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Cross Sections

Physics and Astronomy

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Fall 2010

## Cross Sections Fall 2010

Department of Physics and Astronomy

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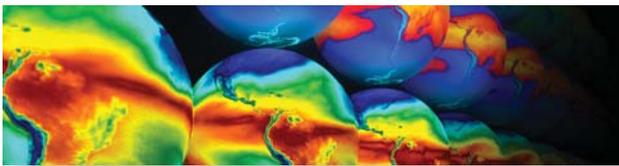
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Fall 2010/Winter 2011

# Training the best students to meet the toughest energy challenges

The sign on Professor Lee Riedinger's new office door reads "Assistant Hall Director," a vestige of the days when Greve Hall housed undergraduate students requiring supervision. The office itself still looks very much like the non-descript dormitory room it once was. But Riedinger sees beyond the closets and built-in bureaus and envisions this space for what it *will* be, as he sees the entire fourth floor of Greve Hall—a bustling, vibrant community of top students and faculty dedicated to solving energy challenges.

In January 2010 the Tennessee General Assembly passed legislation to develop an interdisciplinary program in energy science and engineering at UTK that would provide students with an opportunity to "undertake transformative research activities." Tennessee Senate Bill 7006 also authorized the university to establish an academic unit, in collaboration with Oak Ridge National Laboratory, for interdisciplinary research and education. Out of that came CIRE—the Center for Interdisciplinary Research and Graduate Education, which will soon breathe new life into Greve Hall's renovated dorm rooms.



CIRE will prepare students for challenges in energy and engineering, like understanding the importance of proper simulating water vapor distribution.

## Not Your Father's Ph.D.

At the heart of CIRE is a new model for graduate education. The Ph.D. program in Energy Science and Engineering (ESE) will recruit top students, offer them a competitive stipend, and—under

the tutelage of CIRE faculty—offer them the chance to work on large-scale, problem-oriented research with the combined resources of the university and the national laboratory. Their doctoral degrees will bear the new major: energy science and engineering.

"That's the core unit of CIRE," said Riedinger, who became the center's first director on September 1.

The first step along this path actually came about a year ago, before CIRE, with the introduction of the UTK-ORNL Distinguished Fellowship Program. Designed for highly-motivated doctoral students in three fields—materials science and engineering, computational science and engineering, and nuclear science and engineering—these fellowships allow students to earn a Ph.D. working jointly with ORNL scientists and UTK faculty. Riedinger explained that CIRE will handle the administrative aspects of the distinguished fellowship program, which welcomed its first three students this fall (including Robert Van Wesep in physics, see page 9). The new ESE doctoral degree falls exclusively under the CIRE umbrella as a brand new academic unit, and that starts with getting the best people.

"An academic program needs a faculty," Riedinger said, explaining that the first order of business is recruiting professors from UTK, the University of Tennessee Institute of Agriculture, and ORNL.

"Those faculty members will have a status in our program," he said, although they will keep their day jobs, so to speak, in their current departments and divisions. They will simply add the title Professor of Energy Sciences and Engineering to their existing credentials.

CIRE will also be responsible for ESE student admissions, curriculum requirements, qualifying and comprehensive exams, and bylaws, or, as Riedinger said, "all the usual things that a department does."

The goal is not to poach faculty, grants, or students from existing departments, but rather to build a multi-disciplinary

*Continued on page 9*



# Space

## A Letter from Department Head Soren P. Sorensen

I am sure that when you saw the headline you thought I would discuss exciting topics like space and time in the theory of relativity or maybe the possibility of quantization of space at the Planck length scale. But no, I have something much more prosaic on my mind: the space occupied by our department.

Over the last decade, unfortunately on my watch, we have had several setbacks in the number and quality of the facilities that are available to us. There have also been some important improvements, but unfortunately the setbacks have been more substantial than the improvements. As a result we now have a serious space situation. But let me start by giving an overview of some of the history of the Department of Physics' building facilities.

In 1963 the department moved into the brand new Nielsen Physics building and the future was bright. Nielsen has 66,000 square feet, which was gigantic for that time. Unfortunately much of the design of the building was done to optimize the activities in the department 50 years ago without much thought as to what might happen later on. The Nielsen building was designed with very few windows and contains many small rooms originally used for a particular purpose, like photographic dark chambers, rooms for cotton fiber research, faculty offices with no windows, etc. Personally I spent my first eight years at UTK in a small office on the 6th floor (601) with a slanted roof and no windows. I could stand up in maybe 50 square feet. This was kind of okay 25 years ago, but today there is no way we can recruit top-notch young faculty members if we can only offer them space like that.

When the Science Alliance and the Distinguished Scientist program were started in the mid-'80s, it was decided to renovate South College and house the administrative offices of SA as well as some of the Distinguished Scientists there. Due to the severe space limitations for the Department of Physics at that time, eventually three Distinguished Scientists within our department were housed in South College (Jerry Mahan, Joe Macek, and Ward Plummer) as well as Distinguished Professor John Quinn. In addition, Distinguished Scientist Takeshi Egami was also housed in South College, even if his affiliation is with the Department of Materials Science and Engineering, since

he is closely associated with the Department of Physics and most of his students and post-docs are from Physics.

In 1997 everything changed once again for the better, when the Science and Research Facility (SERF) opened. Since Physics was suffocating in Nielsen and the two upper floors of South College, we were allocated substantial space in SERF. All our experimental high energy and nuclear physics groups moved over to SERF, both offices and research space, and the experimental condensed matter and atomic physics groups were also allocated research space.

So far, so good, but now the troubles begin. After 4-5 years of usage SERF started to get overcrowded and Physics had to give up more than 7,000 net assignable square feet of space, primarily research labs that were handed over to research groups from other departments, who at that time had stronger research funding. Even if we were not happy with these losses we could still accommodate most of our research in the area that was left, maybe with the exception of our experimental high energy groups, who potentially lost out on some big construction projects due to the lack of adequate space for such projects.

The real problem came when Physics was forced to give up the office landscapes we had in SERF, because they officially were supposed to be used for "wet labs." Eventually we swapped the office landscape space in SERF for space on the 2nd floor of Ayres Hall. So in 2003 most of our nuclear and high energy groups moved their offices for faculty, post-docs, research staff, and graduate students to Ayres. We were informed that Ayres was soon going to be renovated and the plans for the new Ayres could easily also accommodate Physics.

