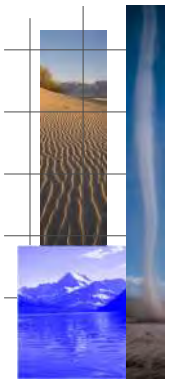

Schrödinger's Tiger

The Clemson University Physics and Astronomy Newsletter

Fall 2022 Volume 17, Issue 2

Profiles in Student Success

A Clemson education in physics for both undergraduates and graduate students can be parlayed into successful careers, not only in the field of physics, but in other industries, as well.

Some physics graduates continue in research and teaching, and others enter into the private sector, where their foundation in physics creates a pathway for career success. Examples of both career trajectories are illustrated by **Pan Adhikari**, who has gone into industry, and **Rafael Mesquita**, who continues in academic research.

Adhikari currently works as a Logic Technology Development (LTD) engineer at Intel Corporation in Hillsboro, Oregon. As an LTD Engineer, Adhikari is responsible for developing the next generation of Intel's microprocessors. He's part of the team to innovate the leading-edge semiconductor fabrication process, which strives to overcome seemingly-impossible barriers as tolerances and specifications for building best-in-class computing devices. His tasks involve designing, executing, and analyzing experiments necessary to meet engineering specifications for high-volume manufacturing of integrated circuits and participating in intellectual property development.

Adhikari says that he is fortunate to have worked with Clemson's world-class research teams (first in the Ultrafast Photophysics of Quantum Devices Laboratory and later at the Clemson Nanomaterial Institute) led by passionate, talented, and accomplished researchers. His interests in semiconductor devices and microprocessors were fueled during his Ph.D. research. Specifically, Adhikari researched the synthesis and electrical properties of low-dimensional semiconductors.

Led by **Dr. Aparao Rao** of the Physics and Astronomy Department, the Clemson Nanomaterials Institute is dedicated to exploring the fundamental properties of nanomaterials and their applications. CNI researchers explore the fundamental physics in nanostructured systems using a wide range of characterization techniques including Raman scattering, atomic force microscopy, electron microscopy, electrical transport measurements, and the electrochemical and harmonic detection of resonance methods.

Adhikari is delighted to be able to utilize his skills and expertise in a manner that benefits every single person on the planet. Therefore, he proudly introduces himself as a Clemson Tiger to the global scientists and engineers he interacts with in the semiconductor industry!

Continued on page 3

A message from the Chair

Greetings to all our alumni and friends. I hope you are as excited for 2023 as I am. We have much look forward to in the coming year, as we seek to fill the inaugural holder of the **Dr. Waenard L. Miller, Jr. '69 and Sheila M. Miller** Endowed Chair in Medical Biophysics. We launched our M.S. and Ph.D. programs in medical biophysics in the fall, and the students are doing great! We also received a record number of applications to our physics Ph.D. program for the next academic year. These students will have an amazing opportunity to work alongside our world class faculty, as they partner with industry in a number of different fields. These include better energy storage technologies, working to push the frontiers of personalized medicine, collaborating with the Space Force to better understand space weather, engaging with NIST to push the limits of quantum electrodynamics, and working with IBM to develop new quantum technologies.

One of the department chairs who played a pivotal role in setting the stage for the success we enjoy today was **Dr. Pete McNulty**, who passed away last semester. As you read our remembrance of our colleague, I trust that you will think back to his service with the same gratitude that I do.

This year, we will host the annual Andrew F. Sobczyk Memorial Lecture. **Dr. Dipti**, a theoretical atomic physicist from the International Atomic Energy Agency, will host the public lecture. Later this spring, the second annual South Carolina Quantum Technology Forum will bring scholars from around the world to Clemson to share ideas about the challenges of the quantum revolution.

The gifts you have generously provided fund scholarships, graduate student fellowships, endowed chairs, and the Physics and Astronomy Advancement Fund. I hope you will consider giving to advance our mission.

Go Tigers!

Dr. Sean Brittain, Chair, Department of Physics and Astronomy
864-656-3416

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. 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. You may visit the Clemson website: https://cualumni.clemson.edu/give/physics-astronomy and make a secure electronic donation. If you have any questions regarding your donations, you may contact the Annual Giving Office at (864) 656-5896. If you have other questions, you may contact the department directly at (864) 656-3416.

