Rocket Launches Shed Light on Turbulence
Sixty Miles High in the Sky

By Dr. Gerald Lehmacher

February 2009. Fairbanks, Alaska. The air nips my nose and ears as I step out from the hotel and walk to the car on crunchy snowpack. The weather forecast says it is forty-two degrees below zero, which is the coldest temperature I have ever experienced. The engine cranks up willingly due to the electric heater that was plugged in overnight; however, the transmission only reluctantly shifts into gear.

Once rolling, the square tires wobble across the parking lot. In Clemson the forsythia are in bloom. I am on my daily commute to Poker Flat Research Range, where four sounding rockets are ready for launch into the upper atmosphere. They carry experiments from Clemson University, Penn State University, and the Leibniz Institute for Atmospheric Physics to probe the atmosphere for turbulence at the highest levels. The upper mesosphere and lower thermosphere, the layer between about 50 and 90 miles above Earth, is constantly pounded by rapid gravity waves launched by storms raging below, swayed by slow, solar-forced tidal waves engulfing the entire globe, and stimulated by electric currents in the auroral ionosphere. The air is a whirlpool of eddies and cascades mixing gases, heat and motions, until the turbulence stops.

The air becomes so tenuous at these lofty heights that it is not a coherent fluid anymore, and a nitrogen or oxygen molecule may travel three feet without encountering a neighbor. Molecular diffusion, which is a slow process near the surface, compared to turbulence, becomes as important for dispersing constituents, dissolving gradients, and diffusing momentum. Where is the turbopause, this hypothetical boundary between the turbulent and diffusive regimes in Earth’s atmosphere? How effective is diffusion in this region of transience?

After driving thirty miles on icy roads, the gate to the rocket range opens by a click on my remote control. I check in with the range manager, the NASA campaign manager, and my mission manager who supervises the payload team of engineers and technicians. My co-investigator is Dr. Miguel Larsen, supervising the camera sites at Poker Flat, Fort Yukon, and Coldfoot, that are all staffed by Clemson students and technicians: Lucas Hurd, Liyu Guo, Patti Larsen, Lamar Durham, and Brian Turpin.
A Message from the Department Chair

As the Department of Physics and Astronomy concludes this academic year there is both good news and bad news to report. First the bad news. We have survived a very difficult budget year, but only by making some serious cuts to the way we operate. Due to lack of funds, we have closed our Physics Learning Center, have eliminated many telephones from the Department, greatly curtailed office supplies, cancelled upgrades to computers and printers, and generally put all infrastructure improvements on hold. Now for the good news...

Twelve seniors graduated in the May ceremony. Although this number is down compared to previous years, these students have excelled both academically and in their future graduate study plans. Moreover, we are expecting a minimum of 24 freshmen in the fall, and hope to grow this number substantially over time.

The faculty is close to streamlining our approach to graduate education. The entire core program will be taught in the first year, followed by the Comprehensive Exams which must also be cleared before the end of the first year. In the second year students will be expected to take courses in their area of research concentration. To attract more high quality graduate students, we must improve the size of our stipend, which is low in comparison to other universities. Our plan is to devise imaginative ways to raise the necessary funds to make them competitive. You will note in this newsletter that we successfully gained tenure and promotion to Associate Professor for two of our young faculty and were able to hire two new faculty members. However, the hiring merely offset the loss of two of senior faculty through retirement.

Our plea for your financial help resulted in several generous donations, but fell short of our goal. Once again I ask you to help the Department to offer the best education possible to our students through your donations to our Development Fund. Our Newsletter has received a very positive response, but it too will have to be eliminated, unless we can reduce costs. In the future we will, most likely, discontinue mailing physical copies to our alumni. The Newsletter is available for viewing at http://physics.clemson.edu and can also be sent electronically to you. I would encourage those of you who would like an electronic version to sign up for this option in the enclosed envelope. Thank you again for your continued support of the Department.

Sincerely,

Peter A. Barnes, Professor and Chair
Department of Physics and Astronomy
Voice: (864)656-3416/e-mail: peterb@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 the 1986 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. The Internal Revenue Service identification number assigned to the Clemson University Foundation is 57-0426335.

