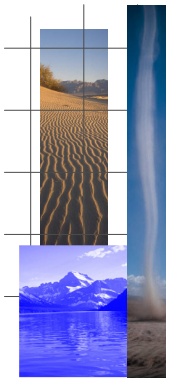


# Schrödinger's Tiger

*The Clemson University Physics and Astronomy Newsletter*

Spring 2012

Volume 7, Issue 1

## Clemson Students Score Big Successes

In This Issue:



Physics and Astronomy held its annual luncheon to recognize exceptional students within the Department on Friday, April 20th in Kinard Hall, followed the next day by the ceremony for student awards through the College of Engineering and Science. Both events were attended by student winners, parents and other family members, and their advising faculty member(s). Interim Department Chair **Dr. Mark Leising** oversaw the department awards ceremony, and Interim **Dean Larry Dooley** presided over the CoES event. The following students received awards for their outstanding academic record: *Goldwater Scholarship* - Marc Andre Schaeuble; *CoES Outstanding Graduate Research Assistant*–Priyanka Bhattacharya; *CoES Senior in Science Award*–Ryan Schurr; *Henry Odom Scholarship for* 2011: Yamil Ruiz and Ryan Caracciolo (not pictured); "*Samantha Erin Cawthorne '10" Award for 2011/12:* Kristyn Brandenburg; *P&A Graduate Teaching Award:* Shawn Witham; Marc Andre Schaeuble and Catherine Matulis *L.D. Huff Junior Award*; Andrew Hanson: *L.D Huff Sophomore Award*; Matthew Daniels: *Sigma Pi Sigma Senior Award.* Congratulations go out to all!

**Interim Dean for CoES, Larry Dooley, presents Ryan Schurr with his *Senior in Science* Award**

**Left to right: Shawn Witham, Matthew Daniels, Kristyn Brandenburg, Catherine Matulis, Andrew Hanson, Marc Andre Schaeuble, and Dr. Mark Leising**

**A Message from the Interim Chair**

It has been a very successful spring and academic year for Clemson Physics & Astronomy. An excellent group of graduates has just crossed the stage into their new lives. Several of our B.S. students also graduated from the Calhoun Honors College, and our students garner a disproportionate number of awards and honors. Ryan Schurr was named the Outstanding Senior in the Sciences in the College of Engineering and Science. Matthew Daniels was selected Outstanding Senior by his peers in Sigma Pi Sigma. Marc Schaeuble, a rising senior physics major, is one of Clemson's two new Goldwater Scholars. Our physics majors are off to interesting sites this summer for Research Experiences for Undergraduates and other programs, including some, of course, who stay here for research. Ph.D. student Priyanka Bhattacharya has been honored as Outstanding Graduate Researcher by CoES, and will be awarded the University's Outstanding Graduate Researcher award at the August commencement ceremony. Our faculty has also had another year of great accomplishments. Emil Alexov and Catalina Marinescu were both deservedly promoted to the rank of Full Professor. Apparao Rao was honored with the Clemson University Alumni Award for Outstanding Achievement in Research, and the College recognized Pu-Chun Ke with the Faculty Award for Achievement in the Sciences. Miguel Larsen and his group took their ATREX experiment to Wallops Island, where NASA launched the payloads on five rockets eighty seconds apart in succession. All launches and releases went smoothly. Spring is exciting because it is our prime season for recruiting new physics talent. Applications and enrollments for our bachelors program are not up over previous years, unlike Clemson's, in general. Nonetheless, we have a very talented freshman class. As a group they are arguably the strongest of those in any major in the university. Many new graduate students number among our top applicants. This recruiting is aided by new contributions for fellowships from family and friends of our late friend, Mr. Charles Curry. During a recent faculty search we had many applications from talented physicists, and the decisions were tough. Hiring is still being finalized at this writing, but we expect great new energy arriving in Kinard Lab this fall with our new colleagues. Physics & Astronomy has good forward momentum, and we expect great things in the coming year.

