Clemson Team Returns to Poker Flat
Research Range for MTeX Mission

The Spring 2013 issue of Schrödinger’s Tiger described the Department’s participation in the newly awarded NASA sounding rocket experiment “MTeX,” led by the University of Alaska to study turbulence in the mesosphere-lower thermosphere region. During the holiday break of 2014/2015 I was fortunate enough to travel with Clemson co-investigator Dr. Gerald Lehmacher to Fairbanks for a one-week period to see firsthand the preparation for the launch of two sounding rockets with MTeX science payloads at the Poker Flat Research Range. With the launch window opening a week after our visit, we mainly oversaw the assembly of the payloads and prepared the CONE ionization gauge before it became inaccessible under the nosecone. The MTeX mission aimed to explore ways in which meteorological conditions can influence the impact of solar radiation received by the atmosphere.

With neutral density as a tracer, turbulence measurements during specific atmospheric conditions of a mesospheric inversion layer allow us to identify a representative distribution of turbulence activity and, thus, better characterize turbulent transport in the upper atmosphere between 60 and 120 km. Two rockets were launched on January 26, 2015 at 00:13 and 00:46 a.m. in order to obtain in situ measurements of turbulence, density and temperature. With the CONE ionization gauge, turbulence is identifiable as small oscillations of 0.1 to 1% in the observed ion current, which is proportional to density. The remaining instruments in the science package (positioned on the four deployable booms) measured aspects of atmospheric plasma using different forms of Langmuir probes, as well as an impedance probe. As a significantly cheaper and as yet unproven method of measuring turbulence and density variations, a three-axis MEMS accelerometer was included in the payload, the subject of my research for the past few semesters. The plasma and accelerometer experiments were built by Embry-Riddle Aeronautical University. Working with Dr. Lehmacher, the Sounding Rocket Instrumentation Creative Inquiry section has explored how we might be able to use the output of the sensitive accelerometer to provide a further means of measuring the atmospheric drag and density. With micro-g resolution and 5 kHz sampling rate, I have previously characterized the amount of noise present in the signal by spectral analysis on data from drop tests performed from the breezeway, as

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A Message from the Department Chair

As another academic year comes to a close, and I reflect on its successes, I am reminded of the remarkable people who come through Physics and Astronomy at Clemson. Our strength, and perhaps the only area in which we rival our strong peers, is in our students, staff, and faculty. Among the awards you’ll read about in this issue, we have another Goldwater Scholar among our majors, Emily Thompson. She is our eighth winner of this award in just over a decade. We have the Outstanding Graduate Researcher at Clemson University for the fourth consecutive year, Margot Petukh. Her advisor, Dr. Emil Alexov, won the Outstanding Achievement in the Sciences Award for his work in the biophysics of diseases. In my exit interviews with our graduates this spring, I was struck by the remarkable enthusiasm they have for their science and optimism for their futures.

Our instrument shop head, Lamar Durham, is retiring after thirty-eight years here. We took him for granted, expecting that of course he could design and build anything we might need, no matter how incomplete our ideas were of what we needed. He contributed so much to so many research projects. He is irreplaceable, but we plan to do our best to try.

Clemson University appears to be growing monotonically. We taught a record number of students in our courses this year, and I think we offer more advanced and more rigorous courses than we did two decades ago. I can compare directly the calculus-based physics course I taught this spring and twenty-three years ago. We are fortunate to have hired two new faculty members: Ramakrishna Podila, who studies nanomaterials and their interactions with biological systems, joined us in January, and Joshua Alper, who works in biophysics studying the mechanics of molecular motors, will join us in August. With new leadership at Clemson and much consideration of new directions for the university, we are optimistic. We are grateful for to our alumni and friends for your generosity in helping us to do things we could not otherwise, such as attracting top students and celebrating their successes. We hope to welcome you to campus and Physics and Astronomy soon.

