Fall 2005

Cross Sections Fall 2005

Department of Physics and Astronomy

THE NEWSLETTER OF THE UNIVERSITY OF TENNESSEE DEPARTMENT OF PHYSICS AND ASTRONOMY

CROSS SECTIONS

FALL 2005/WINTER 2006

RESEARCH HIGHLIGHT

A Very Good Year

It's Not the Vintage: It's the Research Vitality

WHILE 2005 HAS BEEN A BIG YEAR for UT's condensed matter physicists, they hope many of their future successes will be small. On the nanoscale, to be exact.

This year has seen the group publish 18 papers in *Physical Review Letters* and one in *Science*. They have paid careful attention to the way electrons behave, consequently getting a glimpse into the possibilities of nanoscience—the art of manipulating materials at the atomic scale. Materials have marked human history from the Stone Age to the Silicon Age. This new era of "designer materials" promises to have as significant an impact.

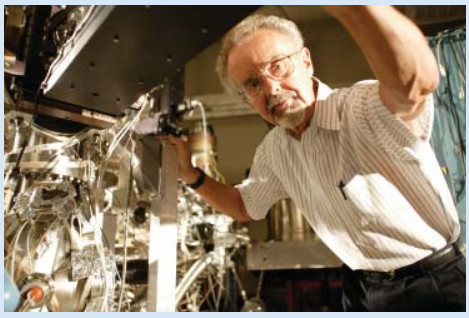
Correlated electron systems provide the backdrop for much of the group's 2005 work. In this scenario, multiple electrons interact strongly with one another to form liquid, solid, and liquid crystal-like states. When they switch phases, they cause drastic changes in magnetic, electrical, and optical properties. These switches can occur in a picosecond or less. Transition metals (like manganese and copper) are especially interesting because deciphering the complex behavior of transition metal oxides can help researchers better understand superconductivity and colossal magnetoresistance—a phenomenon whose potential is still largely untapped. By using powerful tools like scanning tunneling microscopy and spectroscopy, as well as inelastic neutron scattering, UT physicists can zoom in to investigate structure, electronic, and magnetic properties at the atomic level.

Dr. Ward Plummer, who holds a joint appointment as a distinguished professor at UT and a distinguished scientist at Oak Ridge National Laboratory, said these efforts to understand quantum structure are among the group's most significant contributions this year. Complexity resulting in emergent phenomena, and dimensional confinement are currently two key areas in condensed matter physics, and UT's research addresses both.

"We are making our own materials," he said, in "science-driven synthesis aimed at discovery of new phenomena."

Professor Hanno Weitering, for example, is investigating magnetism in semiconductors, as well as transport and phase transitions in atomic wires (short chains of atoms that conduct electricity between two contacts). Together with Dr. Jim Thompson, he is exploring the feasibility of creating robust superconductors at the nanoscale. He is also working with Dr. Jian Shen of ORNL on a project involving magnetic nanowires (wires 100 nanometers or smaller that connect transistors and gates). Dr. Shen, who won a 2004 Presidential Early Career Award for Scientists and Engineers from the Department of Energy, has an adjunct appointment in the physics department.

Dr. Plummer pointed out the importance of the UT-ORNL connection, which translates into a strong graduate program and ultimately, better trained scientific leaders down the road.



Dr. Ward Plummer (photo by Jack Parker)

"We're getting better students because we have these joint faculty, and our students are getting a better education," he said.

A case in point: doctoral student Maria Torija is the first author on a 2005 paper on magnetic nanostructures. She works with Dr. Shen and Dr. Plummer and won the Leo Falicov Student Award at the American Vacuum Society meeting last year.

Another boon to the program came in August, when UT-ORNL won funding to help support a new Joint Institute for Advanced Materials. The institute, sponsored in part by the

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FROM THE HELM

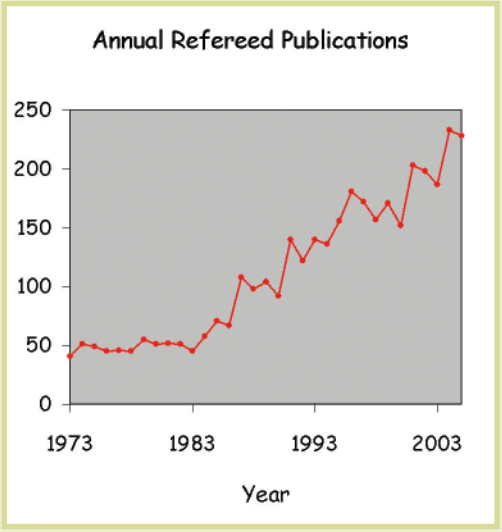
A Message from Soren Sorensen, Department Head

Taking Stock

EVERY 10 YEARS every department at the University of Tennessee is reviewed by a review committee consisting of two external and three internal reviewers. Our last review was in 1994 with a smaller "mid-term" review in 1997. So this fall it was our turn again. On November 7-9, the review committee met with faculty, students, UT administrators, departmental administrators, and even other heads from departments we often interact with. We are still waiting for the final report, but the initial feedback from the committee was very positive. They were impressed with our progress since the last review, the innovative work by our faculty and staff, and the general level we have reached with our research, teaching, and outreach efforts.