**Dr. Mark D. Leising, Interim Chair**
**Department of Physics and Astronomy**
**Voice: (864) 656-3416/email: lmark@clemson.edu**

## 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 the1986 Internal Revenue 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 use the enclosed envelope or 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: **http://www.clemson.edu/giving/how/** 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.

# Sabbatical Research at Jicamarca Radio Observatory in Peru

*By Dr. Gerald Lehmacher*


**From left to right: Dr. Gerald Lehmacher, wife Eunice, and sons Devin and Connor (seated)**

The motivation and purpose of my sabbatical was to conduct several unique experiments with the High Power Large Area (HPLA) radar at Jicamarca Radio Observatory (JRO) near Lima, Peru. JRO operates the most sensitive 50-MHz VHF radar in the world for observing turbulent mesospheric echoes with 2 MW peak power and an antenna area of over 20 acres. I have been using this radar since 2002, including as a NSF-funded principal investigator, in collaboration with **Dr. Erhan Kudeki** at the University of Illinois, resulting in a series of publications and dissertations. These results stimulated the idea to conduct various other experiments and become even more involved in experiment design, operational aspects, and data processing. This is best done when directly working at the radar with the Jicamarca engineers and technicians. The research visit was approved and supported by **Jorge (Koki) Chau**, Director of JRO, and, at the beginning of 2011, I moved to live in an apartment in Lima for eight months. My family joined me from February through July.

Each experiment requires about one week in the operational schedule. The first experiment in March was designed to study small-scale gravity waves across different regions in the mesosphere and lower thermosphere, in regions where coherent backscatter is received. These are the daytime D region (50-85 km), the electrojet region (85-130 km, day and night), and the daytime upper E region (140-200 km). The new set-up included additional pulses to correctly resolve electrojet echoes. In April, I used the main radar and the smaller SOUSY VHF (53.5 MHz) radar to simultaneously study mesospheric echoes with two separate radars with distinct powers and beam widths. In May, I used the big radar in an imaging configuration. The four antenna quarters were used to receive backscattering from the mesosphere at four different angles. The cross-spectra between different quarters may reveal inhomogeneities within the illuminated volume, caused by intermittent turbulence or by aspect-sensitive scatterers. August was devoted to changing the 256 Yagi antennas of the SOUSY array to point 15 degrees towards the south, for another proposed experiment. Every antenna has to be phased correctly to combine into a narrow beam. The data are being analyzed at Clemson and Illinois and provide ample material for graduate and undergraduate research.

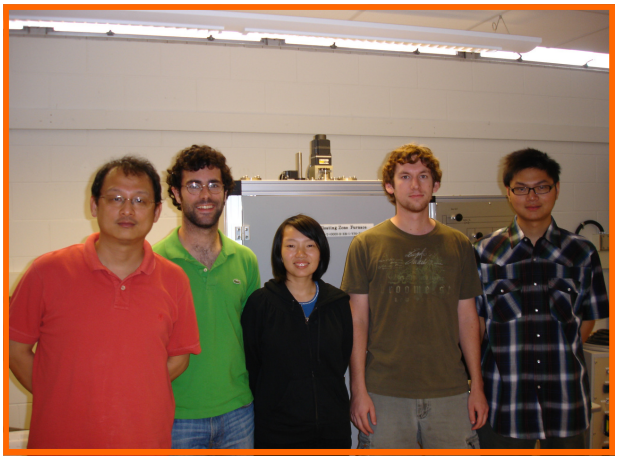
One of the unique experiences of spending eight months in Peru was the immersion in a different language and culture. The previous semester I had taken a basic Spanish language course at Clemson. However, it became clear on the first day in Lima that a working knowledge of Spanish was really necessary. I attended classes at a private language school in Lima and my colleagues at Jicamarca were happy to practice with me: both their English and my Spanish. The benefits and challenges applied also to my family. My children attended sixth and ninth grade at Colegio Alexander von Humboldt, a private school with instruction in German and Spanish, and my wife volunteered at a mission project in one of the poorer neighborhoods. We enjoyed living and traveling in a beautiful tropical country, visiting the ocean, deserts, mountains, and rainforest, and making new friends, Peruvians and "gringos" from around the world.

