Adjunct Professors: A Great Source of Renewal and Growth

A physics department is a complicated and dynamic organization with many categories of people contributing to the teaching and research mission. Regular professors, students and staff historically have always been present. With the growth in the federal government’s research budget after World War II, research professors, funded by research grants, became increasingly common. Currently our department has more than 30 research professors.

Within the past 10-to-15 years a new category of people has become increasingly important: adjunct professors. Originally they were hired primarily to teach classes, which might still be the most common use of adjuncts in other UT departments. However, in the physics department we are now focusing much more on adjuncts as great collaborators who help us increase our research activities and, in particular, the research opportunities for both our undergraduate and graduate students. Most of our adjuncts are employees of Oak Ridge National Laboratory, but recently we have also added adjuncts with other backgrounds, as will be discussed later.

The typical adjunct professor in our department is a successful ORNL researcher who has chosen to work with and supervise one or several of our students. The student will also be supervised by a regular UT tenure-line professor to ensure that he or she is making good progress and that the relationship between the student and the adjunct advisor is positive and constructive. In order to provide research assistantships for the students, the adjunct professor has obtained external funding through our department. In many cases these external grants can also support research associates and in some cases research professors. Often the funding comes from an agency like NSF or NIH, which normally will not be available to ORNL researchers. By collaborating with adjunct professors in fields other than our historically strong areas we have been able to substantially increase the spectrum of research opportunities for our students without any additional costs to the Tennessee taxpayers. This collaboration between UT and ORNL is not highlighted nearly as often as the agreements on distinguished scientists and joint faculty members, but nevertheless has also had a very positive impact on our department.

The first major groups the department worked with as adjuncts were the micro sensor groups at ORNL. Some of the individual appointments go back several decades, but most have been made within the past 10 years. Now we have people like Tom Ferrell, Thomas Thundat, Panos Datskos, Lal Pinnaduwage and Ed Arakawa working with us and by now several of them have become research professors. Tom Ferrell has recently relocated his research group to UT. You can read more about him in the research highlight article in the issue. Thundat was recognized in a Time Magazine article on January 12, 2004, as the inventor of the micro cantilever detector technology, and Thundat and Pinnaduwage were recently highlighted in the local newspaper for their outstanding contributions to the micro cantilever detector technology, in particular detectors capable of “sniffing” TNT and other bomb material. Datskos has been pushing the limits for detecting small amounts of material under ambient conditions and was recently featured in the weekly Physics News Update for having been able to detect amounts of mass as small as five femtograms.

Many of our students are very interested in getting optics experience, so to increase our capabilities in applied optics we have recently appointed three members from the ORNL Engineering Science and Technology Division: John Simpson, Don Hutchinson and Roger Richards. They have an impressive...
Physicists young and old assembled with great anticipation to find out who among them would be recognized at the physics department’s annual honors day celebration on April 28.

Professor and Head Soren Sorensen kicked off the ceremony with a brief welcome before turning things over to UT Classics Professor Chris Craig, who gave the honors day address. Illuminating the study of science and math within an ancient framework, he explained that had you asked learned people in antiquity why they studied physics, the response would simply have been, “to be happy.”

The term physics actually traces its origin to the Greek word for nature and “for the Greeks,” Dr. Craig said, “order is beautiful.” His own heroes from the realms of science and mathematics are Pythagoras, Epicurus, and Socrates. Pythagoras revered numbers as holy. Epicurus believed that to be happy, one had to live in accordance with nature. And Socrates?

While some of the ancients may have viewed scientists in such a dim light, that certainly is not the case for Dr. Craig, who recognized many of the physics students in the audience and praised their broad-minded approach to studying arts and sciences.

“The physics students I know are very far from humanities-blind,” he said. “Enjoy the larger human context of what you’re doing,” he challenged. “The details of what you do can be beguiling.”

At the conclusion of Dr. Craig’s talk, Dr. Sorensen and Dr. James Parks got on with the business of handing out awards. First up was the induction of students into Sigma Pi Sigma, the physics honor society. The department added 16 new members to the UT chapter, including graduate students Watheq Al-Basheer, Jason Haraldsen, Qinghong Kou, Valentina Kuznetsova, Ching-Tsai Lee, Robert Moore, and Juan Urrego-Blanco. Undergraduates received into this prestigious society were James Alsup, Jesse Henderson, Robert Higginbotham, Dan Passmore, Anton Naoumov, Gail Zasowski, James Alsup, Olga Ovchinnikov, Jesse Henderson, Eric Mueller, Dr. Parks.

Socrates was annoying and somewhat obnoxious, always asking questions. “And so,” Dr. Craig said, “he was labeled a natural scientist,” even though in reality he was not.

Next came the presentation of individual awards.

The Outstanding First Year Student Award recognizes exceptional achievement by a student in his or her first year of physics study. Michael Ashworth took home the honor, which included copies of the Feynman lectures.

Two new awards were introduced this spring for undergraduate students. The Robert Talley Award for Outstanding Undergraduate Research went to Anton Naoumov and Scott Outten. Each received copies of the Feynman lectures.

The Robert Talley Award for Outstanding Undergraduate Leadership went to Olga Ovchinnikov, who also received copies of the Feynman lectures.

The Douglas V. Roseberry Award was a $500 prize and went to Joey Nicely.

The Robert W. Lide Citations went to Dragoslav Grbovic and Brandon White. Each received a plaque and $350.

The Outstanding Graduate Teaching Assistant Award recognizes the GTA who has earned the best evaluations from students enrolled in the undergraduate physics and astronomy labs. The $500 award went to Phil Evans.

The Paul H. Stelson Fellowship in Physics (a $2,500 prize) went to Valentina Kuznetsova.

The Fowler-Marion Outstanding Graduate Student Award (a $1,000 prize) went to Anota Ijaduola.