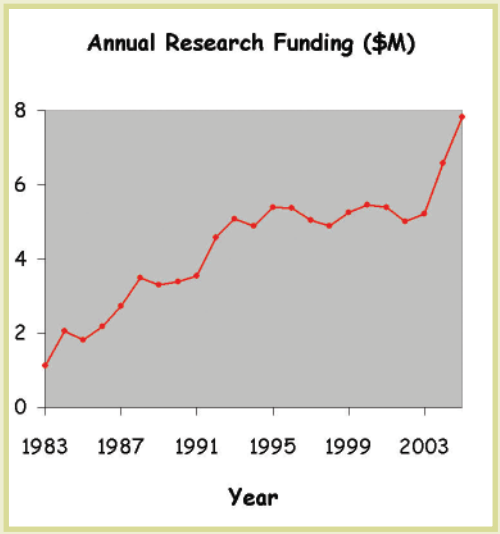
In preparing for this review I had the opportunity to look back in time 10, 20, or sometimes 30 years and investigate how the department has developed over that time span with respect to some of the indicators often used to measure the performance of a physics department: Refereed publications, research funding, degrees awarded, faculty size, endowment, etc. *The general picture that emerged was of a dedicated faculty and staff who have improved their performance dramatically over the past 10 years despite decreasing financial support from the university administration*. Since I know that most of our readers are not afraid to look at a few diagrams I will share with you some of the findings that lead me to this conclusion.

Research productivity is of the utmost importance for a first class science department and here in physics we love to quantify and measure our success. The primary means for us to tell the world about our research results are through publications in refereed journals, and the number of refereed publications written by our tenured, research, or adjunct faculty with the UT Physics byline has continued to increase steadily over the past 20 years. In the mid-'90s we published around 125 publications annually and now we publish close to 225 annually. For 2005 we might even get close to 250, since we have already published 225 papers in the first 10 months of the year. This is an impressive publication rate for a department having only 30 full-time-equivalent (FTE) faculty members.



It is not enough just to publish a lot of papers; you also want other physicists to read them and to cite your work in their papers. A great measure of the impact of the research in our department is the fact that over the past 17 months papers published with the UTK Physics byline have been cited 9754 times! Obviously the rest of the world is paying attention to the research done by our faculty.

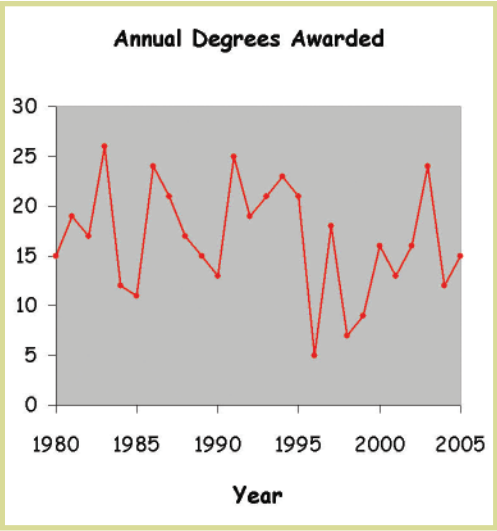
Another valuable performance measure is the amount of external research funding obtained by our faculty, because these external research funds directly measure our capabilities for purchasing equipment and paying research faculty and, most importantly, graduate students. Except for a period in the late '90s there has been a steady growth from $1-2M 20 years ago to $8M last year. Especially in the last two years the growth has been remarkable and our faculty is working hard to keep this trend.



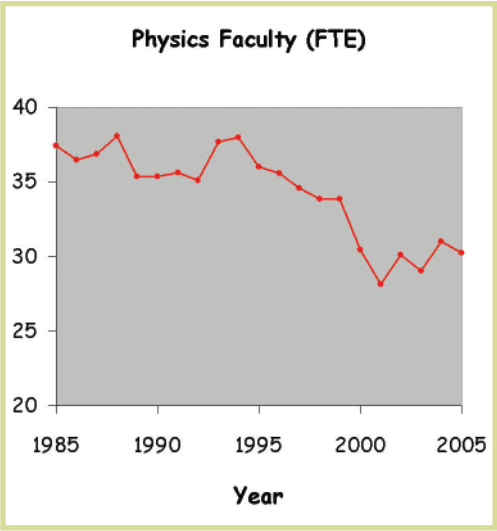
Since the "Golden Days" in the 1980s the number of physics students has been on the decline nationally, and we have unfortunately seen the same trend here. By and large we have been able to keep a steady rate of 15-20 students graduating annually with either a B.S., a M.S., or a Ph.D.

