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Department of Physics and Astronomy

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THE UNIVERSITY OF TENNESSEE KNOXVILLE
DEPARTMENT OF PHYSICS & ASTRONOMY

CrossSections

The Newsletter for UT Physics Alumni & Friends

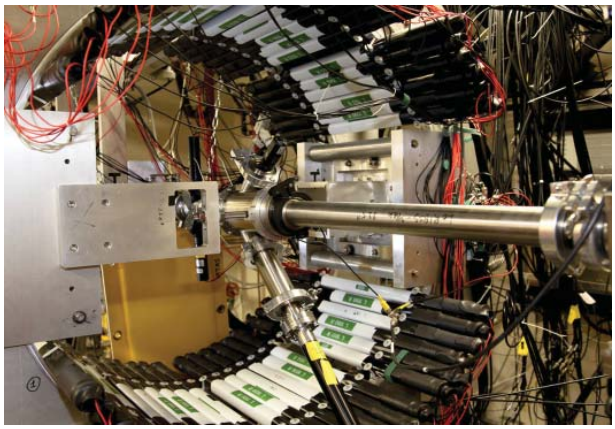
A Very Fine House

JINPA builds on the foundation of the first UT-ORNL joint institute

The acronym is new but the purpose is the same: bringing together scientists the world over to study nuclear physics within a nimble, adaptive framework.

At the Joint Institute for Nuclear Physics and Applications (JINPA), "we provide ways for people to collaborate in support of the joint research at UT and Oak Ridge National Laboratory," said Physics Professor Robert Grzywacz, JINPA Director.

The direct descendant of the first UT-ORNL joint institute, JINPA continues a tradition of investigations into the structure of nuclei and expands it to encompass new terrain, including neutron sciences and interactions of matter at high energies. That research includes both theory and experimental studies and also quite a bit of handiwork: specifically detector arrays and digital electronics used at ion beam facilities around the world.



VANDLE at the HRIBF in 2013

"JINPA doesn't fund the hardware," Grzywacz said, "but it funds people who come and help."

That help resulted in a modal total absorption spectrometer (MTAS), the largest and most efficient of its kind, which scientists have applied to decay studies of more than 20 neutron-rich fission products at ORNL. Studies like these are critical for making accurate assessments of decay heat released by fission products produced in nuclear fuels in power reactors, for example. Another array called VANDLE (Versatile Array of Neutron Detectors at Low Energy) has been successfully used to study nuclear reactions and decays and is currently at home at Argonne National Laboratory, while still others will be used in Japan and other international locales.

Working in diverse areas of nuclear physics at locations all over the world could be both daunting and expensive, but JINPA is set up to emphasize a more fluid collaborative model based on short-term visits rather than simply hiring one person at a time.

"It's a very good use of money," Grzywacz explained. "If you want to hire people you have to: a) convince them to come for a long-term visit; b) go through all the immigration and procedural issues; and c) find the money in different grants to do that. So JINPA is kind of a soft way to do this."

In the past three years alone JINPA visitors have come from Poland, Norway, Sweden, China, Japan, Russia, the U.S., France, Armenia, Spain, Mexico, Colombia, Ireland, Finland, Germany, Argentina, and Greece. Dorm space at ORNL provides housing.

"You don't have to bring people for a very long term," Grzywacz said. "JINPA is this great way to bring them for a week or a month—a few months. We can bring people in who have expertise and knowledge which would help us to carry on with the research."

The institute also hosts workshops and meetings, another layer Grzywacz credits with giving the institute an important professional presence.

"There's a huge benefit for ORNL and for UT, particularly when funding is tight and you cannot really bring people for long-term commitments," he said. "I think that's the biggest deal about JINPA: to have collaborators but without buying them full-time."

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Hitting the High Notes

AY 2015 is over and it has been an extraordinary year for UT Physics. The fall semester ended on a high note for professor Thomas Papenbrock who not only received the Excellence in Research and Creative Achievement Award during the College of Arts and Sciences Winter Convocation, but was also elected Fellow of the American Physical Society. With Thomas joining this elite club, the department now has 11 APS fellows. Soren Sorensen also made the spotlight at the winter convocation by winning the Diversity Leadership Award. Soren has demonstrated a long-term commitment to diversity in academia and is currently leading the "STRIDE" initiative for improving diversity on campus.

