Kepler, CoRoT and now NASA's Transiting Exoplanet Survey Satellite (TESS) promises to change this. "The availability of very sensitive measurements from space has made it possible to observe subtle oscillations in the brightness of a very large number of stars," Christensen-Dalsgaard explained.

The helium core flash produces a series of different waves that propagate through the star. This causes the star to vibrate like a bell, which manifests as a weak variation in its overall brightness. Observations of stellar pulsations have already taught astronomers about the processes inside stars in much the way that geologists learn about the Earth's interior by studying earthquakes. This technique, known as asteroseismology, has grown to become a flourishing field in astrophysics and has benefited from a number of recent KITP programs.

The core flash happens quite suddenly, and like an earthquake, begins with a very energetic event followed by a series of successively weaker events over the next 2 million years — a relatively short period in the life of most stars. As shown in an early paper in 2012 led by KITP Director Lars Bildsten and KITP Senior Fellow Bill Paxton, the pulsation frequencies of these stars are very sensitive to the conditions in the core. As a result, asteroseismology could provide scientists with information that tests our understanding of these processes.

"We were excited at the time that these new space capabilities might allow us to confirm this long-studied piece of stellar evolution. However, we did not consider the even more exciting possibility that these authors explored using the vigorously convecting star to actually get the star ringing," said Bildsten.



Simons Distinguished Visiting Scholar Jørgen Christensen-Dalsgaard

The main purpose of the new study was to determine whether these flashing regions could excite pulsations large enough for us to see. And after months of analysis and simulations, the researchers found that many should be relatively easy to observe.

"I was certainly surprised that the mechanism actually worked so well," said Christensen-Dalsgaard.

The new and promising angle detailed in the paper is that the astronomers have been studying the processes in a very special — and up to now not very well understood — type of star designated a subdwarf B star. These are former red giants that, for unknown reasons, have lost most of their outer layer of hydrogen. Subdwarf B stars provide scientists a unique opportunity to more directly probe the hot core of a star. What's more, the remaining thin layer of hydrogen is not thick enough to dampen the oscillations from the repeated helium core flashes, giving the researchers a chance to potentially observe them directly.

This study provides the first observational information about the complex processes predicted by stellar models at the ignition of helium fusion. "This work took strong advantage of a series of fluid dynamical calculations led by former KITP Graduate Fellow Daniel Lecoanet," Bildsten noted. "If this all works out, these stars may provide a new testing ground for this fundamental puzzle in astrophysics."

Christensen-Dalsgaard said he is eager to apply these findings to actual data. And in fact, helium core flashes may already have been observed. Several of the stars observed by CoRoT and Kepler show unexplained oscillations that appear similar to predictions of helium core flashes. TESS will prove crucial in this future research, he explained, since it will observe a whole swath of stars, including several where these pulsations may be detectable. This will provide further strong tests of the models and an insight of what the future holds for our own sun.

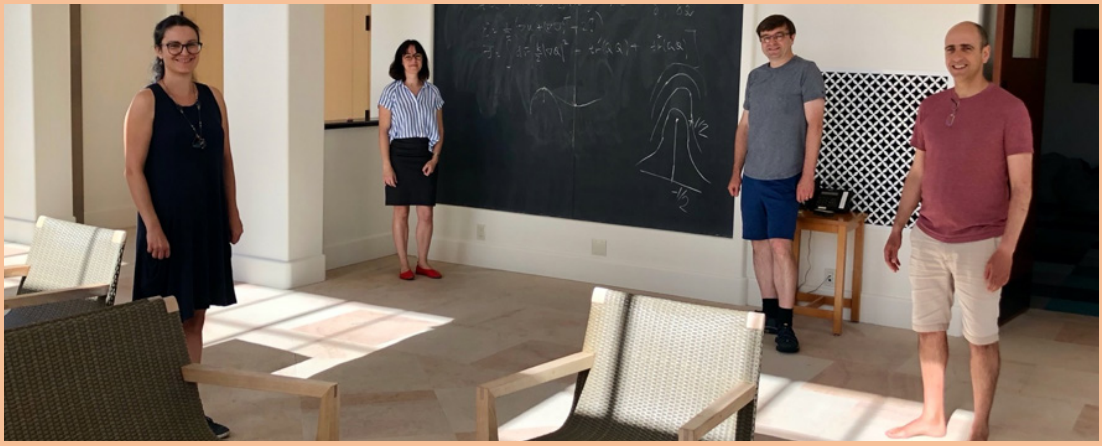
- Harrison Tasoff, Science Writer, UCSB Public Affairs