Well, when the architects finalized their plans for the renovated Ayres, so much space was lost due to the installation of air conditioning, elevators, and other infrastructure that it was decided that Physics could not be housed in the renovated Ayres. So as a token compensation for losing 6,000 square feet in Ayres, Physics was allocated around 1,600 square feet on the first floor of South College and in addition Physics received "ownership" of the building instead of the Science Alliance. So in 2007 we started another big contraction and reallocation exercise where around half of our faculty changed offices. It was a very

tight fit, but at least we knew that we had two old buildings (Nielsen and South College) we could start working on to make them better.

The last chapter in the setback story happened earlier this year, when the university administration reneged on the allocation of South College to Physics and decided to use nearly half of the first floor for graduate teaching assistants from the Department of Mathematics.

So where do we stand with respect to our current facilities? On a positive note we have been able to upgrade our classrooms in Nielsen and even make a new modern Studio Physics classroom in Nielsen 206. We have also been able to renovate part of the mezzanine and clean out old research equipment in Nielsen 108. So progress has been made. Nevertheless, the overall situation is bleak. Two-thirds of our graduate teaching assistants are cramped together in two windowless rooms on the 6th floor of Nielsen, and the rest are housed either in the UTK library or here and there in the dungeons of Nielsen. This is a big handicap for our graduate recruiting efforts, and a major reason we gave up inviting potential graduate students to campus since the facilities we can show the students are not enticing them to join us. One-third of our teachers have offices in Nielsen that are much smaller than the “official” UTK faculty office size of 150 square feet, and many of these offices do not even have a window. Most of our graduate research assistants and post-docs are located in corners of labs, hallways, or windowless office landscapes. And an hour ago I received a message from Professor Mike Guidry, who has a small office on the 6th floor of Nielsen, that once again our roof is leaking in several places.

Unfortunately we are not the only department at UTK suffering from too little quality space. The Department of Anthropology and the Department of Earth and Planetary Sciences have even worse conditions, and both departments are scheduled for a major renovation or a move to renovated facilities in the hopefully foreseeable future. Currently a complete overhaul of the Nielsen building is far out in the future, probably at least 20 years given the current rate of renovations. When that happens, the current plans call for a complete demolition of the building down to the foundation and essentially a new building to be raised on that foundation.

Is there any hope for improvements in the not-so-distant future? Since I am always optimistic about the future, let me mention three events that could improve our facilities. First of all, the College of Engineering might give up some space in SERF when the new Min Kao building is finished next year, and we hope to get access to some of that space for graduate students and the rapidly growing set of major research equipment owned by our experimental groups. Secondly, the new JIAM building on the Cherokee campus across the Tennessee River will hopefully be finished 3-4 years from now. It will provide a wonderful, but somewhat isolated, environment for our experimental condensed matter groups. But at a high cost, since they will be located 20 minutes away from the main campus and we therefore fear the cohesiveness of our department will suffer severely. Thirdly, and very speculatively, there have recently been some rumors that the UTK Chancellor is considering a major new science building on the main campus. It is hard to judge how realistic such an initiative is and what exactly



Photo: Steven Boada (B.S., 2007; M.S., 2009)

would be the scope and content of such a building, but if it happens the Department of Physics is definitely hoping to have a major presence. Finally, some days when things look really bleak, I am of course always dreaming about a knight in shining armor in the form of one of our alumni, who can come to our rescue with a big donation that can form the base for a new physics building.

*S.P. Solomon*

# Sir Jim

## and the magic of the immeasurable

Jim Trolinger won't say for certain that every great idea he's had is actually his own. It's not that he would ever steal someone else's thunder; he is far too generous to even consider that. It's that he is a big believer in the magic of the intangible—the things that can't be measured but somehow tip the balance when good people solve a problem together and everyone claims the credit.

Trolinger visited campus in mid-October to accept the physics department's Distinguished Alumni Award. (He's actually the 2009 recipient, but this fall presented the best opportunity for him to accept the honor in person.) The department recognized him for his "Outstanding Contributions to Research and Applications of Lasers and Holography," the basis for a career that has involved two successful businesses and pioneering work on sophisticated measurements and imaging. That journey began in his native Shelbyville, Tennessee, and continued through the undergraduate and graduate physics programs at UTK.

Trolinger said his interest in science began to percolate around the seventh or eighth grade and gained momentum when he was in high school.

"I was quite lucky in high school because we had an outstanding math teacher who pushed advanced math way ahead of her time," he said. "I also had a very good physics teacher. He actually became friends with a few of us who had special interests in physics. I think that's probably what convinced me to become a physicist."

After high school graduation he came to Knoxville and chose the engineering physics major so that he could work as a co-op student, gaining experience at the U.S. Air Force Arnold Engineering Development Center (AEDC). He finished his

bachelor's degree in 1963 and then travelled southward to Baton Rouge, earning a master's degree in physics at Louisiana State University.

"It was an economic thing, most largely," Trolinger said of his decision to go to LSU. "I had to get a fellowship that would keep me alive and allow me to go to school."

The three-year fellowship he earned imparted two valuable lessons: he wasn't all that interested in high energy physics and if he did well he could get financial support wherever he chose to study. So he came back to the UT Space Institute in Tullahoma to get a Ph.D.

"Because of my experience, I was able to get a fellowship to go to UTSI and work at AEDC," he said.

That's also when he first became acquainted with lasers.

## A Solution Looking for a Problem

Lasers were invented when Trolinger was an undergraduate and they had just become commercially available when he was a graduate student. Even then, no one really seemed to know what to do with them. As Trolinger explained in a special physics colloquium, lasers were first regarded as "a solution looking for a problem." As a graduate student, he and a group at AEDC began looking for some applications for this new technology.

"(Holography) was one of my first laser escapades," he said.