Much has been said in the media and elsewhere about the fierce competition in academia where publication and funding pressures often discourage risk taking such as exploring radically different research directions. Not so for George Siopsis, who for much of his career had focused on strings and quantum gravity. Drawn by the intellectual challenges of quantum information theory and the potential practicality of quantum computing, as well as funding prospects in this emerging field, George rose to the challenge and ventured into new territory. He developed a new graduate course on quantum information and then began building connections with the ORNL quantum information group. Now, with joint faculty affiliates Bing Qi and Raphael Pooser, he won a $1.1M grant from the Office of Naval Research to develop quantum key distribution networks for guaranteed secure exchange of private or classified information by exploiting quantum mechanical principles such as quantum superposition and entanglement. For the department this also represents an entirely new research direction that's expected to become increasingly important.

A year ago, I was worried about the ramifications of faculty departures for our research budget. It is very gratifying to see that quite a few faculty have been able to tap into new funding sources. I can only mention a few highlights, keeping in mind that there is a whole lot more proposal activity going on in the department. Traditionally, subatomic physics in our department is funded by DOE whereas condensed matter was primarily funded through NSF. This spring, however, Lucas Platter (nuclear physics) Tony Mezzacappa (astrophysics) and Sarah Cousineau (accelerator physics) were able to tap into NSF funds. Robert Grzywacz and Kate Jones supplemented their DOE base funding with more grants from the DOE-NNSA's nuclear stockpile stewardship program. Tom Cormier, Soren Sorensen and Ken Read et al. submitted a multi-institution multi-million dollar DOE proposal for the central barrel tracking upgrade of the ALICE Detector at CERN. The project has been approved by DOE program management.

Kudos to our Publications Coordinator Catherine Longmire for winning the prestigious Mary Lynn Glustoff award for outstanding non-exempt staff. Catherine is highly deserving of the award, not only because of her outstanding professionalism but also because of her infectious positive personality and strong work ethic. Kudos also to Tony Mezzacappa for taking the lead, together with sociology professor and lead-PI Stephanie Bohon, and making it through the pre-selection of NSF's Science and Technology Center competition. Their proposal for an NSF Center for Advanced Study and Computational Analysis of Disparities and Equality transforms the way social science research processes "big data." While the center is not associated directly with physics, Tony's expertise as a computational physicist and leadership of JICS will be key to its success.

There are also major developments on the condensed matter front. Adriana Moreo led a highly successful search that resulted in the hiring of Dr. Cristian Batista from Los Alamos National Laboratory. Cristian is an exceptional scientist and educator, and we are extremely lucky to bring him on board. He will succeed John Quinn as the Lincoln Chair professor in theoretical condensed matter physics, starting February 1, 2016. John has held the Willis Lincoln Chair of Excellence since 1992 and will retire in August after a long and stellar career.

Dr. Jian Liu from UC-Berkeley will be our newest assistant professor in experimental condensed matter physics, beginning August 1. Thanks to Norman Mannella for leading this search. Finally, I am pleased to announce the hiring of Sean Lindsay, who will take charge of astronomy instruction after a search led by Raph Hix. Profiles of these new faculty hires will be featured in the next few editions of CrossSections.

There are many rankings out there but this particular one made us smile: http://www.graduateprograms.com/top-physics-schools/. This is a student-driven ranking site that places our graduate program second in the nation. Evidently, our students like our graduate program, which I suppose is not only a testament to the faculty but also to Chrisanne Romeo who excels in making students feel welcome and at home.

Let me save most important compliment for last, as eloquently stated by the academic program review committee in its report last February:

"The Committee was impressed with the quality and enthusiasm of the undergraduate students, the vibrancy of their student organization and their engagement in physics outreach and research."

Indeed, our students are an enthusiastic bunch and fully deserve this praise. So does Jon Levin who took on a very active role mentoring SPS (you can read more about their activities and awards on page 12). Student performance and placement remain the most important metric for any educational institution. Ultimately, it is their success that makes it possible for me to boast about all the other good things that are happening in our department.