The Colloquium Awards were introduced this year to recognize the students who present the most thorough write-ups on the various colloquia topics presented throughout the year. Suzanne Parete-Koon and Valentina Kuznetsova each received copies of the Feynman lectures.

The Society of Physics Students Teacher of the Year Award offers students the opportunity to select the faculty member they feel provides the best
instruction. This year the undergraduates chose Dr. Marianne Breinig and Dr. Jon Levin. Each received a plaque and a stylish SPS T-shirt.

Special recognition also went to John Carruth, the 2003-2004 recipient of the Dorothy and Rufus Ritchie Scholarship. John has just finished his first year in physics.

Dr. Kermit Duckett also presented Astronomer Extraordinaire Paul Lewis (better known as the director of astronomy outreach) with a poster of an X-15 aircraft autographed by Scott Crossfield, who flew the X-15 to become the first rocket pilot to fly three times the speed of sound: over 2,000 miles per hour. “He may be the biggest proponent of aerospace education of anyone I know,” Lewis said of Crossfield.

Students, faculty and guests adjourned to the hallway for a reception following the presentation. Esteemed guests from the College of Arts and Sciences were Dr. Lynn Champion, Director of Academic Outreach; Dr. Don Cox, Associate Dean of Academic Programs; and Dr. Carolyn Hodges, Interim Associate Dean of Academic Personnel. Also in attendance were emeritus physics professors Dr. Ed Deeds and Dr. David King.

**About the Awards**

A striking element about these honors is how personal they are. Half are named for people who had or have a connection with the department—individuals who studied or taught in the University of Tennessee Department of Physics and Astronomy.

**Dr. Robert Talley** learned the intricacies of the infrared under the tutelage of Dr. Alvin Nielsen, earning his master’s and doctoral degrees here. The Robert Talley Awards were introduced this year as a means of acknowledging students for their research expertise and leadership capabilities. Dr. Talley has established a fund at UT to support undergraduate physics education.

In the fall of 1959 the Phi Sigma Kappa fraternity established the Douglas V. Roseberry Award to honor their fraternity brother and physics major Doug Roseberry, whose life was cut short by an aneurysm just five months before he was to graduate. Doug took on research and teaching duties in addition to his undergraduate coursework, spending time at Oak Ridge National Laboratory and the Redstone Arsenal in Huntsville, Alabama. The Roseberry award has traditionally been reserved for an upper-division student who exemplifies similar dedication and excellence.

The Lide Citations were introduced in 1998 to honor Dr. Robert W. Lide, who joined the physics faculty in 1957. Over three decades in the department he worked tirelessly organizing the undergraduate laboratories, a practice he continued even after his retirement in 1991. The department chose to honor his contributions with citations that recognize students of like qualities.

**Dr. Paul Stelson** was an adjunct professor of physics at UT from 1967 until his death in 1992, mentoring many young physicists along the way. He finished his Ph.D at the Massachusetts Institute of Technology at the age of 23. In 1953 he joined Oak Ridge National Laboratory as a nuclear physicist, becoming associate director of the physics division in 1971 and director in 1973. During his tenure, the Holifield Heavy Ion Research Facility was funded, built, and became operational. His family established the Paul H. Stelson Fellowship in 1993 to support young scientists as they complete their graduate education and to carry on the strong relationship in physics research between UT and ORNL. The fellowship goes to a first or second year graduate student who shows the greatest potential for success in graduate school and demonstrates tremendous promise as a researcher.

The Fowler-Marion Award is named for Dr. Joseph Fowler and Dr. Jerry Marion. Dr. Fowler earned his master’s degree in physics at UT in 1938 before going on to earn a doctoral degree at Princeton. He later became head of the ORNL Physics Division. In 1960 he teamed up with Dr. Marion of the University of Maryland to edit a textbook called *Fast Neutron Physics*. They donated the royalties to the physics department. Funds from that gift have provided support for the Fowler-Marion Graduate Student Award, which acknowledges an advanced graduate student who has excelled in scholarship, research, service and leadership.

The physics department has not historically attracted the corporate sponsorship for awards enjoyed by engineering or chemistry, both fields with more intimate ties to industry. Yet the honors offered each spring draw on the very personal and passionate legacy of individuals who learned here, taught here, and continue to make a difference.

“Enjoy the larger human context of what you’re doing . . . the details of what you do can be beguiling.”

Ion Research Facility was funded, built, and became operational. His family established the Paul H. Stelson Fellowship in 1993 to support young scientists as they complete their graduate education.
array of lasers in their lab at ORNL. Over the past year Hutchinson has provided important help in our senior level team research course for the construction of a CO₂ laser.

Currently some of the world’s best accelerator physicists are located in Oak Ridge and working on the Spallation Neutron Source. In collaboration with their dynamic leader, Norbert Holtkamp, we have started a program in accelerator physics by appointing three adjunct professors from the SNS: Stuart Henderson, Jeff Holmes and Marti Stockli. This fall Holmes will teach a course in accelerator physics at the graduate level, which we hope will attract students to this new program.

Medical physics is a rapidly growing area with fantastic employment and salary opportunities for physics graduates. One of the world’s leading medical scanning companies, CTI, is located here in Knoxville. Recently they hired three outstanding medical detector physicists jointly with the UT Medical Center: Jon Carney, David Townsend and Jeff Yap. Since for some time we have been interested in responding to student requests for an expanded program in medical physics, we started a collaboration with these three physicists by appointing them as adjunct professors. Their technology-leading PET scanners and novel photon detectors will provide great research opportunities for students.

The above are examples of the 25 adjunct professors currently working with us. A common theme is the more applied nature of the research being done by these groups. Applied research typically requires fairly large instrumental investments and it is therefore a very cost effective way for us to start collaborations. Reciprocally, the adjuncts get access to our great students to help them with their research. All in all, the adjunct faculty program is a model for academic collaboration with mutual gains and one that we hope we will be able to expand in the future.