Trolinger completed his doctoral degree in 1967, forming and leading a team that pioneered techniques using lasers to measure flow field properties in wind tunnels. Before long they were



Dr. Jim Trolinger at Stonehenge, one stop on his many travels. (Photo courtesy of the WWT Web site.)

working in such fields as combustion and pollution diagnostics, particle and flow field holography, and non-destructive testing. He also served on the UTSI faculty, helping create some of the first programs and courses in coherent optics and holography.

In 1973, Trolinger left AEDC and struck out into the commercial sector. He co-founded two successful high-tech optical companies: Spectron Development Laboratories, Inc. (acquired by Titan Corporation in 1986) and MetroLaser, Inc., where he has worked since 1988 and serves as vice-president and director of research. Research teams under his direction were the first Americans to use holography—making three-dimensional images using light—in hypersonic wind tunnels, internal combustion engines, airplanes, and spacecraft. They pioneered using holographic particle imaging to measure the velocity of fluids. And their non-destructive testing methods can find earthquake damage deep inside a building's columns before any visual cracks are obvious.

## Alumnus Profile

An interesting irony in Trolinger's career is that while his work has been about precise measurements, he attributes a great deal of his companies' success to things that can't be measured at all. He'll gather a handful of people with different specialties and they'll start to brainstorm solutions to a particular problem.

"It's kind of amazing how the process works," he explained. "People start throwing out ridiculous ideas. After half an hour you think, 'This is really a waste of time; we're not getting anywhere.' And then something magic happens. Somebody throws out a statement; it's almost like it triggers something. Then somebody else jumps on it. And somebody else adds to it. Before you know it, you have what looks like may be a solution to this thing. One of the most interesting parts of that is when you get finished and you have what may be an amazing answer, every person in the room thinks it's his idea. The first few times it happened I went away thinking it was my idea. Eventually you find that everyone else believes the same thing."

He added that this brand of magic "goes beyond the scientists in the room." In his view, families, wives, children and or anyone who inspires a researcher's ideas

contributed to the solution.

"Pauline and I are that way," he said, referring to his wife, Pauline Abbott. "We go to very complicated movies sometimes. After the movie we start discussing it, and between the two of us we can piece it together. Before you know it we have a meaningful solution. She always thinks it was her idea," he said with a grin.

Trolinger also draws on his breadth of experience with government agencies, academic institutions, and private industry to come up with solutions to research challenges.

"Having that experience I can kind of think like all three," he said. "I settle arguments a lot. I can do that because I can understand where each guy is coming from and somehow get them to compromise."

That ability to forge compromises and thoughtfully consider other people's ideas was no doubt a factor in winning Trolinger the honor of Holoknight. Founded by the late Dr. Hans Rottenkolber in 1988, the Holoknights are an organization that brings together as friends the world's top researchers in holography. The order promotes cooperation, hospitality, and friendship among Holoknights and their countries. Members are selected not only for their technical leadership, but also for their reputation for hospitality, openness, and assistance to others. Thus far 18 Holoknights (both men and women) have been inducted. Trolinger was knighted as Sir Jim of California in 1995.



Dr. Trolinger accepts the Distinguished Alumni Award from Dr. Soren Sorensen.

"I'm probably prouder of that one than I am of any award I ever got," he said. "And it may be the most valuable."

No matter where they travel, there is typically a Holoknight to welcome him and Pauline and make sure they feel at home. And travelling is something Sir Jim knows a great deal about.

## The World's Worst Tourist

There are people who like to travel the world and see the standard sites prescribed by guidebooks. Jim Trolinger is not one of them.

"The things that are probably the least interesting to me are the tourist attractions," he said. "There are so much more interesting things in every country that are not tourist attractions. It's kind of fun to get into a place where you know absolutely nothing and you can't speak the language and there's a system there that you have to figure out. It can be a really interesting game."

Trolinger has visited 40 countries and started writing about his travels in the early 1980s. With the advent of e-mail, he began sending his travel logs out to a kind of fan club interested in learning about his adventures. When Web sites came about, his daughter Kris put together a site for him as a father's day gift, and thus the World's Worst Tourist Web site was born. A chronicle of his travels across the globe, the WWT site also showcases another of Trolinger's loves: art.

"My art interest started when I was a child," he said.

Among his most profound influences was Miss Corrine Houston, a woman he describes in his writing as follows: "She was, indeed, a master, an aging spinster, an eccentric, little ole, hunch-backed lady." He began taking lessons from her when he was seven years old.

"She taught me the joys of creating things," he said.

That creative spark has stayed with him over the years, as Trolinger tries to work in time to paint everywhere he goes—a task made a bit easier now that he is semi-retired.

"I at least draw if I don't paint," he said. "I carry a sketchbook with me."

That talent for observation was evident when asked to reflect on his successes and offer advice to students just starting out.

"Find the best professors," he said. "It doesn't matter what they teach; take it. That served me well later. You really learn a lot from good professors."

One point he made in his colloquium talk was that what most physics students will ultimately work on probably hasn't even been invented yet. That was the case for him and lasers. But physicists, by nature, are gifted with a natural curiosity that makes getting acquainted with new ideas a joy.

"I find that when you learn about things you enjoy them more," he said. "And I always want to learn more about things."

### Sites of Interest

- ▶ UTK Physics Distinguished Alumni Award ([http://www.phys.utk.edu/alumni\\_physics/alumni\\_awards.html](http://www.phys.utk.edu/alumni_physics/alumni_awards.html))
- ▶ MetroLaser (<http://www.metrolaserinc.com/>)
- ▶ World's Worst Tourist (<http://worldsworsttourist.com/>)



# The Fifth-Grade Litmus Test

A good physics teacher knows the finer points of electricity and magnetism. A great one might just have taught those concepts to a room full of fifth-graders before ever graduating college. With a new program called VolsTeach, physics majors at UTK will have an innovative toolkit to help them become great teachers. And given the current educational climate, they will be in high demand.

Dr. Jon Levin, who directs the undergraduate program for the physics department, can attest to the need for physics teachers. His work with the Fentress County Outreach Project (described in the Fall 2008/Winter 2009 issue of *Cross Sections*) was motivated by the fact that fewer than 200 of Tennessee's 300 public high schools offer physics. That deficiency is compounded by the reality that many physics teachers have limited background in the subject matter. Early in 2010 the National Task Force on Teacher Education in Physics reported that only about one-third of high school physics teachers in the U.S. have a physics or physics education major.

