Harris Center Opens With October Ribbon Cutting

On May 20, 2008, Florida Tech broke ground for the Harris Center for Science and Engineering. Located at the southern end of campus adjacent to the Olin Quad, the three-story building encompasses 28,000 square feet. The Harris Center houses a portion of the Department of Biological Sciences and the College of Engineering's Department of Computer Sciences. The top floor of the building, devoted to computer science, will include a secure facility funded by Harris Corporation for proprietary research on assured information technology. Half of the second floor will accommodate Florida Tech's new Institute for Adaptation to Global Climate Change. Biological sciences faculty Rob van Woesik, Mark Bush and Rich Aronson, the institute's principal scientists, will relocate their laboratories and offices there. Computer sciences will occupy the remaining half of the second floor. The first floor will afford office, laboratory and climate-controlled aquarium space for research in marine biology, fisheries and aquaculture, expanding the facilities biological sciences will lose to construction projects in Simcox Square. Designed by the firm of Harper Aiken Donahue & Partners Architecture Inc. and Systems Analysis (ITAS) at the Research Center Karlsruhe (Germany); Fan Chunliang, Institute of Policy and Management, Chinese Academy of Sciences; Medardo Tapia Uribe, Universidad Nacional Autonoma de Mexico; Phil Laurien, East Central Florida Regional Planning Council; Pierce Jones, University of Florida Agricultural Extension Division; Mike Sole, Florida Department of Environmental Protection; Frank Jackalone, Sierra Club; Lawrence Maxwell, Florida American Institute of Architects (AIA); Bill Young, Florida Solar Energy Center; and Fran Sullivan-Fahs and Charles Whalen, Florida Electric Auto Association. Participants numbered some 150.

2009 International Sustainability Forum Held on March 3–4

Florida Institute of Technology addressed smart growth and environmental sustainability in an era of rapid climate change at its sixth international, interdisciplinary forum, “Sustainability 2009: The Next Horizon,” on March 3–4 on campus. The forum is a collaborative effort of the Florida Tech College of Business and College of Science, and Budapest University of Technology and Economics (BME). “The forum focused on practical solutions to emerging sustainability issues from business, science and socio-political viewpoints,” said Gordon L. Nelson, dean of Florida Tech's College of Science. “It was designed to appeal to a varied audience and offer the latest academic research and perspectives for practitioners and public policy makers.” Forum themes included Climate Change and Adaptation; Tourism and Economics; Sustainability, Technology and Innovation; How Climate Change Will Impact How We Grow in Florida; and Renewable (Sustainable) Energy. Speakers complementing Florida Tech and BME presenters included Randy Parkinson, Brevard County Climate Change Group; David Nolan, Division of Meteorology and Physical Oceanography, Rosenstiel School of Marine and Atmospheric Science, University of Miami; Ken Lindeman, Coastal Science and Policy Inc.; Chad Nelson, Surfrider Foundation; Gerhard Banse, Institute for Technology Assessment and Florida Institute of Technology hosted secretary of the Florida Department of Environmental Protection Michael W. Sole as keynote speaker at “Sustainability 2009: The Next Horizon.” Sole is an alumnus of Florida Tech (Marine Biology, 1986). The standing room only presentation focused on energy and environmental stability in an era of rapid climate change. Sole was named by Florida Governor Charlie Crist as secretary in 2006. He oversees Florida's environmental regulatory and law enforcement programs; the acquisition, conservation and management of public lands, including Florida's award-winning state parks; and the development and regulation of Florida's water resources through the state's five water management districts.
Prairie Chickens Avoid Tall Structures

Christin Pruett, assistant professor of biological sciences, with Michael Patten and Donald Wolfe at the University of Oklahoma and Sutton Avian Research Center, have shown that prairie-chickens avoid tall structures such as power transmission lines. Dr. Pruett and her colleagues used long-term radio-telemetry datasets for lesser and greater prairie-chickens in Oklahoma and GIS analysis to determine that birds were unlikely to approach or cross power transmission lines. They also found that the home ranges, an area used by birds during normal daily activities, were placed away from power lines. With the boom in wind energy development in the Great Plains of North America, the possible negative effects that tall structures might have on prairie birds is of growing concern. Thus, these findings are of importance in the conservation of prairie organisms and especially of the lesser prairie-chicken, a rare grassland bird that is a candidate for listing under the Endangered Species Act. The workers propose that the placement of wind facilities be carefully considered when development occurs in grasslands. This research was published in spring 2009 in the journals Conservation Biology and BioScience.

Faculty Named Fellow of the American Physical Society

Laszlo Baksay, professor of physics and space sciences, was elected a Fellow of the American Physical Society. Election to Fellowship in APS is limited to no more than one half of one percent of the membership and is recognition by peers of outstanding contributions to physics. The citation reads “For his contributions to high energy physics, leadership of international collaborations especially bringing the Hungarian physics community into the international enterprise, innovations and activities in science education and many efforts for the APS international program and the Forum on International Physics.” Dr. Baksay is the first Florida Tech faculty member to receive this honor. In addition, Baksay was informed that the Director-General of UNESCO (United Nations Educational, Scientific and Cultural Organization) has invited him to become a member of the Scientific Board of IBSP, UNESCO’s International Basic Sciences Programme. Finally, Dr. Baksay has also just passed the mark of 10,000 citations of his publications.

Florida Governor’s School Summer Academy

David Cook, head, department of science and mathematics education, was co-PI with Debra Blenis for a Florida Department of Education project to plan a residential Governor’s School of Space Science and Technology for Florida’s gifted students in grades 9–12. Planning directions called for the school to be located at or near Kennedy Space Center and focus on science, mathematics, engineering and technology. The project was an effort of the Joint Institute for Space Exploration and Research partners Embry-Riddle Aeronautical University, Florida Institute of Technology and Florida State University. As a part of the planning effort, the team designed and conducted two sessions of a one-week residential Governor’s School Pilot Summer Academy during 2008. The academies were attended by 35 students selected from a pool of over 300 gifted student applicants from across Florida. In addition to getting a thorough overview of KSC and working on projects with NASA scientists, the students also completed projects on their own, including the design and launching of a high-altitude research balloon.

Costing an estimated $8.1 million, the Harris Center is scheduled to open in fall 2009. Partial funding comes from the Harris Corporation Charitable Fund, through the Community Foundation of Brevard. The balance is being provided through The University Financing Foundation (TUFF).
Summer Academy for Gifted Florida High School Seniors

In the summer of 2009, Florida Tech physics and space sciences faculty Sam Durrance and Niescja Turner led a two-week residential summer academy for gifted Florida high school seniors. The Florida Governor’s School for Space Science and Technology was held primarily at Kennedy Space Center. As a follow-up to work in 2008, Drs. Durrance and Turner taught an inquiry-based space science curriculum and also directed students in a research project involving flying a specialized camera on board an F-104 Starfighter jet. Dr. Durrance, a former astronaut, flew backseat in the jet during the experiment. Students were involved in preparing the camera, watching the flight and analyzing the data. They also learned from scientists and engineers at KSC laboratories, focusing on current lunar exploration research. Like 2008, admission to the school was highly competitive with only 18 slots. All activities at the school, including room and board, are covered by the academy itself at no cost to the students. Florida Tech awarded 10 scholarships to graduating delegates. Governor’s School scholarships will combine resources from Florida Tech and the State of Florida for a minimum guarantee of $15,000 per academic year up to full tuition.

Grand Reunion Alumni Celebration

In conjunction with Florida Tech’s 50th Anniversary, the Department of Science and Mathematics Education invited over 650 alumni to the department’s Grand Reunion Celebration held on campus during the weekend of July 11–12, 2008. A logo was specially designed for the occasion by one of our graduate students and was seen on the invitations and official event settings. Over 70 alumni and faculty came from as far away as Maine to reconnect, share stories with faculty, become acquainted with current students and tour the campus. Everyone enjoyed the welcome mixer Friday evening. Some ventured out on a scenic sunset eco-cruise down the Indian River lagoon. The highlight of the weekend was the grand reunion celebration dinner held Saturday evening in the Denius Student Center. The keynote speaker was alum Tracey Bailey ’88, who traveled from Fredericksburg, Va., with his wife and their nine children to be with us. After completing his bachelor’s in physics education and master’s in science education (physics concentration) at Florida Tech, Mr. Bailey taught physics at Satellite High School. It didn’t take him long to become the Brevard County Teacher of the Year, then the Florida Teacher of the Year and finally National Teacher of the Year in 1994. In keeping with his reputation, and always the teacher, Tracey captivated the crowd with an entertaining and educational science demonstration disguised as a physics “party trick.”

New Bridge

The faculty and staff of the Department of Science and Mathematics Education enjoy the department’s location in the Shephard Building—that’s the wooden building in “the jungle” located on the east side of campus and accessed only via the covered wooden bridge. That was until weather weakened the roof of the bridge so badly that it started to come down in sections. A bridge crew came in, took out the old bridge and built a new one from the jungle floor up. Fortunately, they worked on only half of the bridge at a time, leaving one way to get in and out of Shephard while the work progressed. To celebrate this new edifice in the style of the old covered bridge and the gateway to the Shephard Building, the Florida Tech chapter of Future Educators of America sponsored several “Bridge Parties” open to the campus community on such occasions as the beginning and ending of the semester. In addition to renovating the bridge, offices inside the Shephard Building got a makeover. The lab was rearranged to better accommodate students’ study needs. Finally, fewer, but newer, computers are in service as well as a group study area.
National Consortium of Specialized Secondary Schools of Math, Science and Technology (NCSSSMST)

In March, Debra Blenis, director of teacher education for the Department of Science and Mathematics Education, made two presentations at the 2009 Professional Conference of the National Consortium of Specialized Secondary Schools of Math, Science and Technology (NCSSSMST). The presentations were titled “Florida Governor’s School Pilot Summer Academy for Gifted Students: What We Learned” and “Tapping the Brain’s Funny Bone: Classroom Applications.”

Florida Tech’s FEA Chapter Hosted BFEA Conference

In December 2008, over 300 middle and high school students and their chaperones descended on the Florida Tech campus for the annual Brevard Future Educator’s Association conference. This was a considerably bigger turnout than in years past, yet everything ran smoothly, due in part to the dedicated FEA volunteers. Florida Tech education majors assisted with registration, judging posters, the spirit competition, escorting participants to and from sessions, and they presented at four of the special sessions. Physics education student Mike Greene filled the auditorium with paper airplanes during his applied physics presentation. Graduate science education students Kathryn Jennings and Joy Winet worked through critical thinking exercises that resulted in some truly outside of the box answers. Middle grades math education student Kyan Robinson had students testing their wits with his challenging and fun math puzzles. Middle grades science education student Deirdra O’Donnell had everyone wowed with her hands-on science demonstrations. Debra Blenis, director of teacher education in the Department of Science and Mathematics Education, is the chapter adviser.

Marine Biology, 3rd Edition

Richard Turner, associate professor of biological sciences, and co-authors have released the third edition of Introduction to Marine Biology through Cengage Learning. The updated volume takes an increasingly ecological and evolutionary approach. In the chapters for which Dr. Turner was responsible, a major new theme to unite his presentation of marine microbes, seaweeds and vascular plants is endosymbiotic theory. Endosymbiotic theory deals with the origins of such organelles as mitochondria and chloroplasts and the strange sequences of symbiotic relationships that have led to the great diversity of life on Earth today. The chapter on the open sea has information about the dangers that plastics present for leatherback sea turtles, sea birds and other specialized predators of jellyfish and similar gelatinous plankton. The textbook continues its reputation for high readability and level of illustration.