From Mandeville to Knoxville—by Boat, No Less

Dr. J.E. “Bill” Hancock graduated from UT with a bachelor’s degree in engineering physics in June 1952. He worked as an engineer for a couple of years and then decided to enroll in UT’s medical school at Memphis, graduating in 1961. He is officially retired from the Mary Bird Perkins Cancer Center, based in Baton Rouge, but still works there part-time. His avocation is sailing, and in 2002 he decided to sail from Louisiana to Knoxville to commemorate the 50th anniversary of his UT graduation. The (excerpted) beginning of the story follows.

“As the end of year 2001 approached, I began to think seriously of visiting the campus of UTK, my alma mater. As a member of the class of 1952, I was excited about returning for a visit after 50 years. Naturally homecoming weekend in the fall of 2002 seemed to be the ideal time to make the visit.

I live in the small town of Mandeville, Louisiana, which is on the north short of Lake Pontchartrain. Because of the great number of boating activities, I made plans to move here after my retirement.

Well, I got the idea of going to my 50-year homecoming by boat. Rather than drive, fly, or ride a bus or train, I would be different. I would, no doubt, have traveled the farthest by boat to a homecoming.”

The complete tale is available on the UT Physics Web Site at http://www.phys.utk.edu/alumni_stories.html. If you have a story relating to your UT days that you would like to share, please send it to Catherine Longmire at cal@utk.edu. This is a new section on the Web site dedicated to our graduates and we would love to compile the stories of our alumni.

Dr. Pengcheng Dai co-authors Nature paper

Dr. Pengcheng Dai is the third author on “The structure of the high-energy spin excitations in a high-transition-temperature superconductor,” which appeared in the June 3 issue of Nature.

Superconductors can carry electricity without any loss of energy. Usually superconductivity occurs at very low temperatures; however, in 1986 scientists discovered a new type of superconductor that can now carry electricity at five times the temperature of other superconductors. The authors of this Nature paper have found a clue as to why so-called high-Tc superconductivity occurs. They have observed new excitations that could provide the glue for the high-Tc. Using this knowledge, scientists hope to design new materials with even higher transition temperatures, making superconductors less expensive. (Thanks to Dr. Dai and Ron Walli of ORNL).
Vicki Greene came to the University of Tennessee as a psychology major and ended up graduating with highest honors in physics and math, thus defying the venerable Lee Riedinger’s predictions (a point to be illuminated later). During her early psych days at UT she learned all about research chronicling the adventures of rats in mazes. Now an associate professor of physics at Vanderbilt University, research to Dr. Greene means experimenting with the PHENIX experimental nuclear physics, specifically the goings-on with the PHENIX experiment at Brookhaven National Laboratory’s Relativistic Heavy Ion Collider (RHIC, pronounced “Rick”). So much for the rats.

Dr. Greene is part of a large collaboration working to pin down the quark gluon plasma, an elusive soup comprising quarks (particles that reside inside protons and neutrons) and gluons (the hard-working particles that hold the quarks together). Physicists believe that a messy amalgamation of the two existed right after the Big Bang, and perhaps still does in the cores of neutron stars and in collisions between gold nuclei at high-energy colliders. They may be close to creating the plasma at RHIC.

alumnus profile

“IT’s very interesting,” Dr. Greene said of the experiment’s status. “We’ve gotten these hints that we may have created the new state of matter we are looking for.”

She’s cautious, however, about declaring the QGP corralled at last.

“We’re not ready to make claims,” she said. “You want to be very careful” when analyzing data and drawing conclusions. “You can throw a whole generation (of scientists) off track” if future physicists base their work on faulty research that preceded it.

However, if the PHENIX collaboration has in fact discovered the quark gluon plasma, Dr. Greene said, it doesn’t look the way scientists thought it would.

“It’s a lot more strongly interacting,” she said—somewhat “stickier” than predicted. So the current questions at PHENIX are “Is it what we’re looking for, and if not, what is it?”

Currently the PHENIX collaboration is investigating J/Psi particle suppression as a possible signature for the QGP.

“If you form a plasma, you’ll actually see fewer J/Psis produced,” she explained.

The collaboration is undertaking a long run of gold-on-gold collisions to make those measurements. They are building on similar data taken previously at CERN. Evidently the work has appeal beyond the walls at Brookhaven: Dr. Greene’s research group at Vanderbilt (Experimental Relativistic Heavy Ion Physics) recently won a large grant renewal from the Department of Energy to continue their studies for the next three years.

“It was a real vote of confidence,” she said.

Beyond research, Dr. Greene is also finishing a term as chair of the RHIC/AGS (Alternating Gradient Synchrotron) Executive Committee. The committee represents the roughly 1,000 users at RHIC and tackles items ranging from the quality of life (e.g., dorms) to monitoring funding trends. Working out visa issues for international scientists has also become a more pronounced topic of late, but well worth the time it requires. As Dr. Greene said, “Part of our edge in science has been that everybody in the world comes here to work.”

She spends a minimum of three to four days per month at Brookhaven, depending on where she’s needed. Building systems means a longer stretch, for example when she supervised the building and installation of the PAD chamber—three layers of detectors on the PHENIX spectrometer’s two central arms. Currently she’s working on a detector upgrade to study particles perpendicular to the beam. Down the road she may work at the ALICE experiment (another QGP search) at CERN.

“Right now,” however, “I’m very focused on the present,” she said. “For about 15 years I’ve been working toward this goal and we’re almost there.”

Teaching and “The Physics of Strange Animals”

Like most academic professionals, Dr. Greene balances her research interests with teaching responsibilities. Yet she doesn’t restrict her approach to traditional paths of imparting knowledge. In particular, she said, she enjoys “finding interesting sources and examples to liven up lectures.” Currently, she’s using what she calls the “physics of strange animals” to explain the phenomena of the natural world to students in her principles of physics class.

