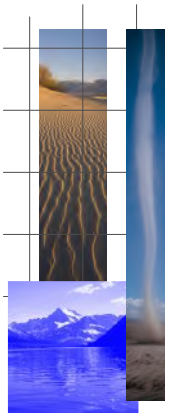
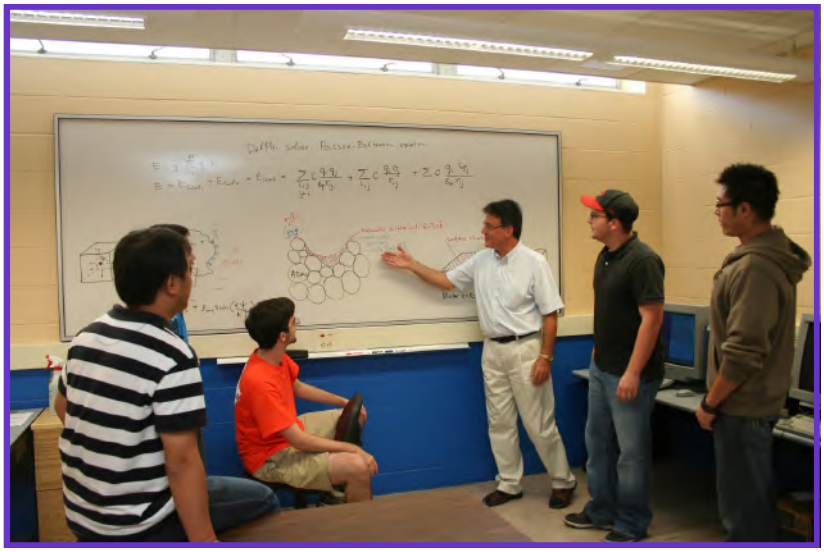


Schrödinger's Tiger

The Clemson University Physics and Astronomy Newsletter

Fall 2010 **Volume 5, Issue 1**

Professor Receives Grant to Research Role of Electrostatics in Biological Macromolecules and Objects



Dr. Emil Alexov with students

Recently, the National Institute of General Medical Science and the National Institutes of Health awarded a grant of approximately $2.2 million to **Dr. Emil Alexov** to maintain and further develop the software DelPhi. This five-year project is a collaboration with the Italian Institute of Technology and Co-Investigator, **Dr. Walter Rocchia**. The project will require developing new approaches and methods for modeling electrostatic potential in a complex system comprising irregularly shaped biological macromolecules, biological membranes with different lipid composition, and geometrical objects with specific dielectric properties and charge distribution. This will allow for modeling electrostatic potential at conditions closely representing the experimental ones. The results will provide better understanding of the role of electrostatics on macromolecular stability and interactions. Since in many cases the system of interest may be made of more than a million atoms, the speed of calculations is also a crucial factor. Dr. Alexov's lab is planning on increasing the computational efficiency and drastically decreasing the execution time, by introducing new technologies and algorithms and utilizing High Performance Computing (HPC) systems, with the help of Clemson HPC group. Currently, they are reviewing the basic principles behind the DelPhi algorithm and are planning to ad new features.

An important effect in the world of biological macromolecules is the explicit ion or water binding to the molecule. Typically, the ions and the waters are treated as a continuum medium, with some average properties; however, when specific binding occurs, the bound ion or water does not retain its average properties. Instead, it should be treated explicitly in the calculations of the electrostatic energies.

Dr. Peter Barnes, Chairman,
Physics & Astronomy

A Message from the Department Chair

The Department continues to do well, and our undergraduates continue to excel. In 2010, we had 19 graduating seniors, 13 of whom were members of the Calhoun Honors College. They are attending the best graduate schools in the U.S and abroad. We had the tragedy of losing Samantha Cawthorne, and in our fall ceremony to induct new students into Sigma Pi Sigma, the national physics honor society, we inducted her posthumously. Our graduate students are also succeeding in their career goals, with two Ph.D.s granted at the December graduation. We had the excitement of Murray Daw and graduate students attending a workshop in Italy in the emerging field de Broglie-Bohm theory. We also lost a dear friend of the department. Mr. Charles Curry, who has generously supported our astronomy program over the past ten years, passed away in December. We will miss a most generous friend. The new NRC rankings of graduate programs are now issued, and the department moved up 39 positions, passing many of our peers. As we continue to strengthen our programs and our young faculty continue to succeed in establishing their research programs, I expect our ranking to continue to improve. We are still in dire need of your support. Therefore, I continue to ask you to think about how you can help. Please know that any financial help you can give to our department in these difficult times will certainly be appreciated.

