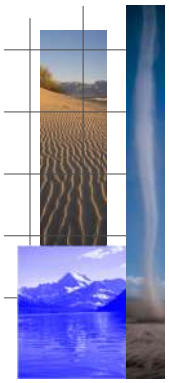

Schrödinger's Tiger

The Clemson University Physics and Astronomy Newsletter

Spring/Summer 2022 **Volume 17, Issue 1**

New Degree Programs in Medical Biophysics

In This Issue:

Clemson University will offer both master's and doctoral degrees in medical biophysics to enable current students and those already working in health care to prepare for entry or advancement in a growing number of health care-related fields, including pharmaceuticals, biotech, and academic research.

The program, which begins in the Fall 2022 semester, is now accepting applications. The graduate-level degrees in medical biophysics focus on understanding the interconnection between fundamental physics principles and complex biological and medical phenomena. They also focus on how scientists can apply those principles to help solve biomedical challenges and provide better health outcomes for everyone, according to Clemson University College of Science's **Emil Alexov**, a professor of physics specializing in biophysics and bioinformatics.

Alexov said medical biophysics has a wide range of applications across the spectrum of health care-related industries. He said current focuses of medical biophysics include the linkage between genetics and predisposition for specific diseases, and how genetic differences manifest at the molecular, cellular and tissue levels.

A master's or Ph.D. in medical biophysics will prepare graduates "to provide medical approaches to treat genetically determined diseases and even prevent them from happening," Alexov said. "This includes providing guidance for lifestyle changes to prevent diseases, as well as developing small-molecule drugs that specifically target disease-causing sources. This is personalized medicine and personalized diagnostics, two health care fields that are quickly developing. Many companies are providing medical treatments now that fold into this — that use the genetic backgrounds of the patients to prescribe proper medication and to administer proper treatments."

Medical biophysics is the application of biophysical approaches to address medical questions, and especially to help physicians identify diseases and treat diseases using biophysical methods," said Alexov.

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A Message from the Chair

Greetings to all our alumni and friends. It has been quite a year! Our faculty continue to be successful at advancing and disseminating frontier knowledge of physics and astronomy, thereby providing opportunities for our students to apply their education to some of humanity's most complex challenges.

This year we had a record number of graduate students complete their theses and launch their careers in academia and industry. Our undergraduate students continue to excel, as well. I like to tell high school teachers and prospective students that physics is for everyone! Unfortunately, our discipline has not done a great job at attracting talent that reflects this reality. Indeed, the fraction of bachelor degrees awarded to women and underrepresented minorities across the country has declined or stagnated over the past twenty years. With this sobering reality in mind, I was gratified to see that 40% of our graduates this year are women – nearly twice the annual average.

To support opportunities for students, our faculty continue to excel at acquiring external support for their research programs and also continue to innovate as we create new degree programs. For example, we launched new M.S. and Ph.D. programs in medical biophysics and have our first cohort of students arriving this fall. We are also working on a developing an undergraduate version of this degree. Stay tuned for more information, when this degree is finalized.

The gifts you have generously provided to fund scholarships, graduate student fellowships, endowed chairs, and the Physics and Astronomy Advancement Fund are key enablers for us to pursue top talent and support the members of our department. As we prepare for a new academic year, I hope you will consider giving to advance our mission.

Go Tigers!

Dr. Sean Brittain, Chair, Department of Physics and Astronomy

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.

Faculty across nine departments at Clemson will teach courses for the two-year master's degree. The degree is online to give those already employed in health care the ability to increase their knowledge and value in the workforce without interrupting their current careers. The Ph.D. program adds three additional years of research and elective courses tailored to each student's studies and needs.

The medical biophysics programs appeal to a wide range of students interested in seeking novel answers to some of humankind's most daunting medical questions.

"The primary motivation to establish this program is so we don't miss students who don't fit into one particular curriculum in one department," Alexov said.