One of the most positive developments over the past five years has been the steady increase in the number of students in our undergraduate program. Around the time of our last mid-cycle

review maybe only 30 students were physics majors. During the fall 2004 semester we had a total of 75 students who had declared themselves as physics majors, with 62 in the College of Arts and Sciences and 13 in the Engineering Physics program. These 75 students include first-year students. Additionally, 25 students have declared they have a physics interest, but have not yet been willing to commit 100 percent to physics. The graduate program has also seen an increase both in the quantity and quality of students. Currently we have 91 graduate students, which is higher than any time over the past 10 years.

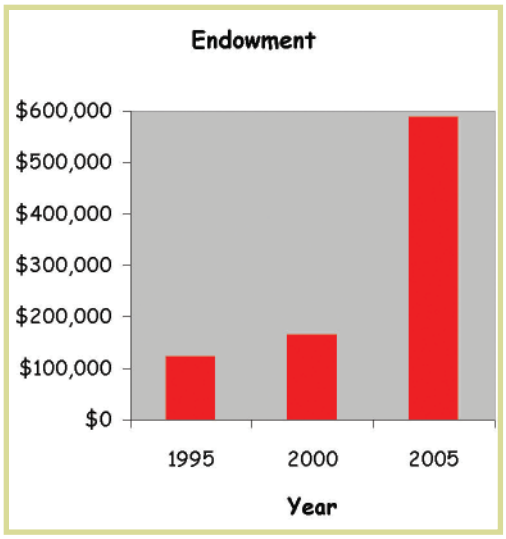


By far the most serious problem we have faced since the last review in 1994 has been the dramatic decline in the number of faculty members in the department. From a level of ~37-38 full-time-equivalent faculty members before 1995 we have over the last decade been reduced to ~29-30 FTE. A loss of eight full-time professor positions over 10 years! It is impressive that our faculty despite this dramatic 20 percent reduction has been able to keep the high research and teaching productivity.



People familiar with UT might argue that every department has lost faculty positions over the past decade and that there is nothing unusual about the loss of positions in the department of physics. However, over the same period the "market share" of our department within the College of Arts and Sciences decreased from ~6.4 percent 10 years ago to ~5.0 today. In FY1994 the total E&G expenditures in physics were $2.6M out of a total college budget of $41M (6.4%) and in FY2005 the expenditures on physics were $3.8M out of $76M (5.0%).

The good news is that the current college and university administration seem to be very supportive of the role of the department of physics as one of the strongest research departments and a leader in our collaborations with ORNL.



Fortunately our alumni and friends have been very supportive of our efforts over the past decade. Every year more than 50 different people are donating to our endowments, which currently have reached a total value of nearly $600,000. This is a wonderful level of support that we are very grateful for. It is also much needed support in a situation where we, as many other universities, might not expect any substantial growth in state funds, but instead we have to rely more heavily on our faculty to generate more research funds and on our alumni to help with scholarships, endowed chairs, and even large educational equipment investments.

I hope by reading this very brief overview of some of the historical trends within our department that you have become just as impressed with the progress our faculty has made for the department over the past decade and have gained an appreciation for some of the difficulties we have experienced in the past. In short: "The state of the department is strong."

"The general picture that emerged was of a dedicated faculty and staff who have improved their performance dramatically over the past 10 years . . ."

Let the Sun Shine In

Duncan Earl Sees a Golden Opportunity

DUNCAN EARL CAN MAKE YOU SPEND MORE MONEY. He can also make you work harder to earn it. A little sun, a little plastic, a little ingenuity cooked up at Oak Ridge National Laboratory—that's all it takes.

ALUMNUS PROFILE

Dr. Earl is chief executive officer of Sunlight Direct, a company that harnesses natural light to boost consumer sales for retailers and productivity for employers. He was working in ORNL's Engineering Science and Technology Division when an idea came along that would ultimately send him into the private sector.

"There was a project for hybrid solar lighting that was funded by the Department of Energy. It was just in the conceptual stage," he said. "About 30 percent of commercial building energy usage is associated with lighting . . . and the Department of Energy wanted to find a way to offset that."

Because most of that energy is used during daylight hours, the obvious approach was finding a way to use natural sunlight instead of electricity. The idea, he explained, was "to develop alternative ways for getting day lighting in where you could deliver the benefits of natural lighting but the convenience of artificial lighting."

Jeff Muhs of ORNL was the catalyst for the work. He was the project's principal investigator and led the development of the HSL technology. The endeavor began in 1996 in what he called the "cartoon phase—(when) all you have is an idea." The funding followed in 1999, after which development took off. Dr. Earl came in on the technical side, helping build a prototype.

"He's one of those unique individuals who can cross over from scientific discovery to implementation," said Mr. Muhs, who is now a legislative fellow and scientific advisor to Senator Lamar Alexander. "He deserves a lot of credit for the success of the program."

