Discovery Confirms Einstein Theory, Exciting Astronomers

Four days before the great American eclipse of 2017, a Clemson University scientist learned a secret that he had to hold until now. Albert Einstein predicted it.

Now, astronomers say it is true. They confirmed the direct detection of gravitational waves or ripples in space time, in addition to light from the collision of two neutron stars.

“Gravitational wave astronomy accomplished its first direct detection of gravitational waves two years ago with the observation of the final collision of two black holes,” said Dieter Hartmann, a professor in Clemson’s Physics and Astronomy Department. “This beautifully confirmed predictions made a century earlier by Albert Einstein.”

The discovery of colliding neutron stars marks the first observation of a cosmic event in both gravitational waves and light. Scientists used the U.S.-based Laser Interferometer Gravitational-Wave Observatory (LIGO) and the Europe-based Virgo detector, along with some 70 ground- and space-based observatories. “The whole field of gravitational wave astronomy garnered the Nobel Prize,” Hartmann said, “but what was missing is the merger of two neutron stars so we could see other light, and that’s just what happened.”

Hartmann said scientists made the discovery just before the coast-to-coast eclipse. “So you can imagine how exciting that was for me, right?” Hartmann asked. The event called GW170817, involved more than 3,000 astronomers, which is about a quarter of all professional astronomers in the world. Hartmann was among them. “What we’re witnessing is the formation of a black hole, but some material will escape and in that escaping flux of material is what we all love, gold,” Hartmann said.

“We actually believe that this is one of the sites in the universe where gold can be produced.” Hartmann said the discovery is a game-changer. “Multimessenger, time-domain astronomy is now an established field, it’s a total new branch of doing astronomy.” Learn more about the discovery at https://www.nsf.gov/news/news_summ.jsp?cntn_id=243382&org=NSF&from=news

Adapted from article by Wanda Johnson, Clemson University Relations, October 17, 2017
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/cos and make a secure electronic donation. Again, please specify that the donation go the Physics & Astronomy Department and indicate to which project you would like to donate. 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.
New Precision Device Could Advance Low-Dose Radiation Cancer Research

Radiation is a powerful weapon against some types of cancer, but using the therapy is still more like a shotgun approach than a surgical strike, shooting a tumor with large doses of broad-spectrum X-rays that damage healthy tissue and cause side effects.

Katelyn Truong, a senior bioengineering major, helped design a device that changes X-ray delivery from a shotgun approach to a surgical strike. Truong authored a journal article explaining the device and its potential to propel research in cancer radiation.

In a study published in the journal PLOS ONE, a team of Clemson University bioengineering and physics students and faculty describe an irradiation fluorescence system they developed that could accelerate research in delivering very specific types of radiation in controlled doses.

They also showed that low doses of specific, controlled radiation are safe for healthy cells. Sources of radiation are everywhere — sunlight, trace amounts of radioactive elements in the soil, medical imaging and outer space, where radiation is a concern for astronauts. At its most basic, radiation is energy released in the form of subatomic particles. Each atom has its own wavelength and energy; collectively, they comprise a spectrum of radiation. If radiation were a rainbow of colors, the Clemson team was able to use and measure a very specific shade of the rainbow at a specific low dose consistently. Previous radiation research has lacked detailed information, making the science difficult to replicate and verify.

“In general, researchers haven’t been too worried about the exact energies, wavelengths and dosages of radiation,” said Delphine Dean, an associate professor of bioengineering at Clemson and the senior author of the paper.

Elements absorb specific wavelengths of energy and release others, a process called fluorescence. In their study, the Clemson researchers bounced X-rays off a small plate of iron. The iron absorbed some wavelengths and emitted others onto a dish of fibroblast cells from a well-established mouse line provided by the National Institutes of Health. For 24 hours after being irradiated, the cells grew slower than cells that didn’t receive radiation. By the third day, however, the irradiated cells were growing at a much faster rate than the non-irradiated cells. The researchers suggest cells slowed growth as a protective measure to minimize DNA damage, then sped up the cell cycle to overcome the damage. By the fifth day, both irradiated and non-irradiated cells were growing at the same rate.