Rafael Mesquita Joins Johns Hopkins APL

Rafael Mesquita earned a Ph.D. in physics in May 2021 from Clemson University, where he was a member of Phi Kappa Phi academic honor society. "I really enjoyed my time at Clemson because I got to travel so much and learn from so many interesting people," Mesquita said.

He began his academic career as an undergraduate at the Federal University of Campina Grande in Brazil, where he studied atmospheric physics. He came to Clemson in fall of 2013, and his research focused on upper atmospheric physics. As a Clemson doctoral student, Mesquita traveled to Ethiopia to install a Fabry-Perot interferometer, an instrument that measures winds and temperature in the upper atmosphere. He also participated in rocket campaigns in Alaska and Norway, where he operated camera sites in coordination with rocket launches that study high altitude winds.

Rafael Mesquita presented his NASA Heliophysics Support to Research Grant project at the American Geophysical Union 2022 fall meeting.

In July 2021, Mesquita joined Johns Hopkins University Applied Physics Laboratory (APL) in Laurel, Maryland, as a post-doctoral fellow in the Geospace and Earth Sciences Group. His focus is to design and develop rocket and satellite missions. And, in August 2022, he was awarded a NASA Heliophysics Support to Research grant to study the relationship between atmospheric tides and low-thermospheric neutral wind shears.

Rafael Mesquita operated a camera site in northern Alaska, where he photographed chemical releases from a rocket launch.

APL Geospace and Earth Sciences Group Supervisor **Dr. Bill Swartz** said, "Rafael wasted no time at all getting integrated into our group research activities while simultaneously charting his own research trajectory. He exceeded expectations by winning a very competitive NASA heliophysics research grant right out of the gate."

In November 2022, Mesquita was promoted to APL Senior Research Staff. He received the notification while he was presenting at an invited plenary at the Latin American Conference on Space Geophysics (COLAGE) in São José dos Campos, Brazil.

Currently, he is working on a NASA-funded satellite project called the Electrojet Zeeman Imaging Explorer (EZIE) that will launch in 2024. The research goal is to measure electric currents in the atmosphere's auroral region that disturb the Earth's magnetic field.

"This mission is crucial because solar energy that is deposited in the auroral region through these currents can propagate all the way to the ground and around the Earth," Mesquita said. "This can affect GPS navigation, as well as damage power lines and oil and gas pipelines, so we need to understand the behavior of these currents."

Public art project in Kinard Laboratory unites art and science

Clemson University's Kinard Laboratory of Physics and Astronomy now features an art installation as unique as the student who crafted it.

"Horizon" is a piece of public art created by **Aidan Rhoades**, a dual-degree student with majors in both art and physics, and the work perfectly incorporates his interest in both disciplines.

"Horizon is inspired by blackbody radiation. This is the phenomenon that explains why hot objects put off electromagnetic radiation, including visible light," Rhoades explained. "As a metalworker, this behavior is fundamental to the way I interact with my medium because it allows me to judge the temperature of my workpiece, and it has been colloquially understood for tens of thousands of years by people practicing my craft."

The partnership to have an art installation in Kinard began with the Presidential Leadership Institute bringing together two department chairs: the Department of Art's **Valerie Zimany** and the Department of Physics and Astronomy's **Sean Brittain**. For Rhoades, the pursuit of dual degrees is both a passion and a challenge. He began his college career in engineering, but found that the interdisciplinary nature of the physics degree allowed him to craft a schedule that allowed him to pursue his Bachelor of Fine Arts degree. His love of science and art are reflected in his work in equal measure.

"It fulfills exactly what PLI is supposed to do, which is to bring different parts of the University together for new collaborations and exchanges," Zimany said. "I think that our college (the College of Architecture, Arts and Humanities) and College of Science have a lot of things in common with cultures that prize inquiry and problem-solving, and Aidan is a great representation of how that can manifest itself in different disciplines."

"While many may not think of art and science having a lot to do with one another, the insights from each sphere of intellectual endeavor are mutually beneficial," said Brittain. "Both art and science elevate humanity by harnessing our creativity and curiosity."

"Horizon plays on that relationship of my two interests by using loose, expressive linework to capture the gesture of a radiating particle, which mirrors the observed forms of celestial bodies as viewed across their radiation spectrum," Rhoades said. "I aimed to draw a line through the colloquial knowledge and mysticism of craft toward the more rigid understanding of the universe through physics."

