

A Word from our Chair:



We are changing. The world is changing. More nations are becoming competitive in science and technology. Our own country is changing. There are new initiatives in education and research to

provide for a better quality of life in 20 years. And Tulane is changing with a new focus on “Engaged Learning”, stimulated by an accreditation review next year. The School of Science and Engineering is playing a leading role in all of this. Our department is a part of that effort.

You may have noticed that we are now the Department of Physics and Engineering Physics at Tulane. Our acronym, thanks to Tim Schuler, is PEP. Our goal is to merge science and engineering in one department with the hope that scientists and engineers can learn from each other thus improving both science and engineering. Good engineers need to understand science, so they have an idea of what is possible. Perhaps buildings that need no paint or roads with less noise and more traction. John Perdew is a world leading expert in materials properties. Engineers, together with John, can identify key opportunities and questions. Norman Horwitz, our new PEPy professor of engineering, is working with Lev Kaplan, a brilliant young theorist taught by Rick Heller at Harvard, to bring quantum mechanics into the engineering curriculum for all engineers. They are our key leaders in designing and developing our new undergraduate degree in Engineering Physics. If current trends persist, Tulane will be graduating more students in engineering physics than in physics in a few years. We are changing.

But make no mistake. The engineers will have a challenge overtaking our physicists. Ulli Diebold won the Outstanding Research Award in the School of Science and Engineering last year. There are rumors that John Perdew’s seminal work is being cited by Martians. And,

oh yes, John will receive the Tulane Award in Teaching at the Graduate and Professional level at commencement in May. Wayne Reed’s new PolyRMC center is bursting at the seams and is making an impact on the local industrial base. Zhiqiang Mao has an exceptionally wide range of well funded research projects, not to mention a reputation to rival Fred Wietfeldt in teaching. Fred continues his highly regarded work in fundamental questions in a variety of fields of physics with his work in cold neutron physics at NIST. Lev Kaplan’s work in chaos, the many body problem and quantum limits is gaining the respect and attention of the physics community. Daeho Kim has joined our faculty and is setting up a laser lab. He is already a leader in Tulane’s efforts to establish a clean room. George Rosensteel continues to be productive in the area of mathematical and nuclear physics. His papers are highly regarded. Dan Purrington has a new book coming out about Robert Hooke and is writing a history of physics at Tulane. Frank Tipler is working on a new book reestablishing the intellectual strength of physics. And perhaps most significant of all, Jerry Shakov is leading efforts to change the way we teach science (he has the largest audience). The person who herds most of these cats is Teresa Parker, who was promoted to Office Manager this year. She is now assisted by Eleanor Berault, our new Administrative Secretary.

All I have to do as Chair these days is to snooze and keep out of everyone’s way, although Norman has been pestering me about making better laundry machines.

~Jim McGuire
mcguire@tulane.edu

Please let us know what you are doing. We are collecting a database of graduates in Physics and Engineering Physics. Even if you are not a graduate of our department we’d love to hear from you. Contact Eleanor at eleanor@tulane.edu or 504-865-5520.

New and Noteworthy

Prof. Ulrike Diebold was awarded the "Outstanding Researcher Award" by Dean Nick Altiero of the School of Science and Engineering in April 2008

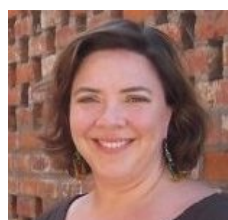


New Additions continued...

Dae Ho Kim,
Assistant Professor
Field of Research: *Thin-Film and Nanostructure Materials*



Dr. John Perdew and Dr. Adrienn Ruzsinszky in the Fall of 2007



Eleanor Berault,
Administrative Secretary
Eleanor joined the department first as a temp in February 2008 and became permanent staff in October 2008. She came to us most recently from FEMA where she worked for 2.5 years following Hurricane Katrina.

Teresa Parker was promoted to Office Manager in the fall of 2008. Teresa has been with the department for 10+ years. You can reach her at tkparker@tulane.edu.



Outgoing...

Graduating Seniors in Physics

We have 6 graduating seniors this year. They are: Chris Hall, Christopher Rodell, Tiffany Spohrer, Erin Vehstedt, Tessa Johnson, and Namdi Brandon. These students were incoming freshman when Hurricane Katrina disrupted life in New Orleans.