Hanno Weitering
Professor and Head

A Very Fine House, Continued from Page 1

The Founding Fathers and the Future

Gathering expert abilities is in many ways the institute's birthright. JINPA is the second generation of the highly successful Joint Institute for Heavy Ion Research (JIHIR), founded in 1983 by UT, ORNL, and Vanderbilt University. The first joint institute (there are now five), JIHIR was the natural progression of an ORNL accelerator program that dates to the 1950s. A decade or so later the national lab built a cyclotron, and by the early 1970s Professor Joe Hamilton of Vanderbilt saw the promise of an experimental lab for nuclei far from stability. With state funding and a collaboration of other universities this became UNISOR, the University Isotope Separator at Oak Ridge, which in turn led to the Holifield Heavy Ion Research Facility. The next chapter was a successful proposal from the joint institute's founding fathers—Hamilton, UT Physics Professor Lee Riedinger, and Russell Robinson from ORNL—for an office and conference facility adjacent to an existing dormitory. The JIHIR was dedicated in 1984; all three institutions are still involved.

Physics Professor Emeritus and long-time JIHIR Director Carrol Bingham said that "while the mission focus of the JIHIR was primarily centered around the Holifield research facility, a very important secondary consideration—perhaps even more important—was the enhancement of collaboration between UT and ORNL scientists in the study of nuclear physics."

He explained that in the early years a key goal was to develop a strong nuclear theory group to support experimental work at the Holifield and other laboratories. JIHIR played a significant role in making the UT-ORNL group a world leader in theory of nuclear structure and reactions and nuclear astrophysics applications. Over its 30-year history, the institute's emphases expanded significantly to complement these strengths with other experimental methods and facilities to measure detailed properties of nuclei. So when the Holifield closed in 2012, JIHIR was fully capable of adapting to that change.

"People started to think that if you don't have a facility, you can't do experiments, so why bother?," Grzywacz said of the closure, "whereas my take on this is that experiments are done by people and there aren't many groups who have expertise and traditions and culture to make those experiments happen. We have expertise, culture, and the right collaborations: the know-how, the software, and the arrays. There is a lot of intellectual weight here."

In light of that evolution, JIHIR was renamed the Joint Institute for Nuclear Physics and Applications last year, and Grzywacz became the director.

"We changed the name because we wanted to bring in more applied physics," he said.

While the institute continues its studies on the structure of exotic nuclei, it also supports work at ORNL's Spallation Neutron Source and ALICE experiments at CERN, home to the Large Hadron Collider. JINPA will also steer some of its expertise toward working with the new Facility for Rare Isotope Beams at Michigan State University, which will provide intense beams of rare isotopes for deeper study of the way nuclei are structured and how they work. In line with this is the institute's historic commitment to UT-ORNL theory research, which capitalizes on the capabilities of supercomputers at the national lab and the university to run extensive calculations. During the past year JINPA sponsored nine projects in nuclear theory and was the U.S. home to the international France-U.S. Theory Institute for Physics with Exotic Nuclei (FUSTIPEN). The theory group and visitors work in the recently constructed theory wing of the JINPA building.

This multi-pronged approach builds on JINPA's legacy of three decades of cooperation while moving into the future of nuclear physics research and keeping the dialogue going.

"People need to see mutual benefit," Grzywacz said. "Without that, there's going to be competition and people working in opposite directions. We stop talking."

Introducing Andrew Steiner

Andrew Steiner purposely avoids sticky situations to figure out what's going on in neutron stars, the remains of massive stars whose lives have ended in supernova explosions.

Steiner joined the faculty January 1, coming to UT from the Institute for Nuclear Theory at the University of Washington, where he was a research assistant professor. His expertise is in theoretical nuclear astrophysics. Specifically, he capitalizes on observations of neutron stars to consider essential questions in nuclear physics, such as how neutrons and protons interact. At present his interest is obtaining superfluid gaps from neutron star cooling.

"Superfluidity is this phenomenon (where) you can have a liquid that flows very freely without viscosity—no stickiness," he explained. "This is a property of some fluids that is deeply ingrained in quantum mechanics. It's a wide area of research, the subject of a couple of Nobel prizes, and it's also connected to superconductivity," where electric current flows without resistance.