Peter A. Barnes, Professor and Chair
Department of Physics and Astronomy
Clemson University, Clemson SC 29654-0978
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.

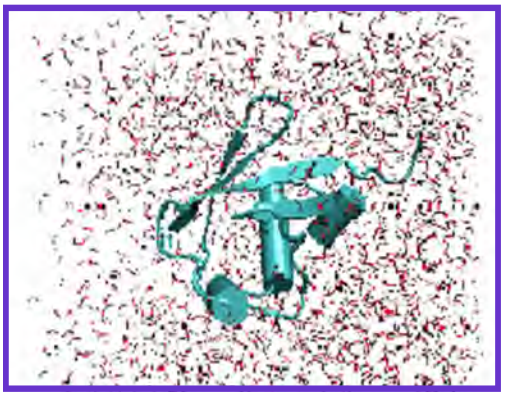
As a non-profit organization, the Foundation is exempt from federal income tax under Section 501(c)(3) of the1986 Internal Revenue Code, as amended. The Foundation has been classified by the IRS as a public charity operated for the benefit of a state university as defined in the Internal Revenue Code 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 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 specified on the memo line.

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. 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.

To address this issue, Alexov's research group is planning to develop methods and computer algorithms that, given the structure of a macromolecule, will predict sites where ions and water may bind. They are very excited at this opportunity to work on such an important project that affects the entire biophysical community, and they are looking forward to achieving the goals of the proposed research. The living cell is a very complicated system, comprising upwards of hundreds of thousands of types of biological macromolecules that constantly interact with each other to maintain the function of the cell. The interactions are very specific, and, frequently, a particular biological macromolecule recognizes its partner among hundreds of thousands candidates. At the same time, the recognition process is fast and, thus, obviously guided through a long-range force that selects and brings the interacting partners together. The best candidate for such a guiding long-range force is the electrostatic force.

While macromolecular interactions are crucial for cell function, the stability and the biochemical function of individual biological macromolecules are equally important. The stability of a macromolecule in the water phase is known to be mostly governed by the so-called "hydrophobic effect", resulting in a formation of a hydrophobic core and a hydrophilic-charged surface, made of charged atoms (charged and polar amino/nucleic acids). Frequently, the charged atoms are located at distances of several Angstroms (10^{-10} meters). Applying the simple Coulomb law to estimate the interaction energy of two point unit charges at distance of 2 Angstroms in a homogenous medium of dielectric constant of two (typical value for proteins) results in an energy estimation of 174 [KJ/mol]. Such energy is



A protein molecule in ribbon presentation (blue) surrounded by water molecules.