"Physics is no different from any other discipline," Levin said. "You wouldn't want an English teacher who didn't know what he or she is talking about."

The good news is that there are programs gaining steam to address this problem. Among them is the VolsTeach initiative, which could well translate into a steady supply of highly-trained physics teachers permeating Tennessee's schools.

## From Burnt Orange to Big Orange

To combat the national shortage of high school teachers in math and science, in 1997 the University of Texas began a program called UTeach. The idea was to encourage undergraduate math and science majors to consider secondary education as a career, in part by removing traditional barriers to certification. Early and intensive field experiences combined with compact degree plans would allow most students to graduate with both a degree and teacher certification in four years. The results have been impressive: the program graduates between 70 and 80 students each year and more than 90 percent of them are teaching.

To deliver that success nationwide, Texas established the UTeach Institute in 2006. The following year 13 universities received grants to replicate the UTeach program. In January 2010, eight additional universities were chosen as replication sites. They include Middle Tennessee State University, the University of Tennessee at Chattanooga, the University of Memphis, and UTK, where the program is called VolsTeach.

"We're the largest replication group outside of Texas," said Dr. Susan Newsom, VolsTeach Assistant Director and Research Assistant Professor with the Center for Enhancing Education of Mathematics and Sciences. "Tennessee has four (universities) and some of the other states have two or one."

Newsom explained that the ball started rolling when Governor Phil Bredesen invited deans from the College of Education, Health, and Human Sciences and the College of Arts and Sciences

to Nashville. They came back with a plan for VolsTeach. A team was put together, a planning period ensued from January until May, recruitment began in the spring, and the first VolsTeach course was offered in the fall of 2010. Partner schools in Anderson, Knox, and Roane Counties have signed on.

"Everybody's worked very, very hard" to have the program in place, Newsom said. And with 60 students already enrolled representing physics, biology, chemistry, math, and other fields, it looks like that hard work is paying off.

## One Degree: Two Career Paths

Jada Johnson has a contagious enthusiasm for VolsTeach. As the recruiter and student advisor, she emphasizes to math and science students that the program offers them additional career options without adding a significant time burden to their schedules.

"If they start off as a freshman, they only have to take one class per semester," Johnson said.

She explained that only when students reach apprentice teaching will they have more than a three-hour load for VolsTeach courses. The program is set up so that students take five field research courses, including their apprentice teaching, and four or five additional courses on topics like research methods in science and math. A key to the curriculum is the early and intensive field work.

"In the Step One (first-semester) class, students will go to an elementary school five times," Johnson said. "They get a chance to observe the mentor teachers in the classroom setting before they have to teach those students."

In Step Two they go to a middle school; then move to high schools for later courses in classroom interactions, project-based instruction, and apprentice teaching.

"They do get quite a bit of experience out in the field before they get to what some would call student teaching or internships," Newsom said. "This is apprenticeship teaching, which is just one semester. It's not a full year like other programs, but they do get a lot of experience. The teaching component is really a licensure piece; it's not a degree. So when they finish, hopefully in four years, they will have their major and they'll also have the secondary license to teach grades 7-12."

Currently there are three physics majors in the program, including Jessie Moore.

"I saw a flyer on campus one day and checked out the Web site," she explained in an e-mail. "It said you would get plenty of field experience throughout the program that was exactly what I was needing. I wasn't certain that teaching was what I wanted to do with my life and VolsTeach was the easiest and best way to try things out without making a huge commitment."

Moore has already observed two classroom sessions and has taught twice—once with a fellow VolsTeach student and once on her own. For the solo flight, she was responsible for writing her own lesson plan. ►

“Experiences like this are something that you just can’t get in a regular Education 100 course or even at an early point in the education program,” she said. “The experiences are definitely important to have early on; they are something that either makes you want to be a teacher even more or sends you running for the hills. You’ll know for sure after you teach your first class of 5th graders!”

Although VolsTeach is aimed at recruiting freshmen, the program is flexible and will accommodate students at any stage in their undergraduate careers. While nearly half of the current students are freshmen, there are also a fair number of sophomores, as well as some juniors and seniors.

“We want to recruit as many people as we can,” Newsom said, adding that the only enrollment limitations would be things like classroom space, and the VolsTeach administration would work through them.

“We want to make sure we have a quality program,” she stressed. “We’re really trying to get students to think deeply about the principles and not just follow a process.”

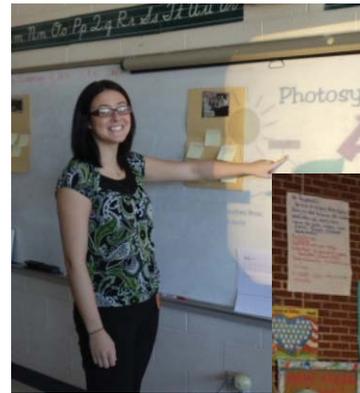
While UTeach replication sites apply for and receive funding from the UTeach

Institute, the Tennessee Higher Education Commission and State Department of Education also allocated federal education grants to fund a statewide initiative.

“It’s really interesting how all this Race to the Top funding and different teacher quality grants are coming together,” Newsom explained. “They’re doing a very nice job at the state level of really having the resources play off of each other and bringing all the partners to the table for the STEM (Science, Technology, Engineering, and Mathematics) education piece.”

The UTeach Institute projects that by 2017, the 21 universities currently replicating the UTeach program will graduate more than 1,000 STEM teachers annually. Future physics alumna Jessie Moore plans to be one of them.

“The program has definitely solidified my desire to be a teacher,” she said. “With the experience in a classroom, I was able to see exactly what it would be like to be a teacher and I loved it! Its hard work coming



Jessie Moore (above) and Lisa Agle (right) are combining the physics major with VolsTeach, an innovative program to get more science and math majors to teach in Tennessee’s classrooms.

up with a lesson plan and then teaching that material to young children, but when it’s something that you really enjoy, it’s obvious to everyone and the hard work doesn’t matter.”