Silver Nanoparticles—Green Chemistry

Silver nanoparticles have attracted much attention due to their unique properties, which provide solutions to technological and environmental challenges in the areas of solar energy conversion, catalysis, medicine and water treatment. The wide range of studies with respect to the synthesis, characterization and applications has led to a review article “Silver Nanoparticles: Green Synthesis and Their Microbial Activities” by Virender K. Sharma, Ria A. Yngard and Yekaterina Lin in Advances in Colloid and Interface Science that was awarded a honorarium by Elsevier Publications.
Two Contracts Awarded; Defense Threat Reduction Agency

New associate professor of chemistry **Andy Knight** has been awarded two contracts totaling $148,278 from the Defense Threat Reduction Agency (DTRA). His project involves designing novel metal-based drugs that will act as broad-spectrum therapeutics to defend against biological warfare agents such as Ebola virus and Venezuelan equine encephalitis. Working with him are Florida Tech graduate students Christa Simmers, Aaron Funk and Christian Agatemor; postdoctoral associate Ria Yngard; and undergraduate student Laura Congiardo. Collaborating with him is Dr. Eddie Chang of the Naval Research Laboratory in Washington, D.C.

Seahorse Aquaculture

Seahorses comprise a group of unique marine fish in both morphology and reproductive biology (the female seahorse deposits eggs into the male’s pouch during mating and the eggs are fertilized and develop into juveniles inside the pouch). They are vulnerable to overexploitation because of low mobility, small home range (site fidelity), mate fidelity, lengthy mating and long parental care. Unfortunately, seahorses are heavily collected for Chinese traditional medicine and aquarium trade, which has led to all 33 recognized species (genus Hippocampus) being listed in Appendix II of endangered species by CITES (Convention on the International Trade in Endangered Species). However, the demand for seahorses remains high and enforcement of CITES is problematic. Many seahorse populations are still facing the danger of local extinction. In recent years, much effort has been devoted to developing aquaculture protocols for breeding seahorses in captivity to reduce the fishing pressure. However, low survivorship during early juvenile stages remains the major bottleneck for commercial production. Seahorses are slow swimmers and suction feeders. Early juveniles only feed on live animals that happen to be nearby. In recent years, **Junda Lin**’s laboratory has used high-speed video to evaluate the effects of different live feed and their density as appropriate diet during juvenile seahorses’ development. They have also analyzed the biochemical composition of the seahorses and different diets to identify optimal feed. Results from these studies, along with effects of feeding behavior and environmental factors (e.g., temperature, light and salinity) have allowed them to develop protocols for culturing juvenile seahorses with high survivorship and growth rates. They have also tested ways to reduce air bubble disease, a common cause of mortality in seahorses as the inhaled air bubbles accumulate inside the seahorses. Dr. Lin was recently elected to the board of directors, World Aquaculture Society (2008–2011).

Study the Final Frontier of the Solar System—Heliosheath

After nearly three decades touring outer planets, Jupiter, Saturn, Uranus and Neptune, the twin Voyager spacecraft have crossed the termination shock, where the solar wind, a tenuous hot ionized gas from the sun, slows down abruptly. The Voyagers, now at roughly 100 times the distance from the sun to the Earth, are exploring the solar system’s final frontier—heliosheath, a vast turbulent expanse where the sun’s influence ends and the solar wind crashes into the thin gas between stars called interstellar medium. To add to the understanding of the heliosheath, NASA launched a new mission called Interstellar Boundary Explorer (IBEX) in October 2008. It is a small satellite about the size of a bus tire in orbit around the Earth. It will observe the heliosheath with its telescopes, which collect particles rather than light. These particles, called energetic neutral atoms (ENAs), are produced in the interaction between the solar wind and interstellar gas inside the heliosheath, and they travel in almost straight lines toward the Earth. The image observed by the ENA telescopes on IBEX will provide information about the properties of the heliosheath where the Voyagers cannot see. **Ming Zhang**, professor of physics and space sciences, has earned three major NASA grants totaling $1.3 million to study the heliosheath. His team at Florida Tech includes **Hamid Rassoul** and three graduate students Xi Luo, Cristina Heredea and Ismael Diaz. A former Florida Tech research scientist Dr. Gang Qin, now at the Chinese Academy of Science, will continue to collaborate on these projects. Two new research scientists Drs. Konstantin Gamayunov and Pingbing Zuo will join the team late summer 2009. Together, they will work on the interpretation of data from Voyagers and IBEX, concentrating on modeling the transport and acceleration of energetic particles and cosmic rays. These projects are a joint effort with researchers from the University of Alabama in Huntsville, Caltech, MIT, the Applied Physics Lab and the Southwest Research Institute.
Florida Tech Outstanding Chapter; Society of Physics Students

The national headquarters of the Society of Physics Students, the student organization of the American Institute of Physics, named the Florida Institute of Technology chapter of the Society of Physics Students (SPS) an “Outstanding Chapter” for the 2007–2008 academic year. This was the chapter’s fifth consecutive award within the Southeastern Zone 6. “To the best of my knowledge, for one SPS chapter among 700 chapters nationwide to win five such awards in a row is unprecedented,” said Marcus Hohlmann, Florida Tech SPS faculty adviser. The annual selection of recipients is based on the level of SPS chapter involvement in physics research, public science outreach efforts, SPS programs such as physics tutoring, community service, hosting and representation at physics meetings and events, and providing social interaction for chapter members. The SPS is the fourth largest physics society in the country. About 5,000 students take part in activities each year. The 2007–2008 officers of the Florida Tech SPS chapter were Pat Malvoso, president; Jan Varada, vice president; Valerie Rapson, treasurer; and Lauren Henry, secretary.

Scholarly Contributions of Florida Tech Mathematical Sciences Department to the Editorial Boards of National and International Mathematical Journals

Ravi Agarwal continues to serve as an editor/main editor/associate editor of over 40 international journals. Some of these journals are considered best in the subject and have a very high impact factor. On average, he receives about 15-plus papers per day. For each paper, he decides the subject area and particular problem it handles, makes a critical decision to choose an appropriate person among the associate editors for much closer scrutiny of the paper, and sometimes deals with the problematic situation when one or more associate editors do not agree. From this, the service potential to Florida Tech is direct as the institute gets recognition as being the place where scholarly activity is encouraged.

The BioMath Group: Where Biology Meets Mathematics

Theory! Who cares about theory? Biology students frequently question the relevance of mathematical constructs and theory, while mathematics students see few real-life applications of theory. An undergraduate program, funded by the National Science Foundation (from 2008–2010), provides the venue that reveals relevance and application of both biology and mathematics. The Florida Tech program annually supports six undergraduate students from the departments of mathematical and biological sciences. Faculty mentors are Semen Koksal and Jewgeni Dshalalow from mathematics and David Carroll, Richard Sinden, and Robert van Ravi Agarwal continues to serve as an editor/main editor/associate editor of over 40 international journals. Some of these journals are considered best in the subject and have a very high impact factor. On average, he receives about 15-plus papers per day. For each paper, he decides the subject area and particular problem it handles, makes a critical decision to choose an appropriate person among the associate editors for much closer scrutiny of the paper, and sometimes deals with the problematic situation when one or more associate editors do not agree. From this, the service potential to Florida Tech is direct as the institute gets recognition as being the place where scholarly activity is encouraged.

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Camp NanoTech 2009

Camp NanoTech offers young students the chance to learn about nanotechnology, an important field of cutting-edge science and technology. Associate professors Kurt Winkelmann and Joel Olson direct the camp for students in junior high and high school. Campers attend half-day long workshops where they get hands-on experience with nanotechnology. Activities include constructing models of atomic structures, making a liquid that responds to magnets, synthesizing gold nanoparticles and ferrofluids, imaging surfaces of materials using scanning tunneling and atomic force microscopes, learning the history of nanotechnology and debating the impact of nanotechnology on society. Campers also get a chance to tour some of the research laboratories at Florida Tech and talk with faculty and undergraduates about college life and research experiences. Florida Tech has particular expertise in this area, as we offer one of the nation’s few freshman-level nanotechnology laboratory courses. Camp NanoTech 2009 was offered July 20–24.

Physics of Active Galaxies

Eric Perlman, associate professor, Department of Physics and Space Sciences, has continued his work on active galaxies using a variety of space and ground-based telescopes. His work on jets with the Hubble Space Telescope has provided the first concrete information on the emission mechanism of the most powerful jets in the x-rays, revealing that both synchrotron and inverse-Compton emission mechanisms are possible. He and his team, which includes postdoc Mihai Cara as well as three graduate students, are supported by multiple NASA grants, including $490,000 from NASA and $160,000 from the Space Telescope Science Institute. They are working on exploring the implications of this finding as well as performing observations of other quasar jets. Dr. Perlman and his team are also gearing up for observations of active galaxies with CanariCam on the new Gran Telescopio Canarias, a 10.4-meter optical/infrared telescope on La Palma in the Canary Islands. Along with his collaborator, Dr. Perlman has access to over 300 hours of time on the GTC for this project, which aims to reveal the dust structures in active galaxies and their role in the physics of these objects.
Bioorganic Research Group Uses Direct Analysis in Real Time

Nasri Nesnas' Bioorganic Research Group is involved in research topics ranging from the synthesis of chromophores and catalysts targeting a better understanding of the chemical process of vision, photoactive neurological agonists, to research geared at generation improved biodiesel fuels, and understanding the chemistry of fish mucous. Rui Guo, a fifth-year Ph.D. graduate student assisted by undergraduate Sam Breit, is generating bio-inspired catalysts for the ultimate construction of visual chromophores. The latter are crucial in the study of the visual cycle, which may reveal potential means of combating the yet unresolved dilemma of age-related macular degeneration, the leading cause of blindness. She is also extending the potential of DART (direct analysis in real time) Mass Spectrometer, pictured, to study the ionization of different classes of natural products. Florida Tech was the first Ph.D.-granting research institute to obtain DART mass spectrometer technology, a result of Nesnas’ and Olson’s initial collaborative work with the co-inventor of DART, Dr. Robert B. Cody. Yannick Ouedraogo, a second-year Ph.D. graduate student who graduated from Florida Tech in 2007, is working on a collaborative project with Janelia Farm at Howard Hughes Medical Institute. Assisted by undergraduate Karissa Albin, he is developing novel techniques at making extremely photosensitive and elusive compounds that will be tested on brain slices for their activity. He has previously successfully synthesized fish pheromones using direct and rapid techniques. Peter Cohen, who is also a second-year Ph.D. graduate student and 2007 alumnus, independently designed his own project on biodiesel research. He directed Stephanie Monaco, a senior chemistry student, and they won an award for their poster that Stephanie presented at the 2009 Northrop Grumman Engineering & Science Student Design Showcase. Biodiesel from algae is an important area of research since it gives promise to a carbon neutral, and sustainable, fuel. The research aims toward finding the fastest growing and most efficient strains as well as developing methods of production that are more efficient and rapid.