huge and definitively is an important component of the total energy of either macromolecular stability or interactions. Thus, electrostatic forces are essential for the function, stability and interactions of virtually all biological macromolecules. The central role of electrostatics is due to the fact that most biological macromolecules, especially DNA and RNA, are highly charged. Long-range electrostatic interactions steer biological molecules toward their pre-binding orientations. Charged groups are essential for the structure, function and interactions of proteins, but their ability to be charged (directly connected to their pKas) is frequently perturbed in proteins, due mostly to electrostatic effects. Many biologically important effects, such as pH and salt dependence, are primarily electrostatic in nature. Moreover, the constant progress of nanotechnology requires modeling of systems made of biological molecules and charged metal/dielectric surfaces and objects. Accurate calculations of electrostatic fields and energies are crucial for successful modeling of virtually all biological processes and many other phenomena occurring in nanosystems and nanodevices. One problem with modeling the electrostatic potential of biological macromolecules and their complexes is that they exist in water at a given ionic strength, and they have an irregular shape. The electrostatic potential in such systems obeys the Poisson-Boltzmann Equation; however, an analytical solution is not available for irregularly-shaped objects. Therefore, the distribution of the potential and the corresponding electrostatic forces and energies can be found only numerically. The most admired numerical method is DelPhi, which was developed by **Dr. Barry Honig** in his lab at Columbia University. The popularity of DelPhi is due to its speed, accuracy, and the ability to handle extremely high-grid dimensions. Additional features, such as assigning different dielectric constants to different regions of space, modeling geometric objects and charge distributions, and treating systems containing mixed salt solutions also have attracted many researchers. In addition to the typical potential map, DelPhi can generate and output the calculated distribution of either the dielectric constant or ion concentration, providing the biomedical community with extra tools for their research. Revealing the electrostatic potential distribution around the enzyme site provides information as to how the substrate may enter the catalytic region. The same distribution modeled on a malfunctioning enzyme will indicate how the potential is altered by disease-causing mutations, and, in the future, can provide some suggestions how to cure the disease.

21st Century Directions in De Broglie-Bohm Theory and Beyond

Adapted from Towler Institute website

Participants at De Broglie-Bohm Theory Meeting

For a week at the end of August 2010, a collection of physicists and philosophers gathered in Valllico Sotto, Italy, to discuss the meaning of a partial differential equation, and related matters. **Dr. Antony Valentini** from the Imperial College of London, (who will be joining the Physics faculty in the spring of 2011), Clemson professor **Dr. Murray Daw**, and graduate students **Daniel Thorpe** and **Maaneli Derakhshani,** participated in the meeting. The aim was to imitate the 1927 Solvay conference (sadly with 19 fewer Nobel prize winners) and to discuss the theory of quantum mechanics first presented by French physicist Louis de Broglie at that meeting. De Broglie-Bohm theory is a "hidden variables" formulation of quantum mechanics initially developed by de Broglie from 1923-1927 that was clarified and extended by American physicist **David Bohm,** beginning in 1952. Just by the simple expedient of refusing to believe that particles cease to exist if you stop looking at them, it is easy to show that (contrary to popular belief) quantum mechanics can be interpreted as a dynamical theory of particle trajectories, rather than as a statistical theory of observation. In such a formalism the standard paradoxes related to measurement, observation, and wave function collapse (Schrödinger's cat, and so on) and largely evaporate. The classical limit does not have to be presupposed and emerges from the theory in a relatively clear way. All the 'talk' is replaced by sharply-defined mathematics, it becomes possible to 'visualize' the reality of most quantum events, and, most importantly, the theory is completely consistent with the full range of QM predictive-observational data. The theory also gives rise to the possibility of new physics and of new mathematical and philosophical ideas, and considerable emphasis was placed on this during the meeting. One of the most common remarks by the participants, many of whom work in relative isolation, was an expression of surprise that there were *all these other people* out there working on topics related to de Broglie-Bohm theory. The number of scientists apparently unaware of each others' work was consistently surprising, and the meeting led to a number of new collaborations.

Maaneli Derakhshani and Dr. Antony Valentini

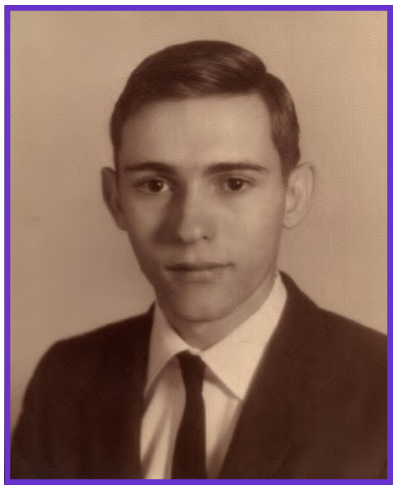
They were also fortunate to enjoy the presence of many of Bohm's former friends and colleagues, including **Basil Hiley**, **Chris Dewdney**, **Paavo Pylkkänen**, **David Peat,** and **Georg Wikman**. Their personal reminiscences of Bohm, who died in 1992, were extremely interesting.