Dr. Mark D. Leising, Chair
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well as at rest in the lab. With the rockets having recently flown we now have flight data and will use it to potentially verify some structures seen by CONE and later calculate drag coefficients of the rocket in flight. The observed accelerometer shows 35 seconds of in-flight measurements. During this period of time, the rocket is being configured for the upward leg science window of the flight. We first see a period of intense modulation from the rocket engine which tapers off as the second stage motor burns out. Then spin effects and precession of the rocket’s velocity vector are visible from 40 seconds to 50 seconds. At this point the nosecone is ejected from the payload. When the nosecone and its shroud clear all the instruments, it is pushed out of the same trajectory as the payload by ejecting a slug radially at high velocity. The despin stage then brings down the rotation rate to 2 Hz followed by booms deploying and payload separation in rapid succession. As final preparation for measurement, attitude control systems further adjust the spin rate and orientation.

Another part of my experience was the lidar which was also at Poker Flat. This technology was used to measure the telltale temperature structure indicative of a mesospheric inversion layer needed for launch. Using powerful pulsed solid-state and dye lasers, certain atmospheric constituents left from meteorite trails are excited and the resulting photons are collected or, (in case of a Rayleigh lidar), backscatter from nitrogen and oxygen is observed to determine counts and doppler shifts at heights from 40 km to over 100 km. With the Rayleigh lidar, a brilliant green beam was visible shooting into the atmosphere that was truly an amazing sight. The facility also operates an iron lidar, which requires an ultraviolet laser and is, thus,

The MTeX instrumentation comprises the CONE neutral density gauge and plasma instruments for observing electrons, ions, and meteoric dust particles. Credit: Gerald Lehmacher

invisible to the human eye. We stayed into the night to watch as a team of graduate students and Dr. Richard Collins, who is also the principal investigator of MTeX, calibrated and operated the system and obtained a temperature profile in preparation for the launch window.

Lastly we did indulge in a bit of tourist allure on our expedition to the final frontier. Heavily layered and armed with a rudimentary knowledge of photography, we stayed late into the night atop Ester Dome to watch the aurora. The hours of 10 p.m. to 2 a.m. were filled with spurts of activity in green from atomic oxygen, as well as periods of nothing more than a dull glow. After tweaking a few camera settings, we obtained some reasonably picturesque scenes of green ribbons decorating the sky. Then as we gave up for the night already quite content with the show, we were blown away by striking white and pink streaks which writhed and darted about at a rapid pace. These colors only show up as a combination of the same green and a red also produced by atomic oxygen at higher altitudes only visible during periods of high solar fluxes.

At right: Recovery site of one of the MTeX payloads. While descending, the payloads kept transmitting GPS positions via the Iridium satellite phone network for a easier location in very remote areas of central Alaska. Both payloads were safely recovered. Credit: NASA Article by Brandon Burkholder, Graduating Senior 2015
At right is a picture of a very young Robert “Bo” Jeanes as a physics student at Presbyterian College, Class of 1960. He is featured in a Presbyterian College publication, alongside Dr. Neil Whitelaw. Bo worked at Clemson (much of that time as a Lab Coordinator) from 1966 until his retirement in 2001.

Former student Rob Hammett recollects that his office was on the third floor directly across from the water fountain. “If you needed any equipment for your experiment, Bo was your ‘go to guy’ in the department. Even if it was something as small as a 10 ohm resistor, you could almost guarantee that Bo would have one or know someone on campus that had one on hand. His office mainly consisted of book cases that housed demonstrations for the introductory physics courses. This ranged from old tesla coils to old videos of Richard Feynman lecturing at Caltech. For some strange reason, he even had a VHS copy of “Star Trek: Wrath of Khan” in his collection. It was rare to catch him in his office during the day. He was always on the go seeing to projects such as lab equipment repair and gave us various jobs to do while he attended to other things. Once, he gave us the task of rewiring and installing digital meters on the lab tables on the second floor. Bo would tell you what he expected then give you room to work. He never hurried us but he always checked our work at the end of each day to make sure it was satisfactory. Wherever Bo is now, I hope he is happy and enjoying retirement.”