## *Alumnus - Postdoctoral Training Hits High Note at UCLA*

**Dr. Sijie Lin**, a former graduate student of **Dr. Pu-Chun Ke** from 2005 to 2010, is now a postdoctoral fellow of **Dr. Andre Nel**, a world-renowned immunologist and director of the NSF Center for Environmental Implications of Nanotechnology (CEIN) at UCLA. Sijie's research at CEIN utilizes zebra fish as a model vertebrate for investigating biological responses to metal oxides and carbon nanomaterials, an extension to his Ph.D. training at Clemson. In addition to ten papers published at Clemson (including a 2007 paper with over 125 citations and a 2009 paper with over 50 citations), Sijie has authored five journal papers at CEIN. An avid collector of Nike shoes and an agile basketball point guard, Sijie's dream is to become a professor after his postdoctoral training ends in 2013. Sije has recently been nominated for the 2012 UCLA Chancellor's Postdoctoral Research Award.

**Dr. Sijie Lin (second from right) with Dr. Paul Weiss (far left), editor-in-chief of the premier journal of *ACS Nano*, Dr. Tian Xia of CEIN (second from left), and Rep. Nancy Pelosi , former Speaker of the House.**

**Deepika Saini** (pictured at right), a graduate student of **Dr. Aparao Rao,** won the competition held by the Clemson Chapter of the Materials Research Society during its 7th Annual Materials and Optics Research Poster Session. Deepika's research focuses on nano/micro electromechanical systems, in order to study the mechanical and sensing properties of nanomaterials that are synthesized in Dr. Rao's lab.



**Isaac Bredeson, (second from right) with his research group and Dr. Jian He (far left)**

## Isaac Bredeson Becomes Chancellor Fellow at the University of Tennessee

**Isaac Bredeson** is a senior in physics and has been working with **Dr. Jian He** of Clemson for more than three years. He recently won a Chancellor's Fellowship for his Ph.D. study at the University of Tennessee. The fellowship includes a generous annual stipend, health insurance coverage, and a tuition waiver for four years. His Ph.D. research will be focused on energy-related functional materials, especially battery materials. The research will be conducted at the University of Tennessee and Oak Ridge National Laboratories in Knoxville. Isaac is listed as co-author in the *Physical Review B* and *Physical Review Letters* for his contribution in growing single crystalline complex transition metal oxide samples. In addition, he participated in several neutron-scattering beam line experiments at ISIS, England and NIST with Dr. He's colleague, **Dr. Hye-jung Kang**.

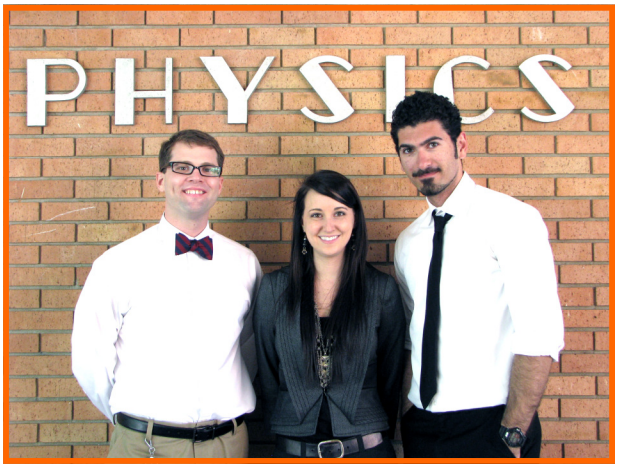
## Priyanka Bhattacharya Wins Distinguished Postdoctoral Fellowship and CoES and 2012 Clemson Graduate Researcher Awards