New Eyes on the Sky at Florida Tech

On Friday, April 18, 2008, about 150 friends and alumni of the Florida Tech Department of Physics and Space Sciences gathered atop the F.W. Olin Physical Sciences Center to officially commission Florida’s largest research telescope. The instrument is a 32-inch (0.8-meter) diameter reflecting telescope, equipped with state-of-the-art instrumentation. Prior to the official christening, guests sampled “astronomical hors d’oeuvres” among 10 small telescopes mounted on the rooftop deck, accompanied by live music. Highlighting the ribbon-cutting ceremony at sunset, amateur magician and Florida Tech chemistry associate professor Nasri Nesnas provided a magical ribbon-cutting. The dedication ceremony was led by Florida Tech president Anthony Catanese, who officially christened the “Ortega Telescope.” Originally, a grant submitted by Terry Oswalt and Matt Wood to the National Science Foundation provided funding to build a 24-inch (0.6-m) telescope on the Florida Tech campus. Dr. James and Mrs. Sara Ortega, residents of Melbourne Beach, contributed an additional $150,000 to upgrade this instrument to 32 inches, making it the largest research telescope in Florida. Dr. James Ortega was the evening’s guest of honor. Ortega retired from the University of Virginia in 1998, where he was the Endowed Charles Henderson Professor and chairman of the departments of applied mathematics and computer sciences. The Ortega Telescope began to be productive even before it was dedicated. Over two dozen undergraduates pursued research projects using the telescope during its first year of operation. Only six months after its dedication, the first master’s thesis was completed by Tomomi Otani, using data collected with the telescope, and several other graduate students are now using it as part of their theses or dissertation projects. It also serves as the focus of Florida Tech’s popular Astronomy and Astrophysics Public Lecture series in which local and external speakers present talks on topics such as the search for life elsewhere in the universe. On a sad note, both Jim and Sara Ortega passed away in October 2008.

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Observations of Transient Luminous Events and Meteors

A low-light TV camera and an all-sky camera have been installed on the roof of the F.W. Olin Physical Sciences Center to observe transient luminous events and meteors. Transient Luminous Events (TLEs) are atmospheric phenomena occurring at high altitudes that are associated with lightning activities in underlying thunderstorms. Discovered in the early 1990s, there are now several types of TLEs known, such as sprites, blue jets, gigantic jets and elves. The typical duration of TLEs is very short with an order of 1-10s milliseconds. A sensitive camera is required for observations. The low-light TV camera provides continuous observations of TLEs. The collected data will be used to compare with those made at other sites and from space. The all-sky camera is part of a ground-based network that can systematically capture sporadic events such as flashes caused by meteors in the upper atmosphere to determine their origins and the composition of the radiating area. The unpredictable nature of sporadic events makes it very difficult to carry out targeting observing missions using satellites. The network of ground cameras therefore offers an effective tool to detect those events and ground truth against satellite data on the atmospheric impacts of meteors and other phenomena. The ground cameras also serve as a research tool for determining meteor effects in the upper atmosphere. This research work is conducted by Ningyu Liu, assistant professor in physics and space sciences, Dwayne Free, a senior engineer from Soneticom Inc. and Guillermo Naranjo, an undergraduate.

Environmental-Friendly Approach for Remediation of Environmental Pharmaceuticals

Several pharmaceuticals have been detected globally in surface water and drinking water, which indicate their insufficient removal from water and wastewater using conventional treatment methods. Recently, the kinetics of oxidative transformations of pharmaceuticals (antibiotics, lipid regulators, antipyretics, anticonvulsants and beta-blockers) by chlorine, ClO2, O3 and ferrate(VI) (FeVIO42-) under treatment conditions was reviewed. This review article by Virender Sharma, in the journal Chemosphere, demonstrated advantages of ferrate(VI) over other oxidants to detoxify pharmaceuticals in the environment.

Liu Received URSI Young Scientist Award

Ningyu Liu, assistant professor in physics and space sciences, received the Young Scientist Award at the XXIX General Assembly of International Union of Radio Science (URSI) in Chicago. Dr. Liu was invited to present his paper, “Further Comparison of Sprite Streamer Modeling Results with ISUAL Spectrophotometric Measurements,” at the assembly. The work results from an ongoing collaborative effort in studying the spectral signatures of massive luminous atmospheric phenomena above thunderclouds. The participants of the effort include scientists from Florida Tech, Penn State, the University of California at Berkeley and National Cheng Kung University. The study utilizes up-to-date models of plasma discharges and photochemistry and data collected by the ISUAL (Imager of Sprites and Upper Atmospheric Lightning) payload on the FORMOSAT-2 satellite. The Young Scientist Awards recognize a group of young researchers who have made innovative contributions and discoveries in radio science. The award is also to promote collaborations between developed and developing countries. Liu joined the Department of Physics and Space Sciences at Florida Tech in spring 2008. He received his Ph.D. from The Pennsylvania State University in 2006.
American Chemical Society Award for Outstanding Graduate Student

In December 2008, Pranav Patel, Ph.D. graduate student of Joshua Rokach, chemistry professor, received from the Orlando Section of the American Chemical Society the Outstanding Graduate Student Award for 2008. Pranav’s main research interest is the use of bioorganic and synthetic chemistry to advance the understanding of biochemical and biological systems. The total syntheses of biologically important molecules are performed, and from these molecules, synthetic probes are designed to identify and isolate enzymes and receptors that have escaped isolation by the most commonly used techniques. Pranav has been working on structural requirements for the activation of the 5-oxo-ETE receptor and syntheses of small molecules as 5-oxo-ETE antagonist. Recently, Pranav successfully accomplished the first total synthesis of 15(R)-Me-PGD2: the most potent and selective DP2 receptor agonist, resulting in a publication in the *Journal of Organic Chemistry*. Pranav is also co-author of eight articles and is first author in four of them.

Excellence in Research Award

The Florida Tech’s 2008 Faculty Excellence in Research Award for outstanding performance was given to Virender Sharma. Dr. Sharma is active in developing innovative and cost-effective methods for reducing the level of contaminants in the aquatic and coastal environments and has published more than 120 peer-reviewed journal articles. Considered an expert, he has been invited to give seminars on this topic at many prestigious institutions around the world.

Publication of a Book

Virender Sharma edited a book *Ferrates: Synthesis, Properties, and Applications in Water and Wastewater Treatment*, which has 30 chapters. This book targets chemists and environmental scientists and engineers who are engaged in understanding the chemistry of high-valent iron (Ferrate) and in applications of green chemistry to treat contaminants in water, wastewater and industrial effluents. The book provides information on synthesis and properties of Ferrate (VI) including oxidation, coagulation and disinfection for the multipurpose treatment of water and wastewater. This book is distributed by the Oxford University Press, 2008.

Physics and Space Sciences Celebrates 50 Years

To kick off the university’s 50th Anniversary Celebration, the Physics and Space Sciences Department hosted its inaugural Alumni Reunion and Symposium. About 150 attended the three-day event, held October 10–12, 2008. It was particularly fitting to open the week-long Florida Tech 50th Anniversary Homecoming Celebration with a reunion for the Department of Physics and Space Sciences, as it was one of the original academic departments. Today, it is Florida Tech’s leading research department and home to one of the largest undergraduate programs of its kind in the nation.

The reunion opened with a reception on Friday, October 10, atop the roof of the Olin Physical Sciences Center. Indeed, as guests were arriving, the stars came out and the International Space Station crossed directly overhead! Another high point of the evening was a tribute to Mrs. Irene Nash, the department’s administrative assistant for nearly 30 years, and “mother” to generations of our students. After technical sessions, the banquet on Saturday night featured Bill Parsons, director of Kennedy Space Center. Mr. Parsons provided an overview of the future of NASA and its plans to return humans to the moon and on to Mars. During the banquet, alumni enjoyed a slide show of photos and memorabilia from the department’s history. The weekend concluded with a casual Sunday brunch.

The Physics and Space Sciences Department Alumni Reunion was sponsored by Gooch and Housego, Aridian Publishing Company, Quantum Technology Service, Inc., Honeywell Corporation, Brahe Corporation and Soneticom Corporation, whose financial support helped make this memorable event possible. Photos from the reunion can be found at http://411.fit.edu/pssreunion.
Sampling Key Ecological Processes on Coral Reefs

Coral reefs occupy only one percent of the ocean’s surface, yet they are the world’s richest repository of marine biodiversity and provide food and resources for hundreds of millions of people. It is not difficult to identify coral-reef stressors, with transformations on adjacent lands, and projected climate change driving temperatures and seawater chemistry to levels outside the envelope of modern reef experience. It is more difficult to understand the dynamics of reef organisms in regard to global climate change, and which coral populations are destined to become the “winners” and which populations are destined to become the “losers”? Rapid environmental change is likely to induce rapid adaptation of some species, shifting ecological and evolutionary rates of change to the same time frame. Changing environments, coupled with the forces of natural-selective pressure, mutation, genetic drift and recombination (through sexual reproduction) all culminate as potential adaptive mechanisms of populations through time. But which populations will have the capacity to adjust? Understanding the response of reef organisms to the various disturbances and stressors will lead to accurate predictive models of population trajectories over time. Most reef studies and monitoring programs examine the state variables of reefs, by assessing the coverage of major benthic organisms; few studies examine the key ecological processes that drive the state variables. The ecological sampling, or common sampling project as it is more commonly known, undertaken by Professor Robert van Woesik and his group, has been assessing the dynamics of coral populations and associated coral reef organisms in four key locations: Zanzibar (Tanzania), Heron Island (Australia), Puerto Morelos (Mexico) and Bolinao (the Philippines). The project is defining key ecological processes that regulate coral populations across the four regions, which is leading to global comparisons. The research, funded by the Global Environment Facility and the World Bank, is in the first phase of a 15-year project to examine coral-population performance.

Setting up one of the study sites (Bawe Island) in Zanzibar; Note that the rope is temporary and removed after photographs are taken for each sampling period.

Showcasing the Research Spirit of our Undergraduate Students

Since 2006, Florida Tech has hosted the annual Design & Research Showcase in the Clemente Center. This showcase includes dozens of research projects developed by undergraduate students, working on their own or in teams, from all academic departments in the College of Science (COS) and the College of Engineering (COE). Students participate in these research projects to gain hands-on experience in applying science and the fundamental principles of their major. The students must conceive, research and/or design and implement the project. Additionally, they prepare a final write-up in a scientific journal format appropriate to their major and present the final outcome of their work. The students apply theory, think creatively and develop practical skills such as teamwork, professionalism and leadership. “It also helps students to weigh up their plans for their post-graduate educations and career,” said Hamid Rassoul, associate dean and co-organizer of the annual student showcases. The 2009 Northrop Grumman Engineering & Science Student Design Showcase was held on Friday, April 3, 2009, in the Clemente Center. The College of Science submitted 38 research projects for the showcase. The program/abstract booklet for all projects can be found at: http://cos.fit.edu.

College of Science Students Win Best Research Awards

The following students, who have been conducting research in Ralph Turingan’s laboratory at Florida Tech, have been awarded recognition for their research. John Majoris, a marine biology undergraduate student, won the 2008 Best of Student Showcase, College of Science, for his research, “Form and Function in Amphiprion frenatus larvae.” Ronald Maliao, a Fulbright Scholar and a Ph.D. student from the Philippines, was awarded the 2008 Young Investigator Award for his research, “Coupling Social and Ecological Indicators in Evaluating the Performance of Marine Protected Areas (MPAs)” at the 7th William R. and Lenore Mote International Symposium in Fisheries Ecology.
Professors Research Radiation from Space Under New NASA Grant

Solar energetic particles (SEPs), especially those of high energies, can negatively affect the near-Earth space weather environment and spacecraft. The SEPs can originate from either energization at a solar flare site or by interplanetary shockwaves associated with coronal mass ejections (CMEs). The charged energetic particles consist of protons, electrons and heavy ions—primarily moving along the solar and interplanetary magnetic fields—can reach Earth in a matter of a few hours and dose the geospace environment with hazardous radiation. To increase understanding of SEP transport, Ming Zhang, professor of physics and space sciences, and his collaborators Hamid Rassoul, from Florida Tech, and Gang Qin, from State Key Laboratory of Space Weather in China, have received NASA funding of just under $400,000 for a three-year project. They will investigate the propagation of SEPs in the three-dimensional heliospheric magnetic fields. The objective of this theoretical and data analysis project is to solve the mystery why some SEP events can come from CME or flare events that are not magnetically connected to the sun, and why SEPs often form a uniform particle reservoir in the entire inner heliosphere. Their specific goal is to assess the role of cross-field diffusion in charged particle transport. “We hope to extract the physics of particle acceleration and propagation in interplanetary space. In addition, the knowledge of energetic particle flow in the solar system will enhance our understanding of many high-energy astrophysical phenomena, such as cosmic rays, supernova remnants and gamma-ray emissions,” said Dr. Zhang.