Andrew Steiner joined the faculty January 1. His expertise is in theoretical nuclear physics: specifically observations of neutron stars.

Superfluidity dates to the 1930s when scientists discovered that helium, when chilled to a certain temperature, can eke its way through even the most narrow passages and climb over container walls. Understanding this state is key in the study of low temperature physics.

"We believe that neutrons in a neutron star are superfluid," Steiner said.

Determining the strength of that superfluidity and over what temperature it works is a bit of a balancing act. Like its cousin, superconductivity, superfluidity typically appears at cold temperatures and vanishes as they rise. This is called the superfluid gap.

"It turns out that it's possible, using theoretical models, to determine this gap energy just through neutron star observations," Steiner said. "You can watch neutron stars cool. You observe them and they have some temperature and you observe them another time and they may have a lower temperature."

Steiner's research requires a multi-pronged approach: phenomenology (which he described as "sort of a descriptive way of doing things where you look at how the world behaves and you try to construct simple models"), as well as statistics and computing. He's had quite a bit of success with that toolkit.

"I recently pioneered the use of Bayesian inference for neutron star observations," he said, and in 2013 five of his papers were among the top 100 articles cited by nuclear theory preprints. He also writes code for his work, sharing much of it as open source.

"I think the majority of nuclear physicists end up writing a little bit of code," he said. "Computing is so widely available, we're actually able to solve problems and analyze data better than we would have even 10 years ago."

Though he's clearly skilled with a computer, his workspace is hardly limited to his office in South College.

"Neutron stars are in many ways my principal laboratory," he said.

Cross-Country Physicist

While his lab lies beyond the atmosphere, Steiner's studies have also covered quite a bit of territory on the home planet. Originally from Fort Collins, Colorado, he earned a bachelor's degree from Carnegie Mellon University in Pittsburgh, headed north for master's and doctoral degrees from the State University of New York at Stony Brook, and held post-doctoral positions in Minnesota, New Mexico, and Michigan before moving to Washington and now Tennessee.

Along with gearing up his research he jumped right into the classroom upon arriving at UT, teaching introductory astronomy for the Spring 2015 term.

"It was a great educational experience for everyone," he said. "It's fun to learn how to talk about astronomy in a way that is interesting and makes sense to people. I had great students. A couple of them told me at the end they want to be physics majors."

When he's not investigating the intricacies of neutron stars or introducing students to astronomy and physics, Steiner enjoys travelling, scuba diving (both he and his wife Cari Crane are certified), and hiking. East Tennessee certainly offers plenty of opportunities for the latter, as well as for collaborations with other scientists, including at Oak Ridge National Laboratory where he holds a joint faculty position with the Physics Division. He also meets regularly with nuclear physics faculty members Raph Hix, Thomas Papenbrock, and Lucas Platter, and has welcomed graduate student Spencer Beloin to his research.

"I have a great number of people to interact with," Steiner said of his move to UT. "This is a really perfect place for me in terms of the strength of the nuclear physics and astrophysics programs. I'm very excited to be here."

Steve Daunt might have made it to Tennessee much sooner had Bill Blass been a more diligent correspondent. But it all worked out and now, after a long career marked by teaching thousands of students, he's ready to retire and embark on a new path that takes him, in a sense, back to his graduate school days.

Daunt's professional trek began at Iona College in New Rochelle, New York. He was among the first six students picked to work in the college's new computer center and developed an interest in computer simulation. His interest in spectroscopy was sparked by courses in modern physics, analytical chemistry and molecular group theory. After earning a bachelor's degree in 1969 with majors in math, physics, and chemistry, he went through the American Chemical Society graduate directory looking for people whose papers had "normal coordinate analysis" in the title, and that's how the New York City native came to be a graduate student at Queen's University in Ontario, Canada.

He got off to an auspicious start, as his advisor had worked for Gerhard Herzberg (Nobel Prize 1971) at the National Research Council of Canada. NRC was a very exciting research place to be during Daunt's graduate school days and provided contacts still useful to him today.

