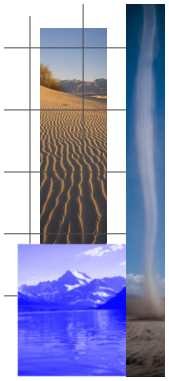

Schrödinger's Tiger

The Clemson University Physics and Astronomy Newsletter

Fall 2020 Volume 15, Issue 1

Clemson Doctoral Candidate Uses Rockets to Surf the Alaskan Sky

In This Issue:

When you think of surfing and Brazil, the first image that comes to mind is probably warm waves crashing on a white sand beach, not a cloud of gas swirling 65 miles above the Earth. But the latter is exactly what was found by Clemson University researcher **Rafael Mesquita**, a native of Brazil.

Physics and astronomy doctoral candidate Rafael Mesquita was lead author on a paper in *Journal of Geophysical Research – Space Physics*. Image Credit: Rafael Mesquita

Mesquita and a multi-institutional research team documented "surfer waves" in the upper atmosphere that create a pipeline of energy between layers in space. Just like ocean waves crash onto the beach, the atmospheric "surfer waves" generate turbulence that carries oxygen down low and nitrogen up high. Usually the oxygen is high in the atmosphere and nitrogen is closer to Earth's surface.

"For many years, atmospheric scientists have studied oxygen showing up lower than it should be, but we identified a possible cause for it and revealed more detail than ever before," said Mesquita, a doctoral candidate in the College of Science's Department of Physics and Astronomy.

The groundbreaking discovery was funded by NASA. It is featured on the NASA Heliophysics homepage and was published July 23, 2020 in the *Journal of Geophysical Research – Space Physics*. The paper is titled "In-situ observations of neutral shear instability in the statically stable high-latitude mesosphere and lower thermosphere during quiet geomagnetic conditions."

The Clemson research team launched rockets that released a harmless gas as a contrast medium to illuminate the atmospheric wind patterns so they could be photographed. Called the Super Soaker campaign, the research was conducted at the Poker Flat Research Range in Alaska on January 26, 2018. "Our measurements were made at 65 miles above Earth's surface and showed winds swirling at about 100 miles per hour," Mesquita said. The "surfer waves," currents of wind curling into each other and creating the dramatic effect of waves in the sky, are a result of the Kelvin-Helmholtz instability (KHI).

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A Message from the Chair

What a year it has been! When we issued our last newsletter little did we know the challenges looming on the horizon. Due to COVID-19, Clemson University closed its campus in March and transitioned to online. Our faculty and GTAs put forth a heroic effort, and we were able to successfully complete the semester online. Since then our faculty worked hard all summer preparing for a fall semester that promises to bring more surprises. They have developed hybrid courses that have online and face-to-face components. Of course, it is always possible that we will see campus close again. Yet despite all this uncertainty, our students, postdocs, faculty, and staff have been remarkably productive.

In the past year, we searched and filled three faculty positions. Joining us during the 2020-2021 academic year are **Yao Wang**, **Kasra Sardashti**, and **Jeffrey Fung**. Yao Wang was a postdoc at Harvard before joining us at Clemson. He is a theorist with expertise in quantum information systems and quantum computing. **Kasra Sardashti** also comes to us after completing his postdoc at NYU. He also possesses expertise in quantum computing. **Jeffery Fung** is a computational astrophysicist with expertise in planet formation and GPU calculations. We are delighted to welcome them to Clemson, and hope to profile them in the spring edition.

Our students also continue to be successful! **Steve Bromley** graduated with his Ph.D. in May and is now a postdoctoral fellow at Auburn. **Xiurui Zhao** started his SAO predoctoral fellowship at Harvard, and **Aniruddha Pan**, our newest Burt fellow, published a fascinating paper titled "Nonlinear spin-current generation in quantum wells with arbitrary Rashba - Dresselhaus spin orbit interactions" in *PhysRevB*. **Rafael Mesquita** published a paper that was featured on NASA's Heliophysics webpage. For the first time in the history of our program, the majority of our graduates this year were women (63%). **Brantley Kerns** completed an online NASA internship this summer, and **Erin Thompson,** who graduated in May, is starting a Ph.D. program at Georgia Tech.