There are several ways to donate. You may use the enclosed envelope or you may send a check to the Clemson University Foundation, P.O. Box 1889, Clemson, SC 29633. Checks should be made payable to Clemson University Foundation with Physics and Astronomy Foundation written in the memo line. Or donations can be made in person at the Foundation Office, located in Tiger Park at 155 Old Greenville Hwy., Suite 105, Clemson, SC 29631.

Alternately, you may visit the Clemson website http://www.clemson.edu/alumni/giving/ways/index.html 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. You may contact the Department directly at (864) 656-3416, should you have any questions regarding your donations. Thank you, as always, for your continued support of the Department.
Penn State’s Drs. Jack Mitchell and Sven Bilén are co-investigators on site, who support me with payload integration and telemetry checkouts, as did Dr. Charlie Croskey from Penn State and Clemson graduate student Shelton Simmons, during testing at NASA’s Wallops Island Flight Facility.

Co-investigator Dr. Rich Collins runs the University of Alaska sodium lidar: strong wave perturbations in the mesospheric sodium layer shall give us the signal to initiate the rocket salvo. The Poker Flat Incoherent Scatter Radar receives meager echoes from the ionosphere. It is a dark night during solar minimum, and only occasionally a meteor trail or auroral electron precipitation causes some stir in the ionosphere detectable for the sensitive UHF radar. Additional information comes from airglow layers in the upper atmosphere: faint green, red and infrared emissions from atomic oxygen and hydroxyl radicals, visible to CCD all-sky imagers, showing us atmospheric waves stretching from horizon to horizon.

It is still snowing in the late afternoon, and large six-pointed crystals cover my car forming a fluffy white blanket. But meteorologists have predicted a clearing over interior Alaska tonight, just before the next major winter storm arrives from the Bering Sea. Indeed, the front moves out, while a leisurely sunset paints the northwestern horizon in pink and orange, and the first fuzzy stars appear through a thin veil of cirrus.

The launch window opens at 7:30 p.m., and everyone is getting ready. Teams from the BBC and the Discovery Channel have set up their video cameras to film the rocket experiment for an upcoming TV documentary on the Arctic.
Everyone is devastated. The payload team had been looking forward to traveling back home soon. To be continued... (just a joke.) The countdown clock is set back to T minus 10 minutes, and we wait until the sky clears up again. But we must launch before 1:00 am, otherwise we will run out of time for all four rockets. The first rocket is fired at 0:59 am. The supersonic boom arrives seconds later. Miguel Larsen and I gaze intently at a video monitor, looking for how the trimethyl aluminum is ejected in puffs, each several hundred yards long. The instable chemical reacts with atomic oxygen and emits a bright white light. Quickly the glowing clouds are developing billows, curls and curves. A large helix indicates the presence of significant tidal winds. The upper atmosphere is dynamic and active with motions on many scales. We decide to go for the entire salvo tonight. The next payload is launched at 1:29 am. At forty miles up, the front part of the payload is deployed forward by the force of twelve long steel springs. The aft part contains the chemical payload, while the forward payload houses instruments to detect electrons and negative ions and to measure the density and temperature of the neutral atmosphere. Small fluctuations on these signals indicate turbulence and instabilities in the neutral gas or the ionospheric plasma. After 105 seconds, the filament of the ionization pressure gauge turns on. All data look good. The 30-foot long, two-stage Terrier-Orion rocket propels the 500-pound payload to apogees of about 400,000 feet. The flight is stable thanks to spinning up the rocket to 300 rpm, but when the payload reenters the denser atmosphere, it tumbles and goes into flat-spin before crashing into the frozen tundra. Only if something goes wrong, the payload may be recovered based on the position from the onboard GPS receiver.

At 1:59 a.m. the second instrumented payload follows, and at 2:49 a.m., the last rocket containing only chemicals. All launches are successful and all data are recorded. Pictures and video are taken of the glowing trails, and ground instruments collect interesting data. Now scientific discovery can begin.