Sheltering in Place at the Charles T. Munger Physics Residence

Participants in KITP's Active Matter Program Find the Silver Linings

When the Governor of California issued the "Shelter in Place" executive order during the COVID-19 pandemic, we and two other participants (Yair Shokef of Tel-Aviv University and Luiza Angheluta-Bauer from University of Oslo) of KITP's "Symmetry, Thermodynamics and Topology in Active Matter" program, hereafter known as ACTIVE20, were already residents at the Munger Residence. ACTIVE20 would begin as the first KITP program to launch online and we were the only participants at the Munger Residence. That was a bit of a head scratch. What will this program look like to us and our small kids while we shelter at home away from home, without their toys, games, and distractions?

Mark Bowick, KITP's Deputy Director and one of the ACTIVE20 organizers recently shared with us the story of Sophie Germain (1776-1831), a self-taught French mathematician who made seminal contributions to the theory of elasticity. Sophie could only do mathematics in isolation, having to hide from her parents in the dark as they took away her candles in attempts to prevent her studies. Mathematics kept her mind secluded from the problems surrounding her, so she persisted, waking up at the crack of dawn to do math "under covers" as her ink froze in the ink-pot. COVID-19 isn't a hardship compared to this. We don't have to pretend to be a man to do science, and the lights are always on. But COVID-19 did force us to isolate and isolation is not commensurate with scientific development. Not even for Sophie Germain, who despite working in isolation, thoroughly enjoyed her exchanges with other scientists like Gauss and Lagrange. While a tempting thought, isolation is not a great aid to pure theorists either. The KITP program on "Gravitational Holography" (QGRAVITY20) was just ending at the onset of COVID-19 concerns. It was fantastic to be at the Munger Residence during that social time and witness how science emerges from a vibrant group who can socialize, play table tennis and even music together.



TOM FAULKNER

ACTIVE20 participants social distancing in the Charles T. Munger Physics Residence. From left to right: Luiza Angheluta-Bauer, Cecilia Leal, Ivan Smalyukh, Yair Shokef

The Munger Residence is a lot calmer now, but that also means that our group can have discussions in person while remaining 12 feet apart (in all dimensions really). We can still have barbecues, play music and table tennis, and the big blackboards are fantastic to homeschool the kids. While COVID-19 is not fully going away anytime soon, scientific conferences and KITP programs will have to adapt to the new realities of pandemic-impacted scientific exchange. Could our stay and participation in the virtual ACTIVE20 program provide some insights on how (perhaps in stages) KITP programs could be brought back as onsite events with face-to-face scientific interactions even before a vaccine is available? The Munger Residence is spacious and the best equipped facility for long-term stay of researchers that we have seen in our careers. At a fraction of its occupancy, it could possibly house two dozen researchers (and some of their families) with plenty of room for "long-range" social and scientific interactions.

The online ACTIVE20 program is fantastic, bringing over 100 online attendees to every talk, with many engaging discussions, spin half-hour events (where you meet new researchers in Zoom breakout rooms), Slack-enabled follow-up exchanges, tutorials, and so on. Most of these events are also recorded and posted on KITP's website, letting the whole world benefit. However, by no means will virtual programs replace what researchers practiced over centuries – the in-person interactions. The Munger Residence was designed to be a home away from home for researchers attending KITP programs and it still is capable of serving this mission during these challenging times. With its caring and helpful staff and location, we believe that Munger is the best place to "shelter in place" at a home away from home.

These days, blackboards at the Residence often feature a mix of remnants of first-grader homeschooling and field theories of active matter, along with messages like "Happy Birthday, Amy!" from a new friend. These blackboards, the embodiment of the knowledge exchange ranging from first-grade math to homotopy theory, wait for new groups of scientists from all over the world to arrive once travel and other restrictions are relaxed. We hope that new groups of residents can come and fill the walls of the Munger Residence with a unique mix of joyful laughter of children and engaging scientific debate.