Despite all the turmoil caused by COVID-19, our faculty continue to be productive. **Dr. Amy Pope** has created a new General Education course for Clemson students titled the "Physics of Sports." She is using different sports to teach mechanics to students who might otherwise not be interested in physics. We also have a new Ph.D. program in medical biophysics that we hope to roll out in the 2021-2022 academic year. Our research expenditures topped $5M this year, and the number of high-impact journal articles continue to climb. **Dr. Jens Oberheide** published a paper based on data collected with the GOLD instrument that will help us develop better models of space weather that was highlighted by the American Geophysical Union. **Dr. Jian He** published a paper concerning inorganic semiconductors. **Dr. Jonathan Zrake** published new work describing how blackholes merge, and **Dr. Feng Ding** published work describing new approaches to making rapid COVID-19 tests a real possibility. Our faculty continue to be recognized for their great achievements, including **Dr. Aparao Rao** having been selected as a fellow of the Materials Research Society and **Dr. Terry Tritt** having been given the Outstanding Achievement Award by the International Thermoelectric Society.

Your generous support of our department makes this possible. Even in the midst of this pandemic, we have continued to pursue our mission of expanding the frontiers of human knowledge through research integrated with education.

Dr. Sean Brittain
Chair, Department of Physics and Astronomy
Voice: (864) 656-3416/email: sbritt@clemson.edu

Super Soaker rocket launches show a portion of their trajectories. Image Credit: NASA/Allison Stancil

This effect is often seen in nature when gases or liquids pass each other at different speeds, creating the curling pattern similar to waves on the beach or dust swirls in the desert. Now that Clemson scientists have observed the KHI in more detail than ever, they have a clearer understanding of how the winds in the upper atmosphere carry gases farther than they thought possible.

"These surfer waves offer insight into the complex system of Earth's atmosphere where slight temperature changes on one side of the world affect wind patterns on the other," Mesquita concluded. "The upper reaches of the atmosphere may seem like a world away, but what happens up there affects us more than we may realize."

Clemson's research team was led by physics and astronomy professor emeritus **Miguel Larsen**. The study was funded by NASA and the National Science Foundation and was conducted in partnership with the Atmospheric & Space Technology Research Associates and the U.S. Naval Research Laboratory Space Science Division.

The rocket range operation and launches were supported by NASA Wallops Flight Facility personnel. Researchers from the Geophysical Institute at the University of Alaska-Fairbanks, and Global Atmospheric Technologies and Sciences provided the supporting instrumentation.

By Rebecca Dalhouse, Special to the College of Science

Creating a Legacy — Giving to Clemson Physics & Astronomy

You can create a lasting legacy through your donation to the Clemson University Physics and Astronomy Department Foundation. Endowments to Clemson assure the best faculty, the brightest students and the most creative research projects. A substantial endowment can transform a good university into a great one. As a non-profit organization, the Foundation is exempt from federal income tax under Section 501(c)(3) of the IRS Code, as amended.

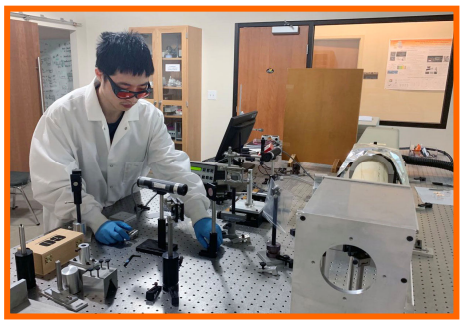
The Foundation has been classified by the IRS as a public charity operated for the benefit of a state university as defined in the Internal Revenue Code of 1986 Section 170(b)(1)(A)(iv). Contributions to the University through the Foundation by individuals, corporations, organizations and other foundations qualify as tax deductions. There are several ways to donate. You may send a check to the Clemson University Foundation, P.O. Box 1889, Clemson, SC 29633.

Checks should be made payable to the Clemson University Foundation with Physics and Astronomy specified on the memo line. Alternately, you may visit the Clemson website: **https://cualumni.clemson.edu/give/physics-astronomy** and make a secure electronic donation. Thank you, as always, for your continued support of the department.

You may contact the Annual Giving Office at (864) 656-5896, should you have any questions regarding your donations. If you have other questions, you may contact the department directly at (864) 656-3416.

Clemson Researchers Shed Light on the Building Blocks for Next-Generation LED Displays

Three teams of researchers at Clemson University have joined forces to unravel some of the mysteries surrounding perovskite nanocrystals, which are semiconductors with numerous applications, including LEDs, lasers, solar cells and photodetectors.