“An electric eel, for example, might act like a battery,” she explained. There are fish that behave like electric dipoles to track and hunt their prey.

“It’s just more fun that working dry problems,” she said of her methodology.

Continued on Page 6
Help UT Recruit Tomorrow’s Alumni

The Office of Undergraduate Admissions is asking associates of the University—alumni, friends, members of advisory and governing boards, faculty, and staff—to recommend students for admission. UT would like your help in nominating high school juniors or seniors or students who are considering transferring to UT from another college or university. The University has put a form online for the “Friends of the University Recruitment Project” at http://www.phys.utk.edu/alumni_friends_of_ut.pdf. If you know of a student we should be talking to, please let us know!

Alumnus Profile (from Page 5)

But Dr. Greene doesn’t bring the animal kingdom into her classroom for the sheer fun of it. She is committed to what she calls “layering” her teaching tools—incorporating equations, words, and pictures into her curriculum—so that students can take hold of the information in whatever manner makes the most sense to them.

“I like to make sure people don’t get lost because they aren’t being presented the material in a way that’s natural for them,” she said.

From Psychology to Physics

Dr. Greene, a Knoxville native, enrolled as a freshman at UT with a plan in mind.

“I wanted to be a psychology major,” she said.

But she didn’t enjoy the large classes or what she called “the illogical nature of interpreting the data.” Fate stepped in, however, and when she enrolled in Lee Riedinger’s introductory astronomy class, everything changed.

“I had never taken physics before,” Dr. Greene said, referring to her high school days as a time when boys took physics and girls took biology. But she had no trouble adapting to the world Dr. Riedinger was introducing.

“This class was wonderful,” she said. “The conclusions that he would draw were perfectly logical.” She said she knew physics was in her future when the lecture turned to spectral lines and she saw, instinctively, where the discussion was headed.

“I immediately realized you could use this to find out what was inside of stars,” she said.

Intrigued by the subject matter, she took two astronomy courses and asked Dr. Riedinger about taking more. He told her a senior level astrophysics course was the next option, but the caveat was that she would have to switch majors from psychology to physics if she wanted to sign up. He did, however, give her some ribbing about the probability of her success in making that leap.

“Later on he told someone else, I’ll give her a five percent chance,” Dr. Greene said.

Undaunted, she plunged into the world of physics and never looked back.

“I took calculus for the first time and I loved it,” she said. “It was a miracle.”

Paul Huray taught her introductory physics class.

“He was a wonderful teacher,” she said. “He never made me feel like I was mismatched for the course.”

In 1984 she graduated with a bachelor’s degree in physics and math, earning highest honors. From there it was on to graduate school at Yale, a school that captured her imagination with a somewhat sloppy letter.

“They sent a letter asking me to apply,” Dr. Greene recalled. “And the letter had Wite-Out on it.”

She figured that if the letter were personal enough have Wite-Out, they must really want her to come to New Haven.

“I went to visit and fell in love with it,” she said. She finished her master’s degree in 1987 and her Ph.D. in 1992.

“I was extremely happy there.”

After Yale, Dr. Greene went to the University of Colorado at Boulder for a post-doctoral position. She earned a fellowship to work on the Superconducting Super Collider, but before she even gave her obligatory fellow’s paper, the SSC project was killed. She left Boulder in 1994 to join the physics faculty at Vanderbilt. In the beginning, she said her focus was on building detector systems and she spent most of her time in the lab. Now, she said, supervising and administration take up more of her schedule.

“Somehow I’m on about five million committees. I think this happens to everyone, naturally.”

Balancing work with her family is another challenge, but one she enjoys.

Dr. Greene is married to Dr. Jonathan Gilligan of Vanderbilt’s Earth and Environmental Sciences Department. Her son is a film production major at Vanderbilt and her daughter is in kindergarten.

“It’s a full plate,” she said, “but I like what’s on it.”

When advising young scientists about a career in physics, she said it’s important to provide insight on the day-to-day life of a physicist and dispel myths about the profession.

“It can be a very interactive, very collaborative, very social experience,” she said.

And if they have questions about careers in physics?

Dr. Greene laughed.

“I’d give them Lee’s phone number.”
Dr. Thomas Papenbrock Joins the Team

Dr. Thomas Papenbrock is signing on to the physics faculty this summer, the latest addition to the joint faculty program that allows the department to hire talented scientists in conjunction with Oak Ridge National Laboratory. And although he is new to the UT roster, Dr. Papenbrock is no stranger to the physics environment in East Tennessee.

“In 2000, I came here as a Wigner Fellow,” he explained.

The Wigner Fellowship program at ORNL was established in 1975 to honor Eugene P. Wigner, the Nobel Prize winner and ORNL’s first director of research. (Dr. Robert Grzywacz, who joined the physics faculty last December, also came to the area as a Wigner Fellow.)

Among Dr. Papenbrock’s research interests are nuclear structure theory, many-body theory, ultracold Bose and Fermi gases, spin chains, and quantum chaos. His UT-ORNL colleagues include Dr. Ted Barnes, Dr. David Dean, and Dr. Witek Nazarewicz.

“I knew them from conferences and seminars but I had not worked with them before,” he said. “The research group is very nice. UT and the (national) lab together offer many opportunities.”

In fact, the nuclear structure group recently submitted a proposal to the Department of Energy for a topical center on radioactive ion beam physics. They should know later this year if it will be funded.

As part of his 50-50 split appointment between UT and ORNL, Dr. Papenbrock will teach a physics course on campus every year. He said he prefers to teach “serial courses for physics majors,” in areas like theoretical quantum mechanics, electrodynamics, or nuclear physics.