"An individual who likes to work in medical biophysics won't be happy with the curriculum of the physics department, chemistry department or biology department, or any other department. This program is very much about interdisciplinary studies, which requires students to have a broad background in fundamental disciplines like physics, chemistry, and biology."

"There will also be research training in the laboratories of participating faculty members," he added. "We believe that the successful students will have a broad knowledge of basic science and will be highly trained in the labs in their particular fields of interest."

To accomplish these goals, the College of Science is collaborating with several strategic partners inside and outside of the University, including the health-science center at Prisma Health, Clemson's Center for Biomedical Research Excellence, the Clemson Center for Human Genetics, the Eukaryotic Pathogen Innovations Center, and the Center of South Carolina Translational Research Improving Musculoskeletal Health.

In addition to the new degree programs, the Department of Physics and Astronomy is searching for the founding **Dr. Waenard L. Miller, Jr.** '69 and **Sheila M. Miller** Endowed Chair in Medical Physics.

Thanks to the generosity of the Millers (pictured left with University president **Jim Clements**), Clemson will attract a world-renowned scholar to advance research on the frontiers of medicine and physics.

Alexov is leading a search committee of faculty from physics and astronomy, bioengineering, genetics and biochemistry, and material science and engineering to identify and recruit that person.

A committee comprising members from all participating university departments will review applications for the graduate programs. Alexov said the admission requirements are flexible to allow students from diverse backgrounds, while meeting all University requirements. Interested students may contact Alexov via email at ealexov@clemson.edu.

Adapted from https://news.clemson.edu/clemson-to-offer-post-grad-degrees-in-growing-medical-biophysics-field/

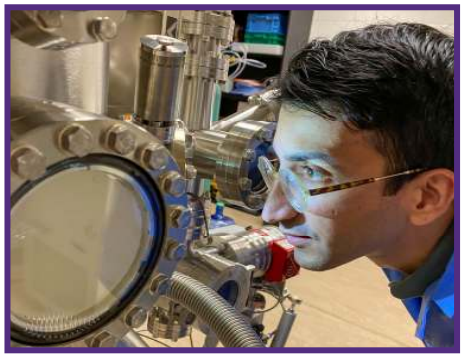
Clemson Physicist Earns Prestigious Junior Faculty Award

Kasra Sardashti, an assistant professor in the College of Science's Department of Physics and Astronomy, has received a 2022 Oak Ridge Associated Universities (ORAU) **Ralph E. Powe Junior Faculty Enhancement Award**.

Forty-one junior faculty from across the country received awards, which aim to enrich junior faculty's research and professional growth.

Each winner receives $5,000 seed money for the 2022-23 academic year, and each recipient's institution matches the Powe award with an additional $5,000. Winners may use the grants to purchase equipment, continue research, or travel to professional meetings and conferences. The award will support Sardashti's research in superconducting quantum computing devices.

"I am thrilled Dr. Sardashti earned this very prestigious and competitive award. It recognizes his immense talent and potential to emerge as a leader in his field. This award will allow him to continue to expand his very productive research program," said **Sean Brittain**, chair of the Department of Physics and Astronomy.



By leveraging two key quantum phenomena — superposition and entanglement — quantum computers can explore multiple solution pathways simultaneously, allowing them to solve problems that would take a traditional computer too long to calculate.

One issue with today's quantum computers is scaling the number of qubits. Semiconductor processors in traditional computers and phones have billions of transistors, which are binary switches that either prevent or allow current to flow through. In quantum computers, it is challenging to put several of the individual processing units, or qubits, together while preventing unwanted crosstalk between them. Sardashti hopes to resolve some of these issues through his research.

Sardashti joined Clemson in 2021, and he recently helped organize the first South Carolina Quantum Technology Forum in April, bringing academic and industrial quantum computing, sensing and communication experts together on the Clemson campus.