**Priyanka Bhattacharya**

**Priyanka Bhattacharya**, a graduate student of **Dr. Pu-Chun Ke**, is a recipient of the Linus Pauling Distinguished Postdoctoral Fellowship with Pacific Northwestern National Labs (PNNL). This fellowship is awarded annually to two young scientists who will "push the boundaries of science to world-recognized discoveries." Priyanka was selected from a pool of over 150 applicants after three rounds of screening that included a proposal evaluation, a panel telephone and on-site interviews. This three-year fellowship (the first time awarded to an experimentalist) will allow Priyanka to continue her research centered on understanding the physics and chemistry of dendritic polymer-contaminant interaction for environmental remediation. Growing up at the foothills of Mount Everest with an engineer father and a psychologist mother, Priyanka has long dreamed to use science to positively impact people in both the developing and developed world. Priyanka earned a Masters degree from the prestigious Indian Institute of Technology and has published extensively in the fields of physical chemistry and physics here at Clemson. She was a COMSET fellow in 2008, winner of the 2012 College of Engineering and Science (CoES) Outstanding Graduate Researcher Award, winner of the 2012 Clemson Graduate Researcher Award (for which she will receive a cash prize and a medallion at the Clemson August graduation ceremony), winner of four presentation awards at international conferences, and a trained performer of Indian classical music. Priyanka will begin her appointment with PNNL on October 1st, upon completion of her Ph.D. at Clemson in August of this year.

## Clemson Team Makes it to Final Round in ACC Clean Energy Challenge

Clemson University teams recently participated in the $100K ACC Clean Energy Challenge, supported by the Department of Energy's Office of Energy Efficiency and Renewable Energy. Student-lead teams submitted business plans with commercial potential in the clean energy space, including projects related to renewable energy, energy efficiency improvements and advanced fuels/vehicles. The winning Clemson University team submitted its project, called "AMAT," a proposal to improve the efficiency of thermoelectric materials for zonal cooling applications, and advanced to the final round in April at the University of Maryland. Although, they didn't win the grand prize, they submitted an excellent proposal under the direction of **Dr. Terry Tritt** of Physics and Astronomy. Congratulations on a great job!




**Left to right: Daniel Thompson, Physics and Astronomy; Jennifer Graff and Arash Mehdizadeh, both from Materials Science and Engineering**

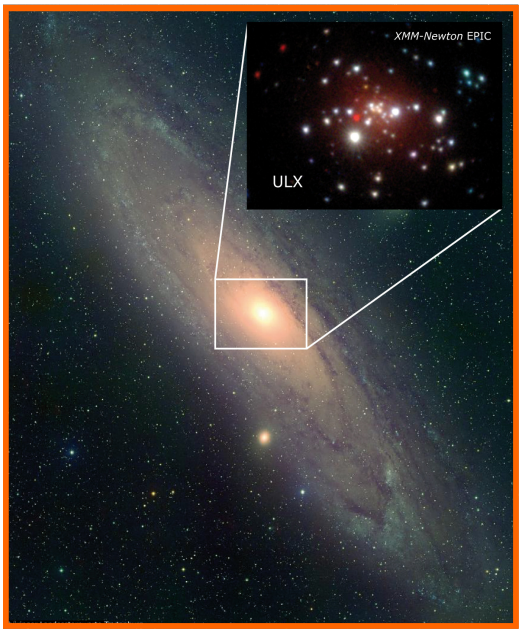
# Astrophysicists from Clemson and Europe Unmask a Black Hole

A study of X-rays emitted a long time ago in a galaxy far, far away has unmasked a stellar mass black hole in Andromeda, a spiral galaxy about 2.6 million light-years from Earth.

Two Clemson University researchers joined an international team of astronomers, including scientists at Germany's Max Planck Institute for Extraterrestrial Physics, in publishing their findings in a pair of scientific journals this week.

Scientists had suspected the black hole was possible since late 2009, when an X-ray satellite observatory operated by the Max Planck Institute detected an unusual X-ray transient light source in Andromeda.