“I am looking forward to teaching,” he said, adding that his own days as a student aren't really that far behind him.

Dr. Papenbrock completed his undergraduate work in physics at the University of Osnabrück before going on to earn his Ph.D. at the University of Heidelberg in 1996. He spent three years as a post-doc at the University of Washington’s Institute for Nuclear Theory before coming to Tennessee.

Outside of physics, his family commands much of his attention. He and his wife, Dervy, have a three-year-old daughter named Isabel.

“She’s getting much of my spare time,” he said.

Dr. Papenbrock seems as pleased to join the university as we are to have him.

“This is a very good place to be,” he said.

Neutron Physics Beamline Coming Along at the SNS

ORNL has received the first year of funding for the Fundamental Neutron Physics Beamline at the Spallation Neutron Source. UT Physics Professor Geoff Greene is the Instrument Scientist for the beamline, whose construction costs will total $9.2 million. The funding comes from the Department of Energy Nuclear Physics program. Known as BL 13, this beamline will use the unique properties of a pulsed spallation source to shed light on elementary particle interactions.

“When it’s completed it will be a national facility for fundamental neutron physics,” Dr. Greene said. “At the moment there are five different groups who have expressed an interest in pursuing experiments here.” UT is involved with all five. The beamline will take about six years to complete, but the first phase will be ready “to do science” in 2008, he said.

In true UT-ORNL collaborative fashion, a full-scale mock-up of the beamline is under construction in the old infrared lab in the Nielsen Physics Building. Students are teaming up with the department’s machine shop to build the mock-up. UT has received approximately half a million dollars to support science done at the beamline. More information on BL 13, and the entire SNS project, is available at http://www.sns.gov.
Undergraduate News

University Exhibit Showcases Research Success

The physics department had a strong turnout at this year’s Exhibition of Undergraduate Research and Creative Achievement, providing seven of 38 entries listed in the Natural Sciences category.

Olga Ovchinnikov won one of four awards in this category for her work with Dr. Robert Compton, entitled, Negative Ions of Buckey-Dumbbells. The awards were announced April 3. The physics department’s Dr. Pengcheng Dai also contributed his time as a competition judge.

Physics students participating in the event were:

James Alsup “Monte-Carlo Event Generator for the Neutron Dissappearance in KamLAND” (Adviser: Yuri Kamyshkov)

Anton Naoumov “Methods of Separation of Chiral Carbon Nanotubes” (Adviser: Robert Compton)

Joseph Nicely and Jesse Henderson “Quasinormal Modes of Black Holes in Antide Sitter Space” (Adviser: George Siopsis)

Scott Outten “Modeling Neutron Detection with SCINFUL” (Adviser: Yuri Kamyshkov)

Olga Ovchinnikov “Negative Ions of Bucky-Dumbbells” (Adviser: Robert Compton)

Daniel Passmore “Tennessee Cosmic ray Project” (Adviser: Soren Sorensen)

Gail Zasowski “In the Dark: Single Photo-electron Response of 17” PMT” (Adviser: Yuri Kamyshkov)

The University Honors Program coordinates the Exhibition of Undergraduate Research and Creative Achievement each year to celebrate the original and creative works of the university’s undergraduate students.

Daniel Passmore and Jesse Henderson were among the many students who presented their research at the spring exhibition.
UT’s Society of Physics Students Chapter Catches National Attention

Undergraduates Gail Zasowski and Olga Ovchinnikov headed to Miami in January to present an update on TECOP at the American Association of Physics Teachers meeting. The TEnnessee Cosmic ray Observation Project is the UT Society of Physics Students’ major research initiative and incorporates area high school students, physics students and faculty, and support from Oak Ridge National Laboratory. Gail presented a poster on Cosmic Ray Detection in East Tennessee and Olga gave a talk on the same subject. The TECOP project, which began in 2003 with a $2,000 grant from the national SPS, is one of the many elements that helped garner the UT SPS chapter a nod from the national organization. In early December the national SPS office named them an Outstanding Chapter for the 2002-2003 academic year. Fewer than 10 percent of the SPS chapters nationwide are so honored: about one per state. The selection is based on the depth and breadth of chapter activities in areas including physics research, public science outreach, tutoring programs, and social interaction. UT’s chapter has 67 members.

More Good News for UT’s SPS . . .

In early June the UT Chapter of the Society of Physics Students won two awards from the national organization. They were among the four chapters honored with the Blake Lilly Award, specifically for their work on “Detection of Cosmic Rays in East Tennessee.” The award “recognizes SPS chapters and individuals who make a genuine effort to positively influence the attitudes of school children and the general public about physics.” Other chapter winners were The University of Louisville, Marquette University and St. Mary’s University. Olga Ovchinnikov was one of two recipients of the 2004 SPS Outstanding Student Award for Undergraduate Research. She was recognized for her project on “Negative Ions of Bucky-Dumbbells,” work she has done under Dr. Robert Compton. Bradley M. Deutsch of Rollins College was the other winner. Olga received a $500 honorarium and a $500 award for the UT SPS Chapter.

Undergraduate Physics Enrollment at UT

1997-1998: 42 Students
1998-1999: 45 Students
1999-2000: 37 Students
2000-2001: 36 Students
2001-2002: 42 Students
2002-2003: 67 Students
2003-2004: 67 Students

Students in Dr. Jon Levin’s Honors Fundamentals of Physics class design, build and present to the class demonstrations illustrating some aspect of course material. Students in this spring 2004 class decided to offer a fiery demo of a standing sound wave in a pipe charged with natural gas.
Getting Under the Skin

Dr. Tom Ferrell’s Group Takes Sensitivity to the Nanoscale

Among Tom Ferrell’s newest physics laboratories is one so minuscule that it will fit snugly underneath the skin of rats.