Hybrid Solar Lighting

If you ask Dr. Earl what HSL is, his answer is short but descriptive. "We're basically piping in sunlight," he said.

The system borrows from both natural and man-made energy.

"We have a solar collector that's mounted to the roof," he explained. "It's tracking the sun and concentrating all of the sunlight into a bundle of optical fibers. This is the same type of stuff you get at the fair," he said, smiling, as he grasped a handful of plastic fibers. "It's not really too high-tech."

The fibers pass through the roof and are distributed just like electrical wires to special lights called hybrid luminaires. They look like regular light fixtures, but they have an extra element—a piece of plastic with micro-etches that scatter the light and mimic a fluorescent tube.

"In the hybrid luminaire we have artificial light and we have the sunlight—they're blended together," Dr. Earl said.

A daylight harvesting sensor monitors the room intensity. When sunlight brightens a room, the system dims the artificial light. When cloud cover masks the sun, it revs up more electricity. The set-up requires a relatively flat roofline, and can light a one-story building or the top floor of a multi-story structure.

"Fibers only run so far," he explained.

In roughly five years ORNL developed a system mature enough to capture the attention of utility companies, as well as other businesses. The project generated enough interest to make Dr. Earl believe that HSL technology had a niche in the commercial market. ORNL granted him entrepreneurial leave to pursue the idea.

"It's something they're really encouraging now at the national laboratory, ever since UT-Battelle took over," he said. "They allow you to work part-time at the lab… and the rest of the time you can work at your small business. It's a real generous arrangement.

"This technology was invented by the lab and they patented it," he explained. "I had to license that patent, and they own a portion of my company as a result. So they're really interested in seeing my company succeed."

Selling Sunlight

Sunlight Direct became a viable business in November 2004, when Dr. Earl spun out from ORNL and sold about 10 HSL systems. Tech 2020 in Oak Ridge provides the company with office and production space. (Tech 2020 is a nonprofit public-private partnership that draws from technology resources in East Tennessee to launch private sector endeavors.) Dr. Earl is the CEO. The president is John Morris, who co-founded NetLearning, a company that sells online training systems to hospitals.

Currently Sunlight Direct is beta testing, mainly at utility company sites. They also have systems at a Wal-Mart in Texas (with ORNL as a co-sponsor) and at Opry Mills Mall in Nashville. The Tennessee Valley Authority is sponsoring a system at the American Museum of Science and Energy in Oak Ridge. Each beta system costs about $24,000 and illuminates 1,000 square feet.

"That cost should be coming down pretty quickly," Dr. Earl said.

The benefits of natural light make the system attractive to a range of clients. Retailers like the fact that shoppers spend more money in natural light, and products look more tempting.

"If you're a sales jeweler, so you're lighting your products, you want those to look the very best," Dr. Earl said. "Diamonds, for example, look a grade better under natural light than under artificial lighting.

"We don't just do fluorescent lighting," he continued. "We can do track lighting, accent lighting . . . we integrate this with their conventional electric spotlights. It's premium lighting. If you want the best lighting system money can buy, this is it."

Studies have also shown that employees' productivity increases when they're working in natural light as opposed to a purely artificial environment.

Commercial applications are the best fit for the technology, although there have been limited experiments in the residential realm.

"There has been a residential unit done," Dr. Earl said. A few years ago ORNL worked with the University of Virginia on a system for a solar decathlon. It was smaller than the beta units, lighting only a couple of bedrooms. And because concentrated sunlight is a power source, there are necessary precautions that preclude it from home use at present.

"The main reason we don't offer a residential system is safety concerns," Dr. Earl said. "It has to be installed properly and maintained properly. Until we understand all aspects of the technology and the safety concerns, I don't think we'll move into the residential. Commercial is a great setting because it's a very controlled environment. You can maintain the product when it's out there. That's where we want to start."

As the costs for the system come down, he said the company would like to expand into schools and industrial sites. That will mean staff additions for the company, which is fully self-funded. Publicity via *Forbes*, *Popular Science*, *Scientific American*, MSNBC and the Discovery Channel has also helped generate investor interest.

"In the last four months we've tripled our number of employees," Dr. Earl said. "That means we're up to three."

He hopes to add more staff within the next six months, and sees great potential in the company beyond the current system.

"Right now we can put a photovoltaic on our solar collector platform," he said. "We can generate electricity with five times the cost effectiveness of current photovoltaics, mainly because we're concentrating the light into a small area so it takes a smaller photocell. So once we get all these units on rooftops, then we can come back, put photovoltaic units on it, and now we're generating electricity. What's really neat about this technology is that lighting is really just the first application," he continued.

Right now they're concentrating on the visible light, not the infrared.

"We collect it too, but we don't put it into the fibers," he said. "It's waiting for our next product."