Faculty Excellence Awards

Two College of Science faculty earned the university’s 2009 Faculty Excellence Awards for outstanding performance. The Award for Excellence in Research went to Marc Baarmand, physics and space sciences. Shortly after joining Florida Tech in August 2000, Dr. Baarmand initiated an experimental particle physics program based on research with the Compact Muon Solenoid (CMS) experiment at the European Center for Particle Physics CERN, the largest high-energy physics lab in the world. This $550 million international project is currently one of the top priorities in the field of high-energy physics supported in the U.S. by the Department of Energy and National Science Foundation. Through Dr. Baarmand’s negotiations with the CMS management, Florida Tech was formally admitted into the CMS collaboration in June 2001. He is principal investigator, project director and Florida Tech representative to the CMS Collaboration Board. To date, he has received more than $1.5 million of funding from DOE for this project. The Andrew W. Revay, Jr. Award for Excellence in Service went to Kurt Winkelmann, chemistry. Dr. Winkelmann is the past president of the faculty senate, the adviser for the ACS student affiliate section, active in community outreach with chemistry demos, active in LASER Day and has developed, with help from NSF, a nanotechnology laboratory course. In addition, he has produced a Mole Day show which is always very well attended.

Florida Tech Doctoral Candidate Wins JSPS Fellowship

The Japan Society for the Promotion of Science (JSPS) has accepted Erik Casbeer to the East Asia and Pacific Summer Institutes (EAPSIs) 2009 Program in Japan. Casbeer is pursuing his doctoral degree in chemistry, with a concentration in analytical chemistry. His research on ferrate chemistry is under Virender Sharma, associate professor of chemistry. Casbeer will be spending 10 weeks, summer 2009, at Konan University in Kobe, Japan. He will be conducting his doctoral work in collaboration with Professor Satoshi Fujii. The goals of EAPSI are to introduce U.S. graduate students to East Asia and Pacific science and engineering in the context of a research setting and to help students initiate scientific relationships that will better enable future collaboration with foreign counterparts. Selected students participate in research experiences at host laboratories in Australia, China, Japan, Korea, New Zealand, Singapore or Taiwan.

Large Synoptic Survey Telescope

Hakeem M. Oluseyi and recent Florida Tech undergraduate students Chris Culliton and Muhammad Furqan have worked for the last year with the development team for the Large Synoptic Survey Telescope (LSST) at the University of Washington (UW). Dr. Andrew Becker, a UW research professor, hosted Dr. Oluseyi and the two students for several weeks during the summer of 2008 as they worked together to determine LSST’s ability to recover the lightcurves of periodic variable stars. LSST is an 8.4-meter telescope that will image the entire sky visible from Cerro Pachon, Chile, every three days for a total period of 10 years. LSST’s data promises to revolutionize many fields of observational astrophysics by opening up the extended temporal domain. A major objective of modern astrophysics is to understand the details of galaxy formation and evolution. Such theories can be

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Fifth World Congress of Nonlinear Analysts

The Department of Mathematical Sciences organized the Fifth World Congress of Nonlinear Analysts (WCNA-2008) from July 2–9, 2008, at the Hyatt Grand Cypress Resort, Orlando, Fla. About 1,100 participants from 80 countries participated and presented scientific talks on topics from various disciplines that deal with mathematical ideas and nonlinear analysis. The College of Science organized a plenary session in honor of V. Lakshmikantham in which several leading mathematicians from around the country and Florida Tech senior administrators paid tribute to “Dr. Lak—The Man and the Mathematician” for all his outstanding contributions to the mathematical community in general and Florida Tech in particular. There was a reception in the evening. During the first day of the Congress, an entire session (2–6 p.m.) was devoted to pay tribute to Dr. Lak, by his many students, colleagues and friends. Dr. V. Lakshmikantham was awarded the Lyapunov Gold Medal by the Russian Academy of Nonlinear Sciences (ANS) on the first day of the Congress, during the Opening Ceremony. The Russian delegation that attended the Congress presented the medal, which was an appreciation of work pioneered and promoted by Dr. Lak in applying Lyapunov’s method and popularizing it well beyond its original scope. Dr. Lak has completed the following three research monographs: 1) The Hybrid Grand Unified Theory, Atlantis Press, Paris, France, 2009. The book is an attempt to provide a hybrid grand unified theory to understand the universe both in its micro-quantum aspects as well as macro-galactic aspects. 2) Theory of Fractional Dynamic Systems, Cambridge Scientific Publishers, Cambridge, U.K., 2009. This book introduces derivatives of non-integer orders of functions known as fractional derivatives, developing the theory of fractional differential equations. It is the first book that deals with the theory of such equations and is very useful for applied scientists who model many real-world problems via fractional differential equations. 3) This is Our History, Bharatiya Vidya Bhavan, Bombay, India, 2009. This book attempts to provide the chronological history of India from 3012 BC.

Florida Tech Promoted Faculty Members

Florida Institute of Technology has promoted six faculty members to the position of professor and 11 to associate professor. Faculty promotions occur annually, in March or April. For the College of Science, promoted to the position of professor were J. Clayton Baum, Department of Chemistry. Dr. Baum, who came to Florida Tech in 1979, was a postdoctoral fellow with Michael Kasha at Florida State after receiving his Ph.D. from Princeton University. He has had an award established in his honor by the chemistry department alumni, which recognizes the outstanding junior chemistry major with a cash scholarship supplement. His research in spectroscopy is very high quality, and he is also one of our best teachers. Promoted to the position of associate professor were Joel Olson and Kurt Winkelmann, both of the Department of Chemistry. Dr. Olson has been at Florida Tech since 2003 and is an expert in scanning tunneling microscopy. His Ph.D. is from the University of Wisconsin. His colorful atomic scale images decorate the hall outside his office. He is popular with his students and has won several teaching awards. Dr. Winkelmann, the immediate past president of the Faculty Senate, has been active in chemical education especially in nanotechnology since coming to Florida Tech in 2002 from Auburn University. He has served as the adviser of our student affiliate section of ACS and is very active in community outreach.

New President of Faculty Senate

Alan Brown of the chemistry department was elected president elect of the Faculty Senate at its March 2008 meeting. He will serve as president from April 1, 2009 until April 1, 2010.

Scientist Earns $465,000 Grant for High Energy Physics Research

Marc Baarmand, professor of physics and space sciences, has received a $465,000 grant from the U.S. Department of Energy (DOE) supporting his research in elementary particle physics and to help understand the origin of mass. This grant brings the total to over $1.5 million that the DOE has funded Dr. Baarmand for his work on the Compact Muon Solenoid (CMS) project, which is located at the European Center for Particle Physics (CERN) in Geneva, Switzerland. After more than a decade of construction and commissioning, the CMS experiment will start processing data later this fall when the Large Hadron Collider, a proton accelerator, starts its operation producing proton-proton collisions at the highest ever energies. Baarmand, research scientist Igor Vodopiyanov and graduate students Hamit Mermerkaya and Mike Ralich are preparing for data analysis. The CMS experiment, an array of large particle detectors, is the size of a five-story building. The experiment will record data on proton collisions, which will occur every 25 nanoseconds in the Large Hadron Collider accelerator tunnel 300 feet beneath the earth.
tested and influenced by a significantly improved understanding of the distribution and kinematics of stars in our own galaxy, the Milky Way, which is a complex and dynamical structure that is still being shaped by accretion of intergalactic gas and by merging with neighboring smaller galaxies. Periodic variable stars such as RR Lyrae provide one technique for mapping the galactic structure and history. LSST will observe millions of these periodic variable stars. During the summer of 2009, two new students will work with Drs. Oluseyi and Becker: Keri Hoadley, a Florida Tech undergraduate in the department of physics and space sciences, and I. Julius Adotonye, an undergraduate at Alabama A&M University. Alabama A&M is a historically Black college where Dr. Oluseyi holds a position as an adjunct professor of physics. The results of this work are expected to be submitted for publication to the scientific journal *Publications of the Astronomical Society of the Pacific* in fall 2009.

**New Institute for Adaptation to Global Climate Change at Florida Institute of Technology**

The second floor of the new Harris Science & Engineering building houses the new Institute for Adaptation to Global Climate Change. Global climate change is no longer a possibility. Global temperature is increasing at 0.2°C (or 0.5°F Fahrenheit) each decade because of emissions of carbon dioxide and other greenhouse gases. We will see roughly a doubling of the pre-industrial concentration of CO₂ in our atmosphere by the year 2100. The land and sea are warming, sea level is rising, and the oceans are turning acidic. Hurricanes may become more intense and possibly more frequent. The geographic ranges of species may shift, introducing many new tropical species to Florida. Warmer temperatures will alter the epidemiology of disease outbreaks around the state. On the positive side, winter freezes that are milder and less frequent could improve growing conditions for citrus crops. Inevitably, the new climates will prompt re-evaluations of risk, insurance and a host of planning decisions. While legislators at all governmental levels grapple with strategies to reduce greenhouse-gas emissions and assess the feasibility in societal terms of reversing climate-change effects, human social entities at all societal levels must adapt to new climates. The Florida Tech Institute for Adaptation to Global Climate Change will lead the way in scientific research, with the explicit goal of recommending adaptive strategies to the state of Florida and beyond. A number of faculty conduct research on global climate change at Florida Tech. The institute’s inaugural director Robert van Woesik, alongside Florida Tech researchers Richard Aronson, Mark Bush, Christin Pruett, John Trefry, John Windsor, Kenyon Lindeman and Semen Koksal, will provide the critical mass to establish a world-class group devoted to climate change. The institute will provide opportunities for undergraduate and graduate students to engage in climate-change research that leads to improved decision-making at local to international levels. The institute will welcome new collaborators and have a broad impact on the local and regional community. The mission will be to provide informed climate-change science and forecast the response of ecological and human communities to climate change in the state of Florida and beyond.

**Community Foundation of Brevard Grants $50,000 to Florida Tech’s Alzheimer’s Disease Research**

A $50,000 grant was given to Florida Tech from the Community Foundation of Brevard’s Kenneth R. Finken and Dorothy Hallam Finken Endowment Fund for research into the cause and cure of Alzheimer’s disease. The lead Florida Tech researcher is Shaohua Xu, associate professor of biological sciences, who is already studying the origin of Alzheimer’s disease, using atomic force microscopy to test his unique theory. Dr. Xu’s theory explains why, in the brain cells of victims of Alzheimer’s, molecules of a normal protein called “tau” do something very abnormal: they join together to form tangled fibers that the cell cannot remove. The fibers accumulate until essential substances cannot move through the cell and the cell dies. As brain cells are lost, memory and mental functioning deteriorate. “Confirmatory evidence is essential,” said Xu. “Two proteins aggregate into toxic fibers in Alzheimer’s disease. We have shown that one protein, tau, aggregates by a colloidal process. Under this grant we are able to provide strong evidence for the theory by showing that the second Alzheimer’s protein, A-beta, also forms fibers following the same pathway.” The grant will make it possible to add critical equipment to the laboratory, including a Bio-Tek Microplate Reader for measuring critical reaction rates. It will allow them to analyze the factors that accelerate the formation of fibers, which may be risk factors, and permit screening potential drug molecules that might inhibit the fiber formation process. Xu’s research is conducted both at Florida Tech and the Space Life Sciences Laboratory, a unique research facility at Kennedy Space Center (KSC) operated by the state of Florida in partnership with NASA and Florida universities. At KSC, he uses a state-of-the-art Atomic Force Microscope.