Previous research has shown that cancer cells have a difficult time repairing themselves after low doses of radiation. But the pause and rapid rebound by the healthy cells in the Clemson project was surprising and encouraging, Dean said. “When we first started working on this, I actually made the students redo the experiments several times because I thought that it didn’t make sense that the cells would start to proliferate faster after irradiation. But it was so nicely repeatable that we knew it was really something there. That’s a lot to do with our system. We know exactly the dose, dose rate and energy every time we do (Continued on next page)
the experiment so there’s no question that what we were seeing was real,” she said. What made the Clems- 
on study different from others started with a collaboration between bioengineering and physics students. 
“I am impressed by how far our students were able to push this research considering that small overlap of 
the two fields. On the other hand, this makes our collaboration exciting and the results unique and valuab-
le for the scientific community,” said Endre Takacs, associate professor of atomic and medical physics in 
Clemson’s College of Science. Truong and Donald Medlin, a graduate student in the atomic and medical 
physics program, work on a fluorescence device like the one they helped create. The combination of bio-
engineering and physics students made the project a success. Truong, a senior at Clemson and first au-
thor on the paper, said the collaboration between bioengineering and physics was “fundamental” in de-
veloping the low-dose X-ray source and performing analytical tests. “The physics students contributed 
tremendously by really delving into calculations behind the X-ray spectra analysis. Specifying precise doses 
and keeping these doses consistent for the cells would have been impossible without their help,” Truong 
said.

“We’re really hoping this PLOS ONE paper gets other research groups to set up similar irradiation systems 
where the dose, energy, dose rate, etc., are well-characterized. This will help the field so that it will be easi-
er to compare results between groups,” Dean said. Suzanne Bradley, Bryana Baginski, Joseph Wilson, 
Leon Zheng and R. Kevin Wilson also were authors of the paper. The study was funded through the 
Clemson Creative Inquiry student research program and an NSF CAREER Award to Dean.

Adapted from article by Clinton Colmenares, Clemson University Relations, February 22, 2018

College of Science Names SeanBrittain as 
Chair of Physics and Astronomy

Sean Brittain, an astrophysicist who studies the stars, but who is also deeply grounded in supporting students and enhancing diversity and inclusion, has been named chair of the Department of Physics and Astronomy in the College of Science. Brittain replaces Terry Tritt, who will retire this summer.

Brittain has experience at both the department and university levels. He has been a graduate coordinator since 2012 and was a member of the Faculty Senate from 2009-2012. He also served on the Athletic Council from 2009-2017 and on the Athletic Admissions Review Committee from 2009-2017. “I am honored and humbled to be selected for this position,” said Brittain, who joined Clemson in 2006. “We have excellent leadership, and I look forward to learning from previous chairs. I’m also excited about finding ways to facilitate our planning at the department level. As a strong advocate for shared governance, I want to do my best to draw on the insight of all my colleagues, as we pursue the goals described in our SciForward strategic plan.”

Brittain earned his Bachelor of Science, in 1997, at LeTourneau University in Longview, Texas, and his Master of Science (2001) and Ph.D. at the University of Notre Dame, in 2004. He is currently on a year-long sabbatical at the National Optical Astronomy Observatory in Tucson, Arizona, where he is working with a team funded by NASA to study the chemistry of planet-forming disks. When he is not gazing at the stars, Brittain enjoys hiking in the woods with his wife, Beth, and children, Olivia, 15, Sam, 13, Charlotte, 8, and their 2-year-old rescue dog, Cali. “One of the best-kept secrets at Clemson is that the physics program provides amazing engagement opportunities and prepares students for a wide range of careers,” Brittain said. “I want to make this less of a secret.”

Adapted from article by Jim Melvin, College of Science, March 9, 2018
Clemson Spinoff Company Receives InnoVision Award for Innovative Medical Technology

Medical Beam Laboratories LLC, a company recently formed by researchers from Clemson University’s Medical Physics lab, has been awarded the InnoVision Award for Technology Development for its work in advanced robotic radiosurgery. The annual award honors one company in South Carolina that has developed a novel technology for commercial or internal purposes.

Started in 2015 by physics and astronomy doctoral student Donald Medlin and professors Endre Takacs and Mark Leising, the company is developing an innovative radiosurgery device to obliterate cancerous tumors quickly, precisely and at a fraction of the cost of current treatments. Physics and astronomy research associate Leon Zheng provided an incomplete design for the device back in 2015, launching the group’s collaboration and leading the creation of the company, which is also known as Beam Lab. Previous winners of the Technology Development Award, such as Milliken, a global manufacturer of chemicals, floor covering and performance materials; and Proterra, known around the Upstate for its zero-emission buses, have been bolstered because of their InnoVision Awards.