The meeting concluded with some of the best talks of the week, a trip to the beautiful city of Lucca, dinner in a high mountain village, late-night fireworks, the Best Cheese in Italy (soaked in barolo), and some Warre's 1991 port in the back garden.

In the spring newsletter, we will profile Dr. Valentini. The Department is excited to have him join the Physics and Astronomy family, and we welcome him to Clemson.

Physics Alum Henry Odom Reflects on his Experience at Clemson

By Henry Odom



Henry Odom

I was born and raised in Florence, South Carolina. Except for courses taken during my post-college work life, my entire formal education occurred in the educational systems of South Carolina. My college experience began at the University of South Carolina, Florence Extension Center (now Francis Marion University). I finished my undergraduate work in Columbia, receiving a B.S. in Physics in 1966. Gratefully accepting a graduate teaching assistance offer, I entered Clemson University in the fall of 1966. I had never been to Clemson before, but had flown to Donaldson Air Force Base near Greenville, as a Civil Air Patrol member in my teens and had been to Table Rock with a Sunday school class. Hence, I had some notion that there was much to be seen and enjoyed in the rolling hills, mountains, and valleys of Upcountry South Carolina. Clemson and the Upcountry have never disappointed!

To my delight I found graduate school at Clemson to be an opportunity to meet a number of folks from different backgrounds and, to me at the time, from far away places. My physics education was enhanced by interaction and discussions with such students. My love of travel and desire to do far more was encouraged by listening to several second-generation Americans speak of their heritage. As a native South Carolinian, I found it rare to meet someone whose parents had not been in the U.S. for two hundred or more years! At Clemson I was exposed to the best of worlds — a solid education program and a stimulating environment that sparked my imagination and widened my horizons. I had the privilege of working under Dr. Carlton Ulbrich in the superconductivity laboratory, where I earned my Masters degree.

My wife, Mary Belle and I have four children, two boys and two girls, all college graduates. Three of our children participated in university-sponsored, off-campus programs that involved foreign travel: one to European capitals; another was a walking tour of northern England with an environmental instructor and class; and, the third was a year spent at the University of Freiburg, Germany. My son, Henry, took a physics course while there, and I attended the class with him on a visit. He spent his high school junior year in a German *gymnasium* through Youth for Understanding (YFU). While our youngest, Rosemary, did not participate in a university, off-campus program, her first commercial flight involved a trip to London with me. She and I later enjoyed a Christmas in the Hartz Mountains of Germany with Henry's host family. You might say that I am sold on the educational value of foreign exchange and travel! Today Clemson Physics and Astronomy has several opportunities for students to experience foreign travel and receive academic credits. I am excited by this, and I believe that for Clemson to successfully compete for today's best students it has to be competitive with other universities and stay abreast of a dynamic education menu, including off-campus opportunities.

After leaving Clemson I settled down at the Naval Weapons Lab in Dahlgren, Virginia. The laboratory is now called the Naval Surface Warfare Center, Dahlgren Division. There I worked in a variety of areas, including ammo and gun barrel testing, pulse power applications, electromagnetic guns, electro-optical gunfire control, missile defense, and space sensors. During my tenure in each program, I had numerous opportunities to interact with research personnel working at the cutting edge of science and engineering. I participated in research efforts that took me to many facilities, where we tested pulse power devices against both foreign and domestic weapon systems. These pulse power devices were built in our laboratory. My first trip across the Atlantic took me to a Pulse Power Conference in Venice, Italy, where I gave a paper. During my last years with the Navy, I served as NAVSPACECOM's representative for National Missile Defense (NMD) and Theater Missile Defense (TMD).

Naval Space Command was the naval (including Marine Corps) component of United States Space Command. Until the Navy (under considerable pressure from Congress) got in the TMD business, I reviewed and provided NAVSPACECOM comments on every NMD and TMD document. Introduction to the world (largely Air Force) of space sensors was one of the highlights of my career. I worked closely with appropriate naval research personnel and program offices to develop, collect and deliver naval requirements to USCINCSPACE and Air Force Space Command. On two occasions, I participated in the Navy's "Scientist to Sea" program. I went to sea aboard the missile cruiser *Ticonderoga* (CG47) and the missile destroyer *Mitscher* (DDG-57). The chance to be at sea on a moonless night, running without lights, and witness a sky filled with more stars than can be imagined is an experience to be valued.