Long fascinated by novel sensors, Dr. Ferrell, a staff member at ORNL and a research associate professor in the physics department, is taking detection to the nanoscale and turning his physics training into new ideas for spectrometry, biology, medicine and optics.

“We’re in the Life Sciences Division at Oak Ridge National Lab,” he explained. “First we do basic research in physics to uncover concepts that can be useful in instrumentation for the life sciences.”

And in the beginning, there was the microscope.

“We built the first scanning tunneling microscope among all the national labs and in the Southeast in 1986,” he said. “We built one by hand just before the Nobel Prize (was awarded). Then we invented a microscope called the photon scanning tunneling microscope.”

At the same time he hired Thomas Thundat to investigate the research possibilities of the atomic force microscope.

Dr. Thundat, a distinguished staff scientist at ORNL and a physics research professor at UT, took notice of the ATM’s sensitivity in scanning surfaces and concluded that it might just make a good sensor. Sensory work, therefore, grew out of what Dr. Ferrell calls “microscopy roots.”

“Historically we’ve worked with surface plasmons,” he continued. “We already had some experience with sensors, so when microcantilevers came along we had some background ready to go.”

Microcantilevers are sensors roughly the size of an ant’s eye that can measure down to sub parts per trillion.

“The biggest problem with these sensors is that they’re too sensitive, so we have to pull a lot of tricks out of the hat to make them work,” Dr. Ferrell said.

These tiny wonders are a key component of a new $2.2 million grant from the National Institute on Alcohol Abuse and Alcoholism. Dr. Sean O’Connor of the Indiana University School of Medicine plans to measure the effects of ethanol in the body. Dr. Ferrell’s group will provide the tools.

“We’re using the same type of sensors for ethanol in acid acetaldehyde, which will go into rats,” Dr. Ferrell explained. “The rats have this interstitial fluid, or water layer, right under their skin. We do too, but theirs is bigger.”

His group is developing capsules to be implanted in that layer to monitor how much acid acetaldehyde the animals produce when given a certain amount of ethanol.

“There’s a little fluid chamber in that capsule with the microcantilevers inside,” Dr. Ferrell said, along with a tiny device that sends signals to a PDA for taking data. The work could provide important new clues about the effects of alcohol on physiological systems.

“There’s never been any real detailed data available on what’s going on inside the body,” Dr. Ferrell said.

The group hopes to have the capsules delivered to Indiana by December so that Dr. O’Connor’s team can start taking data as early as next spring.

In addition to the Indiana project, the Ferrell group has several other research initiatives on campus.

Post-doc Christine Cheney is working on electron beam lithography of metal oxide metal tunnel junctions.

“They’re extremely difficult to make,” Dr. Ferrell said. “She’s working on the nanometer scale.

“Those junctions have a number of applications,” he continued. “One would be flat-screen displays because they give off light in proportion to the voltage.

“If you have a grid of these and you put something at a particular point, it will change the color emitted at that point,” he continued, indicating that the junctions could have sensory value as well.

Nanowires and fabricated pads will connect the junctions to the real world.
Post-doc Rubye Farahi is working on thermo-imaging the veins in the arm to make inserting a catheter a much easier task.

“You use several different infrared sources that shine infrared light into the skin,” Dr. Ferrell explained. “Infrared penetrates a lot further than visible light. Everybody’s the same color in the infrared, so it doesn’t matter what your skin color is.”

As light makes its way back out of the skin, some is absorbed by the blood vessels, while some scatters in all directions.

“The scattering is the overwhelming majority of what’s coming out,” Dr. Ferrell said, and that obscures absorption by the blood vessels.

“Our task is to throw away the scattering and look only at the absorption. That’s a fairly complicated task. It has to be done in real time for each of the different light sources. It takes extensive image processing.”

Currently the group is assembling the necessary components, including a high-end PDA to do the image processing.

“We have to have a processor with memory that allows that to be done in real-time,” Dr. Ferrell explained.

This project is in conjunction with the University of Burgundy in France. Two of their students will join the UT group in the fall.

Another infrared project involves research assistant Aude Lereu and Dr. Ali Passian.

“Aude and Ali have a very interesting project that has good visual effects,” Dr. Ferrell explained. It’s a simple system using thin gold or silver film evaporated on a prism. Graduate student Phil Evans is also working with the group.

“We’re able to take a pulse train in the infrared and transfer it to visible light in any color. In essence it’s an optical amplifier for energy,” Dr. Ferrell said.

They have been able to transform infrared into a visible spot on the wall that will “pulse” up to 10 kilohertz maximum.

“That is a new discovery in physics, really,” Dr. Ferrell said. “In addition to that, they’ve found that when they have an electrical current in the foil, the infrared pulse train will actually also pulse the current—so they can control electrical current with infrared.

“We don’t know what to do with this—it’s solution looking for a problem,” he continued. “What we hope is that somebody out there will find a use for it.”

Another graduate student, Philip Boudreaux, is working in the Ferrell group building a microspectrometer using surface plasmons in a thin gold film instead of a prism or grating.

“Hopefully we would turn that into some sort of integrated optics,” Dr. Ferrell said.

Much of the group’s work is in the beginning stages, but Dr. Ferrell hopes to move to campus full-time by June 30.

*Heinrich Rohrer and Gerd Binnig won the 1986 Nobel Prize for their STM design.

---

**Taking It on the Road**

Outreach Puts Physics in the Classroom

The physics department may have made its reputation on top-notch research, but not to the detriment of teaching or outreach. On May 6, Dr. Jim Parks spent his morning at Big Ridge Elementary School in Union County. Dr. Parks, associate department head and director of the undergraduate physics laboratories, demonstrated the power of magnetism to second and third-graders, concluding the show with crowd-pleasing experiments in liquid nitrogen. Departmental astro-guru Paul Lewis spent the afternoon at BRES explaining the wonders of the universe to a gym full of kids.