If you want to learn more about undergraduate or graduate work in atmospheric and space sciences, please contact the Department of Physics and Astronomy at Clemson University, or the author at glehmace@clemson.edu.
X-linked mental retardation (XLMR) is a particular example of a group of heterogeneous conditions with an estimated frequency of 5-12% in the mentally retarded populations. Specifically, nsSNPs in the SLC6A8 gene (GeneID 6535) that encodes a protein of 635 amino acids were shown to be responsible for about 1% of the XLMR cases. Some of these mutations cause significant changes in the SLC6A8 protein either altering the protein amino acid sequence (alternative splicing), premature termination of the protein chain (stop codon) or altering secondary structure elements (SSE) through the deletion of an amino acid. Consequences of such mutations are severe and almost always pathogenic. At the other end of the spectrum are nsSNPs resulting in a single amino acid substitution. They can be either pathogenic or harmless. Thus, the ability of predicting whether a given nsSNP is disease-causing or harmless is of great importance in the early detection of patients with a high risk of developing a particular disease. The problem is far from being solved in part because the reasons for causing these diseases are complicated. For some cases one allele causes a major health problem. These diseases are usually rare but serious. Other diseases, such as heart disease and cancer, are genetically complex, with alleles from several genes contributing to the disease.

Most of the SLC6A8 variants were discovered by Dr. Charles Schwartz and his coworkers at the Greenwood Genetic Center in Greenwood, South Carolina. However, no explanation of the effects of these variants on the molecular level exists. The investigations in the lab of Computational Biophysics and Bioinformatics at Clemson aim to fill this knowledge gap by revealing these variants’ molecular effect. These variants result in single amino acid substitutions on the structure and function of the protein encoded by the SLC6A8 gene. The work will be done in close collaboration with Dr. Schwartz and his colleagues. The in silico modeling will provide a detailed atomic explanation of the effects caused by these mutations and will enable researchers to compare them with pathogenic and harmless variants. The outcome of such research has the potential to provide valuable insights towards understanding the cause of a given disease and on developing long-term structure-based methods to alter the effect of disease-causing nsSNPs. This investigation is an example of the successful application of physics-based methods in the study of biological objects and demonstrates the potential of detailed modeling in the better understanding of the driving forces behind macromolecular interactions.

The human DNA sequence differs among individuals and the most common variations are known as single nucleotide polymorphisms, or SNPs. The human genome contains 3,164.7 million chemical nucleotide bases (A, C, T, and G). The average gene consists of 3,000 bases, but sizes vary greatly, with the largest known human gene being dystrophin at 2.4 million bases. Almost all (99.9%) nucleotide bases are exactly the same in all people; however, scientists have identified about 1.4 million locations where single-base DNA differences occur in humans. It is known that non-synonymous coding SNPs (nsSNPs - SNPs occurring in protein coding regions leading to amino acid substitutions) can be responsible for many human diseases or cause the natural differences among individuals by affecting the structure, function, interactions and other properties of expressed proteins (see figure at left). A number of genes have been pinpointed and associated with breast cancer, muscle disease, deafness, and blindness. Dr. Emil Alexov and his research group at Clemson are working on these problems and seek to expand their knowledge in this very important field.
Dr. Ke’s Lab Wins 1st Prize for Photography in Clemson’s “Science as Art” Competition

“Though this be madness, yet there is method in it”, (ACT II, Hamlet). This image was obtained as part of an experiment to study the interaction of nanoparticles with cellulose, the major component of bacteria and plant cell walls. The characters in the image at left occurred unexpectedly in a sample of cellulose film, spin coated onto a microscope slide with a single wafer spin processor (Laurell Technologies). The amusing features, resembling the well known characters in Hamlet, showed up when microcrystalline cellulose powder was dissolved in a solvent (9% LiCl:DMAC). They were likely residues of the cellulose and formed sporadically.

Both science and art involve the ambitious quest of those moments when what one perceives suddenly becomes more than what was anticipated. This piece, in its own way, is a symbolic manifestation of beauty in the trash after a long day at the lab, during one of numerous attempts in understanding the physics behind the biological study of life. The sample was platinum-coated and viewed at 15kV on a Hitachi S-4800 scanning electron microscope.