Dr. Duncan Earl with a Sunlight Direct solar collector

From Summer Program to Entrepreneur

Dr. Earl is no stranger to following the next new thing. His father was in the military and consequently he lived in Italy, Germany, and Greece before moving to the United States at age 16. The transition wasn't really all that difficult, as he had family in East Tennessee and spent a lot of time here.

"We visited a lot," he said. "It was kind of funny; for vacations we'd leave Venice and places like that and we'd come to Grainger County, Tennessee. We loved it. I thought K-Mart was the coolest."

He enrolled at UT, where he was introduced to the national laboratory through a Science Alliance Summer Research Fellowship. He earned a bachelor's degree in engineering physics in 1993. After graduating, he started working at ORNL while pursuing a master's in physics. When he finished the degree in 1997, he thought he was finished with school. But Dr. Al Trivelpiece, who was ORNL Director at the time, saw some of the young scientist's work and suggested he go back to UT for a doctorate. The national laboratory paid his full salary for two years while he started working on his Ph.D., which he completed in 2004. He and his wife Jamie had their son, David, during that time.

"I finished my Ph.D. when he was between birth and one year old, so that made it extra challenging," he said good-naturedly. "There wasn't a lot of sleep during that period."

He also chose to go in another direction with his doctoral work.

"I switched from physics to electrical engineering because I wanted something a little different," Dr. Earl said. And having options is part of what attracted him to the sciences in the first place.

"I come from a long line of soldiers," he said. So when I wanted to be a physicist, everybody sort of looked at me like, 'What do you do with this?' I had exactly the same question. The Science Alliance was my first exposure…at the national lab, and I really kind of got a flavor for what you can do. The thing I liked about it was that you could do so many different things and you could change. This is a good example of that. I never thought I was going to be doing a solar-related technology, but that's where it went."

"In the right light, at the right time, everything is extraordinary."

-Aaron Rose

Dr. Handler Orchestrates Tennessee Junior Science and Humanities Symposium

PHYSICS PROFESSOR THOMAS HANDLER WANTS high school students to know that for studying science, there's no better vantage point than Knoxville.

Dr. Handler is the new director for the Tennessee Junior Science and Humanities Symposium, a program that encourages students from across the state to go into science, engineering and math. It's part of a national program supported by the U.S. Army/Navy/Air Force Research Programs and administered through the Academy of Applied Science.

"It came about through Sputnik," Dr. Handler explained.

The cold war prompted military research offices to promote science education at the high school level. Each year, top science students participate in 50 state symposia. The Tennessee regional program is administered by the College of Arts and Sciences, the Department of Physics, the College of Education, Health, and Human Sciences, and UT-Battelle. As of summer 2005, Dr. Handler is now in charge of the administrative aspects of the TJSHS.

> "We want to emphasize that here is the place to be."

The next program is scheduled for March 2-4, 2006. Scientists at UT and Oak Ridge National Laboratory will choose four to eight high school students to present their work to judges at the regional competition in Knoxville. Some 65 additional students as well as teachers will also attend the symposium.

Dr. Thomas Handler

The top three students win scholarship money to attend a college of their choice to study engineering, math, or a scientific discipline. The first and second place winners receive all expenses paid trips to the National Symposium in late April, where more scholarship money is handed out. While the goal is to inspire students to go into science and engineering, Dr. Handler hopes they'll take a liking to UT while they're here.

"We're also going to use this as a recruiting tool," he said.

The program includes tours of on-campus labs to see research in computer robotics and chemical and surface physics, among other projects.

"Students and their teachers will interact with undergraduates and graduate students," Dr. Handler said. For hands-on, engaging science research, "we want to emphasize that here is the place to be."

More information about the symposium is available online at: jshs-tn.utk.edu/.

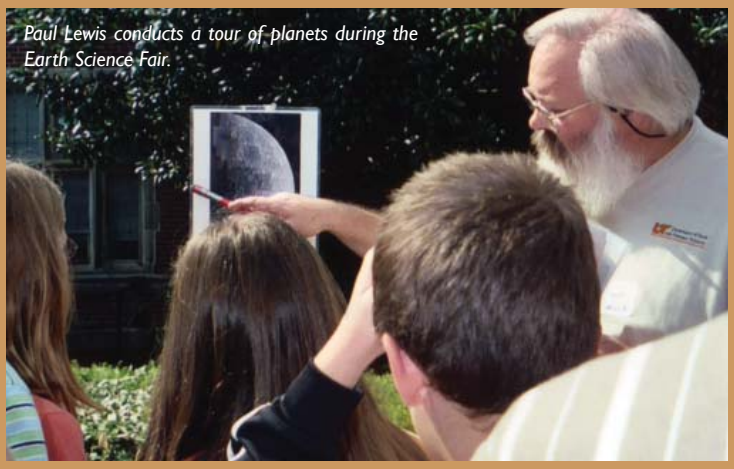
Going Public

Physics and Astronomy Outreach Brings Science to the Next Generation

UT PHYSICISTS KNOW about the intricacies of the atom, the beginnings of the Big Bang, and the sophistication of surfaces. But they can also tell you why an egg drops, which might just make the difference in recruiting budding scientists from local schools.