Horizon was unveiled on April 1, prominently mounted in the entrance of the building. Brittain said that Rhoades' art has already been a conversation starter.

(Adapted from https://news.clemson.edu/new-public-art-in-kinard-laboratory-unites-art-and-science/)

Astrophysicists prove neutrinos originate from blazars

Illustration by graduate student Benjamin Amend

Cosmic rays, charged particles that travel up to nearly the speed of light from deep outer space, constantly bombard Earth.

For more than a century, astrophysicists have tried to determine the origin of those extremely energetic particles, which are up to a million times more energetic than anything achieved by the world's most powerful particle accelerator, the Large Hadron Collider near Geneva, Switzerland.

They also want to know what propels them with such tremendous force.

Solving the age-old mystery could be one step closer, thanks to new multi-messenger research by a team of scientists that includes Clemson University Associate Professor of Physics and Astronomy **Marco Ajello**. Ajello and collaborators **Sara Buson** from Julius-Maximilians-Universität (JMU) Würzburg in Bavaria, Germany, and **Andrea Tramacere** from the University of Geneva have proven with an unprecedented certainty that astrophysical neutrinos originate from blazars.

Astrophysical neutrinos are tiny neutral particles produced by cosmic ray interactions in these extreme accelerators, making them unique messengers, or signals, that could help pinpoint cosmic ray sources.

Because cosmic rays are charged particles, the galaxy's magnetic fields can deflect them during their journey through space. That makes it impossible for scientists to trace where they originated. Neutrinos, on the other hand, have very little mass, are neutral and hardly interact with matter. They race through the universe and can travel through galaxies, planets and the human body almost without a trace. Because electromagnetic forces do not affect them, they can be traced back to their astrophysical sources.

In 2017, the IceCube Neutrino Observatory, buried deep in the ice at the South Pole, detected a neutrino. Scientists traced it back to blazar TXS 0506+056. Blazars are active galactic nuclei powered by supermassive black holes that emit much more radiation than their entire galaxy. The publication in the journal *Science* sparked a scientific debate about whether blazars are cosmic ray accelerators. Using neutrino data obtained by IceCube — the most sensitive neutrino detector currently in operation — and a catalog of astrophysical objects confidently identified as blazars, Ajello and his colleagues found powerful evidence that a subset of blazars originated the observed high-energy neutrinos. Their findings, published in the *Astrophysical Journal Letters*, report the probability of this being coincidence is less than one in a million.

"We had a hint back then (in 2017), and now we have evidence," Ajello said.

(Adapted from https://news.clemson.edu/discovery-brings-scientists-one-step-closer-to-solving-century-old-cosmic-ray-mystery/)

Clemson University Biophysics Group won CAGI-6 challenge

Many human diseases are caused by DNA errors that make individuals predisposed to them. Therefore, it is crucial for early disease diagnostics and treatment that such DNA errors be identified and disease-causing effects revealed. A successful accomplishment of this task will pave the way for providing patients with suggestions about lifestyle changes that will reduce the risk of disease development and will facilitate drug discovery. This has motivated many researchers to investigate the linkage between disease and DNA variations.

One of the most popular platforms for assessing the capability of such efforts is the Critical Assessment of Genome Interpretation (CAGI) forum (https://genomeinterpretation.org/). The overarching goal of the CAGI is to establish the state-of-the-art in the field of interpreting genomic variation though periodic editions of the CAGI experiment and extensive dissemination of their outcomes. For predictors, establishing state-of-the-art involves recognizing best prediction strategies, highlighting innovation and identifying bottlenecks that prevent the field from advancing. For the user community, this involves providing trustworthy information about the most appropriate methods for a particular research or clinical application, and the best way to use the methods.

The outcome of the predictions was reported at the CAGI-6 Meeting, which took place in the David Brower Center at Berkeley University in May 2022. Clemson professor **Emil Alexov's** lab predictions were the best, resulting in PCC of 0.62, while all other predictions yielded PCC either negative or close to 0.1. Alexov's lab made the predictions utilizing in-house developed method termed Single Amino Acid Folding Free Energy Changes (SAAFEC). The SAAFEC-SEQ is a gradient-boosting decision tree machine learning method to predict the change of the folding free energy caused by amino acid substitutions.

