

**Summer 2008**  
<http://www.phys.lsu.edu>

## **CHAIR'S WELCOME . . . *Michael Cherry***

This has been an exciting year for the department. The faculty have spent a good deal of time planning a major expansion in the area of material science. The State Legislature last year provided funds for focused hiring of groups of faculty in designated areas. As part of the University's Multidisciplinary Hiring Initiative program, two areas related to Physics and Astronomy were chosen as specific areas in which groups of faculty could build centers of academic excellence: material science and computational science. Although agreements are not yet official, it currently looks like the Department will undergo a major expansion in both experimental and computational materials science. A detailed description of the MHI program and the new Physics and Astronomy faculty will be available on the Department's newly redesigned website shortly.

Congratulations go to the Department's graduates! Since the last Newsletter, Charles King, Gretchen Raterman, and Christopher Schneider (in December 2007), and Stacey Bright, Chris Britt, Benjamin Carroll, Brad Corso, Rachel Mannino, Anthony McDavid, Luke Smith, Zach Smith, Emily Tanguis, and Nickolas VanMeter (in May 2008) received Bachelors' degrees. Will Hill, Justin Vinci, Charles Bradley, Wesley Even, Jarrod Marsh, Scott Oves, Rajan Rai, and Jacob Slutsky received Masters' degrees, and Megan McEwan, Kalin Drumev, and Chad Hanna were awarded PhDs. At the 2008 College of Basic Sciences Choppin Honors Convocation, Nick VanMeter was awarded the Keen-Morris Prize, Stacey Bright and Brad Corso shared the Undergraduate Research Award, Rachel Mannino received the Undergraduate Service Award, and Shawn Wilkinson received College Honors. VanMeter was additionally honored with a University Medal at the May 2008 Commencement. Congratulations and good luck to all the graduates!

Thanks go to Mr. and Mrs. Scott Brodie of Houston, who recently provided a very generous contribution for graduate student support in the

Department of Physics and Astronomy and undergraduate scholarship support through the College of Basic Sciences' Science Honors Scholar program. The Science Honors Scholar funds were provided as part of a professorship that will provide additional matching funds from the Board of Regents. These funds are fantastically helpful to us in recruiting good students and supporting students during their time in our program. One of the best ways we can improve the quality of LSU and the Department is by improving the quality of the students we attract. Good students will feed on each other, raising their standards and allowing us to raise the level of the education we give them. We have been advertising to our prospective students that we will put them to work in our laboratories with our faculty, and the student support the Brodies have provided makes it possible to do exactly that.

James Painter, Chair of the Dean's Executive Committee, recently donated a 6" reflector telescope which has been placed in the Landolt Observatory at the top of Nicholson Hall, where we will use it for student labs, public events, science teacher training sessions, and Student Physics Society events. Many thanks to him.

As I mentioned above, the Department's web site at <http://www.phys.lsu.edu> has been newly redesigned. It is still undergoing work, but come take a look at the news and research that are highlighted there. We will be happy to include news about alumni. Let us know where you are and what you are doing, and we will gladly share it with the rest of our Physics and Astronomy community.

**NEWSLETTER STAFF**  
**EDITORS**  
**PHIL SPRUNGER**  
**MICHAEL CHERRY, CHAIR**  
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## RESEARCH HIGHLIGHTS

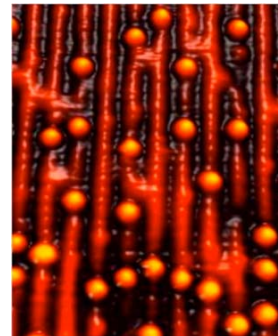
- **LSU Faculty are involved in two of the top 10 physics stories of the year** according to the list published by the American Institute of Physics ([www.aip.org](http://www.aip.org)). LSU faculty are involved in the **MiniBooNE experiment** and the **Auger experiment**. MiniBooNE (which involves Prof. William Metcalf and his research group) recently showed evidence that appears to rule out a fourth generation of neutrinos. Previous measurements of neutrino oscillations had provided tentative evidence for a family of "sterile" neutrinos; MiniBooNE has ruled that out, leaving only the standard three neutrino families associated with the electron, muon, and tau particles. Read more about MiniBooNE at <http://www.boone.fnal.gov/>. Auger, the world's largest cosmic ray telescope, involves Prof. James Matthews; Auger has provided the first direct evidence that the highest energy cosmic rays are produced by active galactic nuclei. The Auger experiment announced the first correlation of ultra-high energy ( $10^{20}$  eV) cosmic ray arrival directions with the directions of nearby active galactic nuclei. The scientific article appears in *Science* and a copy can be found at our web page at <http://www.phys.lsu.edu/dept/news/AugerScience.pdf> - Also visit the Auger experiment web site at <http://www.auger.org/>.