Since 2006 Dr. Pu-Chun Ke’s Lab has been participating in the annual “Science as Art” competition at Clemson, and the annual International Visualization in Science and Engineering Challenge organized by the National Science Foundation and Science magazine. The purpose of these efforts is to broaden the impact of Ke’s lab’s research, and to allow the public to enjoy its scientific endeavors. Works of Dr. Ke’s group that have received awards in these competitions are:

1. “Science as Art” competition at Clemson University, First Prize, for entry “Hamlet” (2009).
2. “Science as Art” competition at the MRS International Materials Research Conference, Finalist, for entry “Streaming” (2008).
Department Extends Welcome to New Faculty Members
Drs. Sumanta Tewari & Hye-Jung Kang

Physics and Astronomy would like to extend a warm welcome to new faculty member, Drs. Sumanta Tewari and Hye-Jung Kang.

Dr. Tewari grew up in a small town in the eastern part of India, near the city of Calcutta, where he attended high school. After graduation he immediately entered into a Masters program in physics at the Indian Institute of Technology (IIT), Kanpur, which is one of the premier higher education centers in India. He later came to the United States, specifically, to the University of California, Los Angeles (UCLA), to pursue a Ph.D. in physics. Under the supervision of Prof. S. Chakravarty at UCLA, he conducted a detailed theoretical study of some of the remarkable anomalous properties of the cuprate high temperature superconductors. These studies culminated in his Ph.D. in physics in 2003, with research specialization in theoretical condensed matter physics. He later took a postdoctoral position jointly held between the University of Maryland and the University of Oregon, and married his wife, Chitrita, in April 2004. Since completion of his postdoc, he and Chitrita have been blessed with their son, Sohom, born in June 2007. Dr. Tewari subsequently was offered and accepted a position on the Clemson faculty.

His research at Clemson has focused on some of the most exciting modern problems in theoretical quantum condensed matter, including quantum computation, high temperature superconductivity, and the physics of the new generation multiferroic materials. In the future he plans to forge productive academic relationships between Clemson and some of India’s leading institutions in the arts and sciences.

Dr. Hye-Jung Kang earned a M.S. degree in physics from Gyeongsang National University, Korea in 1995. After working for five years as a physics instructor there, she decided to come to United States to pursue a Ph.D. in physics, later obtaining her degree from the University of Tennessee-Knoxville in 2005. She has worked as an instrument scientist at the three axis cold neutron spectrometers (called SPINS), at the National Institute of Standards and Technology (NIST) before joining Clemson’s faculty last fall.

Dr. Kang uses neutron scattering techniques to characterize materials by investigating nuclear and magnetic structural properties and excitations in various systems. Her current research focuses on thermoelectric materials and high-temperature superconductors. In thermoelectric materials, one of her goals is to find ways to decouple thermal properties and electrical properties in order to improve thermoelectric efficiency. Dr. Terry Tritt’s group at Clemson employs various material synthesis methods to achieve this goal. Through collaboration with his group, she is studying crystal
By Dr. Mark Leising

The world is celebrating 2009 as The International Year of Astronomy. It was 400 years ago that Galileo first used a telescope for astronomical observations and Kepler published his *Astronomia Nova*, together arguably marking the birth of modern astronomy. Many events are planned worldwide throughout the year. The goal is to bring the fascination and excitement of astronomy to as many new people and places as possible.

A cornerstone event was “100 Hours of Astronomy” held from April 2--5. One million people in 130 countries participated continuously in star parties, planetarium shows, lectures and museum shows. A major focus was sidewalk astronomy -- offering views through a telescope to unsuspecting people in populated areas. We had big plans for events around Clemson, but weather and the absence of those graduate students most dedicated to outreach (busy with, of all things, astronomy on Kitt Peak in Arizona) limited our activities. In the end, we had one partly cloudy night, Saturday, April 4, and one professor hauling around a 12-inch diameter telescope looking for gaps in the clouds.