"The brightness suggested that these X-rays belonged to the class of ultraluminous X-ray sources, or ULXs,"




**This image shows the central region of the Andromeda galaxy in X-rays, where the newly discovered ULX outshines all other sources. Image: Landessternwarte Tautenburg, XMM-Newton, MPE**

said **Amanpreet Kaur**, a Clemson graduate student in physics and lead author of the paper published in the *Astronomy & Astrophysics Journal*. "But ULXs are rare. There are none at all in the Milky Way where Earth is located, and this is the first to be confirmed in Andromeda. Proving it required detailed observations." Because ULX sources are rare – usually with just one or two in a galaxy, if they are present at all – there was very little data with which astronomers could make conjectures.

"There were two competing explanations for their high luminosities," said Clemson physics professor **Dieter Hartmann**, Kaur's mentor and a co-author of the paper. "Either a stellar mass black holes was accreting at extreme rates or there was a new sub-species of intermediate mass black holes accreting at lower rates. One of the greatest difficulties in attempting to find the right answer is the large distance to these objects, which makes detailed observations difficult or even impossible." Working with scientists in Germany and Spain, the Clemson researchers studied data from the Chandra observatory and proved that the X-ray source was a stellar mass black hole that is swallowing material at very high rates. Follow-up observations with the Swift and HST satellites yielded important complementary data, proving that it is not only the first ULX in Andromeda but also the closest ULX ever observed. Despite its great distance away, Andromeda is actually the nearest major galactic neighbor to our own Milky Way.

"We were very lucky that we caught the ULX early enough to see most of its light curve, which showed a very similar behavior to other X-ray sources from our own galaxy,[2] said **Wolfgang Pietsch** of the Max Planck Institute. The emission decayed exponentially with a characteristic timescale of about one month, which is a common property of stellar mass X-ray binaries. "This means that the ULX in Andromeda likely contains a normal, stellar black hole swallowing material at very high rates." The emission of the ULX source, the scientists said, probably originates from a system similar to X-ray binaries in our own galaxy,

but with matter accreting onto a black hole that is at least 13 times more massive than our Sun. Unlike X-ray binaries in our own Milky Way, this source is much less obscured by interstellar gas and dust, allowing detailed investigations also at low X-ray energies.

Ideally, the astronomers would like to replicate their findings by re-observing the source in another outburst. However, if it is indeed similar to the X-ray binaries in our own Milky Way, they may be in for a long wait: Such outbursts occur on the order of decades.

"On the other hand, as there are so many X-ray binaries in the Andromeda galaxy, another similar outburst could be captured any time by the on-going monitoring campaign," Hartmann said. "While 'monitoring' may not sound exciting, the current results show that these programs are often blessed with discovery and lead to breakthroughs – in particular, if they are augmented with deep and sustained follow-up."

**Adapted from http://www.mpe.mpg.de/News/PR20120223/text.html**

## Dr. John Meriwether to Install New Interferometer at Eastern Kentucky University

**From left to right: Lamar Durham, Jonathan Simpson, and Sam Sanders, all of the Physics and Astronomy Lab Shop, and Dr. John Meriwether**

Faculty member, **Dr. John Meriwether**, has been awarded a National Science Foundation (NSF) grant to establish a network of Fabry-Perot interferometers in the eastern continental United States. In this effort the data on upper atmosphere winds and temperatures obtained by the Fabry-Perot interferometer observatory now operating at the Pisgah Astronomical Research Institute (PARI) in North Carolina will be combined with simultaneous measurements obtained at the University of Illinois and University of Michigan observatory sites located near Urbana, Illinois, and Ann Arbor, Michigan. To help fill in the gap between Illinois/Michigan and PARI, a new Fabry-Perot observatory will be installed next to the astronomical observatory on the campus of Eastern Kentucky University in Richmond, Kentucky and managed by **Dr. Mario Ciocca**. These data will be analyzed and posted on the research web site for review the morning after the observations. The aim of this network is to observe transient behavior of the neutral atmosphere following geophysical events, such as solar flares and coronal mass discharges from the Sun. The unique aspect of this network is that the Fabry-Perot observatories are located close enough together to allow for simultaneous observations of the neutral wind vector from two different viewing angles that overlaps in a volume common to both directions. Dr. Meriwether travelled to Poker Flat, Alaska on April 27th to pack up an interferometer so that it could be shipped back to Clemson. This instrumentation will be taken to Kentucky and installed later this summer. **Dr. Jessica Lair**, a former graduate student of **Dr. Mark Leising**, and Dr. Ciocca will be supervising the data collection at the Kentucky site and coordinating their findings with Clemson.