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Shaohua Xu
Global Warming Threatens Antarctic Sea Life

Climate change is about to cause a major upheaval in the shallow marine waters of Antarctica. Predatory crabs are poised to return to warming Antarctic waters and disrupt the primeval marine communities. “Nowhere else than in these ecosystems do giant sea spiders and marine pillbugs share the ocean bottom with fish that have antifreeze proteins in their blood,” says Richard Aronson, professor and head of biological sciences. “The shell-cracking crabs, fish, sharks and rays that dominate bottom communities in temperate and tropical zones have been shut out of Antarctica for millions of years because it is simply too cold for them.” But this situation is about to change. “Populations of predatory king crabs are already living in deeper, slightly warmer water,” says Dr. Aronson. “And increasing ship traffic is introducing exotic crab invaders. When ships dump their ballast water in the Antarctic seas, marine larvae from as far away as the Arctic are injected into the system.”

Aronson and his colleagues published their results in the electronic journal PLoS ONE to coincide with the U.S. National Teach-In on Global Warming Solutions on Feb. 5, 2009. Fast-moving, shell-crushing predators, dominant in most places, cannot operate in the icy waters of Antarctica. The only fish there—the ones with the antifreeze proteins—eat small, shrimp-like crustaceans and other soft foods. The main bottom-dwelling predators are slow-moving sea stars and giant, floppy ribbon worms. To understand their history, Aronson and a team of paleontologists collected marine fossils at Seymour Island off the Antarctic Peninsula. Linda Ivany of Syracuse University reconstructed changes in the Antarctic climate from chemical signals preserved in ancient clamshells. As temperatures dropped about 41 million years ago and crabs and fish were frozen out, the slow-moving predators that remained could not keep up with their prey. Snails, once out of danger, gradually lost spines and other shell armor they had evolved against crushing predators. Antarctica’s coastal waters are warming. Temperatures at the sea surface off the western Antarctic Peninsula went up 1°C in the last 50 years, making it one of the fastest-warming regions of the World Ocean. If the crab invasion succeeds, it will devastate Antarctica’s spectacular fauna and fundamentally alter its ecological relationships.

Keeping attention on the critical issue of global climate change in the first 100 days of the new administration, Florida Institute of Technology held a National Teach-in on Global Warming on Feb. 5. Some 150 people attended the event. The program featured three of Florida Tech’s internationally noted Department of Biological Sciences faculty members. Mark Bush discussed “Conservation of Tropical Biodiversity;” Robert Van Woesik discussed “Coral Reefs: Climate-Change Rumbling in Paradise;” and Rich Aronson, department head, presented “Climate Change in Antarctica.” Tristan Fiedler led a panel discussion.
Faculty Explore Mystery of Lightning Origin in Thunderclouds

How lightning is sparked in thunderclouds remains a mystery. Ningyu Liu, assistant professor of physics and space sciences, seeks to solve that mystery under a $240,000 grant from the National Science Foundation. Dr. Liu and his team, which includes Florida Tech Professors Joseph Dwyer and Hamid Rassoul and graduate student Burcu Kosar, will develop advanced physics-based computer simulation models of the thunderstorm environment. Their research will focus on the role that rain droplets and ice particles may play in lightning initiation inside thunderclouds. By comparing theory with field observations, the goal will be to understand the exact physical mechanisms of the lightning initiation process. “We will investigate one of the very promising theories to explain lightning production, and we believe that our results could have a large impact in this field of study,” said Dr. Dwyer. An international expert in lightning and energetic radiation from thunderclouds, Dwyer’s studies of the phenomenon of runaway breakdown, associated with lightning, proved that x-rays could be created from sparks in the laboratory.

Florida Tech Names New Head of Biological Sciences

Richard B. Aronson, Ph.D., was named head of the Department of Biological Sciences. In January, Dr. Aronson replaced Mark Bush, Ph.D., who served as interim department head since Gary Wells, Ph.D., retired in July 2007. Aronson grew up in New York City. He received his bachelor’s degree in biological sciences, summa cum laude, from Dartmouth College in 1979 and his doctoral degree in biology from Harvard University in 1985. In 1994, after completing a NATO postdoctoral fellowship in the UK and postdoctoral experiences at the Smithsonian Institution and Rutgers University, Aronson joined the faculty of the Dauphin Island Sea Lab in Alabama. He left his position as senior marine scientist at the Sea Lab to join Florida Tech. “With its world-class faculty, Florida Tech is a shining example of how excellence in undergraduate education and excellence in research go hand-in-hand,” said Aronson. “I am thrilled to be here.” Aronson continues to hold adjunct appointments at the Smithsonian Institution, the Natural History Museum of Los Angeles County, the Dauphin Island Sea Lab and the University of Alabama at Birmingham. He is president of the International Society for Reef Studies. Aronson’s research focuses on the effects of climate change on marine communities. Interests include work on marine-protected areas in the Florida Keys and the salt marshes of the southeastern United States. He gave the keynote address at the meeting of the U.S. Coral Reef Task Force in Washington, D.C., on February 25, 2009.

Former Astronaut, Florida Tech Professor Durrance Leads State Commercial Suborbital Research and Training Program

Florida Institute of Technology was awarded $500,000 from the Florida Governor's Office of Tourism, Trade and Economic Development for the Florida Suborbital Commercial Research & Training Program. Former astronaut Sam Durrance, Florida Tech professor of physics and space sciences, will direct the effort. The program and a center of that name were initiated to attract new business to the Kennedy Space Center (KSC) launch site. This effort pursues the new suborbital personal spaceflight industry by using Florida’s space assets and know-how in two key markets: space and tourism. Florida Tech is collaborating with Starfighters Inc. of Clearwater, Fla., using the company’s F-104 former military jet. The private aircraft is capable of simulating the path a horizontally launched spaceflight might take out of KSC, as well as speeds that would create the sonic booms at a similar location and altitude. The plane’s G-forces, altitude and speed support research projects in a high-stress flight environment. Add to this the disorientation created by the flight, and the plane can simulate for tourists a suborbital space mission. State Senator Thad Altman, former chair of Florida’s House of Representatives Education Innovation committee, was instrumental in obtaining funding for the project. The program combines the resources of Florida Tech and Starfighters with the NASA KSC Technology Office, NASA’s Shuttle Landing Facility, Melbourne International Airport, the Federal Aviation Authority, United States Air Force 45th Space Wing and Brevard Regional Hyperbaric Center’s therapy chamber. The high-altitude environment is ideal to test space suits and life support systems. Florida Tech and Starfighters will develop an education outreach program for 6th through 12th grade students. The program’s focus will be on the use of the only commercially available sonic aircraft in the country to teach classes in aerodynamics, high altitude and sonic flight.
Tania Rozgaja is InSTEP with Molecular Biology

Tania Rozgaja is a first-year doctoral student in biological sciences working in the laboratory of Julia Grimwade. Tania wears another hat not shared by other molecular biology graduate students as the first “molecular” InSTEP Fellow at Florida Tech. Fellows of the NSF-funded InSTEP program, under the direction of Rick Tankersley, provide assistance to local high schools to enhance teaching of the sciences, with particular emphasis on an ocean discovery theme. The program has supported 25 fellows over the last four years, but Tania is the first molecular biologist to participate in the program. “I was somewhat apprehensive at first and quite challenged to provide information and activities that were suitable for high school science classrooms,” says Tania. She has learned from her experiences over the last year that high school teachers are intimidated by the subject matter of molecular biology as well as the equipment routinely used to analyze DNA and proteins. For Tania, participating in the InSTEP program has been helpful in ways she did not initially expect. Tania says, “Thinking about new ways to teach molecular biology has certainly strengthened my understanding of the field, and I now realize how important it is to expose students to molecular biology as early as possible. Providing these concepts in an easily digested format is the key, and participation in the InSTEP program has helped improve my presentation skills and confidence level.” After being accepted as an InSTEP fellow, Tania’s biggest concern was balancing her time. She says, “It’s important to manage time wisely, but I seem to be able to do both jobs pretty well.” Does Tania see herself as a teacher or a researcher after she completes her doctoral program? She says, “I’m not sure yet, but taking a less traditional path has really expanded my view of the range of jobs I might consider.”

Florida Tech Scientists Earn NSF Grant to Measure the Age of Stars

Terry Oswalt, Ph.D., head of the Department of Physics and Space Sciences, has won a National Science Foundation grant of more than $380,000 for a unique approach to learning stars’ ages. “How old is it?” is just about the most difficult question you can ask about a star,” said Dr. Oswalt. He and his team will determine ages by studying the chromospheres, or outer atmospheres, of stars like the Sun. Chromospheric activity, like sunspots and the solar cycle, is known to correlate with age but the exact relation has not been explored beyond the age of the Sun. Oswalt is taking a new approach to calibrating and extending this age determination technique. He has selected a sample of stars like the Sun that happen to have “dead” companion stars known as white dwarfs. White dwarfs are the cooling embers of stars that have run out of fuel and are slowly cooling over time. This provides an independent check on the companion star’s age, because stars in a pair were born at the same time. Using white dwarfs, which tend to be very old, Oswalt may be able to extend the activity-age relation for solar-type stars right up to the age of our galaxy, the Milky Way, about 10 billion years.

The research will take several years because to view markers for activity and to get the temperature of a white dwarf, each star’s light must spread out into a spectrum. Very large telescopes are needed to gather enough light to do this—an hour or two for each star is required. Access time on the largest telescopes in the world is highly competitive. This means the typical astronomer is fortunate to win several nights in a given year. A possible by-product of this research is a check on the ages of our Sun and the galaxy that have been obtained by other techniques. The research may also help to determine how much mass a white dwarf loses as it passes through the red giant stage. This is one of the most uncertain parts of stellar evolution theory.

Dr. J. Clayton Baum Chemistry Award Endowed

To help endow the Dr. J. Clayton Baum Chemistry Award, the chemistry department held a fundraiser hosted at the Tortoise Island bungalow of Drs. Michael and Cynthia Babich. It was a great success and culminated in the endowment for this award. Seventy people attended and a wonderful time was had by all. This award, established by alumni of the chemistry department, led by Dr. Jonathan Zung of Bristol-Myers Squibb, is to honor Dr. Baum for his continuing dedication, devotion and service to Florida Tech and the department of chemistry. It is awarded to an outstanding junior student(s) based on his or her academic and research achievements. Sponsors included The Green Turtle Market, M&B Golfcarts, Thallo Design, Southern Photo, Praxair, Pearson, Downtown Produce, Makoto’s, Napa Auto Parts, Mark Novak and Michael Babich. Magic was provided courtesy of our magician-in-residence, Nasri Nesnas of the chemistry department, and a silent auction was held. This year we presented our first Baum Awards to two outstanding junior students.
Physics Professor Takes Sabbatical in the Netherlands

Professor Matt A. Wood spent the 2008–2009 academic year on sabbatical in the astrophysics department of Radboud University in the city of Nijmegen, the Netherlands. The Radboud University astrophysics department is small, having only four faculty on staff, but vibrant in that they have over 5 million euros external funding and over 20 master’s and Ph.D. students. Dr. Wood worked with local hosts Drs. Paul Groot and Gijs Nelemans on projects related to mass transfer binary star systems known as cataclysmic variables. In these systems, stellar material is stripped from the outer layers of a lower-mass secondary star, and typically spirals onto the primary star via an accretion disk. In two systems, the mass-transfer stream impacts the primary surface directly. During the course of the sabbatical, Wood submitted two papers for publication in the Monthly Notices of the Royal Astronomical Society. The first, “Synthetic Direct Impact Light Curves of the Ultracompact AM CVn Binary Systems V407 Vul and HM Cnc” (paper I), was published in the May issue (Wood, M.A. 2009, MNRAS, 395, 378-385), and the second “SPH Simulations of Negative (Nodal) Superhumps: A Parametric Study” (paper II) is currently in press (Wood, M.A., Thomas, D.M. & Simpson, J. C. 2009, MNRAS). Superhumps are accretion disk oscillations driven by the rotating tidal field of the mass-donating star. A third manuscript presenting the results of hydrodynamical simulations of so-called positive superhumps is in preparation for submission during Summer 2009. These latter-two publications present the results of over 66,000 hours of CPU time on the 174-node Florida Tech High Energy Physics Group Linux Cluster (access kindly provided by Marcus Hohlmann) and are the largest-ever numerical studies of accretion disk dynamics in cataclysmic variables. While on sabbatical, Wood gave a talk on an earlier publication on the direct impact stellar binaries at a workshop held in Cape Town, South Africa, during September 2008, and the discussions at that conference led to the pursuit of the research published in paper I.