“We’re really grateful to InnoVision for recognizing our technology,” Medlin said. “I think it brings a lot of attention to South Carolina and Clemson University, as well, because most people in the medical device industry are in Silicon Valley or the Research Triangle. It really highlights the exciting technologies being developed at Clemson University, which could bring more attention to technological development in our state.”

The company’s award-winning device is intended to improve cancer outcomes for people and also for their four-legged friends. “Normal radiotherapy techniques use a broadband X-ray spectrum that cannot focus radiation as well as our device,” Medlin said. “In veterinary applications, the average pet that receives radiotherapy requires 19 fractionations, or sessions, to remove a tumor. So the owner must take the dog or cat in every day for almost a month to get the total amount of radiation necessary.” Beam Lab’s device uses 26 pencil beams of well-defined gamma radiation, which can eliminate a tumor in one to three fractionations.

“The beams are all targeted at the tumor volume and they rotate around the patient so that they’re entering at different angles. This reduces the dose spillage outside of the tumor volume and minimizes the damage to the surrounding healthy tissue,” Medlin said. The precision and effectiveness of the device is based on three novel advancements in radiosurgery: Cobalt-60, an element used as a source of radiation; a series of holes that can be indexed to customize the size of the radiation beams; and a rotating treatment head that stands out against typical, static radiosurgery devices. An image guidance system is included in the design to monitor the tumor’s position in real time, ensuring that the radiation beams don’t stray from their tumor targets. Computer simulations, akin to those used by particle physicists at the Large Hadron Collider on the border of Switzerland and France, have validated the device’s abilities up until this point.

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Beam Lab is currently producing its first device, which will be used for human applications in Europe beginning in the fall of 2018. They’re also fundraising to launch the first radiosurgery device designed and optimized for veterinary applications, which they hope will be piloted by a qualified veterinary hospital in Greenville. The Clemson University Research Foundation (CURF) has patented the team’s technology, and licensing agreements are currently under way.

Data compiled from both veterinary and human applications will provide the foundation for Beam Lab, as the company seeks FDA approval for its device. Medlin said he hopes to have a radiosurgery machine available for domestic hospitals by 2020. He credits the South Carolina Research Association (SCRA) for providing startup funds for the technology, and Takacs, Zheng, and Leising for spearheading the idea with him.

“When I came to Clemson, my intention was to finish my physics education, and along the way I hoped I would figure out some idea that could be used practically, that others could benefit from,” Medlin said. “The stars aligned the day I met Dr. Takacs, and I was able to achieve the goal that I had for myself from the beginning.”

Adapted from article by Hannah Halusker, College of Science, December 7, 2017

**Physics and Astronomy Students Honored for Academic Success**

This year’s Department of Physics and Astronomy and College of Science Awards ceremonies were both held on April 6, 2018 in Kinard Hall and the Iptay Suite in Memorial Stadium, respectively.

Several physics and astronomy students were recognized with awards. In addition to department and college-level awards, the Society of Physics Students bestowed its SPS Senior Award to Bonni “Bae” McKinney.

On the college level, A.J. Miller received the Outstanding Junior in Science Award, while Yunhui Peng garnered the Outstanding Graduate in Discovery Award.

The following students received department awards:

- Benjamin Slimmer - L.D. Huff Sophomore Award
- A.J. Miller - L.D. Huff Junior Award
- Gabriella Wheeler - Samantha E. Cawthorne 2010 Award
- Bonni ‘Bae’ McKinney - SPS Senior Award
- Andrew Garmon - Outstanding Graduate Teaching Assistant Award
- Amy Gall - Outstanding Graduate Teaching Assistant
- Roshani Silwal - Outstanding Graduate Research Assistant Award
- Yunhui Peng - Outstanding Graduate Research Assistant Award

Congratulations to all these super students!
Researchers from Clemson’s Nanomaterials Institute (CNI) are one step closer to wirelessly powering the world using triboelectricity, a green energy source. In March 2017, a group of physicists at CNI invented the ultra-simple triboelectric nanogenerator (or U-TENG), a small device made of plastic and tape that generates electricity from motion and vibrations. When the two materials are brought together — through such actions as clapping the hands or tapping feet — they generate voltage that is detected by a wired, external circuit. Electrical energy, by way of the circuit, is then stored in a capacitor or a battery until it’s needed. Nine months later, in a paper published in the journal *Advanced Energy Materials*, the researchers reported that they had created a wireless TENG, called the W-TENG, which greatly expands the applications of the technology.