## Former Chair Peter J. McNulty Retires and Also Becomes an IEEE Fellow

*By Professor Emeritus and Adjunct Facultty Joseph R. "Dick" Manson*

**Dr. Peter McNulty**, who came to our department in 1988 as Chair and Professor of Physics, and remained Chair of the department until 2002, has recently retired. While he will no longer be regularly teaching after a professorial career of over forty-five years, beginning at Clarkson University in New York State, he plans to maintain an office in the department and continue his research collaborations.

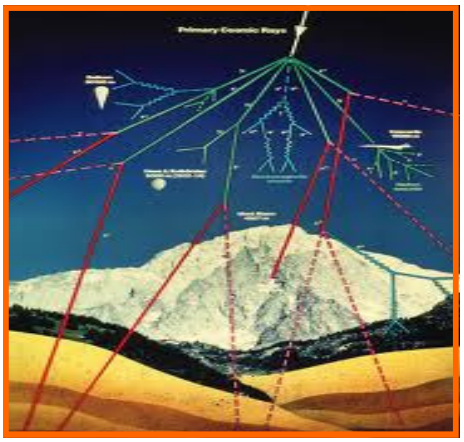

**Left to right, are Jason Reneau, Pete McNulty, and Kelvin Poole at a collaboration with NASA on the DIME experiment conducted several years ago.**

Pete's parents were immigrants from Ireland who settled in New York City where he was raised. There, he attended St. Michaels High School and credits his high school Physics classes with instilling his initial interests in becoming a scientist. He also was strongly influenced by an older sister who was educated as a scientist. Pete received his B.S. in Physics from Fordham University in New York in 1962 and then did his graduate work at the State University of New York in Buffalo where he was awarded a Ph.D. in 1965. He extended his stay at SUNY-Buffalo as a postdoctoral research associate for another year, and it was during this time that he met his future wife, **Patricia**. Pete took a position as Assistant Professor of Physics at Clarkson University in 1966. There he rose through the ranks to Professor of Physics and remained until 1988 when he accepted the offer to come to Clemson. He and Pat have two children that they raised at Clarkson, **Peter** and **Patricia**. (Interestingly, the name Peter is a tradition in the McNulty family and their son is Peter Mc.Nulty VII)

Pete's research interests are wide-ranging, beginning with his thesis at SUNY-Buffalo, which was in high energy physics. This work created quite a bit of interest because it established that the muon elementary particle undergoes electromagnetic interactions only even when producing pions in nuclear reactions. At Clarkson he developed collaborations at the Air Force Geophysics Laboratory at Hanscom Air Force Base and at Brookhaven National Laboratory. During this period some of his research shifted to biophysics where his work demonstrated that strong nuclear reactions can cause mutations in bio-systems. The question of whether the strong nuclear reactions were relevant to biological systems was not at all clear before then. This work on bio-systems led to a series of investigations that received widespread publicity, the generation of light flashes in human eyeballs by cosmic rays. In the early days of the U.S. space flight program, astronauts returning from orbit occasionally reported very mysterious sightings of light flashes that appeared to originate in their own eyes. Pete suspected that these were due to cosmic-ray nuclei passing through the eyeball, and that these particles produced flashes through three mechanisms: direct ionization, Cerenkov radiation, and nuclear-spallation reactions. His research definitively demonstrated that all three mechanisms played a role by computer simulations followed by experiments in which human subjects (who were all volunteer radiation experts with Ph.D. degrees) placed in the line of an accelerator beam at various accelerator facilities. When the "subjects" were placed in the beam in such a way that the fast and highly charged ions passed through the eyeball, they reported seeing not only all the variety of flashes experienced by the astronauts to date, but they also observed one type not previously reported by astronauts, but later reported during the final Apollo mission. Early in his career, he received critical sup-