For more information on VolsTeach, visit the program Web site at: <http://volsteach.utk.edu/index.html>



# Argonauts on an Astrophysics Mission



Screen capture from Student Argonaut Dean Taylor’s video report on the JASON Project’s trip to Oak Ridge National Laboratory. Student argonauts are seated with their mission hosts, Joint Faculty Associate Professor Raph Hix (second from right) and Adjunct Professor Michael Smith (far right).

Middle School “argonauts” from the National Geographic Society’s JASON Project landed at Oak Ridge National Laboratory in October to learn a little Astrophysics from Raph Hix (Joint Faculty Associate Professor) and Michael Smith (Adjunct Professor). Hix and Smith hosted a mission called Astrophysics Beyond the Solar System, which involved two experimental nuclear astrophysics activities with the Holifield Radioactive Ion Beam Facility and a third with theoretical nuclear astrophysics.

The JASON Project sparks students’ interest in science by teaming them with leading scientists both in the classroom and online. This summer and fall, students took to the field to learn about Forces and Motion, Climate, and Space. More information about JASON is available at <http://www.jason.org>.

# They're Here

## Androids set to invade scientific education

Professor Michael Guidry's shirt pocket is teeming with spinning planets and farm animals, the result of an Android invasion he not only welcomes but is working to expand.

The Androids in question, however, are not nefarious trespassers from another universe. They're a new generation of smartphones that lend their architecture to the limitless tinkering of the human imagination, opening up an entire new realm of possibilities for scientific and educational purposes.

Guidry is no stranger to adapting educational concepts to new environments. Working with Astronomy Instructor Tina Riedinger and Professor Ted Barnes of the physics department, he developed *Online Journey through Astronomy*, a complete, Web-deliverable course in introductory astronomy that includes 350 interactive animations. He is also part of the company LightCone Interactive, which specializes in advanced interactive animations for college and K-12 students in the sciences. So it's little wonder that he would see the burgeoning population of mobile devices as the next arena for science education. A few years ago he tried some rudimentary programming with the smartphones of the day.

"That was fun and we did some interesting things, but their capabilities were limited," he said. He purchased an Apple iPhone but never developed any applications for it.

"I never got around to jumping the hurdles to program it," he said, mainly because there were so many barriers caused by Apple's proprietary approach to everything and the need to buy a Macintosh just to run the development software.

One Saturday morning in early 2010, Guidry sat down and decided to give smartphone programming another try. This time he went with Android, a platform Google began distributing about three years ago. Android is an

open system, which, as Guidry explained, means "you can take the Android operating system and modify the system itself." With its software developer kit, any user has access to the same tools as a Google programmer.

For three years he had an iPhone he didn't get around to programming, but within two hours he had the Android software downloaded and a rudimentary working program displayed in an emulator, a device that will run programs on a platform other than the one for which they were written. This summer he spent some time playing with the technology and began developing a Web site for Android programming. For now he's working on simple things, like developing critical portions of applications.

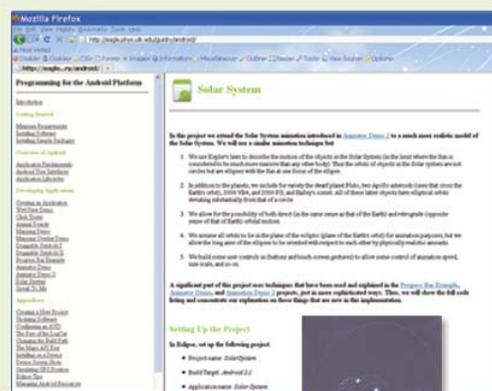
To demonstrate, he pulled a black Samsung phone from his shirt pocket and opened an application he developed of the solar system in motion, complete with labels where, for example, the user can speed up or slow down the orbits of planets. He then launched another application; one he wrote for his granddaughter. This time the screen lit up with photos of a duck, a cow, and a sheep. Tap a picture, and you'll hear the sound that particular animal makes.

"What I'm concentrating on is the pieces: what you need for larger applications," he said, adding that present smartphone applications markets suffer from "a real lack of sophisticated scientific and educational applications." He added that roughly 20,000 new smartphone applications are being launched per month, but only a few of those are useful to more than five or six people in the world.

This is where he sees a real opening for scientific education and programming. He's already transcribed some of his online astronomy programs to make the leap from the desktop to the mobile device environment.

"I just adapted some code I had already written," he said. "There's a whole set of possibilities."

To develop those possibilities and share ideas, Guidry has given two seminars on Android: one at Oak Ridge National Laboratory (standing room only) and one at UTK. He's also planning workshops to offer a more hands-on experience with programming. And for those who want to toy with the platform



on their own, his continuously-updated Web site (which includes the Solar System and Animal Sounds applications) is open to everyone. Students will be able to get in on the action with a new class he'll be teaching in the spring: a freshman-level course on Android programming. All of this is part of what Guidry sees as the next big thing in computing.

"We're talking about something that's having a major impact," he said of Android. "I think it really is a revolution," just as PCs and the World Wide Web were in years past. He added that today a smartphone has the capabilities of the best desktop computers of 10 years ago.

"And," he said, "you've got it in your pocket."

Visit Dr. Guidry's Web site:  
Programming for the Android Platform

<http://eagle.phys.utk.edu/guidry/android/>



approach to secure new grants and recruit new students that no principal investigator could on his or her own. Riedinger also sees a unique opportunity for CIRE to strengthen industry partnerships. Both the Distinguished Fellowship and ESE programs, for example, encourage innovation and entrepreneurship, working where practical with the UTK College of Business Administration.

Yet, “CIRE should be more than these two programs,” he said. He gave the example of Nissan’s electric automobile, the Leaf, and pointed out that the company has two plants in Tennessee; one in Smyrna and one in Decherd.

“Electric vehicles will rise or fall on the quality of the batteries,” he said.

Riedinger can easily imagine a scenario where CIRE students and faculty would work on a solution to develop batteries that double the current 100-mile limit, culminating in a research triumph for the program, an energy victory for industry, and an economic bonus for the state.

“That’s an example of synergies we hope occur all the time,” he said. “I can foresee many different CIRE-industry relationships through R&D. The opportunities are really profound.”