In late June, graduate students Brandon White and James Alsup organized Physics Week for UT's GEAR UP (Gaining Early Awareness and Readiness for Undergraduate Programs) Gradkids program. This U.S. Department of Education grant project encourages low-income students to think big and aims to keep them on a educational path that leads to a college degree. The Gradkids are rising seniors from Cocke County High School, Cosby High School, and Scott High School.

Brandon and James presented a curriculum around the physics of toys (which the students got to keep), with a balance of lectures



Paul Lewis conducts a tour of planets during the Earth Science Fair.

Taking Earth's Temperature

UT Physicists Co-Author *Nature* Cover Article on Geoneutrinos

UT PHYSICISTS ARE among the scientists keeping watch on how hot the Earth gets.

Deep inside the planet, radioactive isotopes generate heat as they undergo the natural process of beta decay. Antineutrinos are a byproduct of the process, and that just happens to be the expertise of some of UT's particle physicists.

Working with the KamLAND (Kamioka Liquid Scintillator Antineutrino Detector) collaboration, physicists Mikhail Batygov, Bill Bugg, Yuri Efremenko, Yuri Kamyshkov, and Alexandre Kozlov keep busy chasing antineutrinos. In 2003, the first KamLAND paper reported the disappearance of antineutrinos produced in nuclear reactors. That paper is still at the top of experimental particle physics citation list. Now, for the first time, the KamLAND group has detected antineutrinos produced inside the Earth.

Antineutrinos are emitted during radioactive beta decay, when a neutron decays into a proton and an electron. Difficult to detect, neutrinos fool their would-be captors by changing their identities. They come in three "flavors:"

electron, muon, and tau. As they travel, neutrinos can change their flavors, a phenomenon called neutrino oscillation. Solar neutrinos produced by fusion exhibit the same oscillation pattern. Historically these particles have been nearly impossible to pin down, as they easily pass through matter undetected and penetrate the whole Earth. But KamLAND, built a kilometer underground in Kamioka, Japan, is uniquely designed to catch elusive antineutrinos.

The 1,000 tons of organic chemicals inside the detector will emit light when struck by electron antineutrinos produced by man-made nuclear power reactors in Japan and North Korea.

Researchers at KamLAND have used the same method to measure antineutrinos produced inside the Earth when uranium and thorium isotopes decay naturally. Results appear in the article, "Experimental Investigation of Geologically Produced Antineutrinos with KamLAND," which graced the July 28, 2005 cover of Nature. Measuring these "geoneutrinos" can serve as a valuable crosscheck of the radiogenic heat production rate. Thus far, KamLAND estimates that the heat produced inside the Earth is in line with current predictive models. By using this powerful detector, researchers hope they can unlock still more geophysical information.

For more information, visit the UT/KamLAND Web page at:

hepd5s.phys.utk.edu/kamland/index.html

and labs. Among the scientific pursuits were construction of a projectile motion device, the physics of amusement parks, and the construction and testing of egg drop devices, which was by far the most popular activity.

The students gave the program high marks. As one wrote in the evaluation survey, "I have already taken a physics course, but I loved the review along with the new knowledge and experiments."

The department also supported UT's Sixth Annual Earth Science Fair in mid-October with presentations on The Physics of Magnetism (thanks to Professor Jon Levin) and a Tour of the Solar System (courtesy of Paul Lewis). The science fair is for middle and high school students from East Tennessee and provides teachers with educational materials to take back to their classrooms.

Pictures from GEAR UP GradKids Physics Week, left to right: James Alsup tries out the bed of nails, students from Scott High show off their official UT diffraction grating eyewear, and Brandon White demonstrates the magic of liquid nitrogen.

With Honors . . .

Physics Faculty Members Earn College and Regional Recognition

Dr. Jon Levin

James R. and Nell W. Cunnigham Teaching Award

This fall the College of Arts and Sciences honored Professor Jon Levin with the James R. and Nell W. Cunningham Outstanding Teaching Award. He was recognized for his expertise in taking a difficult subject and making it accessible to students who aren't majoring in physics. Dr. Levin is well-known for his entertaining lecture demonstrations (e.g., the bed of nails) and his enthusiasm for contemporary teaching approaches. He holds a bachelor's degree in economics from Stanford University and a Ph.D. in physics from the University of Oregon. He joined the UT faculty in 1993. His research field is atomic physics.