In the early summer of 2008, Mary Belle and I dropped by Clemson. For some time I had thought about how I might reach out in a state that had given so much to me and had received so little in return. My son Henry and I had discussed social responsibility and how fortunate our family has been. One result was that he established an endowment at Mary Washington University where he graduated. Prompted in part by his activism and my own belief in the value of education, Mary Belle and I dropped by Kinard Hall and casually mentioned our objective to one of the faculty. Kinard was under restoration, and the office was then across campus. We were given directions and encouraged to "go meet the Chairman". Our entry there was not a surprise! Electrons travel much faster than I can walk! As a direct result of this meeting and a meeting a couple of hours later with Ann Marie Alexander from the Development Office, essentials of my endowment were established. While the endowment is not expected to bear fruit until a few years after being fully funded, a modest grant-in-aid program has so far allowed us to help four physics students who are the first in their families to go to college. Mary Belle and I have met two of them, and we were humbled by how poised, prepared and intelligent students are today.

As a result of my commitment to education and to Clemson, I have been asked to help "The Will to Lead" campaign. This is my first participation in such a campaign. I hope to share and sell the role of academic Clemson, in helping the state of South Carolina and this nation grow. The Clemson of today is a far cry from that of 1966. The student of today has access to tools that few dreamed of back then. Knowledge in engineering, physics and other sciences has grown tremendously, and Clemson has had considerable success in keeping pace and expanding. With the strain on state budgets what has been achieved is at some risk. The global economy has made it necessary that we be more inclusive in our outlook, and I will emphasize the value of off-campus educational opportunities that establish a broader base of interaction on the job, as well as academically.

Clemson offers several ways to make contributions. I will urge those whom I contact to explore them and decide what works best for them. Opportunities range from unrestricted gifts to Clemson to restricted gifts targeted to specific university programs. My focus has been on helping students directly. Others may choose a different way. No matter how one contributes the ultimate winner is the contributor. I hope to begin by contacting the wonderful group of men and the young ladies with whom I attended graduate school and from whom I learned so much about the wider world. I welcome any input, negative as well as positive, to help me better understand how I can serve the Clemson University community, South Carolina, this nation, and friends abroad who share this planet. I thank all in advance for their support, prayers and other input.

Note: In 2008 Henry established the "Henry B. Odom III '70 Annual Grants in Aid", to provide aid to students who are majoring in physics and astronomy in the Clemson FIRST Program. The Clemson FIRST Program assists first-generation college students.

Clemson, Yale, UT Dallas Developing Nanoscale-Based Superconductors

Dr. Aparao Rao's Clemson Research Group

Clemson University, the University of Texas at Dallas (UT Dallas), and Yale University are involved in a project to develop nanoscale materials that superconduct to allow for the more efficient flow of current. The program was allocated $3 million by the Air Force earlier this year for a five-year period.

Based on our present understanding of superconductivity in carbon nanotubes (CNTs), the tube-tube interactions seem to be crucial for the onset of superconductivity in CNTs. This work was done in collaboration with **Prof. Junji Haruyama's** group [for details, please refer to (a) "Pressure Dependence of Meissner Effect in Films of Ropes of Boron-Doped Carbon Nanotubes", **J. Haruyama**, **M. Matsudaira**, **T. Shimizu**, **J. Nakamura**, **T. Eguchi**, **T. Nishio**, **Y. Hasegawa**, **H. Sano**, **Y. Iye, J. Reppert**, and **A.M. Rao**, *Superlattices and Microstructures* **46**, 333 (2009), and (b) "Superconductivity in Thin Films of Boron-Doped Carbon Nanotubes", **N. Murata, M. Matsudaira, J. Haruyama, J. Reppert, A.M. Rao, T. Koretsune, S. Saito and Y. Yagi**, *Physics Review Letters* **101**, 027002 (2008)]. The Rao Research Group at Clemson is employing unique techniques, such as the use of spark plasma sintering process to tune the inter-tube interactions, and simultaneously dope CNTs with promising elements that can lead to superconducting CNTs. An example of this is boron-doped single-walled CNTs. Another challenging task that they are currently addressing is the ability to avoid the use of transition metal catalysts for the growth of single-walled CNTs.