- Cecilia Leal, Associate Professor and Racheff Faculty Scholar in Materials Science and Engineering, University of Illinois at Urbana-Champaign and Ivan Smalyukh, Professor of Physics, University of Colorado Boulder

CECILIA LEAL

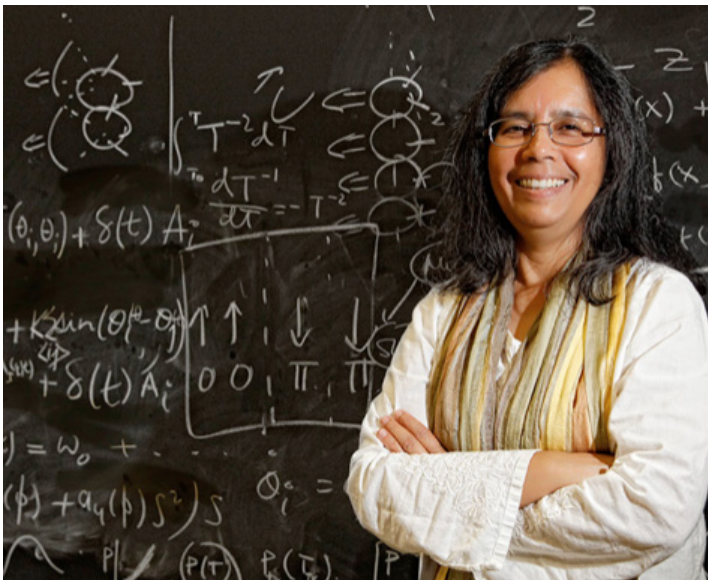
Tom Faulkner, one of the QGRAVITY20 organizers, homeschooling in the Children's Room at the Munger Residence

CECILIA LEAL

Amy Faulkner taking Zoom violin lessons in the Munger Residence Music Room under the watchful eye of a young Joni Mitchell, photographed by Gary Smaby

From Quantum to Classical and Back

Bulbul Chakraborty, a former KITP Advisory Board member and chairperson, is the Enid and Nate Ancell Professor of Physics at Brandeis University. She participates regularly in KITP programs on soft matter and non-equilibrium systems, and in October 2019 I sat down to interview her about the Institute's contribution to those fields. Chakraborty was at KITP for a follow-on – two weeks of focused work with collaborators from the 2018 Physics of Dense Suspensions program she co-coordinated. Since she studies systems governed by classical behavior, I was surprised to hear her excitement about the quantum condensed matter conference in house that week.



MIKE LOVETT

Professor Bulbul Chakraborty of Brandeis University

Chakraborty explained that, in fact, this classical-to-quantum link is consistent with a scientific transition she made over 20 years ago. For the first 15 years of her academic career, Chakraborty specialized in hard condensed matter, material systems governed by quantum mechanics and atomic or molecular interactions. She primarily studied quantum spin liquids - strange magnetic materials that do not exhibit the usual type of magnetic order.
In the mid-1990's, she and other physicists studying quantum spin liquids realized that the materials had important connections with glasses (materials that are solid despite their molecular disorder) and began to study the latter. That shift led her to spend most of fall 1997 at the ITP program "Jamming and Rheology" which gathered dozens of physicists and engineers to develop a coherent framework for modeling granular systems, foams, and glasses. Jamming is when a granular material transitions from flowing like a liquid to acting like a solid—you've encountered this if your coffee beans have ever gotten stuck in the funnel of a grinder.

She says that the timely program led to two major paradigm changes: the concept of an effective temperature in glasses and a now-famous jamming phase diagram with density, temperature, and load as the three axes. This phase diagram was remarkable in that it integrated the physics of glassiness and jamming by including a variable, load, which is not part of any equilibrium phase diagram.

Why did it happen at ITP? She credits the ease of communication that can only exist when a diverse group of scientists assembles for an extended period. "Just going along the corridor and finding someone makes a huge difference."

A few years after the program, a chance interaction pushed her further into classical physics, helping to redirect her research focus into granular systems. She was visiting Sid Nagel at the University of Chicago when she encountered a postdoc who was trying to make sense of a paper on jamming. Chakraborty recalls thinking, "This is exactly what I did in the quantum spin systems; maybe this actually applies here!"" Superficially, the systems have little in common, but she realized that the electrons in a quantum spin liquid and the macroscopic particles in a granular solid are under very strong constraints that may be usefully analogized.