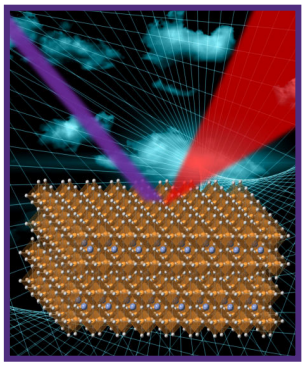


Before returning to China to earn his Ph.D., Jun Yi was a student researcher at Clemson. Image Credit: College of Science

A research article titled "The correlation between phase transition and photoluminescence properties of $CsPbX_3$ (X=Cl, Br, I) perovskite nanocrystals" recently appeared in *Nanoscale Advances*, an open-access journal published by the Royal Society of Chemistry. The article's lead author is **Jun Yi,** and the second author is **Xueying Ge**, who were students working with **Apparao Rao**, the **Robert Adger Bowen** Professor of Physics at Clemson University. The third author is **Exian Liu**, who was working with **Jianbo Gao**, an assistant professor in the College of Science's Department of Physics and Astronomy.

"We are always on the hunt for students to work on challenging projects," said Rao, a professor in the Department of Physics and Astronomy and director of the Clemson Nanomaterials Institute.

"Jun started this project about a year ago, and our teams worked together and ended up with a nice piece of work. In fact, the journal picked our work to be featured on its inside back cover page." Rao said that Yi was able to be a liaison between Rao's team and a team led by Gao – and also a third team led by **Hugo Sanabria**, an associate professor of physics and astronomy. Rao and Gao explained that their research regarding the tiny nanocrystals is focused on the material's optical properties and applications.



This illustration was featured in *Nanoscale Advances*, published by the Royal Society of Chemistry. Image Credit: College of Science

"Jianbo's team and my team have a joint interest in advancing nanocrystals to produce better solar cells, LEDs – things like that," Rao said.

"Basically, the three teams had the necessary instrumentation to complete the study."

The study has relevance to applications that have already found their way into our lives, according to Gao.

"This technology is widely used. For example, you can find it at Costco or Walmart as it is present in the quantum dots that Samsung uses in its QLED TV," Gao said.

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Jianbo Gao (left) and Apparao Rao were co-authors on the paper.

The authors noted in the paper that perovskite nanocrystals are "attracting much attention because of their unique tunable optical properties."

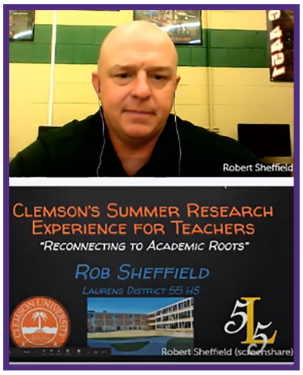
With these particular nanocrystals, the teams' research dealt with a phase transition, one of the most fundamental physical in solid-state physics, which can influence the electrical, optical, magnetic, mechanical and chemical properties of materials. Using nanocrystals made up, in part, of either chlorine, bromine or iodine, the researchers discovered that, when exposed to heat, the chlorine-based nanocrystals behaved differently than the iodide- or bromine-based nanocrystals. "That got us thinking about what the reason could be," Rao said. The paper concluded that the teams' research provides "a deeper insight into the effect of phase-transition on the low temperature photo-physics of perovskite materials."

By John C. Stevenson, Special to the College of Science

High School Teacher's Partnership with Clemson Physicists Leads to Virtual Workshop at Harvard

Science can be taught from a textbook, but it is lived in action. When teachers experience it firsthand, it can translate to rich, memorable opportunities for their students that rise above typical lessons.

Rob Sheffield, a physics teacher at Laurens District 55 High School, has gained hands-on physics research experience at Clemson University that not only enriched his teaching but also afforded him the opportunity to share the results of his efforts. Sheffield was invited to attend a weeklong virtual workshop organized by **Eric Mazur** at Harvard University that aimed at improving and supporting high school physics education. Sheffield came away from the experience brimming with enthusiasm.



High school physics teacher Rob Sheffield participated in a virtual workshop hosted by Harvard. Image Credit: Courtesy of Rob Sheffield

The July 13-17 workshop, funded by the National Science Foundation, brought together secondary physics educators, administrators and methodology experts to discuss the current state of secondary-school physics teaching. Sheffield joined instructors from the United States and Europe and will also have priority access to an in-person workshop to be held at Harvard in the summer of 2021.