- The **ATIC cosmic ray balloon experiment** has been featured on LSU's home page (<http://www.lsu.edu/departments/highlights/2007/11/polar.html>) as part of **LSU's Antarctic research program**. ATIC recently flew its third flight to measure the composition and energy spectrum of high energy cosmic ray nuclei and electrons. Details and the latest news regarding the most recent flight campaign can be found at <http://atic.phys.lsu.edu/aticweb/>.

- **LIGO Sheds Light on Cosmic Event:** Students and research scientists at LSU who are members of the **LIGO Scientific Collaboration**, including Associate Professors Joseph Giaime (head of the LIGO Livingston Observatory) and Gabriela Gonzalez, were co-authors of a paper describing the search for gravitational waves coincident with a Gamma Ray Burst. An analysis by the international LIGO (Laser Interferometer Gravitational-Wave Observatory) Scientific Collaboration has excluded one previously leading explanation for the origin of an intense short-duration gamma ray burst occurring last winter. During the intense blast of gamma rays, known as GRB070201, the 4-km and 2-km gravitational wave interferometers at Hanford were in science mode and collecting data. They did not, however, measure any gravitational waves in the aftermath of the burst. The complete story can be found at <http://www.phys.lsu.edu/dept/news/ligoshedslight.html>.

- **Titanium dioxide ( $TiO_2$ ) has a number of uses in catalysis, photochemistry, and sensing that are linked to the reducibility of the oxide.** Usually, bridging oxygen ( $O_{br}$ ) vacancies are assumed to cause the Ti 3d defect state in the  $TiO_2$  band gap. Associate Professor Phil Sprunger and colleagues from the Interdisciplinary Nanoscience Center, Department of Physics and Astronomy, and Institute for Storage Ring Facilities at the University of Aarhus in Denmark propose that Ti interstitials in the near-surface region may be largely responsible for the defect state in the band gap. Based on data from high-resolution scanning tunneling microscopy and photoelectron spectroscopy measurements, they argue that these donor-specific sites play a key role in and may dictate the ensuing surface chemistry. Density functional theory calculations support the experimental observations. The scientific paper was published in *Science* 320, 1755 (2008). To the right: STM image ( $\sim 6 \times 10$  nm<sup>2</sup>) of the  $TiO_2(110)$  surface. The vertical atomically resolved rows are surface Ti and the bright yellow protrusions are single oxygen atoms.



## RESEARCH HIGHLIGHTS



- John Gibbons, Chief of Clinical Physics at Mary Bird Perkins Cancer Center and an Adjunct Professor in the Department of Physics and Astronomy, has helped introduce a **new treatment for a rare form of eye cancer**, choroidal melanoma, in which low-dose radiation is applied to the affected area in an ingenious way: Radioactive "seeds" about 3 millimeters long are placed inside a solid gold cap, or plaque, that is attached to the eyeball. Approximately two thousand new cases of choroidal melanoma are diagnosed in the United States every year. Gibbons' new treatment procedure is available through a partnership between Mary Bird Perkins Cancer Center ([www.marybird.org](http://www.marybird.org)) and our Lady of the Lake Regional Medical Center and is described in the March 25, 2008 issue of the Baton Rouge Business Report (<http://www.businessreport.com/news/2008/mar/25/rays-hope-tchn1/>).

- Ken Schafer, Professor of Physics, and colleagues from Lund and Amsterdam have **demonstrated that a train of attosecond UV pulses phase locked to an infrared field can be used to control the ionization of helium atoms with extremely rapid precision**. Their work is highlighted in a *Nature Photonics Research Highlights* article that can be obtained at [http://www.phys.lsu.edu/dept/news/Nature Photonics.pdf](http://www.phys.lsu.edu/dept/news/Nature%20Photonics.pdf). In a separate article, Schafer and his collaborators demonstrate the use of a train of ultrafast infrared laser pulses to produce images of electron motion on sub-femtosecond timescales. The "electron stroboscope" enables "unprecedented control of electron dynamics" and is expected to lead to detailed, precise studies of electron-atom interactions. A *Physical Review Focus* article describes the electron stroboscope. This additional article can also be obtained at [http://www.phys.lsu.edu/dept/news/Electron Stroboscope.pdf](http://www.phys.lsu.edu/dept/news/Electron%20Stroboscope.pdf).
- Matthew Anderson, Luis Lehner, Patrick Motl, David Neilsen, Carlos Palenzuela, and Joel Tohline, together with colleagues from Brigham Young University and Long Island University, recently published a discussion of **magnetic field effects on neutron star mergers** and the electromagnetic and gravitational wave radiation that results. An article about the implications for neutron stars with very high magnetic fields ("magnetars") can be found on the Science Magazine website <http://sciencenow.sciencemag.org/cgi/content/full/2008/529/3>. The original paper can be found <http://xxx.lanl.gov/abs/0801.4387>. Anderson and Neilsen were recent Postdoctoral Researchers at LSU and are now working at BYU.
- Additional News can be found at <http://www.phys.lsu.edu>.