For the subsequent 15 years, Chakraborty continued using tools borrowed from quantum materials to study classical systems. In 2018, she co-coordinated a KITP program on dense suspensions which, like granular materials, jam under shear stress. Like the 1997 jamming program, the Physics of Dense Suspensions program brought together physicists, engineers, and chemical engineers. The group grounded in traditional fluid dynamics viewed the intriguing phenomena in dense suspensions from that perspective, whereas the community grounded in statistical mechanics and granular physics emphasized the particulate aspects of the systems. The productive tension between their models of these materials "really changed the course of the study of these materials," she enthused.

In the last 3-4 years, models of spin liquids have advanced rapidly and are now mature enough to provide the sort of insights Chakraborty seeks. "There were bits and pieces, but the full framework had not been constructed . . . At this point, I think we know the connection and we can learn a lot from the quantum spin liquids to understand these frictional systems."

Chakraborty continues to see KITP programs as an extremely efficient way to get into a new field. "Just that whole model of where you could freely exchange ideas and you could actually jump into new fields…that has been a huge thing for me."

- Maggie Sherriffs, Special Programs and Evaluations Manager, KITP

Behind the Scenes of KITP Online Talks

Online Talks – Production & IT Coordinator

Online Talks – Production & IT Coordinator Alina Gutierrez

UCSB alumna Alina Gutierrez joined KITP in 2016 as a student computing assistant, providing technical support to visiting scientists and assisting with the freely accessible, online recordings. She worked directly with our visiting scientists to minimize their time spent on technical difficulties and maximize time spent interacting. Alina eagerly took on additional tasks, such as those associated with managing the institute's website, and quickly learned many of KITP's custom technology systems.

After graduating in 2017, Alina accepted the role of Assistant to KITP's Director, providing administrative support to the Director. From this new vantage point, Alina gained a broader perspective on the organization, all the while continuing to maintain the website, learn new technologies and contribute to the overall enterprise.

Her ongoing affinity for technology, creative problem-solving and passion for accessible academia motivated Alina to apply for a newly-created KITP position, the Online Talks - Production & IT Coordinator, a role which she started in early 2019. Viewing this as an opportunity to make a bigger impact, Alina enthusiastically explained, "The ability to freely access two decades of high-level physics discussions across many subfields and disciplines is invaluable to intellectually curious individuals around the world who may be unable to join us in Kohn Hall."

In close partnership with Doug Eardley, the UCSB Physics professor who created KITP Online Talks over two decades ago, Alina has taken the lead in managing the majority of the production efforts for the KITP Online Talks. Alina's efforts and innovations have immediately made a difference.

For decades, KITP has recorded and posted nearly every talk in Kohn Hall, from daily program talks, to weeklong conferences and outreach events. In addition to full length presentations, the recordings also capture the discussions that occur during and afterwards. Talks are typically published online within a few hours of the recording, enabling responsive engagement and remote collaboration, and dramatically extending KITP's scientific reach to those unable to attend programs.

The archival history is equally valuable in its longevity, with talks continually used as references years after being originally recorded and posted. There are nearly 20,000 talks online dating from late 1997 to February 2020, representing a remarkable open access channel to the research catalyzed at KITP.

Pedagogical talks including publicly accessible talks like Chalk Talks and Public Lectures as well as pan-program colloquia, like Blackboard Lunches, and High School Physics Teacher's Conferences are all cross-posted on KITP's YouTube channel to reach a wider audience. All videos posted to the KITP YouTube channel now have optional closed-captioning as an additional source of accessibility. Over the past year as talks became regularly cross-posted on YouTube, the channel has grown to represent 20% of KITP's overall audience, with over 100,000 views and 1.1 million impressions across YouTube and external sites in 2019, a year-to-year growth of 62%.

During 2019, remote viewers watched an average of 640 hours of recorded talks per day. An average of 3 hours of talks take place per day in Kohn Hall, so the total audience via recordings is roughly 7 times the in-building audience.