Dr. Thomas Callcott

Convocation Marshall

Professor Thomas Callcott is this year's College Convocation Marshall, the highest honor bestowed on senior faculty members within Arts and Sciences. He will carry the college banner at the December and May commencement exercises. Dr. Callcott is a graduate of Duke University and holds a doctorate in physics from Purdue. He joined the physics faculty at Tennessee in 1968. He is a past recipient of the Chancellor's Award for Research, and of the R&D 100 Award for Scientific Equipment Design. A specialist in soft X-ray fluorescence and other spectroscopies, he is a past director of the UT-Oak Ridge National Laboratory Science Alliance and a fellow of the American Physical Society.

Dr. Lee Riedinger

Southeastern Section of the APS Francis G. Slack Award

Professor Lee Riedinger was honored November 11 with the prestigious Francis G. Slack Award, which he accepted at the Southeastern Section of the American Physical Society's annual meeting. The Slack Award is named for Francis G. Slack, a charter member of SESAPS who enjoyed a distinguished scientific career at Vanderbilt University. The honor recognizes scientists who have made significant contributions to strengthen physics research, collaboration, education and outreach through the region.

Dr. Riedinger is currently the associate director for university partnerships at Oak Ridge National Laboratory. He came to UT in 1971 and over the past 30 years has taken leadership roles in establishing some of the university's greatest successes in scientific collaboration: the Science Alliance, the Distinguished Scientist Program, the Collaborating Scientist Program, and the joint faculty and joint institute initiatives. In his current role, he builds partnerships between the national laboratory and universities. In 2004, the U.S. Department of Energy recognized him with two special recognition awards: one for support of minority education and another for "best in class" support of historically black colleges and universities. Dr. Riedinger holds a bachelor's degree in physics from Thomas More College and earned his Ph.D. in physics at Vanderbilt University. He is a fellow of the American Physical Society.

Incoming!

Fall 2005 Freshman Scholarship Winners

THANKS TO THE SUPPORT OF FRIENDS AND ALUMNI, the physics department awarded scholarships to six incoming freshmen this fall. (Three years ago, the department offered only one scholarship.) These outstanding students are:

Matt Hollingsworth
Dyersburg, Tennessee

Robert and Sue Talley Scholarship

Mary Adelle Kane
Roswell, Georgia

William Bugg Physics Scholarship

Lars Patrick
Oak Ridge, Tennessee

Robert and Sue Talley Scholarship

Joseph Rodriguez-Fowler
Tullahoma, Tennessee

Dorothy and Rufus Ritchie Scholarship

not pictured

Andrew Shaver
Cincinnati, Ohio

Dorothy and Rufus Ritchie Scholarship

Jacob Suggs
Oak Ridge, Tennessee

G. Samuel and Betty Hurst Scholarship

(A Very Good Year/Continued from page 1)

national transportation bill, is a collaborative effort across the sciences and engineering and will focus on smarter, more efficient and cleaner transportation technologies. Sensors, composite materials, new alloys, fuel cells, and increasing applications for nanotechnology will make JIAM a premier research hub.

With last year's addition of Drs. Elbio Dagotto and Adriana Moreo, the physics department has a strong condensed matter theory component that will support JIAM objectives. Their studies on correlated electronic materials have shown some exotic arrangements of charge and spin in new thermodynamic insulating phases. Evidence has indicated that electrons in these insulating states or at close temperatures and electronic densities present a phenomenon called "self-organization," similar to behavior often seen in soft matter, such as polymers and biological systems. This phenomenon "emerges," as it's impossible to predict its presence without a very detailed calculation requiring the use of state of the art computational techniques.

"This type of phenomenon leads to 'complexity' in hard materials, a novel area of research that will be among the topics to be studied," at JIAM said Dr. Dagotto, who is a distinguished professor at UT and a distinguished scientist at ORNL. "Complex materials could have exotic functionalities that may lead to interesting applications."

Experimentalists like Dr. Pengcheng Dai and Dr. Thompson work at the other end of the spectrum to look for and measure these properties. Dr. Dai uses neutrons to probe magnetic ordering in these systems; Dr. Thompson uses nanoscale columnar defect structures to tune the properties of high temperature superconductors.

Dr. Elbio Dagotto
(photo by Jack Parker)