Adapted from https://news.clemson.edu/clemson-physicist-earns-prestigious-junior-faculty-award/

Jordan Eagle Receives NASA Postdoctoral Fellowship to Explore Origins of Cosmic Rays

Clemson University astrophysics graduate student **Jordan Eagle** has two key priorities as a scientist — research and outreach.

Eagle has spent the last two years at the Harvard and Smithsonian Center for Astrophysics (CfA) in Cambridge, Massachusetts, on a Chandra X-ray Center pre-doctoral fellowship. Eagle is completing her Ph.D. thesis on pulsar wind nebulae, which are descendants of massive stellar explosions, and the role they play in creating cosmic rays.

After she receives her Ph.D. from Clemson in August, Eagle will continue her studies at the NASA Goddard Space Flight Center as a NASA postdoctoral fellow.

Jordan Eagle, has spent the last two years as a pre-doctoral fellow at Harvard, while she completes her Ph.D. at Clemson.

When stars at least eight times the sun's mass reach the end of their lives, they explode and leave behind remnants of ejected matter and energy called supernova remnants. Some supernova remnants have cores of stars at their centers and, if these stellar cores have enough leftover energy, they can power pulsar wind nebulae.

"Pulsar wind nebulae and supernova remnants are intimately related in the sense that they are coming from these core-collapse systems," Eagle said. "They are very powerful environments, so we suspect they could accelerate the most massive energetic particles that have ever been observed on Earth, which are called cosmic rays."

Cosmic rays are charged particles moving at nearly the speed of light, mostly generated from outside the solar system. They are detected here on Earth and can cause electronic problems in satellites and other space instruments. For instance, cosmic rays are a main source of contamination in space-based telescopes. While some cosmic rays may be produced by the sun, the majority of cosmic rays must come from far more energetic environments, such as the remains of supernova explosions or active black holes. However, these charged particles get deflected as they travel through space, which alters their paths and makes it difficult for scientists to determine from where they originated.

Eagle's Ph.D. and future research focuses on finding pulsar wind nebulae (PWNe) that emit high-energy gamma rays using the Fermi Large Area Telescope. Gamma-rays trace cosmic ray interactions and can be a powerful tool in understanding the possible environments producing cosmic rays.

At Goddard, Eagle will use the population of gamma-ray emitting PWNe from her thesis to predict what these objects will look like at lower-energy gamma rays. The lower-energy gamma-ray band is the least explored part of the light spectrum, so Eagle will focus on realizing the scientific promise of a future NASA mission that will probe these energies.

Continued on the next page

She hails from Hampton, Virginia, and earned her undergraduate degree at Radford University. She is a member of the research group of **Marco Ajello**, an associate professor in the Department of Physics and Astronomy.

"I am not in the least surprised by Jordan winning a coveted NASA Postdoctoral Program fellowship. From day one at Clemson, she has demonstrated outstanding research and time management skills, coupled with a love for science dissemination. Her skills and passion brought her to finish her graduate studies at the Center for Astrophysics at the Harvard and Smithsonian. It has been a joy to work with her in the past five years, and I look forward to witnessing what she will accomplish in her future career," Ajello said.

Her second priority — outreach — is covered with (On) Planet Nine, a YouTube channel she and four other female astrophysicists affiliated with Clemson have started. Their goal is to explain physics and astronomy simply for people without science backgrounds in an entertaining and interactive way. (On) Planet Nine is wrapping up its first season and has tackled topics such as Newton's laws of motion, the scale of the Universe, the history of astronomy, the Big Bang Theory, the moon and the study of light. The season finale featured an interview with **John Tomsick**, associate director of the University of California, Berkeley's Space Science Laboratory and the principal investigator for the recently NASA-approved Compton Spectrometer and Imager (COSI) low-energy gamma-ray project.