The method does not require the 3D structure of the corresponding protein, but only its sequence and, thus, can be applied on genome-scale investigations where structural information is very sparse. SAAFEC-SEQ uses physicochemical properties, sequence features, and evolutionary information features to make the predictions. It is shown to consistently outperform all existing state-of-the-art sequence-based methods in both the Pearson correlation coefficient and root-mean-squared-error parameters as bench-marked on several independent datasets. The SAAFEC-SEQ has been implemented into a web server and is available as stand-alone code that can be downloaded and embedded into other researchers' code.

Students in Alexovs's lab (pictured above) are interested in computational modeling of biological macromolecules and their assemblages as well as predicting biophysical quantities associated with them. One of the primary roles of the lab is to develop and maintain the popular software package DelPhi, that calculates electrostatic potentials and energies of systems comprised of biological macromolecules.

"Father of Thermoelectrics" teams up with Clemson researchers to develop a new evaluation method

Herbert Behlow and Sriparna Bhattacharya

Working with one of the world's preeminent thermoelectric materials researchers, a team of researchers in the Clemson Department of Physics and Astronomy and the Clemson Nanomaterials Institute (CNI) has developed a new, foolproof method to evaluate thermoelectric materials.

Clemson Physics Assistant Professor **Sriparna Bhattacharya,** Engineer **Herbert Behlow**, and CNI Founding Director **Apparao Rao** recently collaborated with world-renowned researcher **H. J. Goldsmid**, professor emeritus at the University of New South Wales (UNSW) in Sydney, Australia, to create a one-stop method for evaluating the efficiency of thermoelectric materials.

Goldsmid is considered by many to be the "Father of Thermoelectrics" for his pioneering work in thermoelectric materials. Bhattacharya first connected with Goldsmid on LinkedIn, telling him she had confirmed one of his theoretical predictions during her graduate studies at Clemson University. Later, Bhattacharya shared a paper she wrote with Rao after she joined his research group. Goldsmid mentioned to her that he had a new method in mind for studying thermoelectrics and shared his one-page theory with her. He was 89 years old at the time and enthusiastically started collaborating with the CNI researchers because he considered Bhattacharya part of his own research "family."

Thermoelectric materials use a temperature gradient (ΔT) to generate electricity. They can be used for power generation by converting heat to electricity (Seebeck method) or refrigeration by converting electricity to cooling (Peltier method). Thermoelectric materials are used in applications ranging from NASA space missions to seat warmers and coolers in vehicles.

The efficiency of thermoelectric materials is measured by a figure-of-merit, or zT, which considers the material's temperature, electrical conductivity and thermal conductivity. The traditional method of determining zT requires two measurements using different sets of equipment, something that sometimes causes researchers to report incorrect results. In other words, researchers sometimes mistakenly measure electrical conductivity (charge flow) and thermal conductivity (heat flow) along different directions in their sample when it is switched from one instrument to the other.

Peltier cooling had not been used previously for evaluating zT because of a high ΔT , or the maximum achievable difference in temperature between the cold junction and ambient. "We used thermocouples containing a metal and a semiconductor junction to reduce the ΔT to a much narrower range so that the temperature dependent zT may be determined with a higher resolution," Behlow said.

Continued on next page

"The idea to use a metal and a semiconductor to reduce ΔT was hidden in plain sight until Professor Goldsmid recognized this was the case and proposed this new method for measuring zT," Behlow added. "The experimental setup we developed at CNI (with the help of the Department of Physics and Astronomy Instrument Shop) to test Professor Goldsmid's theory ensures that the charge flow and the heat flow are measured in the same direction in the sample," Rao said. "Therefore, by design, our method provides accurate zT."

Isabel Rancu, a high school student at the South Carolina Governor's School for Science and Mathematics, also contributed to the study. Rancu, who worked with the team through Clemson's Summer Program for Research Interns, independently verified the model calculations reported by Behlow. The bismuth telluride sample used in the study was synthesized by Department of Physics and Astronomy Senior Lecturer **Pooja Puneet** as part of her doctoral research.

The UNSW-Clemson study titled "Thermoelectric figure-of-merit from Peltier cooling" was published in November in the *Journal of Applied Physics*. It was selected as an "editor's pick," which the team regards as a tribute to Goldsmid.