Sheffield's experience was made possible by a Research Experiences for Teachers (RET) award that was obtained with the help of **Rod Harrell**, a faculty member in the Holcombe Department of Electrical and Computer Engineering. Harrell, who runs a Research Experience for Undergraduates (REU) program, collaborated with College of Science professors **Sean Brittain** and **Chad Sosolik** to add the NSF-funded RET support to his program (NSF Award No. EEC-1560070).

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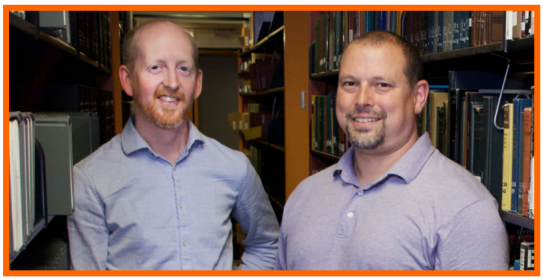
"Chad and I started a collaboration with the Laurens School District probably five years ago now," said Brittain, who is chair of the Department of Physics and Astronomy. "We worked with teachers to provide workshops on math and physics to boost their content knowledge of those subjects with the goal of creating a culture of STEM in the schools."

Sheffield said he had to learn to become a student again.



Professors Chad Sosolik (left) and Sean Brittain facilitated Rob Sheffield's participation with the Harvard workshop. Image Credit: College of Science

"This is a whole different way of thinking about physics, and I think it's correlated to my classroom where I can talk to my students about – for those who are going into a STEM field – what they can expect in a research environment," he said.

"You're not going to have all the answers, but don't let that intimidate you. You can dive into the deep end of the swimming pool and you will figure it out."

The workshops went beyond the science classroom.

"These are teachers from kindergarten through high school – art teachers, music teachers, a little bit of everything," Brittain said. "Our goal was to make it clear that science is for everybody. It touches every part of our daily lives and can be integrated across the curriculum."

An outgrowth of that project was establishing an RET program at Clemson to allow teachers to participate in hands-on research on campus during the summer.

"Rob has participated with us for three years, and this would have been a fourth if we hadn't been scrubbed by COVID-19 this summer," said Sosolik, a senior researcher in the Department of Physics and Astronomy. "Rob fits into our plans in that we need a master teacher who does physics and connects us with the school system. He's the perfect fit. It's icing on the cake that he gets the opportunity to participate in what is a National Science Foundation-funded effort from RET."

And this carries over exceptionally well to Sheffield's classroom. "His comfort level with the material is spectacular," Brittain said. "With this learning approach, you get questions from students that go beyond the textbook. You've got to be able to think on your feet. He's positioned now to have a huge impact on the students who come through his physics class at Laurens High School. His enthusiasm spills over not only to his class, but to other teachers. It changes the culture."

Brittain said this important partnership has the potential to impact schools and students across South Carolina. He said the pandemic – and the resulting virtual learning at his own home – reinforced to him that college faculty and K-12 teachers can benefit each other.

"They have a very special expertise that is irreplaceable," Brittain said. "We have something to offer, and that's the content. This really is a partnership. We've learned a lot about teaching, about how students learn, what it is they need in order to make progress through high school. And we've been able to give them a front-row seat to the scientific process. It's really gratifying to see that this doesn't just work in theory. It works in practice. Rob's a great example of that."

By Chris Worthy, Special to the College of Science

Physics Senior Lecturer Amy Pope Wins National Outstanding Teacher Award

Amy Pope

Amy Pope faces a challenge at the start of the semester: introducing physics – *algebra*-based physics, of all things – to more than 600 Gen Ed students and making sure they feel good about the semester ahead.

It's a teaching challenge Pope loves and has become successful at facing. So successful, in fact, that she has been awarded the Outstanding Teacher Award from the Association of General and Liberal Studies (AGLS), the national organization for general education program administrators.

A Clemson graduate who received her bachelor's, master's and doctoral degrees in physics, Pope is a senior lecturer in physics and astronomy in the College of Science. Pope has been teaching for eighteen years. "I graduated from Clemson and they offered to let me stay and teach. I did that as a stopgap for the first year and I really fell in love with it," she said.