UTK Chancellor Jimmy Cheek and ORNL Director Thom Mason put together a task force that ultimately identified six areas as the initial research directions for the ESE Ph.D. program:

- Nuclear energy
- Bioenergy and biofuels
- Renewable energy
- Energy conversion and storage
- Distributed energy and grid management
- Environmental and climate sciences related to energy

Specifically, students will have the opportunity to work on nearly a dozen “big challenges,” including lowering the cost of solar power, designing high-mileage cars, modernizing the electric grid, and storing alternative energy.

“The expectations are high,” Riedinger said of the program. While it typically takes an average of five years to start a new academic program, “we’re doing this in less than a year. This is going at the speed of light.”

He is wrapping up faculty recruitment (thus far there are 66 applicants) and the task force has set a curriculum based on existing courses, but with flexibility for new ones as the program expands.

## The Top 25

One of the factors driving CIRE is UTK’s goal of becoming a top 25 university, which will require a significant increase in the number of doctoral degrees conferred. The plan is for the center to recruit 20 to 40 high-caliber graduate students each year to boost those numbers.

Riedinger certainly has the mettle to make the program work. He has served in several administrative posts, including head of the UTK Department of Physics and Astronomy, UTK Interim Vice-Chancellor for Research, and ORNL Deputy Director for Science and Technology. He was also part of the original team that put together the university’s bid with Battelle, Inc., that ultimately won the management contract for ORNL.

Soren Sorensen, head of the physics department, encouraged Riedinger to put his hat in the ring for the CIRE directorship, even though the latter had said he was swearing off any new administrative projects. Sorensen described the opportunity as “Lee’s Capstone Experience,” referring to the survey course many graduating seniors take as they complete their undergraduate degrees.

When asked to apply for the position, Riedinger said his initial thought was, “Why would I want to get involved in another administrative job?” But after some consideration, he began to see that maybe it *was* sort of a capstone experience, as he has spent nearly three decades building partnerships between the university and its national laboratory neighbor.

“We all know the great steps forward between the university and the lab over the last 20 years,” he said, ticking off such successes as the Distinguished Scientist Program, several joint institutes, and the Governor’s Chair Program.

And so he agreed to move to yet another office in yet another building, waiting out the renovations until the long, narrow hallway of Greve Hall’s fourth floor teems with enthusiastic scholars.

“We want to bring good people in,” Riedinger said. “That’s what it’s all about.”

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More information on the center is available at the CIRE Web site:  
<http://cire.utk.edu/>



## UTK-ORNL Distinguished Fellow in Physics



Robert Van Wesep (pictured left) is part of the first class of UTK-ORNL Distinguished Fellows. A native of Michigan, he earned a Bachelor of Science in Interdisciplinary Physics from the University of Michigan, where he served as vice-president and president of the U-M chapter of the Society of Physics Students. His research activities involved Bose-Einstein Condensates, as well as a computational physics project at the University of Minnesota on catalysis in hydrogen fuel cells. After graduating, he spent six months working in Tokyo, Japan. He is currently working with Joint Faculty Professor Zhenyu Zhang in condensed matter theory research at UTK and ORNL.



Recent Ph.D. graduate Laurene Tetard has won a prestigious Wigner Fellowship at ORNL.

## New Wigner Fellow

Earlier this year physics graduate student Laurene Tetard won a Chancellor's Honor for Extraordinary Professional Promise. It hasn't taken long for her to demonstrate that she is more than deserving of that distinction. Tetard, who will finish the Ph.D. in December, has been named a Wigner Fellow at Oak Ridge National Laboratory. Established in 1975, the Eugene P. Wigner Fellowship Program honors the Nobel Laureate and first ORNL Director of Research and Development.

Tetard's future research will involve subsurface imaging and chemical characterization of soft matter materials at the nanoscale, with direct applications to bioenergy research and biology. Her graduate work on subsurface imaging at the nanoscale has already helped earn her a place as a recipient of a 2010 R&D 100 Award. She has also co-authored two patents and several publications on subsurface imaging and chemical characterization at the nanoscale.

Tetard received her B.S. degree in physics in 2004 from the University of Burgundy in Dijon, France, where she went on to earn an M.S. degree with a concentration in nanotechnologies and nanosciences in 2006.

The Wigner Fellowships are reserved for outstanding applicants from around the world, allowing them to select and pursue fundamental or applied research in areas of global interest.

## Physics Flashback

**John Herndon** (M.S., 1954; Ph.D. 1957) earned the doctoral degree working with Dr. Alvin H. Nielsen. He sent these images, taken in the summer of 1955 behind the old physics building, of the vacuum tank for the infrared spectrograph. Top: then-Ph.D. candidate Herndon with Dr. Nielsen; the picture below is of Herndon.

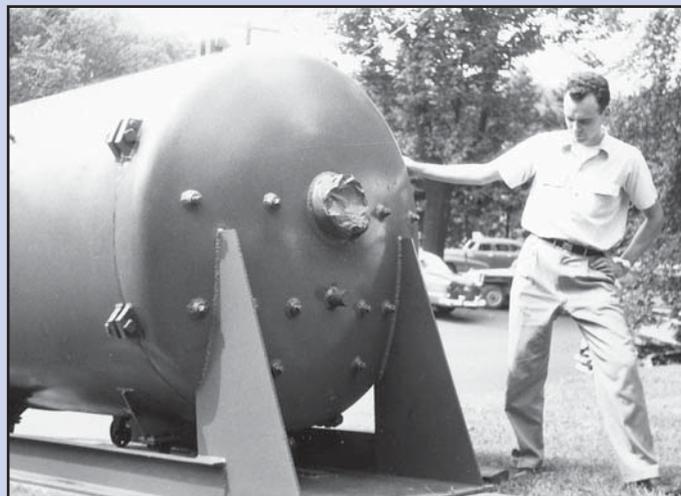


Any photos, anecdotes, stories, or facts about the department you'd like to share?

We're always happy to hear from you!

Send e-mail to [cal@utk.edu](mailto:cal@utk.edu)  
or regular mail to:

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Department of Physics and Astronomy  
The University of Tennessee  
401 Nielsen Physics Building  
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If you're a UTK physics graduate and have helped build a better mousetrap, the American Institute of Physics would like to know.