National Environmental Literacy Assessment Project

In 2004, representatives from the U.S. Environmental Protection Agency (EPA) and the Environmental Education community decided that a national assessment of environmental literacy was overdue. Tom Marcinkowski, associate professor of environmental education in the Department of Science and Mathematics Education, was part of those discussions and served on the research team that prepared a grant proposal to the EPA for the first phase of this research project. That proposal was funded and eventually administered by the National Oceanic and Atmospheric Administration (NOAA) under an Interagency Agreement with EPA. Data for the first phase of this research project were collected in Spring 2007, with support from GfK-Roper. This was a “baseline study” of the status of environmental literacy among a clustered random sample of 49 middle schools located in 30 states around the U.S., and included approximately 1,000 6th and 1,000 8th graders. The final report for this study was completed in August 2008, and is available at the NOAA Web site www.oesd.noaa.gov/NAEE_Report. In 2008, the research team prepared a grant proposal to NOAA for the second phase. The 65 middle schools selected to participate in the Phase 2 study had to have an environmental program in place for at least two years. The research team wanted to see how students in schools with environmental programs performed in comparison to the national sample of schools in Phase 1. The data for Phase 2 are being collected from April into June of 2009. As with the Phase 1 study, Dr. Marcinkowski will oversee data entry, editing and analysis.

Detecting Hidden Nuclear Materials In Cargo

In the High Energy Physics Lab, senior Jennifer Helsby, junior Patrick Ford and May 2008 graduate David Peña have worked for two years on a project that is funded by the Domestic Nuclear Detection Office (DNDO). “They’re a very talented bunch,” said Marcus Hohlmann. “I give them guidance, but they take their own initiative, which is exactly what you expect from a researcher.” The undergrads, with graduate students and a postdoc, have been investigating the use of subatomic particles for detecting hidden nuclear materials in cargo. The effort involves muon tomography. Muons are naturally produced by cosmic rays, arriving from deep space that constantly bombard the Earth’s atmosphere. Dr. Hohlmann is applying a novel type of micro-pattern particle detector, a gas electron multiplier (GEM). The GEM was initially developed at CERN, the European Laboratory for Particle Physics near Geneva, Switzerland. The total funding now stands at $1,047,000 since the grant was renewed for year three.
Life and Times of a Living Fossil: InSTEP Fellows Introduce Students to the Fascinating World of Horseshoe Crabs

In an effort to enhance science instruction in K-12 schools, Florida Tech science departments have partnered with Brevard Public Schools to design and pilot a series of new lesson plans linking core content areas—Earth science, biology, chemistry and physics. The Integrated Science Teaching Enhancement Partnership (InSTEP) is funded through the National Science Foundation. Each year eight graduate students from Florida Tech’s science departments (biology, chemistry, marine and environmental systems, and physics) are matched with local high school teachers to develop lessons that focus on “ocean discovery” as a common theme and incorporate some aspect of the student’s thesis or dissertation research. One series of lesson plans uses the fascinating natural history of horseshoe crabs to introduce students to a range of biological and ecological topics and principles, including growth and development, mating and reproduction, species’ interactions and interrelationships, and conservation and protection of marine resources. The horseshoe crab-based curriculum is aligned with Florida’s Sunshine State Standards and includes activities that incorporate aspects of the thesis research of two InSTEP Fellows, Martha Bademan and Julie Medina, who are currently studying the visual orientation and physiological ecology of larval and juvenile horseshoe crabs. Lessons are also designed to utilize resources and equipment available onboard InSTEP’s SEAS Mobile Laboratory. This “suped up” lab on wheels can accommodate up to 12 students and contains state-of-the-art research equipment and gives schools access to equipment and resources they would otherwise be unable to afford. The Florida Tech InSTEP program is funded by two grants and led by Rick Tankersley.

As part of the lesson on horseshoe crab biology and ecology, elementary school students raise juvenile crabs from eggs.

Feeding A Hungry Mind

Feeding A Hungry Mind ... The Science Café is a place where anyone interested in science can get together in an informal setting to discuss major science issues with the help of an expert in the field. It is free and open to the public. Best of all, it is not a lecture! It is a forum for exploring new frontiers in science and technology. After a brief introduction by our guest speaker (in plain, jargon-free English), the evening is dedicated to informal discussion, eating and drinking. You can learn a lot while enjoying the company of accomplished scientists and other people who are interested in science. “At The Place Where Science Intersects Life, You’ll Find The Science Café.” The Science Café in our area is an outreach initiative for educating the public on various scientific topics, sponsored by Florida Tech and the Brevard Zoo. Based on a popular European concept and modeled after the Pittsburgh Sci-Café, our café brings to Central Brevard a new way for people to connect. Each month, we explore the many ways science enhances and enriches our lives. Some topics include: Hurricanes in a Warmer Whirled, Search for Extra Dimensions, Ball Lightning, It’s Safer To Fly—It’s Easy To Be A Pilot & Why Everyone Should Be One!, We Spent $50 Billion On Cancer Research In The Last 10 Years. What Did We Get For It?, Wind Power: Renewable Green Energy—How To Generate Your Own Energy From Wind Turbines, Black Holes, Time Travel & Parallel Universes, Florida Fisheries—Challenges & Responses, Global Warming & Marine Life in Antarctica and Florida Coastal Hazards. The Science Café is held on the second Wednesday of each month at the Pizza Gallery and Grill, The Avenue Viera, 2250 Town Center Ave., Suite 113, Viera, FL 32940. For more information, visit see http://411.fit.edu/sciencecafe and www.pizzagalleryandgrill.com.
**Biological Sciences Alumni Reunion**

“I had no idea our alumni were doing so much cool stuff,” enthused an undergraduate as she came out of the auditorium where a panel of biology alumni had been speaking. Her awe was matched by that of the alumni who kept saying, “How this place has changed! The students and facilities are incredible!” The last weekend of January 2008, 110 biology alumni returned to Florida Tech to celebrate the 34-year career of Gary Wells.

The weekend kicked off with a wine and cheese reception in the Olin Life Sciences Building. Students, both undergraduate and graduate, presented posters and the alumni had a chance to tour the facility. The Saturday event was an all-day symposium with a morning theme of New Genetics: Implications and Applications and an afternoon of Marine Populations: Challenges and Responses. Over 150 filled the auditorium. The plenary speaker was Bob Crossley ’75, an alumnus of our biochemistry major and now the senior product development manager for M&M Brand Mars Snacks U.S. Bob got everything off to a wonderful start by presenting, first as an image, and then as candy, an M&M bearing a caricature of Dr. Wells. The panel of alumni speakers’ topics ranged from new progress in oncology to the use of DNA in solving missing person’s cases. After a barbecue lunch, five alumni panelists discussed the future of fisheries. Again, the topics were broad-ranging, from protecting fish spawning aggregations in Cuba to the future of invertebrate aquaculture. The banquet that evening featured a keynote address by President Anthony J. Catanese, who relived the rise of Florida Tech from the topic of a bar room conversation to a leader in technology research. Dr. David Johns ’85 led off a series of comments that were part fond remembrances and part a roast of Dr. Wells and introduced the “Gary Wells Endowed Scholarship.” The undergraduates inspired by the alumni, and the alumni inspired by students and facilities, were what made this event so special. It was entirely fitting that this coming together was in honor of Dr. Wells who had brought much of it to fruition.

**Monitoring Enzyme Activity One Cell At A Time**

For years, scientists have measured enzyme activity using large populations of cells. These experiments necessarily measure the average signal from all of the many of thousands of cells in each assay, which introduces error. To address this problem, biological sciences graduate student Leia Shuhaibar developed a novel method for tracking the activity of two different enzymes, MAPK and MEK. These are critical proteins for integrating signals from multiple biochemical pathways. They are found in virtually every cell of the body and in all plants and animals, making them fundamentally important molecules. Leia works in the laboratory of David Carroll, associate professor of biological sciences, where she studies oocyte maturation and fertilization using starfish as a model system. The use of the starfish proved critical for the development of her assay, because they have relatively large oocytes, which can, with some practice, be separated under the microscope and tested individually.

Oocyte from the starfish Patiria miniata showing the large clear nucleus. These cells are about twice as large as a human oocyte—they appear as tiny little dots without the microscope.

Biological sciences graduate student Leia Shuhaibar showing one of the starfish that provide oocytes for her experiments.

Dave Carroll with graduate student Leia Shuhaibar from Venezuela.
Florida Tech’s Neurobiology Laboratory

Biological sciences graduate and undergraduate students in Florida Tech’s Neurobiology Laboratory have had considerable success recently at funding their research. Undergraduate Andrea Cross won a Research Fellowship from the American Microscopical Society (AMS) for the summer of 2008 to support her work on the development of vision in endangered African tortoises. Her research report was published in the Fall 2008 AMS Newsletter. The AMS only awards one undergraduate Fellowship and one graduate Fellowship each year. Doctoral student Bill McLamb followed Andrea’s success by winning the highly competitive AMS Graduate Research Fellowship in 2009 to support his work on the molecular biology of transient receptor potential ion channels in the snake infrared imaging system. McLamb is also supported by a three-year fellowship, the National Defense Science and Engineering Graduate (NDSEG) Fellowship, awarded by the U.S. Department of Defense. Bill McLamb also won a Grant-in-Aid of Research from Sigma Xi, the Scientific Research Society, and a travel grant from the Biology Graduate Student Association for travel to the 36th World Congress of the International Union of Physiological Sciences in Kyoto, Japan. Other recent awards include a Sigma Xi Grant-in-Aid of Research and a grant from the American Society of Ichthyologists and Herpetologists, all to doctoral student Sherri Emer. She won grants from both the Animal Behavior Society and the Society for Integrative and Comparative Biology (SICB), all to support her behavioral research on infrared imaging in snakes. In addition, undergraduate students Andrea Cross and Elizabeth Spinney both recently won research grants from Tri-Beta, the Biological Honor Society. Spinney’s experiments combined pharmacological and behavioral methods to determine how transient receptor potential ion channels function in the infrared imaging system of copperheads, a type of pit viper. Michael Grace directs the Neurobiology Lab and also serves as director of Florida Tech’s High Resolution Microscopy and Advanced Imaging Center.