A large super current value has been reported in proximity-effect-induced superconductivity in a superconductor-CNT-superconductor device. Even in its normal state, CNTs are also known to be able to carry higher current than copper. Therefore, the goal is to take advantage of the tubular morphology and couple it with inherent high strength of CNTs, to fabricate superconducting wires and macroscopic yarns. It is still an open question whether superconducting CNTs yarns will sustain efficient current-carrying capacity, and this is one of the research goals of this project. According to the BCS superconductivity, the Tc is expected to improve since quasi-1-D nature of CNTs yields van Hove singularities (vHS) in the electronic density of states. All said and done, with quasi-1D topology and tube-tube interactions, novel mechanisms of superconductivity are expected.

What superconducting materials are being used in this investigation? Why are they ideal? Besides single-walled CNTs, Dr. Rao is investigating the properties of multi-walled CNTs and other allotropes of carbon, especially graphene. These materials permit examination of superconductivity in alternate morphologies of CNTs: the concentrically stacked tubes and unzipped tubes. To date, he finds that boron-doped single-walled CNTs yield a clear signature for superconductivity, and these samples are stable and amenable to fabrication of superconducting yarns. Importantly, the boron-doped single-walled CNTs are synthesized in a one-step process developed in his lab at Clemson.

The possibilities of using them in other applications are being explored. The project to develop the synthesis of boron doped single-walled CNTs has been supported through funds from Clemson University and a NSF/NIRT grant. It has taken two years and half a million dollars to develop this promising technology.

Dr. Sean Brittain Receives Early Tenure and NSF Career Award

Dr. Sean Brittain

Dr. Sean Brittain, Associate Professor of Physics & Astronomy, recently received the Faculty Early Career Development (CAREER) award from the National Science Foundation (NSF). According to the NSF, this award is "the National Science Foundation's most prestigious award in support of the early career-development activities of those teacher-scholars who most effectively integrate research and education within the context of the mission of their organization." This five-year award will provide the necessary resources for Dr. Brittain and his students to study the evolution of gas in disks around young stars and to identify ongoing gas giant planet formation. His group will use high resolution, near-infrared spectroscopy to measure emission from CO, OH, and H2. By modeling the excitation and line profiles of their spectra, they will be able to determine the geometry of the gas and potentially catch planet formation in the act. This work will include contributions from graduate and undergraduate students. In addition to learning about the science necessary to pursue this project, the students will also learn how to effectively communicate what they've learned to diverse audiences, by collaborating with education majors at Clemson University. They will also work together to develop curricula for high school students visiting Clemson in the summertime as part of the "Emerging Scholars" program. This award will allow the members of Dr. Brittain's group to have the opportunity to spread their enthusiasm for science to the next generation of college students.

DEPARTMENT HOSTS 20TH ANNIVERSARY PRESOLAR GRAIN WORKSHOP

Participants from Clemson, Washington University, the University of Chicago, and the Carnegie Institute gathered at Clemson in November to continue inquiries into presolar grains.

On November 12-14, 2010, the Department of Physics and Astronomy hosted the annual Presolar Grain Workshop. Presolar grains are human blood cell-sized dust grains that condensed in the outflow from dying stars, traveled through the interstellar medium, and were eventually incorporated into asteroids, the meteorite parent bodies in the forming Solar System. Collisions between the asteroids liberated the small bodies that fell to Earth as meteorites. The dust grains isolated from these meteorites provide precise isotopic information about the stellar environments in which they condense, and study of these grains constitute a new kind of astronomy. The workshop is an annual event at which Washington University in St. Louis, the University of Chicago, and

the Department of Terrestrial Magnetism at the Carnegie Institute and the Naval Research Lab in Washington D.C. meet and exchange ideas about the latest developments concerning presolar grains in meteorites. Highlights of this year's meeting were updates on exciting new experimental techniques for isolating and characterizing presolar grains, studies of grains within their host meteorites, and the production of isotopes by cosmic rays as the grains travel through the medium between the stars. The last day of the workshop saw a lively debate on the implications of isotopic abundances in certain presolar grains for mixing of material in exploding stars ten or more times more massive than the Sun.