"I have 600 new students right at the beginning of football season every year, and I laughingly tell them, 'You're going to go to the first football game and you're going to say, Oh my goodness, there's a lot of physics in this!' and, by the time the semester's over, I have students coming back and going, 'You told me I would never look at football the same and I can't.' They can see the physics in it all," Pope said.

"When you hear Dr. Pope talk about her students and her subject, it becomes immediately clear you're hearing from an enthusiastic and innovative teacher," said **Bridget Trogden**, associate dean for Engagement and General Education in Undergraduate Studies who nominated Pope for the AGLS award.

Pope's interest in studying physics came from the few weeks she spent at a national laboratory during high school when, as she tells it, she "got to play around with their high-powered equipment" and decided she had to learn more about how things work. Pope acknowledges many students come to one of her three classes with some trepidation. "It's a different language than most of the students normally speak. It's a language of equations and most future doctors and graphic communications students, they don't really want to talk in that language," she said.

Despite this, Pope notes "It's very interesting to look at the grades in these classes because they start off very poor, and then as the students learn how to think and learn how to process that information, their grades go up and so they end the course on a very positive note and they end up learning a lot." **Taimi Olsen**, director of the Office of Teaching Effectiveness and Innovation, also nominated Pope for the AGLS award.

"She's participated in many OTEI events as a presenter and shown that she thinks deeply about her teaching. And last year she led the faculty learning community on large lectures after participating in it the year before. She just steps up," Olsen stated. "Recognizing the amazing faculty who do the daily work with students is so important," said **Joyce Lucke**, executive director of the AGLS.

A mother of three teenagers and two long-term foster children who's been married twenty-two years, Pope

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is asked about whether she wears her "teaching hat" or "mom hat" when she's at home with her children. She laughs and says she wears all the hats simultaneously.

"I think one of the successes in teaching all the students at Clemson is wearing the 'I care about you' hat and really letting the students know they are valued as a person and for more than just their academic ability. I think that's one of the keys to developing into a really successful teacher," she said.

Regarding physics, which brought Pope to Clemson, she stated, "I miss the research a little bit, but quite honestly teaching is my gift and teaching is really what I love. It's amazing to look out on a sea of 220 faces and see that you've got the majority of their attention and most of them are following you and understanding and making those connections. That's what really excites me: watching that fear diminish, and that knowledge and understanding come into their faces."

Adapted from https://newsstand.clemson.edu/physics-senior-lecturer-amy-pope-wins-national-outstanding-teacher-award/

Retired Clemson Physicist Terry Tritt Receives Prestigious Society's 2020 Outstanding Achievement Award

Terry Tritt is honored by the International Thermoelectric Society with prestigious award. Image Credit: College of Science

Terry M. Tritt, who retired from Clemson in 2018, was recently honored as a recipient of the International Thermoelectric Society's 2020 Outstanding Achievement Award.

Tritt earned his undergraduate ('80) and doctoral ('85) degrees from Clemson and came back as a faculty member in 1996, after serving as a National Research Council Fellow and then as a research physicist at the Naval Research Laboratory in Washington, D.C.

"I have been a member of the International Thermoelectric Society for about twenty-five years," said Tritt, Retired Emeritus Alumni Distinguished Professor of Physics in the College of Science's Department of Physics and Astronomy.

"I served on the board of directors for several terms. This award is something we created in 2010 to acknowledge people who made a lifetime impact on the field of thermoelectric materials research. It's a great honor to be selected for this."

The organization's 2020 conference was to be held in Seattle starting June 28, but was canceled because of the coronavirus pandemic. Tritt now plans to travel to Krakow, Poland, the site of the 2021 conference, to receive the award. He called the honor "a crowning jewel" of his career.

Tritt was the recipient of the 2008 S.C. Governor's Award for Excellence in Scientific Research and is a fellow of the American Physical Society. He has written more than 200 peer-reviewed journal publications and twenty review articles, and his work has received more than 18,000 citations. In addition to owning four patents, Tritt has edited thirteen books and given more than 150 invited

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presentations at national and international meetings, as well as many university seminars.

"This is certainly one of the highlights of my career," he said. "In 2017, I was selected for the Class of '39 at Clemson, which is the highest faculty honor that can be given to a faculty member at Clemson."