*"Every day I remind myself that my inner and outer life are based on the labors of other men, living and dead, and that I must exert myself in order to give in the same measure as I have received and am still receiving."*

Albert Einstein

## LSU Professor Works with International Researchers to Make Quantum Physics Discovery

Ashley Berthelot, *LSU Media Relations, LSU NEWS*



John F. DiTusa, professor of physics and astronomy at LSU, and his international colleagues have discovered an unusual magnetic material that behaves very

differently from the average refrigerator magnet.

He recently co-authored an article “Mesoscopic Phase Coherence in a Quantum Spin Fluid”, in *Science* 317, 1049 (2007).

The results of the research have strong implications for the design of devices and materials for quantum information processing.

The group’s main goal was to demonstrate string order – also called quantum phase coherence – and to determine the factors affecting the ability to maintain this property over a finite distance. In order to investigate this, the team looked at a quantum spin liquid, a system where electron spins are coupled but point in random directions. These spins can be thought of as atomic-sized magnets that point in random arrangements, in contrast to the behavior of household magnets where the spins are mostly aligned. The material in which they discovered the quantum spin liquid is composed of chains of nickel-oxygen-nickel atoms.

The group found that the string order was maintained for relatively long distances, nearly 30 nanometers, or 100 times the distance between nickel atoms in the solid state, at temperatures close to absolute zero.

“I like to think of this novel state of matter as an orchestra without a conductor, each musician playing whatever comes to mind,” said DiTusa.

“Though one trumpet player likes to play Jimmie Hendrix and an oboe player likes to play Bach, a miraculous occurrence takes place and, without realizing it, the entire room of musicians becomes locked into playing a Brahms symphony.”

In this case, DiTusa contends, the whole orchestra is acting as a single coherent entity, even though they are playing different parts of a nonexistent score. This coherence has a length scale of the size of the concert hall and lasts a time determined by the length of the symphony.

“In our nickel oxide magnet, although the individual nickel atoms don’t have spins that point all in the same direction, or even form a regularly repeating pattern, they all hang together to make a beautiful, coherent symphony,” he said.

Collaborators on this research include: Guangyong Xu of Johns Hopkins University and Brookhaven National Laboratory; Collin L. Broholm, Ying Chen and Michel Kenzelmann of Johns Hopkins University and the National Institute of Standards and Technology Center for Neutron Research; Yeong-Ah Soh of Dartmouth College; Gabriel Aeppli of the London Centre for Nanotechnology and University College of London; Christopher D. Frost from the ISIS Facility, Rutherford Appleton Laboratory, U.K.; Toshimitsu Ito and Kunihiko Oka of the National Institute of Advanced Industrial Science and Technology, or AIST, in Japan; and Hidenori Takagi, also from AIST and the University of Tokyo.

For more information, contact DiTusa at [ditusa@phys.lsu.edu](mailto:ditusa@phys.lsu.edu) or 225-578-2606.

Information on all of our department's research activities can be found on our web page @

<http://www.phys.lsu.edu>

## LSU Professor Receives Award for Work with International Neutrino Experiment:

Thomas Kutter works on large-scale project in Japan in hopes of solving neutrino mysteries.

*Ashley Berthelot, LSU Media Relations, LSU NEWS*

August 22, 2007



Thomas Kutter, assistant professor of physics and astronomy at LSU, has received an Outstanding Junior Investigator Award given by the Department of Energy's Office of High Energy Physics. This competitive and prestigious

award provides funding for independent research by accomplished junior faculty members.

Kutter received the funding, initially available in the amount of \$90,000 annually for three years, for a proposal titled, "Optimization, Construction and Commissioning of the Side Muon Range Detector for the Tokai-to-Kamiokande Off-Axis Neutrino Long Baseline Experiment."

Kutter originally teamed up with the Tokai-to-Kamiokande, or T2K, project, in 2003. This large-scale international project, which brings together more than 200 physicists from 11 countries, aims to provide insight into the fundamental characteristics of neutrinos, one of the most abundant - and mysterious - subatomic particles in the known universe.

Despite the abundance of neutrinos available for study, little information is known about them because these particles interact with other forms of matter very rarely.

"In fact," said Kutter, "every second, millions of neutrinos penetrate our bodies, but only about

once in your lifetime will a neutrino actually interact with any of the atoms in your body."

The low interaction probability proves to be a major obstacle for researchers, since neutrinos only become visible through interaction with other forms of matter. But the desire for more information about these tiny particles drives scientists to push forward through all the difficulties surrounding such research.

"Studying neutrinos is of interest because it might explain our very own existence," said Kutter, "such as why our universe is made out of matter and not an equal amount of matter and antimatter."