Adapted from https://news.clemson.edu/ph-d-student-receives-nasa-postdoctoral-fellowship-to-explore-origins-of-cosmic-rays/

Clemson grad, Steve Bromley, receives 2022 AAS Dissertation Prize.

2022 LAD Dissertation Prize Goes to Steve Bromley

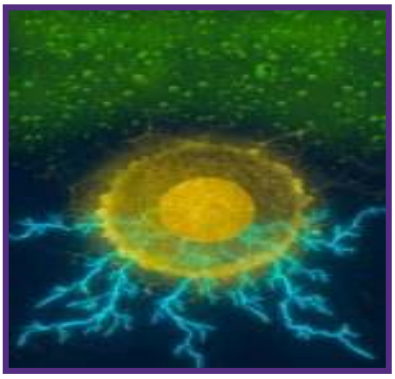
The Laboratory Astrophysics Division (LAD) of the American Astronomical Society (AAS) is pleased to announce the recipient of its 2022 Dissertation Prize, given to an individual who has recently completed an outstanding theoretical or experimental doctoral dissertation in laboratory astrophysics.

This year's prize goes to **Dr. Steve Bromley** for his thesis "Atomic Data Needs in Laboratory Astrophysics: Experimental Methods for Spectroscopy and Charge Exchange with Ions."

Dr. Bromley earned his Ph.D. at Clemson University, working with **Dr. Joan Marler**. He is now a post-doctoral fellow at Auburn University in the Department of Physics.

Bromley's research is at the intersection of plasma physics and high-energy laboratory astrophysics. Applying a variety of experimental techniques, his groundbreaking laboratory measurements on the spectra of Au I and Au II generated critical data for our understanding of heavy metal formation in neutron star mergers. The LAD Dissertation Prize includes a cash award, a framed certificate, and an invited lecture by the recipient at a meeting of the Laboratory Astrophysics Division.

Turmeric Could be Key to More Efficient Fuel Cells



Combining ethanol (in green) with curcumin-coated gold particles yields energy. Credit: Sri Sai Prasad Nayak and Lakshman Ventragada.

Turmeric, a spice found in most kitchens, has an extract that could lead to safer, more efficient fuel cells. Researchers at the Clemson Nanomaterials Institute (CNI) and their collaborators from the Sri Sathya Sai Institute of Higher Learning (SSSIHL) in India discovered a novel way to combine curcumin — a turmeric extract— and gold nanoparticles to create an electrode that requires 100 times less energy to efficiently convert ethanol into electricity.

Fuel cells generate electricity through a chemical reaction instead of combustion. They are used to power vehicles, buildings, portable electronic devices, and backup power systems.

Hydrogen fuel cells are highly efficient and do not produce greenhouse gases. While hydrogen is the most common chemical element in the universe, it must be derived from substances such as natural gas and fossil fuels because it occurs naturally on Earth only in compound form with other elements in liquids, gases or solids. The necessary extraction adds to hydrogen fuel cells' cost and environmental impact. In addition, hydrogen used in fuel cells is a compressed gas, creating challenges for storage and transportation. Ethanol, an alcohol made from corn or other agricultural-based feeds, is safer and easier to transport than hydrogen because it is a liquid.

"To make it a commercial product where we can fill our tanks with ethanol, the electrodes have to be highly efficient," said **Lakshman Ventrapragada**, a former student of Clemson University professor **Aparao Rao,** who worked as a research assistant at the CNI and is an alumnus of SSSIHL. "At the same time, we don't want very expensive electrodes or synthetic polymeric substrates that are not eco-friendly, because that defeats the whole purpose. We wanted to look at something green for the fuel cell generation process and making the fuel cell itself."

The researchers used gold as a catalyst. Instead of using conducting polymers, metal-organic frameworks, or other complex materials to deposit the gold on the surface of the electrode, the researchers used curcumin because of its structural uniqueness. Curcumin is used to decorate the gold nanoparticles to stabilize them, forming a porous network around the nanoparticles. Researchers deposited the curcumin gold nanoparticle on the surface of the electrode at a 100 times lower electric current than in previous studies. But the research could have broader implications than improved fuel cells. The electrode's unique properties could lend itself to future applications in sensors, supercapacitors and more, Ventrapragada said.