Four of these seniors are unusual in another respect. They have all worked in the PEP office as student workers at some point during their tenure at Tulane. We will especially miss Tessa, Christopher, Tiffany and Erin, *the office girls*.



► More Physics Dept. news is available at <http://www.physics.tulane.edu/PhysicsHomeNews.html>

Incoming...

Norman Horwitz, Professor of the Practice
Engineering Design Coordinator



New courses in Physics and Engineering Physics

PHYS-315	Intro to Neutron Science (Wietfeldt)
PHYS-370/670	Electronic Properties of Materials (Mao)
ENGP-201	Electric Circuits (Martinez)
ENGP-231	Product & Experimental Design (Oertling/Murfee)
ENGP-232	Computer Concepts and Application (Shevkopyas)
ENGP-243	Mechanics of Materials (Aung)
ENGP-312	Materials Science and Engineering (Moore)
ENGP-317	Computational Physics and Engineering (Kaplan)
ENGP-370	Electronic Properties of Materials (Mao)
ENGP-431	Senior Engineering Design Project (Horwitz)
TIDE 135	Mysteries of the Quantum World (Kaplan/Uskov)

Ph.D's Earned since October 2007

- Carroll (Bob) Trull, Fall 2008 (Wietfeldt)
- Pascal Enohnyaket, Fall 2008 (Reed); Scholarship for MBA program at Rice University
- Khabibulakh (Bulat) Katsiev, Spring 2009 (Diebold); Postdoctoral work at MIT
- Tomasz Kreft, Spring 2009 (Reed): Postdoctoral Fellow, University of Warwick, England
- Michael Huber, Spring 2009 (Wietfeldt)

DFT Fest honoring Dr. John Perdew

The achievements of John Perdew were in the spotlight on Sunday, May 9, 2008 at a special symposium. The symposium honoring Perdew's work in Density Functional Theory (DFT) was held as part of the annual March meeting of the American Physical Society, held on the Tulane uptown campus. International scientists who are leaders in their field were in attendance. Perdew's colleague, Ulrike Diebold, said that Perdew "is arguably one of the world's most influential physicists." Starting in the 1970's, Perdew, together with coworkers such as Mel Levy, Tulane chemistry professor emeritus, devised a major improvement to DFT that helped promote the theory, which is now used in a large variety of fields such as solid-state physics, physical chemistry, surfaces, catalysis, and biomolecules.



in

2008 Annual Faculty retreat

The Physics and Engineering Physics Faculty retreat was held on August 25, 2008 in the Waldenberg Board Room of the New Orleans Museum of Art in City Park. Several students, both graduate and undergraduate, were invited to attend and participate in the discussion about the direction of the newly founded PEP department. Nick Altiero, Dean of the School of Science and Engineering, also came to join the conversation for a while.



Research notes from our Faculty

Prof. Zhiqiang Mao's group currently has one postdoc, four graduate students, and one under graduate student. His group has a wide range of active research projects, supported by NSF, DOE, DOD, Research Corporation, and LBoR. Prof. Mao has received NSF Career Award, Cottrell Scholar Award, Tulane President Early Career Development Award. One of his graduate student, David Fobes was selected to attend the *58th Meeting of Nobel Laureates and Students in Lindau, Germany in 2008*. Dr. Mao's research mainly focuses on these materials in recent years. The major objective of his research is to seek novel quantum phenomena in bulk perovskite ruthenates using high quality single crystals, investigate their underlying physics, and explore their potential applications.

Prof. Lev Kaplan's research group, currently consisting of graduate students Basil Davis, Matt Smith, and Linghang Ying, postdoctoral associate Luca Celardo, and faculty advisor Lev Kaplan, is engaged in the study of quantum chaos and complex systems. As one example of our recent work, we are studying the formation of rogue waves in the ocean by random eddy currents. A new area of research for our group is quantum information and metrology, where we are collaborating with Research Professor Dmitry Uskov.

The new Engineering Physics program continues to thrive with 21 students currently enrolled, and our first graduates will proudly receive their degrees in the Spring of 2010. Since the program was launched, we have added new courses in "Computational Physics and Engineering" and "Electrical Properties of Materials," thus expanding the range of courses offered for both Engineering Physics and traditional Physics majors. The program emphasizes integration between modern physics and technology, with a focus on nanotechnology and 21st century materials.