Physics faculty members often volunteer their time to serve as mentors or give special presentations to area schools. “Captain Comet” (Lewis) teaches astronomy classes for Kids U every summer and speaks to countless school children each year. The department is committed to doing its share to balance the university’s three-fold goal of research, teaching and public service.

(Right) Dr. Jim Parks with students from Big Ridge Elementary School.
Physics Family News

**students**

**Congratulations to our Spring 2004 Graduates!**

David Bogema  
B.S. in Engineering Physics

Jimmy Bullard  
B.S. in Electrical Engineering  
Minor in Physics

Trey Forgety  
B.S. in Applied Physics

Jason Goon  
Ph.D. in Physics

Robert Higginbotham  
B.S. in Engineering Physics

Brent Mundie  
B.S. in Engineering Physics. Brent was also commissioned as a Second Lieutenant in the United States Air Force. His first job is at Kirtland Air Force Base in Albuquerque, New Mexico. He will be working for the Air Force Operations Testing and Evaluation Center. Brent explained that the “AFOTEC tests all of the AF’s new gadgets” before they’re put into use. He will be working with classified items.

Joey Nicely  
B.A. in College Scholars (emphasis in Mathematical Physics) and a B.S. in Physics (Academic Concentration).

Brandon White  
B.S. in General Physics

**faculty**

Professor and UT-ORNL Joint Faculty Member Ted Barnes was quoted in *USA Today* concerning the success of recent Japanese experiments designed to detect pentaquarks. The article appeared May 3. Dr. Barnes was also asked to be conference summary speaker for theory at QNP-2004, the International Conference on Quark Nuclear Physics, at Indiana University in late May. This is a major biannual conference on aspects of quark degrees of freedom in nuclear and hadron physics.

Professor Witek Nazarewicz was quoted in the February 1 issue of *The New York Times* reporting the discovery of two new superheavy elements: 113 and 115 (Uut and Uup). He provided insight on the “magic numbers” of atomic nuclei and the implication of the discovery for nuclear physics.

Professors Soren Sorensen and Lee Riedinger were quoted in a May 9 article in *The Knoxville News Sentinel* concerning security regulations and their effect on the scientific community at UT and ORNL.

Research Professor Thomas Thundat was featured in a special section on “Innovators” in the January 12 issue of *Time*. Dr. Thundat has developed microcantilevers for detecting a number of interesting items, including cancer-related proteins and plastic explosives. His research could make identifying such markers more accurate and cost-effective.

**alumni**

Ted S. Lundy (B.S., 1954) is retired from ORNL (1988) and Tennessee Tech (2000) and living in Knoxville.

Richard M. Martin (B.S., 1964) is professor of physics at the University of Illinois and a member of the physics department board of visitors.

Bronson Messer (B.S., 1991; Ph.D., 2000) is a research associate at the ASCI/Alliances Flash Center, part of the University of Chicago Department of Astronomy and Astrophysics.

Khaled S. Mriziq (Ph.D., 2003) is a research scientist with Lynntech, Inc., in College Station, Texas.

Korey D. Sorge (Ph.D., 2002) is a postdoctoral research associate at the University of Nebraska, Lincoln.

Richard Styles (B.S., 1991) is an assistant professor in the geological sciences and marine science program at the University of South Carolina in Columbia.

Macy W. Summers (B.S., 1981) is vice president of technology with Pegasus Communications Corp. in Bala Cynwyd, Penn. He is also a member of the physics department board of visitors.

Izabela Szlufarska (Ph.D., 2002) is a postdoctoral researcher at the University of Southern California.

Gerald Woods (Ph.D., 2001) is a research assistant professor in the University of South Florida Department of Physics.

Lilia Woods (Ph.D., 1999) is an assistant professor in the University of South Florida Department of Physics.

Ali R. Yazdi (M.S., 1974; Ph.D., 1978) is associate dean of the northeast campus, Jefferson State Community College, Birmingham, Alabama.
The department took over Clark Center Park in Oak Ridge for a few rounds of soccer, hot dogs, and the legendary students versus faculty softball game.
Alumnus Robert Talley visited the physics department in early May and imparted a valuable lesson: sometimes knowing what you don’t want is just as important as knowing what you do.

As a young man coming of age in the 1940s, Dr. Talley was enrolled in the Reserve Officer Training Corps and was about to enter Milligan College, located in northeast Tennessee. But that wasn’t the school the Erwin native particularly wanted to attend. As he stood in line with the other cadets, he listened carefully as the young man in front of him answered some questions. When it came to “What’s your major?” he answered, “Engineering.” It turned out Milligan had no engineering program, so the cadet had to choose another school. By his own admission, the young Mr. Talley had not given much thought to an academic major. But he saw an opportunity and ran with it. When asked for his chosen field he confidently proclaimed engineering, thus ending up at the University of Virginia before transferring to the University of South Carolina.

As graduation neared some other decisions had to be made. Dr. Talley explained that after adding up his various hours he wasn’t sure what sort of degree the good people of USC might confer on him. They said, “We have this new major called naval science and engineering, and you have enough credits for it.” So he paid $6.00 for the sheepskin and became a USC graduate. After sweeping mines for the U.S. Navy in Japanese waters for more than a year he applied to the graduate program in physics at the University of Tennessee.

“They asked if I had a degree,” he said. He did, of course, but cautioned the department, then under the leadership of Dr. Ken Hertel, that he had taken only one year of physics. It was enough to get in but he had to take the other three years during the first year in graduate school. Robert Talley earned his master’s degree in physics in 1948 and his Ph.D in 1950 under the direction of Dr. Alvin Nielsen. His specialty was all things infrared, and he made a career of it.