This year's event was historical: Clemson hosted the inaugural workshop exactly twenty years previously on November 11-14, 1990. Retired Clemson Professor **Donald D. Clayton**, the organizer of the first workshop, gave a historical overview of the workshop and of developments in the field of presolar grain astronomy in the past twenty years. Also, in keeping with the historical nature of the meeting, many participants toured Ashtabula, the antebellum plantation house in nearby Pendleton. Other participants looked forward to the future by touring Clemson's Information Technology Center, where Clemson physicists will host web sites and run parallel computer calculations important for presolar grain research. The workshop banquet took place after the tours in historic Farmers' Hall in Pendleton. Past, present, and future converged during the meal as participants discussed their coming research plans, in the setting where Thomas Green Clemson announced his plan to leave his estate for the formation of Clemson University.

The Department Loses a Dear Friend and Supporter in Charles E. Curry (1918-2010)

Charles Ewing Curry

Charles Ewing Curry, 92, passed away at his home in Key Largo, Florida on December 13, 2010. Charles was a great friend of the Clemson Physics and Astronomy Department and will be deeply missed. Through the auspices of the Curry Foundation that he maintained, the Department and University received close to one million dollars. These contributions were primarily in the form of Curry Foundation fellowships for graduate students in astrophysics and gamma-ray astronomy, as well as the funding of Clemson's portion of National Optical Astronomy Observatory (NOAO) telescope usage fees over a period of three years. This payment allowed Clemson students thirty nights per year of viewing opportunities at NOAO's Kitt Peak Arizona 4m telescope. For his tremendous generosity, he was awarded Clemson University's Algernon Sydney Sullivan Award in 2007.

Born in Kansas City, Missouri in 1918, Charles lead a full life, which included serving as a captain in the U.S. Navy from 1942-1945, much of that time on a submarine chaser. Before the war's end, he became an officer on the Submarine *Macabi*. Later, he returned to Kansas City and began life as a businessman, eventually serving as the presiding judge of Jackson County, Missouri. Always interested in politics, Charles became the Treasurer of the National Democratic Party in 1981, after moving to Washington, D.C.

In 1996, he moved to Salem, South Carolina on Lake Keowee, to be in close proximity to Clemson University, as he had developed a interest in some of the newest research in high-energy astrophysics. He attended classes at Clemson, read scientific books and journals, and attended symposia on astrophysics in Europe and at NASA, Huntsville. He also had the opportunity to have a private viewing of the giant telescopes in the remote mountains outside of La Serena, Chile in 2005. He is survived by his wife of 24 years, Charlotte Rommel Curry; six daughters and one son; fourteen grandchildren and two great-grandchildren. A memorial service was held on January 10, 2011 at the Ocean Reef Chapel in Key Largo, Florida. Per his family's request, donations in his honor may be made to the Clemson University Physics & Astronomy Department or Hospice of the Florida Keys.

Student Awards & Achievements

Tatsiana Ratnikova

Tatsiana Ratnikova recently won a Professional Enrichment Grant Application Service (PEGAS) travel award from Clemson. This award of $1,000 enabled Tatsiana to travel back to her home country of Belarus in December, to present her research at the Institute of Biophysics and Cellular Engineering of the National Academy of Science of Belarus (NASB). NASB is the leading scientific institution in the country for its research in cell and tissue engineering, human disease diagnostics, biotechnology, and plant biology. Tatsiana worked as a research scientist in biophysics at NASB for two years, prior to joining **Dr. Pu-Chun Ke's** group in 2007. Her Ph.D. research at Clemson is focused on fullerene-biosystem interaction at the molecular, cellular and whole organism level. She has published in major journals and has presented her research findings in Helsinki, Stockholm, and Amherst, Massachusetts. She is expected to graduate in August 2011.