The journal *Nano Energy* published the findings in a paper titled, "Green synthesis of a novel porous gold-curcumin nanocomposite for super-efficient alcohol oxidation." Following Ventraprada's graduation, the electrode was characterized and tested by the SSSIHL research team from India, which includes **Sai Prasad Nayak**, **J.K. Kiran Kumar**, and **Sai Sathish Ramamurthy**.

Adapted from https://news.clemson.edu/extract-from-a-common-kitchen-spice-could-be-key-to-greener-more-efficient-fuel-cells/

Yang Yang Awarded Harvard-SAO Predoctoral Fellowship

Please join us in congratulating **Yang Yang** for being awarded a Harvard-SAO Predoctoral Fellowship. Over the past few years, several Ph.D. students from our department have had the opportunity to work at other research institutions as part of their graduate education. Yang Yang is the fourth student in recent years (joining **Amy Gall**, **Xiuriu Zhao**, and **Jordan Eagle**) to be awarded this prestigious fellowship. Kudos to **Dr. Endre Takacs** for the mentorship and support he has provided to help Yang achieve this opportunity. At the SAO she will use their electron beam ion trap to generate laboratory astrophysics atomic data for AtomDB, the database maintained by SAO for the analysis of astrophysical spectra. She is also actively involved in collaborative work with the University of Georgia and Auburn University funded by NASA. This is a very exciting achievement for Yang!

Yang Yang works with an electron beam ion trap to reproduce extreme physical environments found in astrophysical objects, such as stellar coronae, merging stars and supernova remnants.

Student Awards

PandA departmental Student Awards ceremony was held on Wednesday, April 13th in Kinard Lab. Our winners for the 2021-2022 term are:

L.D. Huff Sophomore Award	**Jonathan Green**
L.D. Huff Junior Award	**Regan Frye and Jacob Jeffries**
Samantha E. Cawthorne '10 Award	**Sarah Fields**
Outstanding Graduate Researcher Award	**George Hamilton and Jordan Eagle**
Outstanding Teaching Assistant	**Aniruddha Pan and Abhishek Khanal**
Sigma Pi Sigma Outstanding Senior Award	**Shane Blade**

At the College of Science level:

Outstanding Graduate in Engagement Award	**Jordan Eagle**
Phi Kappa Phi Certificate or Merit Award	**Sarah Fields**

Congratulations to all of our outstanding students!

Clemson Astrophysicist Works to Solve Mystery of What Happens after Neutron Stars Collide

Clemson University astrophysicist **Jonathan Zrake** is a detective of sorts.

But Zrake is not a part of a team of investigators reconstructing a crime scene to identify a suspect. Instead, he is among international researchers working to determine what caused a new X-ray glow three and a half years after two neutron stars merged 130 million light-years away from the Earth, creating a new black hole and a bright "kilonova" explosion.

GW170817 is the first, and so far only, neutron star merger observed in both gravitational waves — minute but recently detectable vibrations of space-time — and electromagnetic radiation, or light. X-rays are a type of light.

"The event was a cataclysmic thing that happened in seconds. But the dynamics that took place in that very short window of time are still playing out," Zrake said.

Astrophysicists have two leading explanations for the new X-ray source: either a "kilonova afterglow" — a plasma shock wave that could have been re-strengthened by outflowing gas — or matter heating up and shining as it falls back into the black hole left behind after the neutron stars merged. In either case, it would be the first time such a phenomenon has been observed.