(https://news.clemson.edu/father-of-thermoelectrics-teams-up-with-clemson-researchers-to-develop-a-new-evaluation-method/)

Dr. Xian Lu awarded grant from NSF's Grand Challenges in Integrative Geospace Sciences

Clemson University Department of Physics and Astronomy Associate Professor **Xian Lu** leads a team of researchers studying how the Earth's ionosphere and thermosphere — the area about 60 to 400 miles above the Earth's surface — change because of atmospheric waves from terrestrial sources and geomagnetic disturbances triggered by solar activity. The research aims to improve space weather forecasts in order to minimize disruptions and damage.

Lu and her collaborators have received a three-year, $900,000 grant from the National Science Foundation's Grand Challenges in Integrative Geospace Sciences: Advancing National Space Weather Expertise and Research toward Societal Resilience (ANSWERS) program to study the impacts of atmospheric waves, geomagnetic activity and solar irradiance to the variability of space weather during quiet and storm times.

The grant supports a multi-disciplinary team including **Jens Oberheide**, a professor in the Clemson Department of Physics and Astronomy, and researchers from Embry-Riddle Aeronautical University, Massachusetts Institute of Technology, New Jersey Institute of Technology and Virginia Tech.

(Adapted from https://news.clemson.edu/looking-for-answers-nsf-grant-boosts-effort-to-better-understand-what-controls-space-weather/)

The Department remembers Peter J. McNulty faculty member and department chair

Peter J. McNulty, long-time chair and faculty member in Physics and Astronomy at Clemson, passed away on June 6, 2022. Pete played a major role in making Clemson Physics and Astronomy what it is today. Pete was hired in 1988 to lead the change from a department dedicated mainly to teaching to one with many faculty members engaged in forefront research. This was not without challenges, but Pete managed the transition quickly and effectively, and the department made many strong hires under his guidance. He was a caring mentor to young faculty members, and he taught two Colleges and the University about startup funds for new faculty, and the importance of teaching release for active researchers, which we now take for granted. Pete was wise in his consideration of administrative demands, in those days, mostly for paperwork, coming from the colleges and university. If something was truly important, he knew it would be requested multiple times. He also understood that his faculty would learn this principle from him and take it to heart.

Pete was an outstanding researcher, studying space radiation effects in electronic devices. He maintained a group of up to a dozen researchers for years, and found opportunities to fly experiments on numerous NASA spacecraft. They measured effects, especially single event upsets, in standard electronics, and they designed devices to characterize the particle radiation itself, for both cosmic rays and trapped protons, and constrain models of both. Pete continued this work until very recently, and his former students are leaders in the field.

Pete will be deeply missed by his colleagues and the many students whom he mentored during his career.

Clemson students present their rocket research at ESA symposium

Clemson undergraduates **Austin Smith** and James Hutchinson presented the student rocket experiments carried out under the supervision of Professor **Steve Kaeppler** and graduate student **Alvaro Guerra** over the last two semesters at the 25th ESA Symposium for European Rocket and Balloon Programmes and Related Research in held on May 1-5, 2022 in Biarritz, France.

Their oral presentation entitled "Clemson University Student Space Program: Educating Students in the Field of Space Physics" was given in the "Rockets and Balloons in Space Education" session and received broad attention and feedback from scientists and students in the audience.

Left to right: Austin Smith, James Hutchinson, and Dr. Gerald Lehmacher of Physics and Astronomy

https://blogs.clemson.edu/physics-and-astronomy/2022/06/02/clemson-ci-students-present-their-rocket-research-at-esa-symposium/

Sounding rocket experiment INCAA featured in popular German podcast

German radio journalist **Kristian Thees** and German actress and entertainer **Anke Engelke** featured a discussion of the NASA sounding rocket experiment, INCAA, and the image of tracer releases in Alaska on their popular German-language podcast on May 26, 2022. The topic and research was submitted by listener Clemson professor **Gerald Lehmacher**, Physics and Astronomy, who was co-investigator for the experiment. Lehmacher's colleagues professors **Steve Kaeppler** and **Miguel Larsen** were principal investigator and co-investigator, respectively. The podcast (in German) can be accessed at: https://www.swr3.de/podcasts/wie-war-der-tag-liebling-100.html

The photo at left was taken by **Danute Paukstys** from Wasilla, Alaska and was featured in the podcast's blog and discussed in the episode (starting at about 8:50 min). Two sounding rockets were successfully launched on April 7, 2022 from Poker Flat, Alaska to study ion-neutral coupling under active aurora.

The payloads carried experiments from the University of California Berkeley, the University of Calgary, and Clemson University.