**Clemson Researcher Explores the Night Sky in *Scientific American***

“The night sky may look dark; however, it is filled with photons that are produced by star formation processes and accreting black holes over the history of the Universe,” says Dr. Alberto Dominguez, a post-doctoral researcher in Clemson’s Department of Physics and Astronomy. “This diffuse background of photons is known as the extragalactic background light (EBL).”

“Our *Scientific American* article describes different methodologies to measure the EBL from galaxy data taken by deep surveys to the observation of super massive black holes in gamma-ray energies, both from space and ground instruments. Interestingly, independent techniques are converging and allowing us to decode the galaxy evolution and cosmological information imprinted in the EBL, letting us learn about our Universe.”

Dominguez, along with Dr. Joel E. Primack of the University of California at Santa Cruz, and Trudy E. Bell, author and former scientific journal editor, have team-authored the article on extragalactic background light, which is scheduled to appear in the June issue of *Scientific American*.

Clemson is Dominguez’s second postdoctoral appointment, where he works on galaxy evolution and high-energy astrophysics. He received his Ph.D. in astrophysics in May 2011 from the University of Seville, although he spent time at the University of California at Santa Cruz working with Primack. Later, he accepted a postdoc at the University of California Riverside, before coming to Clemson.
It is said that the excitement of learning separates youth from old age, and that we stay young as long as we are learning. A true testament to this statement was the recent “Nanotechnology Day,” co-hosted by the Clemson Nanomaterials Center (CNC) and the Roper Mountain Science Center (RMSC) in Greenville, South Carolina. On March 14, 2015, “Pi Day,” as it is called (for its similarity to the ubiquitous irrational number $\pi$), attracted about 800 visitors aged 7 to 70 years, who attended the Nanotechnology Day event despite the pouring rain. While it was raining outside, it was enthusiasm and curiosity that was pouring inside the RMSC. The enthusiasm of kids and senior citizens alike reaffirmed the fact that no matter how old you are, learning about things at the nanoscale is definitely fun.

To captivate the enthusiasm and unleash the imagination of its young visitors, CNC brought its nanolab to the doorstep and illustrated intriguing physics phenomena through simple experiments. Some such activities included: the art of levitation, which demonstrated a floating piece of graphene on magnets, (much like the magic carpet of the Arabian nights); the extraction of graphene from graphite in pencil that won the Nobel prize (pencil to Nobel); and, the magic of ferro fluids, the power of nano-sponges, the nano-movers and shakers (nano diving-board like cantilevers), just to name a few. Other nano activities using the RMSC’s Network Nano Days Physical Kit from the Nanoscale Informal Science Education (NISE) grant were also included. The audience was awed by the possibility of delivering nanomedicine and storing energy using nanomaterials. Indeed, many of them truly learned, despite its size, that nanotechnology is no small thing. “It was a really fun and exciting experience to teach kids about nanoscience,” remarked Dr. Sriparna Bhattacharya, Research Assistant Professor at CNC, “I believe learning went both ways. We learned as much as they did.”

Anthony Childress, a Physics and Astronomy graduate student, and a member of CNC, presented “The Magic of Nanomaterials,” a thirty-minute talk where he introduced the interesting physical phenomena at the nano-level. The audience, which included both kids and seniors, was thrilled and asked him many interesting questions. He concluded his talk with a live demonstration of making nanosweets (nanocarbons from sugar and drain cleaner) that undoubtedly piqued the interest of everyone. “Clemson is being recognized as an international center of excellence for nanomanufacturing,” said Dr. Apparao M. Rao, Director of CNC, “One of our goals is to convey the excitement of cutting-edge research developed at CNC to K-12 and undergraduate students through programs such as the Nanotechnology Day.”

“We intend to develop a larger workforce in South Carolina and the nation,” explained Dr. Ramakrishna Podila, Assistant Professor of Physics at Clemson. “We want to train the next generation scientist to solve future challenges in the fields of energy and biomedicine through innovations in nanoscience.”
This year’s department and College of Engineering and Science (CoES) physics student awards ceremony was held on Friday, April 3rd in Kinard Lab, followed by a small reception outside in the courtyard. Our outstanding students are winning honors and recognition again. In addition to department and college-level awards, the Society of Physics Students gave its SPS Senior Award.