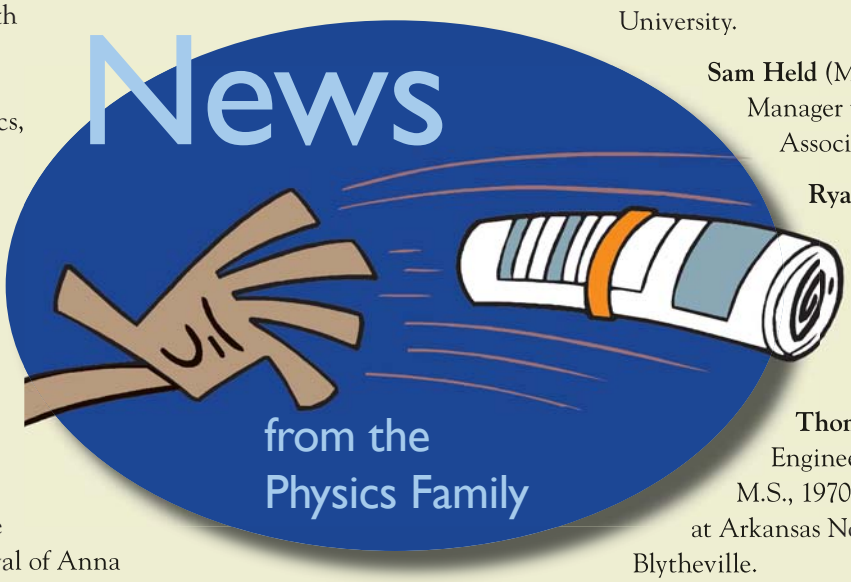
Dr. Plummer explained that UT's strengths in theory and experiment are part of the "fountain of youth" approach to materials science. By continually re-examining the possibilities of materials, research causes new phenomena that can change science and society. And that means a promising future.

As Dr. Weitering said, "This is not an anomaly, but lots of good things are going to come next year as well."

Faculty

Congratulations to **Professor Carrol Bingham,** who has just been named a fellow of the American Physical Society.

Professor Witek Nazarewicz has been appointed to the National Research Council's Rare Isotope Science Assessment Committee. This group will address the role that the Rare Isotope Accelerator would play in the future of nuclear physics, with particular emphasis on its potential impact on nuclear structure, nuclear astrophysics, fundamental symmetries, stockpile stewardship and other national security areas. The need for such an accelerator will be addressed in the context of international efforts in this area.



Congratulations to **Assistant Professor Robert Grzywacz** and his wife, Kate Grzywacz-Jones, on the arrival of Anna Louise, born May 24.

Staff

The department is pleased to welcome **Maria Fawver**, who joined the physics staff in November. Maria is working in the accounting office.

Students

Graduate Student Donny Hornback was one of roughly 700 students worldwide chosen to attend the 55th Meeting of Nobel Prize Winners in Lindau, Germany. The meeting was June 26 through July 1 and gave the students the opportunity to meet outstanding researchers in medicine, chemistry, and physics.

Congratulations to **Graduate Student Robert Mahurin** and his wife, Ellen, on the birth of daughter Hannah Ruth on October 27.

Alumni

John T. Ellis (Ph.D., 1987) is a Senior Principle Engineer with Digital Fusion, Inc., in Huntsville, Alabama.

Trey Forgety (B.S., 2004) is enrolled in law school at UT.

John Gibbons (Ph.D., 1991) is Chief of Clinical Physics at the Mary Bird Perkins Cancer Center in Baton Rouge, Louisiana.

Dennis Hall (Ph.D., 1976) added another prestigious fellowship to his CV when he was formally named a Fellow of the American Association for the Advancement of Science in February. He is also a Fellow of the Optical Society of America, the American Physical Society, and the International Society for Optical Engineering. Dr. Hall is a member of the department's Board of Visitors and is Associate Provost for Research and Graduate Education at Vanderbilt University.

Sam Held (M.S., 1999) is a Program Manager with Oak Ridge Associated Universities.

Ryan Holloman (M.S., 2005) is a Physicist with the National Ground Intelligence Center in Charlottesville, Virginia.

Thomas B. Holmes (B.S., Engineering Physics, 1967; M.S., 1970) is a Physics Instructor at Arkansas Northeastern College in Blytheville.

Joseph G. Kreke (Ph.D., 1996) is an Applications Portfolio Manager with Computer Sciences Corporation in Frederick, Maryland.

George L. Marshall, Jr. (B.S., 1965) is retired from the U.S. Army Aviation and Missile Command (Redstone Arsenal, Alabama) and lives in Gurley, Alabama.

Chad Middleton (Ph.D., 2005) is an Assistant Professor of Physics at Rhodes College in Memphis.

Andrew Wig (M.S., 1995; Ph.D., 2000) is an Assistant Professor at Benedictine University in Lisle, Illinois.

To submit your news or stories, visit the physics alumni Web site at: www.phys.utk.edu/alumni.html

Graduate Student Donny Hornback, (far right) meets Norman Ramsey, who won the 1989 Nobel Prize in Physics, during the 55th Meeting of Nobel Prize Winners in Lindau, Germany.

Thanks to our Donors!

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Department Head: Dr. Soren Sorensen
Associate Department Head: Dr. James E. Parks
Publications Coordinator: Catherine Longmire
(865) 974-3342 phone (865) 974-7843 fax
physics@utk.edu
Web: www.phys.utk.edu

Original photograph by Chad Middleton (Ph.D., 2005)

DEPARTMENT OF PHYSICS AND ASTRONOMY

CROSS SECTIONS

401 Nielsen Physics Building
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