“We use Teflon, because it has a lot of fluorine groups that are highly electronegative, whereas the graphene-PLA is highly electropositive. That’s a good way to juxtapose and create high voltages,” said Ramakrishna Podila, corresponding author of the study and an assistant professor of physics at Clemson.

The W-TENG was engineered under the same premise as the U-TENG, using materials that are so opposite in their affinity for electrons that they generate a voltage when brought in contact with each other.

In the W-TENG, plastic was swapped for a multipart fiber made of graphene — a single layer of graphite, or pencil lead — and a biodegradable polymer known as polylactic acid (PLA). PLA on its own is great for separating positive and negative charges, but not so great at conducting electricity, which is why the researchers paired it with graphene. Kapton tape, the electron-grabbing material of the U-TENG, was replaced with Teflon, a compound known for coating nonstick cooking pans.

To obtain graphene, the researchers exposed its parent compound, graphite, to a high frequency sound wave. The sound wave acted as a sort of knife, slicing the “deck of cards” that is graphite into layer after layer of graphene. This process, called sonication, is how CNI is able to scale up production of graphene to meet the research and development demands of the W-TENG and other nanomaterial inventions in development. After assembling the graphene-PLA fiber, the researchers pulled it into a 3-D printer and the W-TENG was born. The end result is a device that generates a maximum of 3,000 volts — enough to power 25 standard electrical outlets or, on a grander scale, smart-tinted windows or a liquid crystal display (LCD) monitor. Because the voltage is so high, the W-TENG generates an electric field around itself that can be sensed wirelessly. Its electrical energy, too, can be stored wirelessly in capacitors and batteries.

The W-TENG is 3-D printed out of a graphene-PLA nanofiber, creating the bottom electrode of the technology. A Teflon sheet is then added as the top electrode. “It cannot only give you energy, but you can use the electric field also as an actuated remote. For example, you can tap the W-TENG and use its electric field as a ‘button’ to open your garage door, or you could activate a security system — all (Continued on next page)
without a battery, passively and wirelessly,” said Sai Sunil Mallineni, the first author of the study and a Ph.D. student in physics and astronomy. The wireless applications of the W-TENG are abundant, extending into resource-limited settings, such as in outer space, the middle of the ocean or even the battlefield. As such, Podila says there is a definite philanthropic use for the team’s invention. “Several developing countries require a lot of energy, though we may not have access to batteries or power outlets in such settings,” Podila said. “The W-TENG could be one of the cleaner ways of generating energy in these areas.”

The team of researchers, again led by Mallineni, is in the process of patenting the W-TENG through the Clemson University Research Foundation. Professor Apparao Rao, director of the Clemson Nanomaterials Institute, is also in talks with industrial partners to begin integrating the W-TENG into energy applications.

However, before industrial production, Podila said more research is being done to replace Teflon with a more environmentally friendly, electronegative material. A contender for the redesign is MXene, a two-dimensional inorganic compound that has the conductivity of a transition metal and the water-loving nature of alcohols like propanol. Yongchang Dong, another graduate student at CNI, led the work on demonstrating the MXene-TENG, which was published in a November 2017 article in the journal Nano Energy. Herbert Behlow and Sriparna Bhattacharya from CNI also contributed to these studies. Will the W-TENG make an impact in the realm of alternative, renewable energies? Rao said it will come down to economics. “We can only take it so far as scientists; the economics need to work out in order for the W-TENG to be successful,” Rao said.

By Hannah Halusker, College of Science, February 5, 2018

A Step Closer to Personalized Medicine

Imagine the future of personalized medicine, when we will receive health care based on our individual DNA. Using the methods that are currently developed, your primary physician will assess your disease risk and work with you to prevent disease from happening and will offer you a personalized lifestyle plan. This sounds like a science fiction, but many researchers and clinicians are currently working very hard to provide the foundations for personalized medicine. The National Institutes of Health (NIH) is at the front line of health research and is the primary source for external funding for researchers conducting health-related investigations.