Society of Physics Students Senior Award - - 
Kristyn Brandenburg
Kristyn is from Goose Creek, SC and has done research with Dr. Endre Takacs for the past two years.

L.D. Huff Sophomore Award - - Jacob Covington
Jacob began at Clemson in 2013. Last year, he was the recipient of the Henry B. Odom Scholarship.

L.D. Huff Junior Award - - Jaclyn Schmitt
The recipient is Jaclyn Schmitt from Greenville, SC. Jaclyn joined Clemson in 2012. She received the L.D. Huff Sophomore Award last year and does atomic, molecular and optical physics research with Dr. Joan Marler.

Samantha Erin Cawthorne 2010 Award - - Rachel Andorfer
From Greer, SC, Rachel joined Clemson in 2011. Her research interests are in experimental biophysics.

The Outstanding Graduate Teaching Assistant Award - - Ethan Kilgore
Ethan Kilgore of Paint Lick, Kentucky, has displayed extraordinary effectiveness in supporting teaching and learning within the department.

The Outstanding Graduate Researcher Award - - Jingyi Zhu
The recipient is Jingyi Zhu. A native of Nanjing China, Jingyi received a B.S. and M.S. from Lanzhou University, before joining Clemson in 2011.

CoES Graduate Research Assistant and University Graduate winner - - Marharyta Petukh
Marharyta got her B.S. and M.S. from Belarus State University, before coming to Clemson in 2011. Her work in biophysical modeling resulted in an impressive eighteen peer-reviewed publications. Margo will graduate in August and plans to do a postdoc with a long-term career goal in the biophysics branches of the military, or as faculty at a research university.

CoES Junior Researcher and Goldwater Fellow - - Emily Thompson
Emily is from Rochester, NY, and started Clemson in 2012. She is interested in gravitational waves and high energy physics. The Barry M. Goldwater Scholarship was established by the United States Congress in 1986 and is the most prestigious undergraduate award given in the sciences, math, and engineering.
Majorana Fermions in Topological Ferromagnetic Nanowires
Eugene Dumitrescu, Brenden Roberts, Sumanta Tewari, Jay D. Sau, S. Das Sarma;

By Sumanta Tewari, Ph.D.

Fermions are half-integer particles which, along with bosons, make up all the matter in our Universe. To date, all fermions have anti-particle partners with an opposite charge, e.g., electrons and positrons. In 1937, the brilliant Italian physicist Ettore Majorana proposed a new class of charge-neutral fermions which are their own antiparticles. Despite Majorana’s mysterious disappearance at sea in 1938, physicists have searched for evidence of Majorana fermions ever since, with most research being in the context of neutrino physics. In an unexpected twist, Majorana fermions have recently been proposed to exist as emergent quasiparticle excitations in a class of materials known as topological superconductors. These Majorana fermions, which can be viewed as collective modes in the sea of billions of superconducting electrons at temperatures close to absolute zero, appear in highly entangled pairs. Due to their non-locality and strong entanglement, Majorana fermions can even be used to execute completely fault-tolerant quantum logic gates by physically braiding them around one another.