The AIP Center for the History of Physics is working on a three-year study on the history of physicist entrepreneurs. This is the first systematic study of physics-based startups and their role in industrial research and development. As part of that study the institute is trying to develop a database of physics graduates and faculty who have gone on to found or co-found their own companies. If that's you, please let us know! AIP would like the following information:

1. Name of the Entrepreneur(s)
2. Name of the startup
3. Contact information (e-mail, telephone and/or address)
4. Year the startup was founded
5. Current disposition of the company
6. Nature of the business

The project staff consists of Joe Anderson (janderso@aip.org or (301) 209-3183) and Orville Butler (obutler@aip.org or (301) 209-3167).

## The Physics Top 10 List

Over the next few issues of *Cross Sections*, we'll be highlighting the Top 10 Most-Cited Papers from our department, with insight from the authors, beginning with Number 10. These papers show the breadth and influence of the physics department's research program.

**#10**

**Title:** Mean-field description of ground-state properties of drip-line nuclei: Pairing and continuum effects

**Authors:** J. Dobaczewski, W. Nazarewicz, T. R. Werner, J. F. Berger, C. R. Chinn, and J. Dechargé

**Journal:** Phys. Rev. C 53, 2809–2840 (1996)

**Times Cited:** 328 (as of 11/17/2010)

rare isotopes; hence, closeness to the particle continuum of scattering states and resonances. In this new situation, the decay channels must be taken into account explicitly. As a result, many cherished approaches of nuclear theory must be modified. This is particularly true for the treatment of nucleonic pairing.

Any attractive interaction between fermions at low temperatures generally leads to fermion pairing, analogous to the Cooper pairing of electrons in superconducting metals. It is not surprising, therefore, that pairing lies at the heart of nuclear physics. Nucleonic superconductivity is present in finite nuclei and in the nuclear matter of neutron stars. Pairing can determine the existence of a nucleus. A classic example is the chain of helium isotopes: the N-even nuclei  $^4,^6,^8\text{He}$  are bound while the odd-N isotopes  $^5,^7\text{He}$  are not. Such an odd-even effect in nuclear binding energies is well known, but it is particularly important in weakly bound nuclei. Indeed, pairing in such systems may take on such importance that single particle motion in a mean field is no longer a viable ansatz.

The paper described the nuclear density functional theory for superconducting weakly bound nuclei. The theory was formulated in coordinate space, thus properly accounting for the influence of the particle continuum. Measurable consequences of spatially extended pairing fields were reviewed and new phenomena expected to occur in rare isotopes were discussed.



### Summary

*Courtesy of Professor Witek Nazarewicz*

Physics of radioactive nuclear beams is one of the main frontiers of nuclear science today. Theoretically, rare isotopes represent a formidable challenge for the nuclear many-body theories and their power to predict nuclear properties in nuclear terra incognita. The unique structural factor is the weak binding of

# News from the Physics Family

## Faculty



Stuart Elston

Two of our physics faculty members were honored November 30 at the College of Arts and Sciences Winter Convocation: A Celebration of the Faculty. **Professor Stuart Elston** was recognized with a Faculty Academic Outreach Award and **Assistant Professor Kate Jones** was honored with a Faculty Advising Service Award. Dr. Elston has a long tenure of outreach contributions, including leading summer

workshops for teachers and serving as a College of Arts and Sciences Scholar-in-the-Schools. He is currently involved with TEACH/Here, an innovative teacher residency program to prepare highly skilled math and science teachers for hard-to-fill positions in Knox and Hamilton county schools, operated by a partnership

between the school districts, the College of Arts and Sciences, the College of Education, Health, and Human Sciences, and the Public Education Foundation of Chattanooga, and supported by private and public funding, including TVA, Americorps, and a \$2.8 million grant from the National Science Foundation. Dr. Jones has offered her tireless support to students in the College Advising Service to ensure they are on the right track academically.



Adolfo Eguiluz

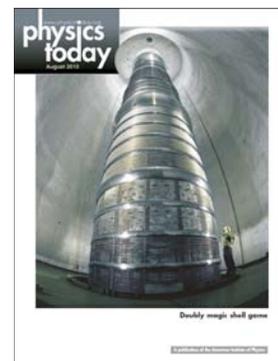
**Professor Adolfo Eguiluz** and colleagues from ETH Zurich received the honorable mention for special achievements in scalability for their project “Toward First Principles Electronic Structure Simulations of Excited States and Strong Correlations in Nano- and Materials Science” as part of the 2010 Gordon Bell Prize awards. Their scientific results were computed using the Cray XT5 supercomputer at Oak Ridge National Laboratory (known

commonly as Jaguar). The team presented an efficient method to compute, from first principles, a key parameter for  $\text{La}_2\text{CuO}_4$ , the canonical parent compound of several cuprate high-temperature superconductors. The announcements were made in November at the Supercomputing Conference SC10 in New Orleans. The Gordon Bell Prizes recognize outstanding achievement in high-performance computing applications.

JUSTIPEN—The Japan-U.S. Theory Institute for Physics with Exotic Nuclei—has a new cousin: **FUSTIPEN: The France-U.S. Theory Institute for Physics with Exotic Nuclei**, which opened

in October. Located at GANIL in Caen, France, the institute will support travel grants for U.S.-based nuclear physicists to visit French collaborators to work on common projects. The inaugural FUSTIPEN Workshop will be held on January 18-19, 2011, at GANIL. **Professor Witek Nazarewicz** is principal investigator and a member of the governing board. He was also instrumental in the establishment of JUSTIPEN, where **Associate Professor Thomas Papenbrock** is now associate director.

**Assistant Professor Kate Jones’** work on “doubly-magic” Tin-132 provided the cover article for the August 2010 issue of *Physics Today*. The paper, “Testing the doubly magic character of tin-132,” describes Jones’ and her colleagues’ work at the Holifield Radioactive Ion Beam Facility at Oak Ridge National Laboratory, where they collided Tin-132 with a deuterium nucleus, creating Tin-133. The investigations revealed that Tin-133 had purer states than even Lead-209, which resides outside the doubly-magic nucleus Lead-208, leading the team to conclude that Tin-132 is most likely the best existing example of a doubly-magic nucleus.