In January 2018, NIH awarded $2.27M grant to a team of researchers, Emil Alexov of Clemson University, and Andrew G. Clark and Haiyuan Yu of Cornell University. This team, led by Yu, hopes to contribute to the gigantic effort of making personalized medicine an available option for each of us.

The human body is a delicate, self-regulating machine, which can respond to its surroundings and internal needs. Such self-regulation involves various processes, ranging from processes on atomic and molecular

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level to processes occurring in organs and tissues. Despite such tremendous complexity, somehow all humans, broadly speaking, are quite similar. However, slight differences in DNA can lead to a multitude of other physical differences. Some of these differences are harmless, such as eye, hair, and skin color, while other differences may be disease-associated. Distinguishing between disease-causing (pathologic) and harmless (non-pathologic) DNA variants is crucial for the success of personalized medicine.

The culmination of the usefulness of the individual’s genomic data resides in personalized medicine. The basic concept of personalized medicine, (or sometimes called precision medicine) is a combination of a joint venture of personalized diagnostics, pharmacogenomics, and personalized preventive care. Overlooking ethical considerations associated with providing individuals with predictions about their long-term health, an early preventive treatment for plausible disease would have enormous effect on society and the individuals themselves. Preventive care can be divided into several categories: (a) preventive care for conditional diseases; (b) preventive care for developmental diseases; and (c) preventive care for an individual’s lifetime.

The most easily addressable preventive care is the care for individuals who may develop a disease which depends on certain environmental conditions. Obviously, avoiding these conditions will dramatically decrease the disease risk.

For example, chronic beryllium disease is a disorder found in some individuals being exposed to beryllium, in addition to having a particular genotype. If every individual applying for a job in a beryllium-rich environment were genotyped, and individuals possessing the risk genotype were notified of this risk and potential dangers, then this would be the best preventive care for people susceptible to this disease.

Other examples are the cases of individuals predisposed to lung or skin cancers. These individuals should avoid smoking or exposure to intense ultraviolet light, respectively. The list of examples can be extended to many other cases, but the message is that clear identification of individuals predisposed to diseases whose development depends on certain conditions would greatly decrease their reliance on medical treatment later on in life. In addition, in mental disorders the susceptibility profile of each individual depends on the psychosocial environment, and this should be taken into account in delivering the prognosis. Developmental diseases are typically quite severe, and, even if the patient survives, the effects are often permanent. Another important distinction between developmental diseases and other diseases is that once they are clinically manifested, it is typically too late for treatment. Due to the severity of these diseases, predicting an individual’s genetic predispositions must be done at a very early stage in his or her development and the appropriate treatment must be administered.

Finally, there are many diseases and conditions that require a lifetime of care. It is desirable that such cases are detected before the patient becomes sick. However, the preventive care in such a case, when the disease is still not manifested, will require quite different (from current) thinking from both the patient and the primary care physician. It may require decisions that will be difficult to justify without presence of the disease, and, in some cases, may result in the wrong treatment. The straightforward solution is to avoid radical interventions, but to subject these high-risk patients to constant monitoring and frequent examinations.

By Dr. Emil Alexov
Yunhui Peng, a Ph.D. student in Department of Physics and Astronomy, in Emil Alexov’s lab, was awarded a 2017 Chateaubriand Fellowship by the Embassy of France in the United States and is currently interning at the Inserm Institute in France.

This is very prestigious award, and this year no other institution in South Carolina has received it. Yunhui Peng competed with candidates from other top institutions in the United States and received a nine-month fellowship.

Peng will carry research in Dr. Maria Miteva’s laboratory “Therapeutic Molecules in silico (MTi)”. MTi is a combined unit of the University Paris Diderot and Unit 973 of the Inserm Institute, which is the French national health research institute. MTi comprises three teams working on the development of in silico approaches that assist the design of new therapeutic molecules and pharmacological probes. The goal of the lab is to develop novel in silico protocols and new algorithms to design “high quality” peptides and low molecular weight chemicals with timely applications essential for the areas of cancer, rare diseases and cardiovascular diseases.