T2K will focus on the conversion of neutrinos from one type, or "flavor," to another, specifically from muon-neutrino to electron-neutrino, a phenomenon that has not yet been observed.

Kutter is primarily responsible for a subdetector of the project, called the Side Muon Range Detector, or SMRD. In addition to spearheading the design of this subdetector and coordinating research, he also serves on the T2K technical board responsible for making sure that all subdetectors involved in the project will ultimately integrate into one complete, functioning detector.

Currently, Kutter and a team of postdoctoral staff and graduate students travel to Japan approximately three to four times each year. But construction and preparation for the actual installation of T2K will require more extended travel in the period from 2008 to 2009.



## **Faculty & Staff Focus, Honors & Award**

*Matt Mullenix, Office of Research & Economic Development, LSU NEWS;  
Ashley Berthelot, LSU Media Relations, LSU NEWS*

### **Top-producing Research and Creative Faculty Dubbed “Rainmakers”**

BATON ROUGE - Offering due recognition for their exceptional productivity, LSU will celebrate the accomplishments of 100 outstanding research and creative faculty in the first annual Rainmakers Gala, a dinner and award ceremony to be held Sept. 10. Out of the 100, 7 were from the Physics & Astronomy Department: **Bradley Schaefer, Gabriela González, Joel Tohline, Jorge Pullin, Kenneth Schaefer, Luis Lehner, and Ed Seidel.**

The metaphorical “Rainmaker,” a term borrowed from the business parlance, is one whose special skills and efforts bring welcome resources or respect to an organization.

In the university context, Rainmakers are those who are nationally and internationally recognized for innovative research and creative scholarship, who compete for external funding at the highest levels and who attract and mentor exceptional graduate students.

Among this year’s round of award recipients are faculty from all disciplines on the LSU campus. Vice Chancellor Brooks Keel, head of the Office of Research & Economic Development, solicited nominations from nearly 50 departments representing 12 major academic divisions in both scientific and artistic fields.

“We didn’t want to define the winning criteria too narrowly,” said Keel of the award’s initial conception. “We see the Rainmaker event as a way to encourage and reward scholarly productivity in general, by whatever measures are commonly accepted in each field.”

The nomination process will be repeated annually, giving opportunity for recognition to all faculty who demonstrate exceptional academic productivity in a given year. Nominees are eligible regardless of their tenure at LSU and may include both emerging and well-established university scholars.

For more information about the Rainmakers Gala celebration or the outstanding work of this year’s selected recipients, contact the Office of Research & Economic Development, 225-578-5833 or e-mail [Research@lsu.edu](mailto:Research@lsu.edu) placing “LSU Rainmakers Gala” in the subject line.

For a complete list of all Rainmakers, please visit [www.lsu.edu/pa/mediacenter/nr/2008/05/Rainmakers.pdf](http://www.lsu.edu/pa/mediacenter/nr/2008/05/Rainmakers.pdf)

### **College of Basic Sciences Announces Hall of Distinction Inductees**

Renowned orthopedic surgeon Dr. James Andrews, Shreveport urologist Dr. Eugene St. Martin and Boyd Professors Emeritus William A. Pryor and **Joseph Callaway (1931-1994)** were inducted into the College of Basic Sciences Hall of Distinction on Friday, 2 May.

Callaway was a noted expert in solid-state physics, particularly the calculation of band structures, and detailed calculations of electron-hydrogen atom scattering in atomic physics. His pioneering research and his leadership are regarded as major factors shaping the development of LSU’s Department of Physics & Astronomy.

For more information, contact John Grubb at 225-578-2935 or [cxjohn@lsu.edu](mailto:cxjohn@lsu.edu).

## FACULTY RECOGNITION



• **Arlo U. Landolt** has been selected as a Fellow of the American Association for the Advancement of Science (AAAS).



• **Jorge Pullin** has been inducted into the Mexican Academy of Science.



• **Jerry Draayer** and **Jorge Pullin** (pictured above) have been appointed to the editorial board of *Research Letters in Physics*, an open access journal.



• **Luis Lehner** has been selected to the "40 under 40" by the *Baton Rouge Business Report* which is a selection of men and women under 40 years of age who are achieving success and influencing decisions; **Dr. Lehner** has also been appointed to the

selection committee of the Nicholas Metropolis Prize of the American Physical Society (APS). This prize is awarded each year for the best dissertation in computational physics worldwide. Dr. Lehner was the first recipient of this prize in 1999.



• **Joel Tohline** has been selected as a Fellow of the American Association for the Advancement of Science (AAAS); **Dr. Tohline** has also been invited to serve a 3-year term on the National Science Foundation's Directorate of Math and Physical Sciences Advisory

Committee (MPSAC) - the only official advisory body to the Divisions within the Math and Physical Science Directorate.