Priyanka Bhattacharya won a student poster award and a cash prize at the 37th Federation of Analytical Chemistry and Spectroscopy Societies (FACSS) Conference, held in Raleigh, NC in October, 2010. Fifteen out of 500 students were awarded for their research presentations at this international conference. Priyanka joined Dr. Ke's group in 2008. Her Ph.D. research is centered on the supermolecular assembly of dendrimer-pollutants and the applications of dendritic nanotechnology for environmental remediation. Priyanka has published in leading physical chemistry journals and has presented at international conferences held in Pittsburg, Hong Kong, and Raleigh, North Carolina.

Priyanka Bhattacharya

Alexa McClennan Brown, Luis Navarro, and Dr. John Meriwether with the Fabry-Perot Interferometer

Alexa McClennan Brown, is finishing her studies as a physics major at Mt. Allison University in New Brunswick, Canada. She took **Dr. John Meriwether's** optics course in the fall of 2009 as an exchange student, and he offered her a summer 2010 position to work with him. She helped with data analysis and various laboratory testing of the Fabry-Perot apparatus with which Dr. Meriwether works so closely.

Luis Navarro is a senior in electrical engineering at the San Marcos University in Lima, Perú. He spent ten weeks this summer working with Dr. Meriwether, learning the fundamentals of the Fabry-Perot interferometer and helping him with the data analysis processing of the FPI images. The new Fabry-Perot interferometer was sent to Perú in early August for installation on the country's west coast, at Paracas. The purpose of this FPI observatory is to observe gravity wave activity that is propagating through the thermosphere region.

From left to right: Sanjib Gupta, Anu Vaidyanathan, and Ashish Ahuja, all new faculty at IIT at Ropar

Sanjib Gupta, who earned his doctorate in nuclear astrophysics at Clemson in 2002, was profiled in the August 15,2010 *Chronicle of Higher Education* article, "An Indian University Finds Success Recruiting in the U.S." To read the article in its entirety, please see: *http://chronicle.com/article/An-Indian-University-Finds/123888.* The article focuses on the academic trajectory of many young Indians who study outside of India and have returned to populate the ranks of the teaching staff at the new and upcoming Indian Institute of Technology at Ropar. Prior to returning to India to work at Ropar, Sanjib worked for several years at Michigan State University and later at Los Alamos National Laboratory in Los Alamos, New Mexico.

Amanda Crumpton, Risé Sheriff and Celesté Hackett of the office staff get dressed up for Halloween.

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.**

NAME: _____

CLASS: _____

E-MAIL ADDRESS OR PHONE NUMBER: _____

YOUR GOOD NEWS:

_____

_____

The Clemson University Physics and Astronomy Newsletter

118 Kinard Laboratory
Box 340978
Clemson, SC 29634-0978

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

We're on the Web!
physics.clemson.edu

Nonprofit Organization
U.S. POSTAGE PAID
Clemson, S.C.
Permit No. 10

Department News

Congratulations and best wishes to **Adria Updike** and **Bethany Johns** on their new careers. **Adria** has taken a postdoctoral position with **Dr. Eli Dwek** at the Goddard Space Flight Center in Greenbelt, Maryland. Adria studied with **Dr. Dieter H. Hartmann** at Clemson, recently earning her Ph.D.

Bethany Johns also has graduated with her Ph.D. in physics and will be working as the new Bahcall Public Policy Fellow, employed by the American Astronomical Society (AAS). Her responsibilities will include promoting AAS issues in Washington, D.C. While at Clemson, Bethany studied under **Dr. Mark D. Leising**.

Associate Professor **Dr. Gerald Lehmacher** will spend most part of his sabbatical year 2011 as visiting scientist at the Jicamarca Radio Observatory, near Lima, Perú. He will expand his previous NSF-funded studies of equatorial mesospheric echoes with this most capable 50-MHz radar. His plans include conducting experiments to simultaneously observe gravity wave modulations in the electrojet and the lower F region.

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.**