Prof. Wayne Reed's PolyRMC, whose personnel are members of PEP, now includes full-time staff, visiting scientists and graduate students. Prof. Alina Alb is Associate Director for Research and Michael Drenski is Associate Director for Instrumentation. Alex Reed is temporarily performing Lab contracts, operations, and marketing. Over 50% of PolyRMC funding now comes from private sources and patent royalties.

Recent scientific and technical advances at PolyRMC include means of simultaneously monitoring colloidal and polymer characteristics during emulsion polymerization reactions (patent pending), predictive control of polymerization reactions using semi-batch operations, fundamental new insights connecting the synthesis of copolyelectrolytes to their physical behavior, first time monitoring of basic kinetic phenomena during reactions, new methods in monitoring controlled radical polymerization, and the beginnings of a 2nd generation ACOMP platform for monitoring the onset of macromolecular stimuli responsiveness during synthesis (patent pending).



PolyRMC has had visitors from around the globe this past year. Prof. Rilton Alves de Freitas, Univali University (Itajai, Brazil) visited on sabbatical from March-Sept. 2008, sponsored by CNPq. He investigated chitosan derivitization using online monitoring and other characterization methods. Prof. Fabio Florenzano, Dean of Health Sciences Center at Univ. do Vale do Supucuí (Pouso Alegre, Brazil) visited on a 2 month sabbatical to work on characterization of functionalized materials. Dr. Frank Bentram is on an 8-month sabbatical from the U.S. Naval Research Center (Gulfport, MS). He is working on computer simulations for chain growth reactions and phase transition behavior in polymers. Prof. Nodirali Normakhamatov, Uzbek Academy of Sciences (Tashkent, Uzbekistan) is visiting under the Civilian Research Development Fund US/Uzbekistan agreement. He works on

monitoring and characterization of sulfonated cellulose for use as new generation antibiotics, using PolyRMC technologies. Prof. Hyuk Yu, Walter H. Stockmayer Prof. Emeritus and Eastman Kodak Prof. Emeritus of Chemistry at Univ. of Wisconsin-Madison, and an Advisory Board member of PolyRMC spent time in New Orleans this past winter. He will be consulting PolyRMC personnel on different scientific matters and other strategies regarding PolyRMC development. Dr. Daniel Elizarraras spent one year with the support of Total North American Services, Inc. at PolyRMC using ACOMP to study grafting reactions. Our current graduate students are: Colin McFaul and Zheng Li who both began in fall of 2007, and Zifu Zhu began in fall 2008.

Prof. Norman Horwitz

- We had a very successful VIP tour of the NASA Michoud Assembly facility in New Orleans. We saw NASA building the fuel tanks for the Current space shuttle. We were briefed on NASA's plans for the Orion and Ares projects. Highlights were the 27 ft diameter 100 ft long lithium Aluminum alloy tanks, friction stir welders 4 stories high and carbon fiber weaving machines.

- We are progressing on our partnering for internships and the Senior Engineering Design Project course for the Fall. Our contacts include manufacturing companies, chemical plants, refineries, ship builders and Engineering consulting firms.

- Designs are all around us: Case study

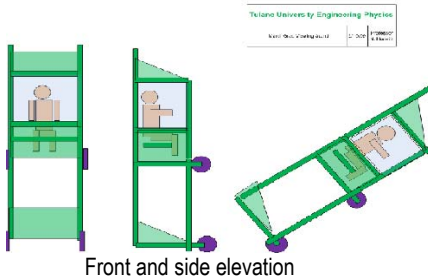
Case study: opportunities for new and unique designs are all around us, this is an example of a simple project that includes the basics for engineering design of a fun concept.

Problem: I want to take my 3.5 yr old granddaughter to a Mardi Gras Parade, but how can she see over the crowd, how can I protect her from being hit by projectile beads, how can she get the beads and stuffed toys they throw, and how can I transport my design to the parade site?