This will keep theorists busy for some time. We may argue about the most viable explanation, but no matter what, the enhancement of the X-ray emission is a big discovery. On Aug. 17, 2017, astronomers detected gravitational waves from the merger of two neutron stars — the very dense cores of collapsed giant stars — using the Advanced Laser Interferometer Gravitational-wave Observatory (LIGO) in the United States and Virgo, a detector in Italy. Scientists detected visible and infrared light several hours later.

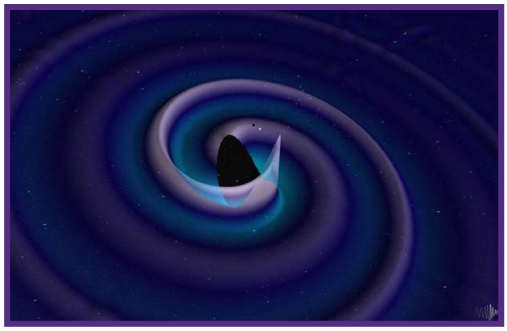
"It highlights the importance of multi-messenger astrophysics. We would have never detected this event at all if the gravitational wave observatories hadn't seen it first. We saw the light, but only because the gravitational wave detectors told us where and when to look," said Zrake who studies the dynamics of astrophysical explosions and is among a group of scientists trying to explain a new source of X-rays nearly 3.5 years after the merger of two neutron stars.

NASA's Chandra X-ray Observatory detected X-rays from GW170817 nine days later. Researchers believe the merger produced a narrow jet of high-energy particles that wasn't pointed directly towards Earth. The X-ray emission caused by the jet had been steadily getting fainter since early 2018. But researchers noticed that the decline stopped in March 2020, and the X-rays steadied. One explanation is that the expanding debris from the merger generated a shock, like a sonic boom from a supersonic plane. The emission produced by material heated by the shock is called a "kilonova afterglow."

Continued on next page

An alternative explanation is that some of the material launched by the merger fell back into the black hole left behind after the neutrons stars merged, producing radiation because it got very hot. That phenomenon is called fallback accretion.

Scientists are continuing to monitor GW170817 in X-rays and radio waves. If it is a kilonova afterglow, it should lead to increasingly bright radio emissions, said Zrake, whose research group at Clemson studies the dynamics of black holes and astrophysical explosions. If it is fallback accretion, the X-ray emission should stay steady or steadily decline. Either way, scientists are learning something new about what happened.



Simulation of a neutron star-black hole (NSBH) binary merger. Image Credit: LIGO Interferometer Gravitational Wave Observatory

"It's inevitable that something like this will happen again. It's just a question of when. When it does, this team of astronomers and astrophysicists, including scientists at Clemson, will be poised to investigate it," Zrake said. *The Astrophysical Journal Letters* published the findings.

Adapted from https://news.clemson.edu/clemson-astrophysicist-works-to-unravel-mystery-of-what-happens-after-neutron-stars-collide/

Emil Alexov Awarded Distinguished Professorship

Dr. Emil Alexov has been awarded the **Dr. Wallace R. Roy Professorship**. This professorship recognizes a high degree of collaboration with Prisma Health, success in health research funding and scholarship, evidence of leadership for multidisciplinary health research teams, and mentoring of graduate students. Dr. Alexov is entering his seventeenth year as a member of the faculty of Physics and Astronomy. During this time, he has developed into one of the leaders of the Department. He was instrumental in leading the efforts to build the current biophysics program that now includes three other outstanding faculty, and he is now leading the search for the **Dr. Waenard L. Miller, Jr.** '69 and **Sheila M. Miller Endowed Chair in Medical Biophysics**. Additionally, he has taken the lead on forming our new M.S. and Ph.D. programs in medical biophysics. To accomplish this task, he has brought together thirty-five faculty across ten departments at Clemson, as well as three doctors from Prisma Health. This program will provide outstanding opportunities for students who will be prepared to apply fundamental physical principles to clinically-relevant biophysical problems.