Beginning in 2020, Alina has started to assign Digital Object Identifiers (DOI) to each posted talk. DOI is a standardized citation service that can be used to identify talks, with the goal of increasing the citability in research papers of the posted talks. As Online Talks integrate a standardized citation service with DOI, the impact of talks given at KITP and posted at KITP Online Talks will be more fully measurable. In addition, the DOI registration for each talk encourages more speakers to share their talks publicly at an early stage in their research, prior to publication. This effort boosts the amount of featured nascent questions asked in Online Talks recordings and progressively broadens the interdisciplinary, worldwide connections made at KITP.

While Alina continues to maintain the excellent legacy of KITP Online Talks, she also innovates, explores new ideas, and identifies ways to reach broader audiences. Her purpose remains clear throughout, noting that "KITP is an excellent place of high scientific impact for scientists from everywhere to gather and connect; our online talks library shares these unique connections to an even wider scope of scientists."

Alina's work now extends to assisting with recording all of KITP's remote activities necessitated by the current pandemic.

- Lisa Stewart, Chief Administrative Officer, KITP

Finding Community in the Castagnola-Hunter Tower Room

During her time as an organizer of the Intertwined Order and Fluctuations in Quantum Materials program in 2017, Cornell Professor of Physics Eun-Ah Kim initiated a series of regular lunches for women at KITP. Kim saw the lunches as an opportunity to cultivate a community of female theorists that was not available at their home institutions, and jumped at the chance to provide such a resource.

"KITP is a selective place," She explains her reasoning behind the lunches, "Hence people who make it to KITP have a real shot at climbing the ladder and improving the stubbornly-stuck gender ratio at the senior level. Young female researchers coming to KITP often do not have senior women theorists who can be their mentor at their home institutions. Only at KITP will they have a chance to meet these senior women theorists."

A historically male field, physics departments are often lonely places for female faculty. In 2018, only 16% of physics faculty members at PhD granting institutions in the US were women. "There are so few women theorists and hence we never have cohorts at home institutions," Kim explains. To complicate matters, the field also has an enduring culture of rigorous discussion among peers. "The "louder person getting the stage" approach is often unnatural for women," She notes. "We can mistakenly think our opinion and perspective matter less because our voice can be drowned out. Figuring out how to navigate the extremely male-dominant arena of "discussions" is critical in setting off for a path for success in early career."

The lunches in the second-floor Castagnola-Hunter Tower Room at Kohn Hall provide encouragement to younger theorists who learn that their struggles, ranging from imposter syndrome and the two-body problem to insensitive comments from colleagues, are shared by others. For more senior theorists, it is an opportunity to encourage each other as they navigate the next steps in their careers. The Castagnola-Hunter Tower Room is named after longtime Friend of KITP and local philanthropist Virginia Castagnola-Hunter in honor of her lifetime support.

Even after Kim's departure, the lunches continue to be popular among program participants, 20% of whom are women. Although they formed out of a desire specifically for female theorists to build a community, the meetings do not exclude anyone from participating. With the help of Program Manager David Kaczorowski and Deputy Director Mark Bowick, KITP formally facilitates the gatherings, which are now known simply as "Tower Room Lunches."

Armed with a directory of incoming participants of each program, Bowick and Kaczorowski maintain a list of female scientists who might be interested in the lunches, identify a discussion leader, and reserve the Castagnola-Hunter Tower Room space for however they would like to use it. "We provide the resources," Kaczorowski explains, "But the participants decide what it becomes."

MIA NIE

Yi-Ting Hsu (Cornell University), Ingrid Mertig (University of Halle), Brittany Richmand (University of Maryland), Maria Vozmediano (Materials Science Institute of Madrid) participate in a Tower Room Lunch in October 2019

A recent Tower Room Lunch coordinator was Tamara Bogdanovic, an Assistant Professor at Georgia Tech who was at KITP to participate in the New Era of Gravitational-Wave Physics program in Spring of 2019. "If there was an interest, I saw organizing these meetings and lunches as a worthwhile thing – building a little bit of a community," She spoke about her decision to coordinate the meetings. "In retrospect, it was definitely worth doing, because when we actually gathered, it was quite positive and inspirational… We had some very interesting conversations over lunch. They were about science – but not all. Some were about the anthropology of science."