Dr. Miteva is the head of the laboratory named “Virtual Screening and Rational Design of Protein-Protein Interaction Modulators with Balanced ADME-Tox Properties.” Her team focuses on development of innovative therapeutic molecules and pharmacological probes. The team conducts methodological developments associated with complex molecular mechanisms like ADME-Tox predictions and the modulation of protein-protein interactions with small molecules. This category of targets offers unique opportunities with approximately 500,000 protein-protein interactions critical for human life and the need to rationally explore new areas of chemical space comprising several billion compounds. The goal is to be able to develop small molecules up to early stage clinical trials. Many applications of innovative therapeutic targets are being studied with experimentalist partners in France and around the world. The team has several molecules in various stages of development, from the stages of in silico-in vitro studies to experimental evaluation using animal models on about ten therapeutic targets.

Yunhui Peng is a fourth-year Ph.D. student in professor Alexov’s Computational Biophysics and Bioinformatics lab. His current research is focused on understanding and mitigating the effects caused by disease-causing human DNA variants. His main research goals are to reveal molecular effects of known disease-causing missense mutations on wild-type properties of the corresponding protein (as stability, dynamics and interactions), to identify drug-like small molecules which binding to dysfunctional mutant protein reduce or completely eliminate disease-causing effects (restore wild type stability, dynamics and interactions), and to verify the predicted effects on the wild-type characteristics of the protein and the effects of small molecule binding.

Peng is progressing very well with his research and has published already eleven peer-reviewed papers, including five first-author papers. He has presented his research at various scientific meetings, including the Gordon Research Conference in 2016. Thus far, he has presented three posters, gave an invited talk at the annual meeting of the American Chemical Society in 2017 and chaired a session at the same meeting. This is much more than typically is expected from a fourth-year Ph.D. student. Well-done Yunhui Peng!
The AGU Fall Meeting is the most important meeting in Earth and space science worldwide and is attended by more than 24,000 scientists. The Outstanding Student Paper Awards (OSPAs) promote, recognize and reward undergraduate, Master’s and Ph.D. students for quality research. It is a great honor for young scientists at the beginning of their careers, and only the top 3 to 5% of presenters in each section or focus group is awarded an OSPA. More information about Komal’s research can be found on the “Atmospheric and Space Physics – Global Dynamics” at: http://globaldynamics.sites.clemson.edu/

**George Hamilton Receives Fellowship in Germany**

George Hamilton, a second-year graduate student physics and astronomy, has received a three-month fellowship to conduct research this summer at Heinrich Heine University-Düsseldorf in Germany. The research will strengthen the collaboration between Hugo Sanabria’s lab at Clemson University and Claus A. M. Seidel’s group at Heinrich Heine University (HHU). Sanabria, an assistant professor in physics and astronomy, is an HHU alumnus, and Hamilton is a member of Sanabria’s lab. While in Germany Hamilton will study the dynamics of PSD-95, a protein found in neural postsynaptic densities, which is a potential target for treatment of strokes.

“I feel incredibly honored and privileged to have received this award,” said Hamilton, a native of Raleigh, North Carolina. “I have always dreamed of traveling internationally, but have never had the chance. Now I have the opportunity to do just that for three whole months, while continuing research in a field I love. It feels like the summer can’t come soon enough.”

Hamilton’s research will lead to a joint publication that will help pave the way to facilitate additional research. In the long term, the collaboration will lead to jointly funded programs.

“I am happy for George to have such an opportunity. It is truly a complete package traveling abroad and doing state-of-the-art science,” said Sanabria, who is also a Clemson University School of Health Faculty Scholar. “Dr. Seidel is one of the pioneers in single-molecule spectroscopy and his group is well-known in the biophysics field.”

Adapted from article by Jim Melvin, College of Science, February 12, 2018
Debra Helvie, the “face” of our department and long-serving administrative assistant will retire on June 29, 2018, after nearly thirty-two years of service. Debbie will be greatly missed, but we wish her well in her retirement.

Members of the Clemson Physics and Astronomy Department faculty celebrate the end of the semester at Clemson’s famous watering hole, “Nick’s.” From left to right: Drs. Jian He, Jason Brown, Brad Meyer, Dick Manson, Terry Tritt, Rama Podila, Mark Leising, and Dieter Hartmann.

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