Rama Podila awarded Sonoco FRESH initiative grant

The Sonoco FRESH initiative at Clemson University has awarded three research grants to professors who are addressing issues regarding the safety, security, and sustainability of food throughout the value chain. With funding provided by Sonoco (a global provider of a variety of consumer packaging, industrial products, protective packaging, and displays and packaging supply chain services), each project focuses on how packaging can extend the shelf life of food, with particular emphasis on perforation density, recyclable adhesives and gas permeability.

Among the faculty members receiving the research grants is Assistant Professor of Physics and Astronomy, **Dr. Rama Podila,** pictured bottom left. "Sonoco has been honored to sponsor several calls for research proposals to be funded through Sonoco FRESH," said **Jeff Schuetz**, Staff Vice President, Global Technology at Sonoco and FRESH Advisory Board Chair. "The unique multi-disciplinary FRESH research program recognizes the importance of developing solutions, and we encourage companies at each step of the food value chain to support this program."

Yao Wang receives DOE Early Career Award

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 the spectroscopy of quantum materials and extend this work to the simulation of spectroscopy of laser-engineered non-equilibrium matter. Quantum materials are characterized by having entangled electrons that behave in ways that cannot be described classically.

Dr. Wang's work will transform our knowledge of exotic materials and has the potential to lead to breakthrough discoveries in superconductors, energy storage, and quantum devices. The DOE Early Career Award is "a part of the DOE's long-standing efforts to develop the next generation of STEM leaders who will solidify America's role as the driver of science and innovation around the world." This year 83 awards were granted to faculty at 47 different universities and 13 national labs. These awards provide $750k over five years that in the words of **U.S. Secretary of Energy Jennifer M. Granholm**, "...[allows] the recipients the freedom to find the answers to some of the most complex questions as they establish themselves as experts in their fields."

Jens Oberheide to lead NASA focused science topic

The stated goal of the "Living With A Star" program is to understand how and why the Sun varies, how the Earth and Solar System respond, and how the variability and response affects humanity in Space and on Earth (space weather). The Focused Science Topics (FST, https://lwstrt.gsfc.nasa.gov/focusedsciencetopics/) with the program coordinate large-scale investigations that cross disciplines and technique boundaries. FST #1 "Impact of Terrestrial Weather on the Ionosphere-Thermosphere" aims to advance our fundamental scientific understanding of terrestrial weather's impact on Earth's upper atmosphere and ionosphere, as well as enhance future space weather prediction capabilities.

In spring 2022, NASA selected five four-year projects for this FST, about $1 million per project. PandA's project is led by **Professor Jens Oberheide** (co-Investigator **Professor Xian Lu**) and will explore the space weather response to a recurring weather pattern in the tropics, called the Madden-Julian Oscillation, which is related to the Monsoon. Professor Oberheide was also appointed to lead the overall FST effort, by coordinating the research of the individual projects. The initial kick-off meeting will be held in the last week of January 2023 at Clemson's Madren Center with participants from Clemson (including several graduate students), NASA, MIT, Embry-Riddle Aeronautical University, Naval Research Lab, National Center for Atmospheric Research, University of Alaska, Virginia Tech, Orion Space Solutions, and Computational Physics Inc.

The Clemson University Physics and Astronomy Newsletter

118 Kinard Laboratory
Box 340978
Clemson, SC 29634-0978

Tel: (864) 636-3416
Fax: (864) 656-0805
E-mail: sbritt@clemson.edu

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Department of PHYSICS AND ASTRONOMY Clemson University

Department News

Clemson Physics and Astronomy graduate students **Mengke Li**, **Ben Amend**, and **Samalka Anandagoda** spent the summer of 2022 at the Los Alamos National Laboratory (LANL) in Los Alamos, New Mexico performing research relevant to their respective Ph.D. projects. Ms. Li used Machine Learning to study nuclear masses related to rapid neutron-capture (r-process) nucleosynthesis. Mr. Amend studied how r-processs products from neutron star mergers are ejected into the galactic medium, and Ms. Anandagoda computed the background gamma-ray flux from all types of astrophysical sources. While there, Ms. Li worked with **Dr. Matthew Mumpower**, while Mr. Amend and Ms. Anandagoda worked with **Dr. Chris Fryer**. Drs. Mumpower and Fryer are both staff scientists at LANL.

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Kim Webb at: kwebb4@clemson.edu

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