After a series of papers in which my graduate student Eugene Dumitrescu and I studied the symmetric and topological properties of one-dimensional magnetic topological superconductors, (motivated by a remarkable set of recent experiments performed in Princeton on chains of magnetic atoms on a superconductor), in this work, we, along with Clemson undergraduate Brenden Roberts and collaborators from the University of Maryland, College Park, show that a multichannel ferromagnetic wire deposited on a spin-orbit coupled superconducting substrate can realize a non-trivial chiral topological superconducting state with Majorana fermions localized at the wire ends. The non-trivial topological state occurs for generic parameters requiring no fine tuning, at least for large ferromagnetic moments in the wire. We theoretically obtain the signatures of Majorana fermions which appear in the presence of an arbitrary number of Majoranas in multi-wire systems incorporating the role of finite temperature, finite potential barrier at scanning tunneling microscope (STM) tip, and finite wire length. These signatures are presented in terms of spatial profiles of STM differential conductance, which clearly reveal zero energy Majorana end modes and the prediction of a multiple Majorana-based fractional Josephson effect. A substantial part of this work is devoted to a detailed critical comparison between our theory and the Princeton experiments which claim the observation of Majorana fermions in ferromagnetic atomic chains on a superconductor. The results are easily generalizable and can be applied, after suitable modifications, to cold atomic systems, as well.

At left: Schematic experimental set up, ferromagnetic Iron (Fe) atom chains deposited on Lead (Pb) superconductor, to realize MFs. The set up can be modified to make it realizable also using cold atoms.

At right: STM differential conductance as a function of applied voltage V along the length of the ferromagnetic chain (x). Zero bias conductance, indicating existence of MFs, is localized near the end of the wire, as the Majorana bound states decay in the bulk. Right: Same as left, but at a higher temperature, which is still smaller than the topological superconducting gap. Majorana fermions are localized near the wire ends.
On Friday April 10, I was invited to participate in the TedX Greenville lecture series, where I delivered a talk called “Listen to Your Genes” (https://www.youtube.com/watch?v=BY7ZziM28UQ). The purpose of this talk was to highlight the ways in which we can take our understanding of our unique genetic markers and apply that knowledge to making better informed decisions about our lives and personal health.

One point that I emphasize is the uniqueness of each of us. We are all different from each other, and this is good. We have our strengths and weaknesses — different disease risks, different talents and different capabilities. The role of DNA variations on these individual differences and how these genetic variations are interpreted (without interpretation the DNA sequence is useless) is tremendously important. Such DNA analysis should be taken in the early stage of a person’s life, not after he or she gets sick. Genetic information can be used to make lifestyle decisions. For instance, some DNA defects (for now) do not have cures, but the effects of many others can be avoided if the individual is informed ahead of the time. In the end, humans are very complicated biological machineries and not everything depends on our DNA: many things still are up to us.

I participated in “Personal Genome Project” (https://my.pgp-hms.org/) and in September 20, 2014 went to Boston to give a blood sample for my DNA to be sequenced. When the results are fully developed, I will make them publicly available and will use them for my teaching at Clemson (I teach a course on human genetic variations). Most importantly, I will use the interpretation of my genetic signature to make lifestyle decisions.

DNA sequencing is important for people who already ill and for their families, in order to figure out the best treatment possible and to prompt regular screening for the family members who may develop the same disease (as I outlined in the talks of Bolick (TEF Greenville 2013) and Resnick (TED Boston 2011)). While this is very important and paves the way for personalized medicine and personalized diagnostics, I would like to go a step further: everyone (who is interested) should have their DNA sequenced and genetic variations interpreted. I would like to be aware of my disease risk before I get sick. I would like to know my genetic predisposition even for diseases not seen previously in my family.

DNA sequencing and variant interpretation is beneficial not only for assessing disease risk. Human DNA variants are associated with various human capabilities. For example, people having a DNA defect in the myostatin gene develop extra muscles and carry practically no body fat. Thus, if I am provided with interpretation of my DNA variants, I will be able to make decisions about my professional goals: (a) perhaps if I have myostatin gene defect, I will choose a profession requiring physical strength for example; (b) if I have defect in DR2 gene I will not seek employment in ceramic industry, since defects in DR2 are associated with high risk of developing beryllium disease (see http://www.ncbi.nlm.nih.gov/pubmed/25369028). On a similar note, genetics can inform lifestyle decisions. If my DNA variants are properly interpreted and I am told that I have high risk of developing allergy, I will be able to make an educated decision
where to live and how to adjust my lifestyle to avoid the risks. The emphasis is again on making decisions before one gets sick.