• **Gabriela González** has been selected as a Fellow of the American Physical Society (APS); **Dr. González** has also been appointed Chair of the committee that will select the winner of the GWIC thesis prize. GWIC is the

Gravitational Wave International Committee that selects the winner based on the best thesis in gravitational wave research worldwide.



• **Robert O'Connell** and **Ravi Rau** have been honored as "Outstanding Referees" by the American Physical Society



(APS). This recognition was awarded to referees who "have been truly exceptional in their contributions to the physics community by their hard work and careful attention to the peer review process.



• **Dana Browne** has been selected to receive the 2008 Basic Sciences Tiger Athletic Foundation President's Award.



• **Edward Seidel** has been elected to the Board of Trustees of Internet2; Dr. Seidel also has been elected as a Fellow of the American Physical Society by the Division of Computational Physics (DCOMP).



• **Kenneth Hogstrom** has been selected as a Fellow of the American Society for Therapeutic Radiology and Oncology.

**LSU Center for Computation & Technology Director To Head  
National Science Foundation's Office of Cyberinfrastructure**  
*NSF Press Release 08-099*

June 10, 2008

The National Science Foundation (NSF) has selected astrophysicist Edward Seidel as its director of the Office of Cyberinfrastructure. This office awards competitive, merit-based grants to researchers who demonstrate cutting-edge information technology that can lead to breakthroughs in science, engineering and other academic disciplines.

Seidel, who is Floating Point Systems Professor in the Louisiana State University (LSU) Departments of Physics & Astronomy and Computer Science and also is director of the LSU Center for Computation & Technology, or CCT, will begin this position Sept. 1, 2008.

"NSF's Office of Cyberinfrastructure is immensely important to all aspects of the science and engineering research the agency funds, and we're excited that a respected leader such as Dr. Seidel is able to join us," said NSF Director Arden L. Bement, Jr.

As Seidel prepares to assume his new responsibilities at NSF, LSU's Vice Chancellor of Research and Economic Development Brooks Keel will work with CCT's transition team to advise on and implement the center's new leadership plan.

"It is no surprise that the National Science Foundation sought out a scholar of Ed Seidel's stature for this impressive appointment," said LSU Executive Vice Chancellor and Provost Astrid Merget. "Under his leadership, LSU has emerged as a pacesetter in high-performance computing. Ed's singular stature in the field, coupled with his vision and development of CCT, has served as a magnet to attract some outstanding scholars to LSU whose contributions have advanced innovations in the sciences as well as the arts. As a catalyst for change

and innovation that crosscuts many disciplines, Ed is unparalleled. His post at NSF will only enhance LSU's position and reputation in computing and technology for the modern age."

The CCT transition team consists of Keel, CCT Executive Director Jarek Nabrzyski, Associate Director for Computing Applications Gabrielle Allen, Associate Director for Administration Joel Williams, Chief Technology Officer Charlie McMahon.

"This appointment is a true testament to the many accomplishments and the international reputation Dr. Seidel has gained in the field of high-performance computing and cyberinfrastructure," Keel said. "It is a fantastic opportunity for him, and LSU is certainly proud to have one of our truly outstanding faculty serving in this role."

NSF is an independent federal agency that supports fundamental research and education across all fields of science and engineering, with an annual budget of \$5.92 billion. NSF funds reach all 50 states through grants to more than 1,700 universities and institutions. Each year, NSF receives about 42,000 competitive requests for funding, and makes more than 10,000 new funding awards. NSF also awards more than \$400 million in professional and service contracts yearly.

NSF's Office of Cyberinfrastructure coordinates and supports the acquisition, development and provision of state-of-the-art cyberinfrastructure resources, tools and services essential to the conduct of 21st-century science and engineering research and education. The office supports cyberinfrastructure resources, tools and related services such as supercomputers, high-capacity mass-storage systems, system software suites and programming environments, scalable interactive



## **LSU Center for Computation & Technology Director To Head National Science Foundation's Office of Cyberinfrastructure (cont.)**

visualization tools, productivity software libraries and tools, large-scale data repositories and digitized scientific data management systems, networks of various reach and granularity and an array of software tools and services that hide the complexities and heterogeneity of contemporary cyberinfrastructure while seeking to provide ubiquitous access and enhanced usability.

Seidel said such technology is crucial to the country's future success in both industry and academia. "I have spent much of my career working to advance cyberinfrastructure, particularly since I came to LSU, and the CCT aims to catalyze and transform research and education through applications of cyberinfrastructure across disciplines," Seidel said. "It is an honor to accept a position that will allow me to address these issues on a national level while continuing my work here at the University."