Vero Beach Marine Laboratory

Planning is well under way for a major upgrade to Florida Tech’s Vero Beach Marine Laboratory (VBML). Originally built as a radar tracking station in the 1960s, this four-acre ocean-front facility was transferred to Florida Tech in 1980 and has since supported a wide range of faculty and graduate student research programs. Current programs at VBML include Junda Lin’s work on algal biofuels and ornamental shrimp and seahorses, Geoffrey Swain’s...
New Directions in Flame Retardant Nanocomposites Research

Florida Tech College of Science Dean Gordon Nelson and research scientist Feng Yang have successfully undertaken the flammability and physical properties investigation of silica and alumina based polymeric nanocomposites (PNCs). It was concluded that in general, PNCs exhibit higher thermal stability than unfilled polymers and the degradation mechanisms for polymers are different for metal oxide and nonmetal oxide nanofillers. The Cone Calorimetry results of PNCs showed significant reduction in peak heat release rates. In order to take advantage of the flame retardant mechanisms of nanofillers, it is necessary to slow down the burning process and allow these mechanisms to occur. The synergistic effects of flame retardants and nanofillers can greatly impact the performance of current flame resistant/retardant materials. The resulting materials require less flame retardant to meet flammability requirements, without sacrificing critical physical properties that are usually associated with adding flame retardant additives alone. As part of this effort, a new class of clay polymer nanocomposites was successfully developed from Attapulgite clay (average size is ~10 microns) and polystyrene. With a technique that was developed in the investigators' laboratory, attapulgite clay was successfully delaminated into nanoscale needle forms and compounded with polystyrene. An investigation on the thermal stability and flammability of this class of nanocomposites showed that their performance matches that of alumina whiskers.

Exfoliation of Attapulgite 601p studied by SEM. Left is after one-hour treatment and right is after 24 hours.

New Directions in Flame Retardant Nanocomposites Research

Dean Gordon L. Nelson co-edited a book, Fire and Polymers V—Materials and Concepts for Fire Retardancy. The possibility always exists that a material will catch fire, which can lead to loss of property or life. Although fire risk is not a new problem to society, as new polymeric materials are introduced into more and more everyday activities, the potential for fire sometimes increases or changes in such a way that one must remain vigilant in addressing this risk. The typical method of addressing this risk is through the use of fire-retardant additives, which interact with polymers through physical and chemical mechanisms to either prevent the polymer from burning or to slow the rate of polymer burning so that it can be easily extinguished. As a class of industrial additives, flame retardants are the largest group of materials used and sold worldwide. Because fire and polymers are important social issues for safety and due to the complex scientific issues and multiple disciplines of science involved, a symposium on the subject of fire and polymers was organized at the American Chemical Society National Meeting held in New Orleans, La., in April 2008. The symposium was the fifth in this series. A total of 44 papers from researchers from around the world were presented, representing academia, government and industrial research. From those presentations, 22 chapters were selected for incorporation into the book. The book is distributed by Oxford University Press (2009).

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project on biofouling, George Maul’s ocean observation project, and Hamid Rassoul, Joe Dwyer and Ningyu Liu’s lightning research and projects carried out by collaborative companies. These projects use only a small portion of the site, which is a true “diamond in the rough.” Because of the superb seawater system and the diverse Florida Tech faculty, the VBML has been selected as a main component of the proposed “Florida Marine Fishery Enhancement Initiative.” This statewide program (www.fmfei.org) seeks to rebuild recreational fishery populations through a combination of aquaculture and release of juvenile fish, habitat restoration and education. Florida Tech efforts, led by Jon Shenker, have resulted in VBML being designated as the primary site for an aquaculture building for brood stock and larval culture for east coast fishery stocks. The $12 million plan for rebuilding VBML also includes replacing the current laboratory structure with a new building for marine biology and coastal oceanographic research, turning the radar tower into a platform for research on lightning and coastal processes, and constructing an education center for the local community and a dormitory for visiting researchers and students. Funding requests for the site are included in FMFEI program proposals as well as individual proposals prepared by Florida Tech researchers.
Florida Tech is One of the World Leaders in Lightning Research

Florida Tech is currently one of the world leaders in lightning research and the undisputed leader in the area of energetic radiation from thunderstorms and lightning. Team members include Joseph Dwyer, Hamid Rassoul, Ningyu Liu from the College of Science, Mike Splitt from the College of Engineering, seven Ph.D. graduate students and nine undergraduate students. "Lightning has baffled physicists for decades because the electric fields inside thunderclouds do not appear to be strong enough to generate a conventional discharge of current—about three million volts per meter—but nature manages to initiate this big spark over and over," said Dr. Dwyer. "... we are after the missing physics link between the formation of a fully charged cloud and its subsequent lightning discharges." "Our findings show that lightning is a surprisingly complex and perplexing phenomenon that requires a full understanding of atmospheric sciences, plasma physics, high-energy physics and electromagnetic radiation engineering," said Dr. Rassoul. The following lists the top 10 accomplishments by Florida Tech’s lightning research team over the last seven years:

1. Established that lightning emits x-rays. This supports the idea that lightning somehow accelerates electrons to nearly the speed of light in a phenomenon called runaway breakdown.
2. Discovered that x-ray emission in lightning is associated with leader steps, which affects lightning propagation in the air.
3. Introduced a fundamentally new electrical breakdown mechanism of air based upon high-energy electrons and positrons.
4. Discovered x-rays from laboratory sparks and established some of the key characteristics of streamer and spark discharges.
5. Discovered that Terrestrial Gamma-ray Flashes (TGFs) originate from thunderstorms, not from high altitude sprites as had long been assumed.
6. Discovered the “Dwyer Instability” that puts a fundamental limit on the magnitude of electric field in air and introduced a new technique for remotely measuring thunderstorm electric field—the key factor in the forecasting of lightning discharges.
7. Discovered Terrestrial Electron Flashes (TEFs) from a space platform (CGRO/ BATSE and RHESSI Spacecraft).
8. Reported the observations of the first ground-level TGF event and showed that the energetic radiation doses to aircraft passengers may be dangerously large inside thunderstorms.
9. Brought the world’s premier lightning research facility to Florida Tech, the UF/Florida Tech International Center for Lightning Research and Testing—and built the largest ground-based x-ray detector array.
10. Brought external funding of about $2.5 million in lightning research for the department, including the current funding of $2 million for the group.

Florida Tech lightning research work has received worldwide scientific recognition, including a full article in Scientific American, news articles in Nature, The Economist and New Scientist Magazine, articles in many newspapers, radio interviews broadcast throughout the United States and Canada, and feature stories in documentaries by the BBC, NOVA, Discovery Channel and National Geographic Channel.
Edward Principe is a research faculty professor in the physics and space sciences department and the principal scientist for Carl Zeiss in North America who is an expert in focused ion beam technology, electron microscopy and electron spectroscopies. Through collaboration with Carl Zeiss and Omniprobe, a state-of-the-art FIB-SEM microscope is available to researchers and students on campus within the microscopy center. A FIB-SEM is a combination of a Focused Ion Beam Microscope and a Scanning Electron Microscope combining the capabilities of both in one platform. Focused ion beam microscopes are not common, only fairly recently migrating from the semiconductor industry in the last 10 years. While the SEM is based upon a scanned electron source, the FIB is based upon a liquid metal ion source, typically gallium. The FIB, like the SEM, can be scanned across the surface to produce images, with a resolution up to approximately 5nm. However, the ion beam, typically operated at 30kV and currents up to 50nA, can be used to mill away and pattern any material on the nanoscale. In addition, these platforms can be combined with a gas injection system to permit both electron beam and ion beam induced deposition of insulators and conductors. The ability to cut and section any material with the FIB makes it a primary tool for 3D characterization and failure analysis. Nano-sectioning enabled by the FIB can be combined simultaneously with the nanometer resolution of the SEM to produce serial section images for automated acquisition of 3D nanotomography. Dr. Principe is an early pioneer in the development and application of FIB-based nanotomography. Investigations of biological structures in particular benefit from a hierarchical approach to probe from the millimeter range down to fine ultra-structure on the nanometer scale. The latter scale is a niche for FIB-SEM nanotomography. Recent 3D nanotomography modeling has included investigations of the nano-porosity network formed by canaliculi and lacunae in mammalian bone (Shaohua Xu/Kate Lin). Future research interests include deposition of advanced materials in the FIB-SEM, integration of a femtosecond laser with a FIB-SEM and 3D printing of biomaterials, such as scaffolds, based upon FIB-SEM nanotomography data. The bone studies, and quantitative analysis of FIB-based nanotomography in general, also has potential synergy with the research interests of Manolis Tomadakis, associate professor in the department of chemical engineering. Manolis develops random walk algorithms to estimate the transport properties of porous and multiphase media including effective molecular diffusivity, viscous permeability, thermal and electrical conductivity, magnetic permeability, and dielectric constant. FIB-based tomography can provide the input for the analysis through a digitized 3D array of data points mapped to segmented regions of the volume on the nanoscale. Future research interests include deposition of advanced materials in the FIB-SEM, integration of a femtosecond laser with a FIB-SEM and 3D printing of biomaterials, such as scaffolds, based upon FIB-SEM nanotomography data.

Andrew Knight, associate chemistry professor, has been selected by the Office of Naval Research (ONR) as a Faculty Fellow for the 2009 American Society for Engineering Education (ASEE) Summer Faculty Research Program. Dr. Knight, who joined Florida Tech in 2008 from Loyola University New Orleans, is currently researching the interface of inorganic chemistry and other scientific sub-disciplines including organic synthesis, nanoscale and layered materials, medicinal chemistry, molecular biology, biodfense and green chemistry. The ONR coordinates, executes and promotes the science and technology programs of the United States Navy and Marine Corps through schools, universities, government laboratories, and nonprofit and for-profit organizations. Sponsored by the ONR, the ASEE program provides funding for university and college faculty members to conduct meaningful research at United States Navy Research and Development Centers during the summer. Knight will perform his research at the Naval Research Laboratory in Washington, D.C., for the 10-week program, which began in May 2009.
The High Resolution Microscopy and Imaging Center

Florida Tech’s Center for High Resolution Microscopy and Advanced Imaging is a multidisciplinary laboratory providing state-of-the-art equipment and expertise for microscopic analysis of almost any kind of material. The center provides light and fluorescence microscopy, laser-scanning confocal microscopy, transmission electron microscopy, scanning electron microscopy, scanning probe microscopy, x-ray microanalysis and focused ion beam microscopy of natural and artificial materials. The director of the Microscopy Center is Michael Grace, associate professor of biological sciences. Dr. Grace is assisted by Gayle Duncombe, a research associate who trains users in microscopic technique and helps users interpret the microstructural and microchemical data that they collect. A Zeiss Axioscope 2 provides light and fluorescence analysis of thin samples and relatively transparent materials. One important use of this microscope has been the analysis of the effects of lasers on skin tumors and breast cancer. Recently, Grace was awarded a grant from the National Science Foundation to enhance these capabilities by adding a new Nikon C1Si multispectral laser scanning confocal microscopy. This system includes two computer-controlled microscopes (upright and inverted), a bank of lasers, and an image collection and analysis software package. The confocal microscope provides the ability to precisely localize tagged molecules and inherent fluorescence in thick materials by eliminating out-of-focus information. Users may collect “stacks” of razor-sharp images, which can then be converted into rotatable three-dimensional views of complex materials. Light and fluorescence microscopy provide resolution on the scale of parts within single living cells, but the Microscopy Center also contains electron microscopes having resolution down to the level of a few nanometers. The center’s transmission electron microscope operates much like a light microscope, but instead of the sample being viewed by the transmission of light, it is bombarded by a high-voltage electron source. The liquid-nitrogen-cooled Zeiss EM900 transmission electron microscope is equipped with a Morada 11-megapixel cooled CCD digital imaging system for crisp high-resolution images, and the scope is supported by a Leica Ultracut EM UC6 ultramicrotome for preparation of samples only nanometers in thickness. The center also includes a JEOL JSM6380LV low-vacuum scanning electron microscope (SEM) for surface analysis of materials. This SEM is capable of analysis of almost any kind of material, and the center includes a host of equipment for sample preparation (critical point drier, gold sputter coater, carbon accessory, etc.). In addition, the SEM is equipped with an EDAX energy-dispersive x-ray spectrometry system for microanalysis of the chemical composition of materials. Through a partnership with Carl Zeiss SMT, the Microscopy Center also features focused ion beam microscopy, a system that operates much like a scanning electron microscope except that a gallium ions beam (instead of an electron beam) is scanned over a sample. In low power mode, the FIB microscope operates like a SEM, providing high-resolution surface structure. At high beam power, the system can precisely mill specimens on a sub-micron scale. The FIB system was placed at Florida Tech as a platform for the development of new FIB applications. Development of the High Resolution Microscopy and Advanced Imaging Center has been funded by two major research instrumentation grants from the National Science Foundation and a grant from the U.S. Air Force Office of Scientific Research.