He has served as a CUSHR fellow and developed productive collaborations with clinicians at Prisma Health, thus translating the insights that have emerged from his fundamental scientific work to applications in a clinical environment. His research has garnered $4.3M in support and resulted in over 170 peer-reviewed publications. He maintains a software package, DelPhi, for analysis of macro-biomolecules that has been downloaded over 7000 times from users in 137 different countries.

Please join the Department in congratulating Dr. Alexov for his excellence in transformative research and mentorship.

Clemson Students Recognized for Work with Covid-Detecting Smartphones

Two Clemson University students placed in SCBIO's Challenge Accepted video competition for their videos presenting research from the lab of **Ramakrishna Podila**, an associate professor in the Department of Physics and Astronomy, on inexpensive COVID-19 and tuberculosis sensors using smartphones.

Alan Rowland, a first-year graduate student in physics from Easley, South Carolina, and **Dylan Carroll**, a first-year genetics major from Knoxville, Tennessee, won second and third place, respectively.

"As we've seen during the COVID-19 pandemic, there's been lots of problems with access to testing and how long it takes to get results," Carroll said. "With Dr. Podila's research, you could get test results in under 15 minutes at home using your smartphone. That would solve a lot of problems with access to testing."

Rowland's video focused on research that turns a smartphone into a spectrogram to detect tuberculosis, a bacterial infection that attacks the lungs. Tuberculosis is the leading infectious disease killer in the world.

Participating students created videos no longer than three minutes highlighting life science innovation or research in South Carolina. The videos were judged on the content, production quality and creativity, and potential impact of their work on the industry. The competition was part of SCBIO's annual conference held February 22-24 in Charleston. SCBIO is a member-driven organization formed to advance South Carolina's life science industry through collaboration, advocacy and resource support. It provided students a creative way to engage with the state's life sciences ecosystem, said **Zach Hargett**, SCBIO's programming and special projects director.

"Often, tests have to be done by trained medical professionals. That can be a problem," Rowland said. While some people would think lack of access to medical tests would be a problem in the developing world, it also affects countries like the U.S., Podila said. "While the COVID test is free, if there is any other test, you pay a minimum of 100 bucks. You have to go to the doctor, and that's another 100 bucks for the copay. You have to make an appointment, which can take time," Podila said.

The sensors are ready for human clinical trials, according to Podila. Bharat Biotech, a COVID-19 vaccine manufacturer in India, has inquired about using the sensors developed by Podila's lab to check antibody levels of people in their clinical trials. SCBIO CEO **James Chappell** said, "The SCBIO student video competition is a unique way to cultivate relationships between life science industry leaders and some of our most talented students. This relationship leads to career opportunities for the individual students and establishes comfort and familiarity between the companies and schools, leading to a more long-term talent pipeline."

Adapted from https://news.clemson.edu/clemson-students-place-in-scbio-challenge-accepted-video-contest/

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Clemson University

Department News

Dr. Xian Lu's proposal to the NSF Grand Challenges in Integrative Geospace Sciences program, Advancing National Space Weather Expertise and Research award Societal Resilience (ANSWERS), has been awarded. This grant will support a multidisciplinary team led by Dr. Lu to study space weather – in particular they will explore how terrestrial weather events originating at lower altitudes and the solar wind lead to variations in space weather.

Professor Yao Wang was awarded a DOE Early Career Award for a proposal titled, "Analog Quantum Simulation for Solid-State Spectroscopies". He has proposed to develop analog quantum simulation protocols for spectroscopy of quantum materials and extend this work to the simulation of spectroscopy of laser-engineered non-equilibrium matter.

Norberto Davila, who has graduated with his Ph.D. in astrophysics has accepted a new job at MIT Lincoln Laboratories in Lexington, Massachusetts. Norberto is a student of Dr. Bradley S. Meyer. We wish Norberto and his wife Kaitlyn all the best on this new chapter in their lives.

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Kim Webb at: kwebb4@clemson.edu

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