Constraints: cost, available materials, speed and ease of construction, limited tools available, portability, easy set up and take down

Design: The "Mobile Bead Proof viewing Platform"

Fabrication: see pictures



Design in action

Prof. John Perdew's research group in density functional theory currently includes Adjunct Professor Adrienn Ruzsinszky, Dr. Lucian Constantin, and graduate students Xiaolan Zhao, Jianwei Sun, Yuan Fang, and Pan Hao. Xiaolan is finishing up her work with us and starting an experimental project with Professor Dae-Ho Kim. Some of us recently completed the third rung of the density functional ladder by constructing a simple, easily-calculated semi-local density functional that predicts accurate lattice constants and surface energies for solids, and accurate atomization energies for molecules. We are moving toward fully nonlocal functionals that can describe strong correlations and long-range van der Waals interactions. John Perdew will receive the President's Graduate and Professional Award for Excellence in Teaching at the May 2009 commencement. A special issue of the Journal of Chemical Theory and Computation has been published in April 2009 in recognition of his career. This is the Festschrift coming out of the Tulane Density Functional Theory Fest of March 2008, organized by Professors Ulli Diebold, Kieron Burke (Irvine) and John Perdew, and supported by Tulane's Research Enhancement Fund.

Prof. Fred Wietfeldt

A new course, PHYS 315 / PHYS 615 Introduction to Neutron Science, was created and developed by Prof. Fred Wietfeldt and taught by him for the first time in Fall semester 2008. This is a 3 credit course for upper division undergraduates and beginning graduate students presenting a broad introduction to the physics and applications of thermal, cold, and ultracold neutrons. Low energy neutrons have large deBroglie wavelengths and interact coherently, like a wave, with solids and liquids. Neutron scattering is an important tool for studying condensed matter, molecular, nuclear, and biological systems. Neutron imaging technology is widely used by industry. Precision measurements of neutron decay and interactions are advancing the frontier of particle physics. New and upgraded neutron science research facilities such as the Spallation Neutron Source in Tennessee and the NIST Center for Neutron Research in Maryland answer these needs by delivering intense cold neutron beams to experiments and instruments. The course covers neutron scattering theory; neutron optics; thermal, cold, and ultracold neutron production and transport; neutron interferometry; neutron beta decay; and application of these to problems in condensed matter physics, particle physics, biology, and engineering.

Prof. Dan Purrington

Currently Guy Norton and I are exploring the application of sophisticated modeling techniques developed by Norton and others to describe sound propagation near the ocean surface, with a rough interface, various inhomogeneities including bubbles, etc., to the problem of ultrasound propagation in tissue and bone. This modeling treats dispersion and attenuation in a very robust way, and represents a great improvement over techniques currently used. This has resulted in a paper recently submitted to the Journal of Sound and Vibration, and a paper at the upcoming IMACs meeting in Athens, GA.

On the history front, my scientific biography of Robert Hooke, titled *The First Professional Scientist: Robert Hooke and the Royal Society of London*, will be published by Birkhauser this summer. Previous books have been on the history of cosmology, Newton, and physics in the 19th century (the actual title). My next project will be variously speculated to be (by me) on archaeoastronomy, in which I have published over the years, on Galileo, or (most likely) on Euler. In the latter cases, language is a big issue, of course.

I have also guided the astronomy program since 1972, and managed to talk the university into spending \$250,000 on a new facility on top of Jones Hall about nine years ago. Present duties involve providing observing sessions for students which give a concreteness to what they learn in lectures, equipping the observatory with something approaching modern instrumentation, and keeping it running.

Prof. Tim Schuler

Outreach programs associated with the Physics and Engineering Physics department continued to expand into new realms over the past year, with a number of new projects, new community partners, and new thoughts on how best to use our talents and manpower to perform outreach within our community. Our Introduction to Physics Pedagogy (PHYS 291) service learning course, which pairs undergraduate physics students with science teachers at Lusher Elementary School, had its largest class ever and expanded into 3rd grade science classes from the normal 4th and 5th grade classes. Instructors Jerry Shakov and Tim Schuler considered the semester and the expansion to be another resounding success in the 4-semester-old program.

Beginning last July, Jerry Shakov has also been working with a Math and Science Partnership project called "NOLA SMILE" (Science and Math: Inquiry, Learning, and Exploring) where 3rd and 4th grade science teachers from schools in New Orleans received a 3-week-long intense professional development training, followed by a series of workshops and field trips throughout the academic year. Tim Schuler recently hosted the AP Physics students of O. Perry Walker High School for an afternoon of demonstrations and experiments concerning electrostatics, including his demonstration of electron transitions in atoms utilizing the Magic Glowing Pickle Machine he developed.



Physics and Engineering Physics
6400 Freret Street
2001 Percival Stern Hall
New Orleans, LA 70118

504.865.5520 phone
504.862.8702 fax



www.physics.tulane.edu