Why do people like the I-Phone so much (or any other I-something)? In part it’s because we have the feeling that our phone is designed just for us - my I-phone is different from yours. The same is valid for anything else. Each individual is different from others. Even identical twins are not totally identical and may have completely different lifestyles. Because of these lifestyle differences DNA variation interpretation cannot entirely be based solely on comparison. It will always be useful to accumulate genetic data on diseases, but this will never be complete. Instead, de-novo DNA variant interpretation should be the primary tool. As mentioned in the literature the current situation is: $1,000 for DNA sequencing and $1,000,000 for interpretation.

What about discovering your hidden talents? Many individuals have talents that will never be discovered. One can hire the best teachers to teach a child to play on piano, but if the child does not have the talent, it will not work. You can coach me to be an Olympic swimmer (I tried many times), but it won’t work simply because I do not have the “right” genes. Imagine if DNA variant interpretation is accurate and accessible to everyone, then the contribution to the society will be tremendous.

While waiting for the results of whole genome sequencing, I also submitted my sample to 23andMe (23andme.com) to have some initial idea about my predisposition to known diseases. It took less than four weeks for the results to come in, and, using a third party service, I got my first rough interpretation of my DNA. I was relieved to see that I do not have any DNA variant strongly associated with disease, including no elevated risk of stroke, heart attack and cancer. From an academic standpoint I was pleased to learn that I have DNA variant, rs1800497(C;C), which makes me “learns from mistakes more easily” and another DNA variant, rs4680(A;A), which gives me an “advantage in memory and attention tasks.”

Furthermore, I have a DNA variation, rs17070145(C;T), which is interpreted as a tendency for “increased memory performance.” With this good news, I am looking forward to successful teaching and research without making much effort!

Young students came to Clemson on March 19th to participate in the Math Kangaroo competition sponsored by Physics and Astronomy. This competition, which was held at the Madren Center, was featured in last semester’s newsletter. It draws 1st through 12th grade students from a five-county wide area for a competition in math skills. This event is being hosted every year by the Department and is coordinated by Dr. Jason Brown. For information on this coming year’s competition, please email brown6@clemson.edu.
From left to right: Dr. Joaquin Guerra, Vice Chancellor for International Affairs for Tecnológico de Monterrey, Didier Rousseliere, Rodrigo Martinez, and Hugo Sanabria, visitors from Clemson, seek common areas in which to collaborate.

The goal of a Clemson University visit to the Tecnológico de Monterrey in Monterrey Mexico in April was to formalize an academic exchange program and to investigate areas in which both institutions share common goals.

Didier Rousseliere, Director of Global Partnerships and Initiatives at Clemson, Dr. Rodrigo Martinez, professor in the Department of Mechanical Engineering and Dr. Hugo Sanabria, professor in Physics and Astronomy met with representatives of Monterrey to establish a new academic exchange program.

“We are very pleased to be able to initiate a joint collaboration, understanding that we have many areas in common, and I can see the potential of what we are going to develop. We want to collaborate with Tec de Monterrey and, at the same time, we are discussing a number of areas in which we would like to work together: one is related to engineering, such as physics, mechanical engineering, automotive engineering and probably in the future other areas will be considered,” Rousseliere declared. Exchange programs for students, as well as visiting professors and research projects, are some of the areas in which the first steps of the collaboration will be focused, the director of the Clemson program emphasized.

One important factor in establishing this relationship is that professors Martinez and Sanabria are both graduates of Tecnológico de Monterrey and have conducted collaborative research with the university within each of their respective disciplines.

“We see many similarities between our institutions, and I believe there is much potential to generate collaborative projects between the two countries and translate those into student programs, professor exchanges and industry collaboration,” Rodrigo Martinez said.

As part of the visit, the Clemson committee met with Associate Vice-Chancellor for International Affairs, Dr. Joaquin Guerra, as well as professors in Automotive Design, the Cervantina Library, and the Center for Biotechnology. Accompanying the visit was David Huerta, Director of the International Liaison Office for Yale University.