Set up in the shadows near Doug Kingsmore stadium, there were plenty of interested fans during and after the baseball game. All we could manage were a few “oohs” and “aahs” for close-up views of the moon when it found gaps in the clouds. Later our luck improved with the telescope set up near the bluegrass concert at Tri-County Technical College. A few dozen people, including many children, were lounging on blankets behind the stage area listening to the music. They got long looks at Saturn and at least three of its moons, the Great Nebula in Orion, and the craters on the Moon. No one sees Saturn with his own eye for the first time without some exclamation of amazement, and not many things make three year-olds, as well as ninety-three year-olds giddy. A few observers left and returned with families and friends in tow. Kids decided on the spot on careers in astronomy and started their next Christmas lists with a telescope.

After the surprise of the fireworks just forty meters from us, a fraction of the large crowd headed in our direction for their cars. A line formed for the telescope, and several dozen more people got their first look at Saturn. This was a trigger for questions about distance scales, extraterrestrial life, black holes and worm holes. Two families remained near the telescope for ninety minutes. We rarely achieve this level of outreach, nor do we get this much enthusiasm or gratitude from our classes. We will definitely repeat this on campus and around the Clemson area.

---

structures and correlations of phases and phonons of various systems.

In high temperature superconductors, she studies how magnetism, phonons, and structural distortion affect superconductivity. High temperature superconductivity in copper oxides is achieved when holes or electrons are doped into the antiferromagnetic insulation systems. Recently discovered Fe-based superconductors also show an intimate relation between antiferromagnetism and superconductivity. Dr. Kang is studying the various roles of magnetism in high temperature superconductivity using neutron scattering. Besides physics, she enjoys fishing, boating, playing tennis (she’s always looking for a new tennis partner!) and gardening. Hye-Jung is married to Joe Parish, a tennis instructor at Cardinal Racket Club in Anderson.

---

2009 is the International Year of Astronomy

By Dr. Mark Leising

The world is celebrating 2009 as The International Year of Astronomy. It was 400 years ago that Galileo first used a telescope for astronomical observations and Kepler published his *Astronomia Nova*, together arguably marking the birth of modern astronomy. Many events are planned worldwide throughout the year. The goal is to bring the fascination and excitement of astronomy to as many new people and places as possible.

A cornerstone event was “100 Hours of Astronomy” held from April 2--5. One million people in 130 countries participated continuously in star parties, planetarium shows, lectures and museum shows. A major focus was sidewalk astronomy -- offering views through a telescope to unsuspecting people in populated areas. We had big plans for events around Clemson, but weather and the absence of those graduate students most dedicated to outreach (busy with, of all things, astronomy on Kitt Peak in Arizona) limited our activities. In the end, we had one partly cloudy night, Saturday, April 4, and one professor hauling around a 12-inch diameter telescope looking for gaps in the clouds.

Set up in the shadows near Doug Kingsmore stadium, there were plenty of interested fans during and after the baseball game. All we could manage were a few “oohs” and “aahs” for close-up views of the moon when it found gaps in the clouds. Later our luck improved with the telescope set up near the bluegrass concert at Tri-County Technical College. A few dozen people, including many children, were lounging on blankets behind the stage area listening to the music. They got long looks at Saturn and at least three of its moons, the Great Nebula in Orion, and the craters on the Moon. No one sees Saturn with his own eye for the first time without some exclamation of amazement, and not many things make three year-olds, as well as ninety-three year-olds giddy. A few observers left and returned with families and friends in tow. Kids decided on the spot on careers in astronomy and started their next Christmas lists with a telescope.

After the surprise of the fireworks just forty meters from us, a fraction of the large crowd headed in our direction for their cars. A line formed for the telescope, and several dozen more people got their first look at Saturn. This was a trigger for questions about distance scales, extraterrestrial life, black holes and worm holes. Two families remained near the telescope for ninety minutes. We rarely achieve this level of outreach, nor do we get this much enthusiasm or gratitude from our classes. We will definitely repeat this on campus and around the Clemson area.
Fingerprinting Cosmic Abundances

The Big Bang created hydrogen and helium, but essentially all other elements (referred to as metals by astronomers) were forged in hot stellar furnaces and subsequently recycled through the processes of stellar explosions (supernovae) and star formation from the cold gas between stars (the interstellar medium). This cosmic cycle is a fundamental concept in our understanding of “chemical evolution”, and ultimately the formation of planets and the development of life, as we know it. The fingerprints of these processes are observed by Clemson’s astronomers via optical spectroscopy of stars near the Sun.