The Class of '39 Award for Excellence is presented annually to one distinguished member of the faculty whose outstanding contributions for a five-year period have been judged by his or her peers to represent the highest achievement of service to the university, the student body and the larger community. But Tritt said he would have none of these honors without a strong team behind him. "This award is really shared by the twenty-one Ph.D. students who I graduated at Clemson," he said. "They were phenomenal, and without them, this would not have been possible."

Tritt also credits colleagues **Jian He** and **Joe Kolis** at Clemson, **Joe Poon** at the University of Virginia, and **George Nolas** at the University of South Florida for their support for many years. When Tritt returned to Clemson as a faculty member, he started the Complex and Advanced Materials Laboratory. Tritt is especially proud that seven of the twenty-one Ph.D. students in his lab were female, a percentage that far exceeds what is typical in the field.

Tritt is spending retirement in nearby Pendleton, still teaching, but with a decidedly different focus. "I've had my four-year-old grandson here since early March and we've been planting a garden, making wood projects, going trout fishing," he said. "Every day, we plan projects and we build birdhouses and picnic tables. He's like a sponge soaking it all in. I've been able to start playing golf again. I've even been able to reassemble my old bluegrass band, "The Grass Roots Revue," and I'm playing a lot of music. I've got five granddaughters and one grandson and I'm basically spending my life now just enjoying them and doing things with them. It's fun to teach and mentor again, just like it was with those students."

Adapted from article by Chris Worthy, Special to the College of Science

Clemson Faculty Member, Feng Ding Working to Create a Faster COVID-19 Test

Clemson scientist **Feng Ding** is working to develop a quick detection test for COVID-19 with funding from a one-year National Science Foundation RAPID grant.

Feng Ding is an associate professor in the Department of Physics and Astronomy. Image Credit: Clemson

Ding said that current COVID-19 tests require samples to be sent to a lab with a potential waiting period of days before patients get back their results. Ding is hoping this $190,065 grant and his work with **Pengyu Chen**, a Clemson alumnus and now an assistant professor at Auburn University in Alabama, will change the turnaround rate for COVID-19 testing. Ding and Chen plan to do this by developing a new nanomaterial-based sensor with the capability to detect virus proteins in real time.

This project builds on prior research of riboswitches commonly used by single-cell organisms for gene regulation. When sensing metabolites or small molecules, a riboswitch can change its three-dimensional shape and subsequently turn on the "switch" of enzyme expression for unitizing the nutrient.

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In this project, the SARS-CoV-2 proteins will be targeted by computationally designed "riboswitches," and nanomaterials will be used for reporting the corresponding change of shape in the presence of the virus. Further testing of this method for detecting the actual virus should allow for fast screening and isolation of COVID-19 patients, a key to breaking the chain of transmission to stop the current pandemic, as well as potential new waves of the SARS-CoV-2 after reopening the economy, Ding said.

They are in the beginning stages of their research, and plan to start testing the method soon. Then the plan is to work with the doctors in testing real COVID-19 samples. Ding said one of the hurdles they have to tackle is making their test available without the use of high-powered microscopes that only can be found in state-of-the-art research labs. But they have an idea that they will test as well while they work to determine a faster testing option.

They are working to build alternative approaches such as electrochemistry-based – instead of optics-based – detection of riboswitch shape changes upon recognizing the virus. Ding said this idea is still in development, but ideally, the device that can measure the electrochemistry-based information would be small and portable.

"We are hopeful this method of testing will be a viable alternative to the current testing methods," Ding said. "The idea is that this test is easy to conduct without the requirement of expensive equipment."

By Frances Parrish, Clemson University School of Health Research

Remembering Malcolm Skove

Dr. Malcolm John Skove, 89, died Sunday, June 7, 2020 at the Cottingham Hospice House in Seneca, South Carolina.

Malcolm Skove was a beloved faculty member who will be deeply missed by his family, colleagues and the students he taught.

Malcolm was born in Cleveland, Ohio, the son of the late **Thomas** and **Ethel Rush Skove**. A graduate of Clemson University, he earned his Ph.D. from the University of Virginia and taught physics at Clemson for thirty years, retiring as an alumni professor. He was professor emeritus for years thereafter. He was a member of the Forum Club and enjoyed hiking, traveling, gardening, and volunteer work. Malcolm was also a distinguished veteran, having served in the United States Army in the Korean War, stationed in Japan. Surviving in addition to his wife **Janet** are two sons, **Anthony Skove**, **Benjamin Skove**; brother, **Thomas Skove**; and grandchildren, **Max**, **Alexander** and **Madeleine**.