Seidel's scientific career has focused on solving Albert Einstein's equations of general relativity, pioneering techniques and algorithms especially for simulating black hole collisions and gravitational waves on supercomputers. Seidel and collaborators also developed software approaches needed to solve the general relativity equations, which led to development of more general toolkits to attack complex problems from other disciplines using advanced computing environments.

LSU recruited Seidel in 2003 to leverage its investment in the Governor's Information Technology Initiative, when he created the CCT. He previously had worked for seven years as a professor at the Max-Planck-Institute for

Gravitational Physics (Albert-Einstein-Institute) in Potsdam, Germany, where he founded and led numerical relativity and e-science groups. While at Max-Planck, he led the EU Astrophysics Network of 10 institutes across Europe, and participated in the EU GridLab project.

Seidel has had many accomplishments during his five years at LSU, including spearheading and serving as chief scientist for the state's \$40 million Louisiana Optical Network Initiative (LONI), which makes Louisiana one of the most well-connected places in the world, leading the statewide "CyberTools" project to develop advanced applications and tools for collaborative research, founding the \$15 million LONI Institute involving Louisiana's six research universities, and helping lead a \$2.2 million award from National Science Foundation that enabled LONI to join the TeraGrid, in January 2008.

Seidel's awards include the 2006 IEEE Sidney Fernbach Award for innovative work in high-performance computing, the 2001 Gordon Bell Prize and the 1998 Heinz Billing Prize of the Max Planck Society. He also was named to the Internet 2 Board of Trustees as Discipline Researcher Representative earlier this year and in 2007 became a Fellow of the American Physical Society.

Seidel earned his doctorate from Yale University in relativistic astrophysics. In addition to his work at LSU and the Max-Planck Institute, Seidel was a senior research scientist at the National Center for Supercomputing Applications and associate professor in the Physics Department at the University of Illinois, Urbana-Champaign.

### *LaACES continues with flight of student neutron detector*

The end of the fifth Louisiana Aerospace Catalyst Experiences for Students (LaACES) year was marked on May 20, 2008 with the launch of the ACES-09 and ACES-10 sounding balloon vehicles.



LSU students Ravi Chimmalgi, Brad Wood, Robert Giglio and Shiloh Meyers waiting for the launch of their payload.

The two balloon vehicles carried six science experiments developed by students at McNeese, UNO, Grambling and LSU. Close to 30 students and 10 faculty from these institutions participated in the flight operations. The students from LSU included Ravi Chimmalgi (Freshman, Computer Science), Brad Wood (Sophomore, Physics), Robert Giglio (Freshman, Mechanical Engineering) and Shiloh Meyers (Freshman, Mechanical Engineering), who developed the Neutron Detector (NeD) experiment. NeD was designed to measure neutrons produced in the particle showers generated by high energy cosmic rays in the atmosphere. The NeD sensor is a 2" long, 2" diameter cylinder of plastic scintillator with a 2% doping of Boron viewed by a vintage RCA6655 photomultiplier tube. An energetic neutron enters the plastic and undergoes elastic scattering with the protons embedded in the plastic and within a few hundred nanoseconds loses enough energy to become a thermal neutron. The thermal neutron then diffuses through the plastic until encountering and interacting with a Boron nucleus. The

interaction, which can occur up to 50  $\mu$ s after the neutron entered the scintillator, produces an energetic alpha particle and a Lithium nucleus. The electronics developed by the NeD team took advantage of the delayed coincidence between the initial elastic scatter and the energetic alpha from the nuclear interaction with Boron to provide a trigger that would separate neutrons from charged particles.

NeD was flown on the ACES-09 vehicle which was launched just a couple of minutes before ACES-10 at 7:40 am from the NASA Columbia Scientific Balloon Facility in Palestine, Texas. Both vehicles required quite a chase and, unfortunately, communication with ACES-10 was