Port, including advice and the loan of accelerator beam lines from **Leon Lederman** and **Gerry O'Neil** at Brookhaven National Laboratory's Alternating Gradient Synchrotron and **Martin Perl** of the Stanford Linear Accelerator. Lederman and Perl later became Noble Laureates. **Milton White** of Princeton made the Princeton Particle Accelerator for the light-flash studies and the staff of the Bevelac accelerator at Lawrence Berkeley Laboratory spent three days working around the clock in order to provide individual relativistic nuclei for human exposures. Their generosity to a young scientist made a career possible and should remind us of our obligation to the young scientists that follow us.

These various studies of radiation effects in biological systems eventually led to the work for which Pete is most famous, induced upsets in micro-electronic circuits due to reactions created by highly energetic protons. Most specifically, he is noted for predicting and leading one of the teams that first demonstrated proton-induced upsets in micro-electronic circuits. As circuits shrink, proton-induced upsets become more important for spacecraft, and they have provided many topics for scientific study. In particular, they have changed how radiation environments must be monitored and modeled in order to predict risk to satellite systems. Such studies have led to participation in many rocket and orbital satellite launching programs investigating electronic upsets caused by cosmic rays and the development of techniques for monitoring the components that make up the radiation environments of space.



**Muon generation by cosmic rays (http://www-f9.ijs.si/~rok/sola/praktikum4/mioni/muonexp.html)**

Pete is currently funded through the National Aeronautics and Space Administration (NASA) for participation in their SET-1 Satellite program which is scheduled to fly on the U.S. Air Force's DSX Satellite.

While Department Chair from 1988 to 2002, Pete oversaw a number of changes in the department. During this period the number of faculty grew from about 20 to over 25. He developed a strong program in Astrophysics and Astronomy and significantly expanded the department's research program in Atmospheric Physics and Biophysics. It was under his leadership that the epartment made the transition from one in which the faculty had rather heavy teaching loads to one in which all faculty were heavily involved in research. Pete can be proud of the fact that under his stewardship, Physics and Astronomy transformed itself from a largely teaching-oriented to a mature research department. During his time as Chair the annual rates of research funding by national granting agencies went from a few hundred thousand dollars to nearly three million dollars. During his long career he has published over 140 papers, graduated 14 Ph.D. students and 23 Masters students, many of whom have gone on to distinguished careers themselves. He has had a number of prominent positions, including Technical Chair and Short Course Chair for conferences of the Institute of Electrical and Electronic Engineers (IEEE) and service on various panels for government funding agencies. Recently, he was elected a Fellow of the IEEE, an honor limited each year to no more than one tenth of one percent of the senior IEEE membership.

Pete and Pat make their home at Lake Keowee near Seneca, S.C. They are looking forward to opportunities for travel. However, it should be clear from the foregoing that Pete plans to continue his scientific studies for the foreseeable future, and much of this travel will involve his research collaborations. In the near future, they envision at least one trip to Europe, primarily France, for scientific conferences and research collaborations. We all wish Pete and Pat a very happy and enjoyable retirement, and we fully expect to see them actively participating in the life of the department for many years to come.

# First Indo-U.S. Workshop on Thermoelectrics


**Terry Tritt (on right) listens as the Deputy Director of ITT-Bombay, Dr. R.K. Malik, addresses the workshop.**

**Dr. Satish Vitta** from the Indian Institute of Technology Bombay, India spent six months working with **Dr. Terry Tritt** at Clemson on a Fulbright Fellowship in 2011. Subsequently, they have collaborated in putting together a joint workshop funded by the Indo-U.S. Science and Technology Forum.