"Prof. Malcolm Skove's research interests were rooted in the measurement of elastic properties of metal alloy whiskers as a function of temperature, external strain or stress, or in the presence of a magnetic field. He laid the groundwork for the measurement methods and science of the so-called third-order elastic constants, which manifest due to deviations from the Hooke's law. In a chance conversation with me in 2005 on the basement floor of Kinard, he explained to me his on-going experiments with spider silk at that time, which behaves radically different from the metal alloy whiskers. This prompted me to propose to him a similar challenging study using carbon nanotubes instead of micron-scale whiskers, or spider silk. In his inimitable style he said "Let me think about it", but wasted no time.

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He met with me in the lab the following day and started working with my graduate students to develop the Harmonic Detection of Resonance method, which is one of the its kind that could electrically actuate and electrically detect oscillations in one-dimensional nanostructures, such as the carbon nanotubes and nanocoils. Needless to say that HDR is now a patented method. Additionally, Malcolm came up with a unique way to plot and analyze HDR data, which we started referring to them as Skove plots in his honor. He published two book chapters, two review articles, over thirty research papers, and served as a committee member on half a dozen students who graduated from the Clemson Nanomaterials Institute. He will be deeply missed at CNI," said colleague **Dr. Aparao Rao**.

Astrophysics Grad Student Marcotulli to Give Talk at Virtual TEDxGreenville in November

Grad student Lea Marcotulli hosts TedX Greenville talk. Image Credit: College of Science

Astrophysicist **Lea Marcotulli**, whose research extends to the farthest reaches of the universe, will tell others about her discoveries when her previously recorded speech airs on the virtual TEDxGreenville 2020 conference on November 6. The TEDx Talk was originally scheduled to be given in-person on March 28, but the event was postponed because of the COVID-19 pandemic.

Marcotulli is a sixth-year graduate student in the College of Science's Department of Physics and Astronomy who has done extensive research into black holes, focusing on how they form, where to find them, and what they look like. The supermassive black holes that she will describe in her talk were formed about thirteen billion years ago. Marcotulli recorded her talk, which is titled "The Biggest, Baddest Black Holes," on September 10 in Greenville without an audience. Because of the new online format of this year's event, Marcotulli prerecorded her talk in a room containing about ten crew members and a few other bystanders. Despite the unusual circumstances, Marcotulli was able to make the most out of the experience.

"I would make a joke and then there would not be a big reaction because most of the people listening were focusing on the technical parts," Marcotulli said. "I was told to pretend that there was an audience, so I had to look around and pretend that I was talking to hundreds of people."

Marcotulli's mentor said that being chosen to speak at a TEDx conference is a high honor.

"Being selected requires perseverance, fantastic communication skills and, in particular, sincere passion about science," said **Marco Ajello,** an associate professor in physics and astronomy. "Lea has all these qualities, and it is great that such an endeavor has been taken on by one of our own graduate students."

The last TEDx speaker from the College of Science was professor **Apparao Rao**, who is a "highly accomplished and revered scientist," Ajello added. Now, it's Marcotulli's turn to shine in the spotlight.

Adapted from article by Ellee Mikell, College of Science student intern

The Clemson University Physics and Astronomy Newsletter

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Department News

We are happy to announce that our 2020-2021 STEM Competition season is underway! Please go to http://www.clemson.edu/science/departments/physics-astro/outreach/ to register your student for the upcoming Spring 2021 competitions. All competitions will be held online. Please direct any questions you might have to **Dr. Jason Brown** (brown6@clemson.edu).

- Math Kangaroo on ***March 18, 2021,*** is an international math competition that engages more than six million students. For students in grades 1-12. Registration fee: $21.
  Registration Deadline: ***December 15, 2020.***
- AMC 10/12A on ***February 4, 2021***, are high school math competitions. Registration is free.
  Registration Deadline: ***January 15, 2021.***
- AMC 10/12B on ***February 10, 2021***, are high school math competitions. Registration is free.
  Registration Deadline: ***January 15, 2021.***
- F=ma High School Physics Competition. Competition date to be announced. Registration is free.
  Registration Deadline: ***January 15, 2021.***
- USABO (Biology Olympiad) on February 11, 2021 for high school students. Registration is free.
  Registration Deadline: ***December 11, 2020.***

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