Dr. Mark Leising, Chair of the Physics and Astronomy Department, notes that this exchange program, which was approved by the College of Engineering and Science, will allow students of physics and mechanical engineering from each university to attend the other for equivalent credit at their home institution and will be a “win-win” for both Clemson and Tec.

(Translated and adapted from panorama.mty@itesm.mx)
Dr. Brad Meyer Collaborates with International Team to Gain Insights into the Astrophysical Production of Nature’s Heaviest Elements

We have known since the mid 1950s that about one half of the naturally occurring elements heavier than iron were synthesized in a rapid neutron-capture nucleosynthesis process (known as the r process) of nucleosynthesis. The exact astrophysical setting in which the r process occurs, however, is still unknown. The most likely settings are either the explosion of a massive star or the tidal disruption of one of a binary neutron star pair as it spirals into its companion.

One of the crucial factors that limits our determination of the r-process site is the fact that the nuclei involved are extremely neutron-rich. This means that their properties are difficult to measure and typically must be extrapolated from known nuclei using theoretical nuclear models. Thus, when the results of nucleosynthesis models disagree with the solar system abundance distribution, it is not clear whether the problem is with the astrophysical model or with the input nuclear physics extrapolations.

Recently, an international team of investigators, from Japan, the U.K., the U.S., Spain, France, Korea, China, Hungary, Italy, Germany, Australia, and Belgium, including Dr. Bradley S. Meyer of Clemson, has made a major step in reducing the nuclear physics uncertainties and thereby improving the reliability of r-process calculations. The team collided fast uranium nuclei with beryllium targets at the Radioactive Ion Beam Facility at RIKEN in Wako-shi, Japan. This allowed them to produce and measure the lifetimes of 110 key isotopes involved in the r process.

The team then studied the implications of the new measurements for nucleosynthesis using Dr. Meyer’s open-source nuclear reaction network tools (http://sourceforge.net/p/nucnet-tools). The results showed that the new lifetimes alleviated the underproduction of isotopes just below and above the mass number 130 peak, which has been a problem in r-process calculations for over two decades. The team was also able to confirm that the nuclei in the mass 130 region were probably produced in a neutron capture/photodisintegration equilibrium, which may favor a massive-star explosion origin for these species. Their results were published in May 2015 in Physical Review Letters.

New measurements of the properties of even more exotic nuclei will soon be underway in Japan, Germany, and at the Facility for Radioactive Ion Beams under construction at Michigan State University. Meyer looks forward to using his codes to explore the implications of these upcoming measurements for r-process nucleosynthesis.

At left: Comparison between the r-process solar-system abundance pattern and the abundances calculated (a) without and (b) with the new half-lives. In both calculations, input mass from the KTUY mass model and reaction rates from the ReaclibV1 library. The half-lives, other than the new ones, are from the FRDM+QRPA model. Copyright © 2015 American Physical Society
Department News

Tianhong Yu, former graduate student of Dr. Bradley S. Meyer, got married in March to Ling Gao in a ceremony in Houston. After graduating with his Ph.D. in physics from Clemson, Tianhong moved to Houston, where he works as a seismic imager for CGG Service Inc.

Dr. Emil Alexov was appointed in March as a professor in the Clemson University School of Health Research (CUSHR). CUSHR is an inter-disciplinary unit of Clemson University established to facilitate health-related research and scholarship.

Lamar Durham has retired from the Physics Instrumentation Shop. Lamar has been working in the Physics and Astronomy Department since 1977. The Shop designs and builds experiments and instrumentation for department-sponsored research. We wish Lamar well on his retirement!

Dr. Joshua Alper has been hired as a new biophysics professor and is scheduled to join the Department this fall. Alper comes to Clemson from Yale Medical School, where he recently completed a postdoctoral appointment.

Dr. Ramakrishna Podila was hired by the Department as an assistant professor. He completed his Ph.D. at Clemson in nanotechnology and biophysics and was appointed as a postdoctoral researcher at East Carolina University before returning to Clemson.

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