That the Milky Way has continuously increased its metal content over its approximate ten billion year life (the Sun was not yet around when the Galaxy was formed) is a well established fact, and looking back in cosmic time to distant quasars provides evidence for progressive enrichment from ground-based observations with the largest telescopes. Dr. Dieter Hartmann of Clemson, working with a team of scientists from the U.S., Italy, and Japan, under the leadership of Dr. Chryssa Kouveliotou (NASA/MSFC, Huntsville, AL), proposes to extend such investigations via X-ray spectroscopy of the most distant stellar explosions known to astronomers, called gamma-ray bursts (GRBs). Reconstructing the cosmic history of metals from the first population of stars that formed in the very young Universe to the present, and probing processes involved in the formation of galaxies and clusters of galaxies, represent major observational challenges. Of the gas produced in the Big Bang, only a small fraction has been incorporated in collapsed, dense objects (stars). Most of this gas in fact resides in diffuse structures, in proto-galaxies and clusters of galaxies, and is predicted to trace the vast filamentary structures created by the ubiquitous Dark Matter.

X-ray spectroscopy of diffuse matter has the capability of simultaneously probing a broad range of elements (carbon through iron) in all ionization and binding states (atomic, molecular, and solid), providing a unique survey. To carry out this task one requires bright X-ray sources at the largest distances, in order to detect the chemical fingerprints (absorption lines) of gas along the line of sight. GRBs produce such extremely luminous, albeit fading, X-ray sources. They are associated with massive stars, which places them back in time to an epoch when the Universe was only a few percent its present age. Kouveliotou, Hartmann, and collaborators have proposed a new satellite mission, Xenia (named for the Greek word for hospitality) to Astro 2010: The Astronomy and Astrophysics Decadal Survey conducted by the National Academies. Xenia combines cryogenic imaging spectrometers and novel wide-field X-ray optics, with fast repointing to collect information from several tracers of cosmic metals.

(Left) The goal to map the evolution of cosmic metals can be realized with X-ray monitoring, wide-field imaging, and high-resolution spectroscopy, using three major tracers: the filamentary Warm Hot Intergalactic Medium, Galaxy Clusters, and GRBs in (proto)-galaxies. 

Hubble image of the supernova remnant N49, that resulted from a stellar explosion in the nearby Large Magellanic Cloud, a small companion galaxy of our Milky Way at a distance of about 150,000 light years.
Dr. Hartmann is also a team member of another proposed satellite project, EXIST (led by Prof. J. Grindlay at Harvard University) which also plans to use the power of GRB afterglow emission to trace the cosmic history of star formation. In this project gamma-ray detection of GRBs would be followed with autonomous observations in the near infrared part of the spectrum with a telescope mounted on the satellite. Currently Dr. Hartmann’s graduate student, Adria Updike, is carrying out her Ph.D. research with GRB follow-up for NASA’s Swift and Fermi satellites, and he hopes that future generations of Clemson students will work on exciting frontier science with these GRB missions.

More information on this project can be found at: the Xenia Website: http://sms.msfc.nasa.gov/xenia/. Additionally a video for the general public on Xenia is available at http://www.youtube.com/watch?v=E3SCn3HgXp8. For information on the other projects, please visit the EXIST Website: http://exist.gsfc.nasa.gov/; Swift Website: http://www.swift.psu.edu/; Fermi Website: http://fermi.gsfc.nasa.gov/; and, the Astro 2010 Decadal Survey: www7.nationalacademies.org/bpa/Astro2010.html.