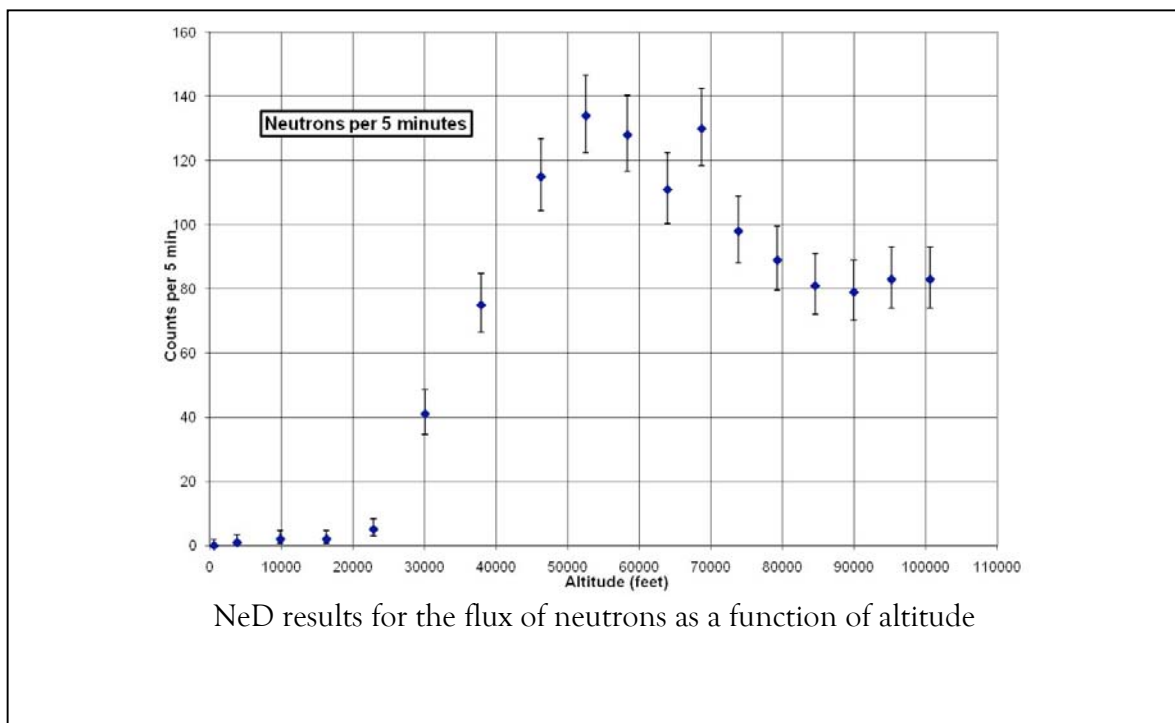


Launch of the ACES-09 balloon vehicle on May 20, 2008

***LaACES continues with flight of student neutron detector (cont.)***

lost about 1 ½ hours after launch as it was descending through 23,000 feet. Subsequent land and air search of the projected landing area have yet to find the missing payloads. ACES-09, however, was followed down to a landing on top of several trees located on property belonging to the “Deadwood Hunting Club”. After contacting the local sheriff’s office and obtaining permission to enter the property, it was still several hours before payload recovery was complete. The total effort was well worthwhile. When the team downloaded and analyzed their results, they found that not only did their instrument continue to function in the vacuum and cold of near-space, but they had also succeeded in measuring the flux of neutrons as a function of altitude beyond 100,000 feet. The neutron flux peaks at about 60,000 feet, where the flux of cosmic ray shower particles also peaks, and is about a factor of 15 to 16 less intense relative to the flux of charged particles. Over the summer the NeD group will be refining their detector calibration, configuring their payload to fly as a standalone payload on LSU’s larger HASP instrument, and preparing a paper on their experiment for publication. The NeD team thanks J.H. Adams and M. Christl of Marshall Space Flight Cent for the loan of the borated scintillator and the LSU Space Science group for the donation of the RCA6655 photomultiplier tube.

To find out more about the LSU student ballooning program, look through the LaACES website at <http://laspace.lsu.edu/aces/> as well as the HASP website at <http://laspace.lsu.edu/hasp/>





*Bringing the Physics & Athletic Department Together  
Pictures by A.R.P. Rau*



Photo: Skip Bertman & Mike Cherry



On May 19<sup>th</sup> the Physics & Astronomy Department presented Skip Bertman, LSU Athletic Director with a Physics T-shirt, designed by Undergraduate student Michelle Browne, at the Physics Crawfish Boil. Now people actually do walk around with Physics T-shirts on, and so did Skip.



Photo: Clockwise from upper left: Juhan Frank, Edward Zganjar, Richard Imlay, Robert Collyer, Jo Zganjar, Arlo and Eunice Landolt, Joel Tohline.

Photo: William Metcalf, Arnell Dangerfield, Shemeka Ezeff, Ophelia Dudley, Richard Imlay



Physics T-Shirt Design

Photo: David Young, Mette Gaarde, Kenneth Schafer, Richard Kurtz.



### *Physics Inspires Art: Modern Physics and the Mystery of Reality*

The LSU School of Art hosted a collaborative art exhibition and symposium featuring visual works inspired by modern physics. The exhibition ran at the Alfred C. Glassell Jr. Exhibition Gallery at the Shaw Center for the Arts in Baton Rouge (Nov.-Dec. 2007) and presented again at the March Meeting of the American Physical Society (New Orleans Convention Center, 2008).

The collection of 16 original paintings consisted of a collaboration between five physicists from our department (**Jonathan Dowling, Thomas Kutter, James Matthews, Jorge Pullin, A. Ravi P. Rau**) and 16 painters from six Louisiana universities (headed by Melody Guichet, LSU Professor of Art). The physicists wrote short descriptions of concepts such as “relativity of time”, “flying near a black hole”, “superposition”, “quantum entanglement”, “flavor oscillations”, “Schrödinger’s cat”, etc., which the painters rendered in their own medium. The display puts these words by physicist and painter alongside the paintings. An example of one of these collaborations is shown below with text from both artist and physicist.