When asked if she found the lunches to be useful overall, she replied, "How do we define useful?" But continued on to say, "It's, in a sense, finding a community. It's a positive outcome, and the most important one."

She acknowledges that a weekly lunch with visiting female theorists may not change much "in the big picture of things," as physics still persistently trails behind many fields in diversity. "Events like this are needed, but we probably have more work to do," she concludes.

For Eun-Ah Kim, she is happy to know the lunches have become a regular occurrence at Kohn Hall. Although she does not often have the chance to interact in person with many of the women who were a part of that first series of Tower Room Lunches, she says, "seeing publications of their papers gives me new energy to charge on with my day and be bold with my ideas and make a push."

- Megan Turley, Development Coordinator, KITP

A Physicist Left on Biology's Doorstep

For Professor Andrew Murray, Time at KITP is "Rigorous Fun"

RICK FRIEDMAN

Professor Andrew Murray

Andrew Murray is the Herchel Smith Professor of Molecular Genetics at Harvard and a Howard Hughes Medical Institute Professor. He describes himself as "a physicist who was left on a biologist's doorstep," interested in the "rules of the game" rather than the mechanisms. His research group uses synthetic biology, experimental evolution, and cell biology to study how cells function and evolve.

For a biologist, leaving the lab for a month to participate in a KITP program is an exceptional act. Murray thinks it's worth it—his KITP visits have big impacts on his thinking. "It's the most intellectually fun place I go to talk about science. And that has huge, but rather difficult to measure, benefits for science."

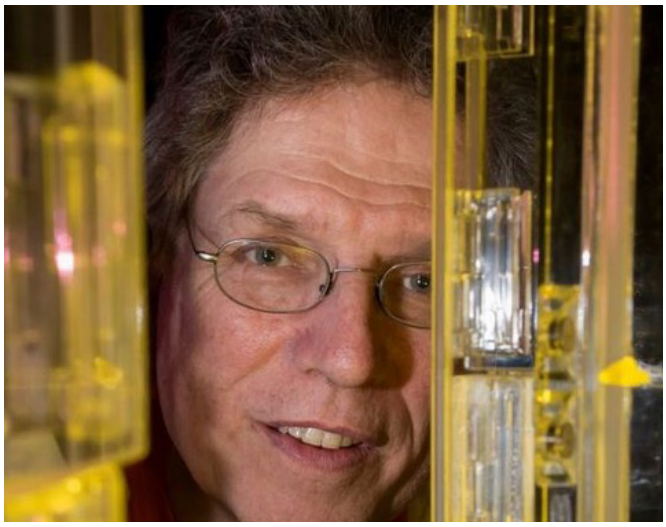
He describes what makes KITP an exceptionally productive place for scientists to gather. "You can have places that are friendly and you can have places that are rigorous. It's really quite hard to do both." The primacy of discussion in KITP seminars means that scientists can ask tough questions. The relaxed schedule and immersive "summer camp" experience mean that those questions aren't hostile acts but rather welcome entreés into discussions that lead to real progress. "You see [your fellow scientists] all the time, you sit next to them in lectures . . . if you disagree, you should talk about it and you should try and figure out, how constructively can you disagree?"

Murray tells an allegory about the magic of KITP: "You're working on some problem, you're drinking a cup of coffee. You take a sip, and all of a sudden, a genie emerges from your coffee cup. The genie says, 'I will answer one well-posed question about the problem you're working on.' . . . if you have two people in two separate offices but working on the same problem and one is a physicist and one is a biologist, they will ask the genie really substantially different questions . . . it's stimulating to mix people together who ask different questions about the same thing."

"To me, going to KITP is as close as I ever get to being a graduate student again, and the intellectually happiest time of my life was being a graduate student," Murray says.

"It's summer camp for scientists."

- Maggie Sherriffs, Special Programs and Evaluations Manager, KITP



RICK FRIEDMAN

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There are many ways to stay up to date on the exciting science happening at the institute:

- Subscribe to our Public Events Mailing List at www.kitp ucsb.edu/subscribe
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- Become a Friend of KITP by making a philanthropic gift - call (805) 893-6307, visit www.kitp.ucsb.edu/support-kitp or email friends@kitp.ucsb.edu