He went on to become chief of the Naval Weapons Center Solid State Division in White Oak, Maryland. In 1958 he moved to Santa Barbara, California. He went to work for the Santa Barbara Research Center, a Hughes Aircraft Company, building infrared detectors and sensors for the Department of Defense and the national space program. One of the sensors was for the Pioneer satellite and it took pictures of Venus, Jupiter and other planets before being the first man-made object to leave the solar system with the sensor still working 30 years later. He retired in 1989 as president and CEO.

Dr. Talley is married to Sue Talley, who graduated from UT in 1946 with a degree in home economics. They are extremely grateful for this endowment.

The Talleys’ generosity is not limited to their Santa Barbara home. They have established the Robert Talley Physics Scholarship Endowment at UT to encourage undergraduate physics education, bolstering the fund with a $100,000 gift this past winter.

Department Head Soren Sorensen said the gift “will give the department an unprecedented opportunity to provide substantial scholarships to attract academically outstanding, but financially disadvantaged, students in physics. We are extremely grateful for this endowment.”

Robert Talley may not have known exactly where he was headed when he left Erwin all those years ago. But the path he chose will make the trail a bit easier for a number of students following in his wake.

The creation of a thousand forests is in one acorn.

Ralph Waldo Emerson
Thanks to our Donors!

The University of Tennessee Department of Physics and Astronomy would like to thank the generous alumni and friends who have offered financial support to our programs.

(The following gifts were forwarded from the University Development office from November 31, 2003 through June 4, 2004)

Chang-Hyuk An
Kim An
Norma Jean Beaver
Neva Claiborne Burke
Taylor George Burke
Barbara B. Cate
John P. Cate
Margaret M. Compton
Robert N. Compton
Thomas M. Cunningham, Jr.
Jing Ding
Caius V. Dodd
Linda K. Dodd
John T. Ellis
Liz Ellis
Dennis J. Erickson
Mary S. Ferry
Robert A. Ferry
J.D. Fox
Jo Ann Guidry
Michael W. Guidry
J.E. “Bill” Hancock
Sara W. Harris
Leigh H. Harwood
Jackie T. Hill
Sandra J. Hinsdale
R. Craig Hunter
Larry D. Johnson
Albert C. Kahler III
Sarah H. Kahler
Andrew G. Kulchar
Margaret R. Kulchar
Mary V. Lasley
Scott E. Lasley
Barbara T. Lide
Mark E. Littmann
Peggy A. Littmann
Gerald P. Lubert
Jane Houston Lubert
Janet C. Lundy
Ted S. Lundy
Ellen A. Macek
Joseph H. Macek
Beverly C. Martin
Richard M. Martin
Nancy P. McCorkle
William C. McCorkle
Wheeler K. McGregor, Jr.
Elizabeth Reid Murray
Raymond L. Murray
Witek Nazarewicz
Barbara C. Parks
James E. Parks
Kenneth F. Read, Jr.
Valerie D. Read
Noah S. Reon
Jane C. Robert
James B. Roberto
Alice M. Rohr
Robert C. Rohr
Anne M. Sayer
Royce O. Sayer
Frankie Simons
George Siopsis
Gordon K. Soper
Shiela R. Soper
Dianna L. Sorensen
Soren P. Sorensen
Korey D. Sorge
Audrey T. S. Stelson
Robert M. Talley
Sue Talley
Dawn Thompson
James R. Thompson, Jr.
Michael V. Torbett
Charles C. Watson
Nancy Watson
Ali R. Yazdi
Roya Yazdi
Glenn R. Young

Giving Opportunities

Undergraduate Scholarships
The William Bugg General Scholarship Fund
The Dorothy and Rufus Ritchie Scholarship Fund
The G. Samuel and Betty P. Hurst Scholarship Fund

Undergraduate Student Awards
The Douglas V. Roseberry Memorial Fund

Graduate Awards
Paul Stelson Fellowship Fund
Fowler-Marion Physics Fund

Other Departmental Funds
Physics General Scholarship Fund
Physics Equipment Fund
Robert W. Lide Citations

Giving to the Department:
If you would like more information on how to make a donation or a pledge to our scholarship funds, please contact:

Office of Development
College of Arts and Sciences
4 Alumni Memorial Building
The University of Tennessee
Knoxville, TN 37996-1320
Phone: 865-974-2365
Address Changes

❖ Please remove my name from the Cross Sections mailing list.

❖ Please update my address as marked below:

Name: ________________________________

Address: _______________________________

City: __________________ State: __________

Country: _____________________________

Zip or Postal Code: _______________________

E-Mail Address: __________________________

Return info by MAIL (Cross Sections, 401 Physics Building, University of Tennessee, Knoxville, TN 37996-1200), FAX (865.974.7843) or E-MAIL (cal@utk.edu)

Department of Physics and Astronomy

401 Nielsen Physics Building
The University of Tennessee
Knoxville, Tennessee 37996-1200

The University of Tennessee does not discriminate on the basis of race, sex, color, religion, national origin, age, disability, or veteran status in provision of education programs and services or employment opportunities and benefits. This policy extends to both employment by and admission to the University.

The University does not discriminate on the basis of race, sex, or disability in the education programs and activities pursuant to the requirements of Title VI of the Civil Rights Act of 1964, Title IX of the Education Amendments of 1972, Section 504 of the Rehabilitation Act of 1973, and the Americans with Disabilities Act (ADA) of 1990.

Inquiries and changes of violation concerning Title VI, Title IX, Section 504, ADA, the Age Discrimination in Employment Act (ADEA), or any of the other above referenced policies should be directed to the Office of Equity and Diversity; 2110 Terrace Avenue; Knoxville, TN 37996-3560; telephone (865) 974-2498 (TTY available). Requests for accommodation of a disability should be directed to the ADA Coordinator at the Office of Human Resources Management; 600 Henley Street; Knoxville, TN 37996-4125.

PA#E01-1060-002-04