There were eight American speakers (including **Drs. Tritt and Apparao Rao** from Clemson) and eight Indian speakers, along with twenty students who received support to come to this workshop in Mumbai in late January. The first Indo-U.S. Workshop on Thermoelectrics, *Theory, Materials and Applications* was held from January 30 to February 1st at the Indian Institute of Technology Bombay, in Mumbai, India. The conference was organized by Dr. Vita of the Indian Institute of Technology-Bombay and Dr. Tritt of Clemson. One of the highlights of this workshop was Dr. Tritt's inaugural talk, in which he gave an overview of the past three decades of developments in the field of thermoelectric devices. This was followed by four invited speakers, **Drs. Dave Johnson** (University of Oregon), **George Nolas** (University of South Florida), and **Apparao Rao** (Clemson), all of whom discussed a range of issues from developing new type of crystals known as ferecrystals, to the 'nano' approach for making thermoelectric materials and the difficulties involved in making efficient devices. The first day of the workshop concluded with seven contributed presentations from students and researchers representing different organizations in India. These presentations discussed a variety of thermoelectric materials ranging from graphene to oxides. Dr. Tritt offered the following assessment of the workshop:

"The main outcome of the 1st Indo-U.S. Workshop on Thermoelectrics was to introduce U.S. and Indian scientists to each other's work, in order that we might be able to develop collaborative research projects between the two countries. It was decided that we would like to have another workshop in two years. Furthermore, we felt that India should try to propose to host the International Conference on Thermoelectrics in 2016. This was held in Clemson in 2005 and is in Denmark this summer in July. After the conference, some of the Americans stayed an extra day and did some sight seeing of Mumbai, basically by car. One could really see the influence of the British in many of the downtown office and government buildings. We saw many beautiful sights but we also saw the abject poverty that is still prevalent in the country. My greatest surprise was to see big bulls walking down the streets among the people and neither paid much attention to the other!!"


**Brahman cattle are a common sight in the urban areas of India.**


Participants from Physics and Astronomy in the 2012 President's annual "Race to the Rock," a 5-K race held on March 31, 2012, to raise funds for the Clemson Library. From left: Brenden Roberts, Dr. John Meriwether, Patti Larsen, the Clemson Tiger, Dr. Gerald Lechmacher, and Dr. Chad Sosolik

## *Share Your Story with Us*

Gotten married? Added a new member to the family? Landed your dream job? If so, we'd love to share your good news in future issues. Visit **physics.clemson.edu** for contact information, or use the form below. Mail your completed form to: **Department of Physics & Astronomy, Clemson University, 118 Kinard Laboratory, P.O. Box 340978, Clemson, South Carolina 29634-0978.**

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The Clemson University Physics and Astronomy Newsletter

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# Department News

Lab alumnus, **Dr. Jun Lin**, has become a Howard Hughes Medical Institute (HHMI) postdoctoral fellow at Cornell University. In biophysics, HHMI and Burroughs Wellcome Fund (UK) fellowships are two of the most prestigious. Jun Lin was the graduate student of **Dr. Pu-Chun Ke**, while at Clemson. Dr. Ke himself has won the 2012 College of Engineering and Science Faculty Achievement in the Sciences Award.

**Dr. Adria Updike** is now an assistant Professor at Roger Williams University in Bristol, Rhode Island, and she is very excited about this new phase of her career. Adria is a former graduate student of **Dr. Dieter H. Hartmann**.

**Ginger Bryngelson** has accepted a position as Assistant Professor of Physics and Astronomy at Francis Marion University in Florence, South Carolina, to begin this fall. Ginger is completing her Ph.D. work under the direction of **Dr. Mark Leising** and will graduate in August.

We all wish a speedy recovery to retired physics professor, **Dr. Max Sherrill**.

If you have any suggestions for the newsletter, or any other constructive input, please email your thoughts to: rvogt@clemson.edu. To subscribe or unsubscribe to *Schrödinger's Tiger*, please go to our mail list at: **https://mail.clemson.edu/mailman/listinfo/panda-newsletter**