Three Physics & Astronomy Professors receive Awards from University for Faculty Excellence

From left to right: Dr. Terry Tritt, Dr. Apparao Rao, and Dr. Pu-Chun Ke

On April 16, 2009 the Twelfth Annual Faculty Award Banquet was held at the Madren Center on campus. Clemson President, Dr. James Barker, Provost Dr. Dory Helms and Dean of the College of Engineering and Science, Dr. Esin Gulari, were all present, along with the University’s Board of Trustees, to honor and recognize faculty members who had excelled in their respective fields with the “Award for Faculty Excellence”. Eighty-eight faculty from six University colleges (Emeritus College, CALFS, CBBS, CAAH, CoES, HEHD) were honored on the occasion. Within the Physics and Astronomy Department, three professors were recognized for their academic achievements. They were Drs. Terry Tritt, Apparao Rao and Pu-Chun Ke. Dr. Tritt won his Award for Faculty Excellence for his previous awards: 1) the Clemson Alumni Award for Outstanding Achievement in Research; 2) the South Carolina Academy of Sciences Governor’s Research Professor of the Year Award; 3) the Anderson University Alumni Achievement Award; and, for becoming a Fellow of the International Thermoelectrics Academy, as well as its Vice-President.

Dr. Ke received his award for his National Science Foundation Early Career Development Award and for being first inventor on U.S. Patent #7,456,972 for “Surface Plasmon Induction in Multiwalled Carbon Nanotube Arrays”. Dr. Rao was given his award for his fellowship in the American Physical Society and his work with Dr. Ke, and Dr. Francesco Stellacci of M.I.T., on the same patent.
Lucas Hurd Wins
American Geophysical Society Award

Physics undergraduate Lucas Hurd was recently notified that he has been given an Outstanding Student Paper Award for his presentation at the American Geophysical Meeting that was held in December 2008 in San Francisco. What is even more noteworthy is that while Lucas is still an undergraduate, his competitors were all graduate students.

He has worked with Dr. Miguel Larsen in the atmospheric physics program on a new kind of overturning instability that occurs near the transition between the turbulent mesosphere and the laminar thermosphere. The instability has the potential for explaining anomalously large mixing rates in parts of the atmosphere where turbulent mixing should have ceased.

Lucas has done an excellent job, both on the data analysis that produced the material for the talk and on the presentation itself. The material in the talk will also be the basis for a first-author paper by Lucas that has been submitted for publication and is currently under review.

Annual Student Awards Luncheon

Physics and Astronomy held its annual luncheon to recognize exceptional students within the Department on Saturday, April 11th in the Hendrix Student Center. The student winners were accompanied by their parents (and other family members), along with their advising faculty member(s) from the Department. All awards were presented by Dr. Peter Barnes, Department Chair. Three students won the L. D. Huff Sophomore Award: Edward Ball from Charleston; David Harrison from Greenville; and, Austin Schwartz, also of Greenville. The L. D. Huff Junior Award was given to Jessica Herrington from McBee, SC and to Kemper Talley from Easley. The Sigma Pi Sigma Award was given to Laura Laughlin of Aiken, and Ginger Bryngelson, of Waco, Texas garnered the award for Outstanding Graduate Teaching Assistant. Congratulations go out to all these super students!

Newly Reconstituted Society of Physics Students Renews Activities

A group of enthusiastic Physics undergraduates has restarted the activities of the Society of Physics Students at Clemson. One of their first events was to host a discussion between Drs. Murray Daw and Dieter Hartmann on Friday, April 17th on the various interpretations of Quantum Mechanics. Events such as these allow students to experience a wide range of scientific opinions on important topics.

We will be profiling more of this group’s activities in the months to come. For more information on the Chapter’s upcoming events, please contact Samantha Cawthorne, Chapter President, at cawthor@clemson.edu.
Congratulations go out to Drs. Pu-Chun Ke and Chad Sosolik, who have been promoted to the rank of Associate Professor and granted tenure effective May 1, 2009. Since joining the faculty both Pu-Chun and Chad have enhanced the Department’s ability to provide an outstanding education in Physics through their valuable contributions to their respective fields in both teaching and research.

Dr. Fivos Drymiotis has been selected as this year’s recipient of the “Award of Excellence for Teaching” in the Sciences for the College of Engineering and Science. The award will be presented to Fivos on Thursday, May 21 at Clemson University’s Outdoor Laboratory in Kresge Hall, as part of the CoES Faculty Award and Recognition Ceremony.

The Department welcomes Amanda Crumpton back from maternity leave after the birth of her daughter, Molly, on March 5, 2009.

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