Advances in Teaching and Learning Math in College

Michael Gallo, associate professor of science and mathematics education, led a team of researchers that explored the teaching and learning of mathematics in two-year colleges. Implementing contemporary theoretical approaches advocated by the National Research Council, Dr. Gallo and his community college colleagues found, among other things, that promoting self-regulating and metacognitive strategies in the classroom augmented positive student learning behaviors. The complete report of the study was published in the winter 2008 issue of Academic Exchange Quarterly.
Improving Astronomical Images—Inventing CCD Phase Dithering

Hakeem Oluseyi has invented a new technique for improving the quality of astronomical observations that is more efficient and simpler to implement than current techniques. To understand this invention, consider that a digital image is made up of millions of little squares called pixels. The effect of this pixilation is that images are not an exact reproduction of the scene being observed, thus degrading the science return from such images. Measurement of both the size of objects and the amount of light striking the detector are affected by the pixilation. To address this problem, astronomers developed a technique called “dithering.” Dithering is the act of obtaining multiple overlapping images of a scene by repointing the telescope or instrument by fractions of a pixel at a time. While this may sound simple, consider that the average pixel size is about one one-hundredth of a millimeter! Imagine moving the entire space telescope in steps that are one-third of this tiny distance. Another problem with the standard dithering technique is that it takes time to repoint a telescope and allow it to cease vibrating before an image can be acquired, the so-called “step and settle” time. Dr. Oluseyi’s method performs the dithering process with detector electronics rather than by moving the telescope. This new technique has been coined “CCD Phase Dithering.” It allows one pixel to effectively become nine smaller pixels. One may think of this technique as being able to convert a 1 Megapixel camera into a 9 Megapixel camera at no extra cost! The figure shows the results of an experimental feasibility study carried out by Dr. Oluseyi and his student. This work has been submitted to the journal IEEE Transactions on Electronic Devices for publication with a former Florida Tech undergraduate student Patrick Malvoso as a co-author.

The three images show the effect of Dr. Oluseyi’s new CCD Phase Dithering (CPD) invention. The top image is a normal image. The central image is an image obtained using “normal” dithering, which requires repeatedly (and accurately) repointing a telescope by thousandths of a millimeter. Note the increase in spatial resolution and the effectively smaller pixels. The image at the bottom was created using Dr. Oluseyi’s CPD invention. Note that it has an equivalent increase in spatial resolution but does not require repointing the telescope. The CPD image also appears to more accurately reproduce the brightness distribution of the image compared to the normally dithered image.

Fifth North American Echinoderm Conference

On July 20–25, 2008, our campus was the venue for an international meeting, the Fifth North American Echinoderm Conference. The meeting was co-organized by Richard Turner, biological sciences, and by James McClintock, of the University of Alabama at Birmingham, both of whom have worked on echinoderms for decades. Echinoderms include such familiar seashore animals as seastars (or starfish), sea urchins and sand dollars. They are one of the dominant groups of animals that live on the sea floor, from the surf zone to the deepest ocean trenches. Although mostly from North and South America, the 79 scientists and 14 additional participants represented 12 countries from as far away as New Zealand, Japan and Israel.

In addition to oral and poster sessions on their research, conferees attended evening receptions, banquets and a movie night of echinoderm videos. Guests experienced various Florida ecosystems during a day of field trips to several locations in Brevard County, and they tasted a grand array of Florida flavors at a banquet specially concocted by Chef de Cuisine Jon Skoviera. David Carroll, biological sciences, and his students presented a paper “MAP kinase in single starfish oocytes and eggs.” Dr. Turner and his students presented three papers: “A new kind of echinoderm pedicellaria,” “Loss of arm spines in the basketstar Astrophyton muricatum” and “Ciliated funnels in the sea cucumber Synaptula hydriformis.”
**International and National Outreach**

From work in Africa to work for the Science Channel, Hakeem Oluseyi has been working for many years on helping to improve astrophysics education and research in Africa. 2008 was a very busy year. In April 2008, the first Middle East Africa IAU Regional Meeting took place in Cairo, Egypt. Dr. Oluseyi was an invited keynote speaker at the event. Dr. Oluseyi has also continued to work with Hands-On Universe (HOU) to improve science education in Africa. This project allows school children to utilize the worldwide network of Internet accessible telescopes to obtain real-time observations of heavenly bodies and then to analyze their observations to perform real science. Dr. Oluseyi was joined with astronomers from Portugal, Poland and Japan to work with Kenyan students on HOU projects. He has also worked with students in South Africa at the University of Cape Town (UCT), where he spent a month lecturing cosmology to students enrolled in the UCT National Astronomy and Space Science Program (NASSP). The NASSP is a graduate program aimed at increasing the number of South African astronomers.

In addition to his international outreach activities, Dr. Oluseyi has been active in reaching American audiences through popular science TV programming and/or writing short articles for school-age science books. In 2008, he was recruited to the Discovery Channel’s Scientific Advisory Board and agreed to be an on-air contributor. He is scheduled to appear on at least 10 episodes of the fall season of the show Brink. The show highlights cutting-edge breakthroughs in the world of science. Dr. Oluseyi will serve as the resident expert on all things astronomical. In addition, Dr. Oluseyi and his science have been featured in two books in the last year. One is a high school science textbook, CPO Science’s *Foundations of Physical Science with Earth and Space Science*. The other is a book designed to encourage students to enter into science careers titled *Choose a Career in Science* by Barbara Louv. Note also that last year Dr. Oluseyi and his science were featured in a middle school textbook by McDougal-Littell titled *Space Science*.

**CMS, LHC and CERN in 2008!**

The world of high energy particle physics started 2008 with a lot of anticipation. After more than a decade of construction, the Large Hadron Collider (LHC) accelerator complex at the European Center for Particle Physics (CERN) in Geneva, Switzerland, was scheduled to start operating in fall 2008. The LHC will produce the highest energy ever proton-proton collisions allowing for scientific exploration of nature at an ever smaller and more fundamental level.

The Florida Tech High Energy Physics (HEP) group main particle physics effort is the Compact Muon Solenoid (CMS) experiment. Faculty Marc Baarmand, Laszlo Baksay and Marcus Hohlmann, research associate Igor Vodopiyanov, graduate students Samir Guragain, Himali Kalakhety, Hamit Mermerkaya and Mike Ralich, and several undergraduate students have been fully engaged in completing detector commissioning and preparing for physics analysis waiting for imminent data.

Major events in 2008, in chronological order, were:

- Early January: CMS scientists around the world celebrated the lowering of the final piece of the CMS detector into the underground collision hall at CERN. This final piece, a large disk nearly 45 feet in diameter, weighing approximately 1,430 tons and carrying many fragile detectors, was lowered at a pace of about 6 inches per minute. (See photo to right)
- September 10—LHC start-up and first beam: CERN scientists attempted for the first time to send a proton beam around the 27-kilometer-long tunnel. To join the celebrations, Baarmand organized a pajama party for protons—50 students attended this party and viewed the LHC successfully circulate its first protons. The historic event happened at CERN at 10:35 a.m. (4:35 a.m. EST) and viewed via a live webcast.
- The disappointment: Only a few days into the life of LHC, an incident caused by a malfunctioning interconnect in a superconducting dipole magnet brought the operation to a screeching halt! The repairs are under way, and the new schedule aims at LHC operation starting in October 2009, more than a year of delay!

In the meantime, the Florida Tech team has made the best use of the extra months. Two noteworthy activities are two physics analyses: Ralich’s Ph.D. analysis studies the angular and momentum correlations in bottom quark pair production at LHC and Mermerkaya’s Ph.D. analysis is a study of spin correlations in top quark pair production at LHC.

The Florida Tech HEP group’s research at CERN has been funded by the Office of Science in DOE since 2003. In recognition of valuable contributions to CMS and upcoming physics at LHC, DOE has now approved continued Florida Tech funding until mid 2012.


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Mathematical Sciences


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Physics & Space Sciences


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**Biological Sciences**


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Lin, J., "Clam Aqua Culture," Clams R Us, $41,625.

Lin, J., "Effects of probiotics and algal species on growth of hard clams (Mercenaria mercenaria)," Clams R US, $41,625.


Xu, S., "Alzheimer’s Disease Research," Community Foundation of Brevard (CFB), $50,000.

**Physics & Space Sciences**


Baarmand, M., "CMS Project - CERN Travel," US CMS / Fermilab / DOE, $20,000.

Baarmand, M., "Experimental Investigation of Hadron Collisions at the Highest Center-of-mass Energies," DOE, $120,000.

Baksay, L., "Quarknet at Florida Tech," NSF, $15,000.

Durrance, S., "Florida Sub-orbital commercial Research & Training Center," State of Florida (OTTED), $192,842.

Durrance, S., "Florida Sub-orbital commercial Research & Training Center," State of Florida (OTTED), $500,000.

Durrance, S., "Nonlinear Electrostatic Properties of Lunar Dust - GSA (Stacy Irwin)," NASA (KSC), $30,000.

Dwyer, J., "Data Analysis of ACE / ULEIS Energetic Particle Measurements," JHU (NASA), $24,000.


Hohlmann, M./Mitra, D., "Detection of Heavily Shielded Nuclear Contraband through Muon Radiography with Advanced Micro-Pattern Detectors (2nd year funding)," DHS-DNDO, $571,453.


Marcinkowski, T., "FL Learn & Serve: K-12’s Special Initiatives," FSU Florida Learn & Serve, K-12 through Florida State University, $8,822.

Marcinkowski, T., "FL Learn & Serve: Statewide Coordination," FSU Florida Learn & Serve, K-12 through Florida State University, $14,671.


**Science & Mathematics Education**

Marcinkowski, T., "FL Learn & Serve: K-12 through Florida State University, $8,822.

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**Chemistry**


Sharma, V., "Decontamination of Chemical Warfare Agents by Environmentally-Friendly Oxidants Iron (IV) and Iron (VI)," NATO Science Program, Collaborative Linkage Grant, $21,296.


**Mathematical Sciences**


**College of Science Externally Funded Research Contracts—$20.9 Million**

60% of Florida Tech’s current grants/contracts were awarded to the College of Science. The average funding per active research faculty for our college is about $486,000.

**Physics & Space Sciences**

$11,527,790 33.1%

**Biological Sciences**

$7,099,896 20.4%

**Chemistry**

$1,950,137 5.6%

**Mathematical Sciences**

$319,791 0.9%

**Science & Math Education**

$12,499

TOTAL $20,910,113 (May 09)
I would like to make a donation to support the College of Science fund of my choice, as selected below.

- $50
- $100
- $150
- $200
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