Witek Nazarewicz

**Professor Witek Nazarewicz and Assistant Professor Kate Jones** shared their insights on exotic nuclei in the September 2010 issue of *The Physics Teacher* with “Designer Nuclei: Making Atoms that Barely Exist.” The article is an accessible overview of nuclear physics with an emphasis on the fabrication and characterization of short-lived nuclei with desired properties. The authors

also offer ideas for teachers in presenting nuclear physics in the classroom. You can see the article online at *The Physics Teacher* Web site: <http://tpt.aapt.org/>.

A February 2011 conference called Waltzing to the Nuclear Limits will honor the career achievements of **Professor Lee Riedinger**.

The meeting, to be held on Hilton Head Island, South Carolina, will recognize the many contributions he has made to research on nuclear structure and his extensive service to the nuclear physics community. More information is available at the conference

Web site: <http://www.phy.anl.gov/nuclearlimits2011/>.



Lee Riedinger

For the second year in a row, **Professor Jim Thompson** and **Research Assistant Professor Yuri Zuev** are among the co-developers of an R&D-100 Award project. The 2010 winner was titled "High-Performance, High-Tc Superconducting Wires enabled via Self-assembly of Non-superconducting Columnar Defects." The work represents the first successful introduction of nanoscale defects in high-temperature superconducting materials that allow large currents to flow through the materials in the presence of high applied magnetic fields. These wires have the highest superconducting performance to date world-wide. The research team comprised members from UTK, ORNL, Superpower, Inc., and the University of Houston. The R&D 100 Awards identify and celebrate the top high technology products of the year and span industry, academia, and government-sponsored research.



Jim Thompson

## Alumni

**Dr. Rodney Sullivan** (Ph.D., 2004) was named Daniel-Mickel Foundation Master Teacher at the May 2010 awards night ceremony at Christ Church Episcopal School in Greenville, South Carolina.

Sullivan teaches physics in the Upper School and was recognized with the prestigious honor for "his ability to explain complex ideas with clarity, his genuine interest in students and their lives outside his classroom, and his tough academic standards."

This the second consecutive honor for Sullivan; last year students at Christ Church voted him the Outstanding Teacher of the Year.



Rodney Sullivan

## physics family snapshots



It wouldn't be Fall without the annual **Society of Physics Students Liquid Nitrogen Ice Cream Sale**, this year with a menu addition of Root Beer Floats.



**Department heads past and present:** Dr. Soren Sorensen (left), Dr. Bill Bugg (center), and Dr. Lee Riedinger (right) celebrate the re-opening of Ayres Hall on November 11.



**Department Head Soren Sorensen and Glon Lanagan**, the Maintenance Specialist who keeps the Nielsen Building running.

# In Memoriam

The physics family lost several friends this summer and fall, all of whom made important contributions to our department.

## Dr. Sam Hurst



Dr. Sam Hurst, former Ford Foundation Professor and founder of the UTK Institute of Resonance Ionization Spectroscopy, passed away on July 4, 2010. He was born in 1927 in Ponza, Kentucky, and graduated from Berea College with a physics degree in 1947. In 1948 he earned a master's degree at the University of Kentucky, and then began his esteemed scientific career at Oak Ridge National Laboratory, simultaneously completing work for the Ph.D. in the UTK Physics Department. Among his many scientific accomplishments were the development of the fast neutron counter, which measured radiation in human tissue, and resonance ionization spectroscopy, an ultra-sensitive technique to detect single atoms. Hurst's stellar career expanded to include academe—as a Ford Foundation Professor at UTK and a Physics Professor at the University of Kentucky—and industry, where he founded or co-founded five companies. Among those entrepreneurial projects was Elographics, Inc., which was dedicated to the touch-screen technology that grew out of his research program and is now enmeshed in hundreds of everyday tasks. Altogether he held 30 patents and was an author on more than 200 publications. Deeply devoted to education, he and his wife, Betty, established an undergraduate scholarship fund in the physics department to assist students working toward a bachelor's degree in physics.

## Dr. Felix Obenshain



Dr. Felix E. Obenshain, Ford Foundation Professor, passed away on August 19, 2010, at the age of 82. He was born in Pikeville, Kentucky, and grew up in Roanoke, Virginia. After serving two years in the U.S. Navy, he earned a B.S. degree from Virginia Tech in 1952. He was a staff scientist at Westinghouse Atomic Power Division in Pittsburgh, Pennsylvania, and earned a Ph.D. at the University of Pittsburgh in 1959. While at Westinghouse he assisted in the development of reactor shielding for the first nuclear submarine, the Nautilus. Obenshain joined Oak Ridge National Laboratory in 1960 and retired as senior scientist in 1995. During his tenure at ORNL his work in nuclear physics research took him to CERN, Los Alamos National Laboratory, and Brookhaven National Laboratory. As a Ford Foundation Professor in the physics department he helped strengthen the bond between ORNL and the university, mentoring many young scientists along the way.

## Ginger Roseberry

Edna Ginger Roseberry passed away on October 31, 2010, just two months after celebrating her 99th birthday. In the late 1950s, her son, Douglas, was an energetic undergraduate physics major preparing for graduate studies at Princeton. His promising career was cut short when an aneurysm claimed his life in October 1959. The following spring, the physics department awarded the first Douglas V. Roseberry Award to honor the young scholar's legacy and recognize another student of like qualities. The honor was established by Phi Sigma Kappa, Douglas' fraternity, and is now the department's oldest and most prestigious undergraduate award. Mrs. Roseberry was a faithful friend to the physics department, kindly inquiring after the students and delighting in the accomplishments of the long list of Roseberry Award winners over the years. Sadly, Douglas' widow, Bonita, passed away just a few days before Ginger—October 28—at the age of 72. Through the recognition of so many outstanding students in the past five decades, the Roseberry Family's legacy has been, and will continue to be, an important part of the physics department's story.

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The physics department has several award and scholarship funds to support our vision of excellence in science education at both the undergraduate and graduate levels:

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- Paul Stelson Fellowship Fund
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If you would like more information on how to make a donation or a pledge to any of these funds, please contact either the physics department, or the College of Arts and Sciences Office of Development at (865) 974-2365.

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