#### ***Randell Henry : Artist***

To generate ideas for interesting forms to develop in this painting, I put successive layers of color over color to work my way through an entanglement of forms. I need to go through this process of entanglement and interference by making colors and shapes interfere with each other, to bring an order to this chaos. With the use of bright and dark colors, I begin developing papers and rhythms to make some type of existential dialogue happen within the forms in the painting. Every form has to co-exist.

My goal is to get the viewer to stand before these layers of strangeness and comprehend the overall painting by putting the forms together like a puzzle, to bring coherence. This may require the eye to weave in and out and around and over forms to see what will be found by one who wants to be puzzled.

I enjoy watching forms appear and disappear and come back in new ways.



**Image:** *Land of Bright and Dark Places*, Acrylic and oil paintsticks on canvas, 50 x 61”, 2007

#### ***A. Ravi Rau : Physicist***

A fundamental principle of quantum physics is that linear combinations (“superpositions”) of states of a physical system are also possible states in which it can exist. Consider, for instance a light switch. As a classical object, it has one of two positions, up or down, or on/off. A coin, with heads/tails, is another example of such “two-level systems”. Rendered into mathematics as 0 and 1, this “binary code/arithmetic” is the basis of all classical computers, which do their operations on the billions of such (tiny) electrical switches that they contain, each one a “bit”. A “quantum switch (or coin)”, denoted as a “qubit”, also has two observable states, up/down, but “in between” (when not being observed) can exist in an infinite superposition of those two possibilities.



### *Physics Inspires Art: Modern Physics and the Mystery of Reality (cont.)*

There are many examples of such quantum switches, usually microscopic such as the (“spin”) states of an electron or states of a charged atomic ion. The striking aspect is that any observation will only see the system as  $|0\rangle$  or  $|1\rangle$  and in that sense behave just like any ordinary coin or switch. But each such “qubit” exists also as a superposition with a myriad of intermediate possibilities. A useful metaphor for picturing this is of a sphere or globe. Imagine a pointer from the center of the sphere to its surface. A classical bit, or a qubit when observed, has the pointer at either the north or the south pole. The qubit’s general state corresponds, however, to a free rotation of that pointer so that its tip can be at any point on the surface of the globe.

Therefore, a qubit has enormously more “potentialities” than a classical bit (the entire surface of the globe instead of just the two poles). This is why, if we succeed in building a quantum computer out of many qubits, it may be much more powerful in memory and speed than our current computers.

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### *Sigma Pi Sigma 2008 Induction*

Sigma Pi Sigma ( $\Sigma\Pi\Sigma$ ) is a physics honor society requiring all new members to exhibit high academic performance and a commitment to studying physics. The 2008 induction ceremony was held April 30, 2008 at the LSU Faculty Club. The Master of Ceremony this year was Physics and Astronomy Associate Professor Dr. Jeffery C. Blackmon. In addition to describing the  $\Sigma\Pi\Sigma$  history, goals, objectives and symbols, Dr. Blackmon also introduced Physics and Astronomy Chair Dr. Michael Cherry who, in turn, provided insight into the meaning and utility of a physics degree. Together, Dr. Blackmon and Dr. Cherry welcomed new members into the society and honored graduating members with  $\Sigma\Pi\Sigma$  stoles. The new members inducted this year were Stacy Newbold Bright, Jessica Danielle Brinson, Joseph Paul Chatelain and Emily Mae Tanguis. In addition,  $\Sigma\Pi\Sigma$  members who



Attendees of the 2008  $\Sigma\Pi\Sigma$  ceremony include (left to right) Department Chair Dr. Michael L. Cherry, Faculty Advisor Dr. T. Gregory Guzik, Emily Mae Tanguis, Rachel Louise Mannino, Stacy Newbold Bright and Master of Ceremony Dr. Jeffery C. Blackmon.

will be graduating this year are Stacey Newbold Bright, Christopher Tillman Britt, Rachel Louise Mannino, Karthik Omanakuttan, Emily Mae Tanguis and Shawn Lawrence Wilkinson.

## WELCOME NEW MEMBERS TO OUR DEPARTMENT!

Slaven Radic, Intern (Kutter)  
Amar Karki, Research Associate (Young)  
Vincent Vaughn, Research Specialist, Machine Shop  
Yimin Xiong, Postdoctoral Researcher (Adams)  
Milan Matos, Postdoctoral Researcher (Blackmon)  
Christian Buth, Postdoctoral Researcher (Schafer)  
Kalin Drumev, Postdoctoral Researcher (Draayer)  
Joseph Gallagher, Postdoctoral Research (Clayton)

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