Back to the Beginning

It was around this time when UT Physicists Fred Masri, a postdoc, and Professor Bill Blass wrote papers describing top-notch computer programs for spectroscopy research that caught Daunt's attention. He wrote to Masri to learn more, but Masri had returned to his native England.

"He said, 'Write to Blass.' So I wrote to Blass. A couple of times," Daunt said. "I didn't get an answer."

His fortunes changed, however, when Daunt found himself at the International Symposium on Molecular Spectroscopy (founded at Ohio State by Alvin Nielsen's brother, Harald). The meeting proved to be memorable for several reasons, beginning with his arrival, as he had to navigate his way into a dorm through a crowd of four Nobel Laureates.

"Dr. Herzberg is in the doorway … and I recognize Charles Townes, Arthur L. Schawlow, and Robert Mullikan," he said. "So I'm standing there with my luggage wondering, 'What do I do, tell these four Nobel Prize guys to get out of my way?'"

Herzberg recognized him and kindly made way, and later Daunt found himself in the coffee room reading nametags when he saw a guy named Bill Blass from the University of Tennessee. Blass looked at Daunt's nametag and said, "Wasn't I supposed to send you something?"

The pair went to lunch and Blass invited Daunt to UT to learn the computer simulations his group was using.

"That was the beginning of a decades long research collaboration and friendship," Daunt said.

He began taking spectra and building spectrometers for his boss, commuting between Ottawa, Kingston and Knoxville while finishing his Ph.D. When he was near graduation in 1975, Blass invited him to postdoc at UT alongside Don Jennings (UT Ph.D. 1974). He began a long association in astronomy-based research with the NASA Goddard Space Flight Center where Jennings later became a scientist on the Voyager mission. In time, he said,

Steve Daunt's retirement won't be leisurely; he's getting back into research on infrared spectra.

the Canadians also came calling and offered him a position through their University Faculty Fellows program. For 10 years, he had a joint appointment with UT and Concordia University in Montreal.

The early 1990s, however, brought serious health issues that forced Daunt to decide what he wanted to do. By then he was a tenured associate professor at Concordia with grants and students, but he considered Tennessee home.

The upside of staying at UT was that he got to engage his love of teaching. He taught Governor's School courses for 20 years; as well as mechanics, electricity and magnetism, optics, astronomy, and countless sections of service courses. He also worked in student advising.

"I loved that," he said. "Students come back and ask for you, or stop by to visit."

He continued travelling to Goddard, but health and family issues got the better of his time, so research had to go on the backburner. With retirement, he's re-establishing connections at the National Institute of Standards and Technology and the National Research Council in Canada.

"They've got me back in," he said. "In August I get to run my first accelerator-based infrared spectra at the Canadian Light Source synchrotron, which is at the forefront of the field now."

He said his colleagues and their students are now doing this kind of work, but he's fine with getting caught up.

"I feel like I'm a graduate student again," he said, but "I'm *happy* to be like a grad student again."

Dr. Isabel Tipton retired in 1972, but her work still has an impact, and a new scholarship honors her contributions.

Isabel H. Tipton, B.S. University of Georgia 1929, M.S. University of Georgia 1930, Ph.D. Duke University 1934, joined the Department of Physics of the University of Tennessee in 1948 where she served until her retirement in 1972.

Isabel H. Tipton's specialized research activities encompassed the fields of spectroscopy and health physics. She was recognized widely for numerous publications in professional journals and monographs on the trace mineral content of human tissues sent to her from around the world. She was one of the first recipients of the Alumni Outstanding Teaching Award.

Contributed by Jennifer Tipton

My mother was Dr. Isabel H. Tipton, who was a Professor in the UT Physics Department from 1948 to 1972. She was born Isabel Hanson on June 17, 1909, in Monroe, Georgia. Her mother was a primary school teacher and her father a high school math teacher and principal. She had two younger brothers. Her father chose to use the Montessori method to educate his two eldest children. He taught my mother through the third grade. I have always credited him with the fact that my mother used her mind more deeply and thoroughly than anyone else I have known.

When my mother graduated from Girls' High School in Atlanta in 1925 she went to the University of Georgia in Athens. She wanted to be a chemist but the chemistry department would have nothing to do with a woman. The physics department, on the other hand, accepted her with open arms. In 1929 she received her BS and in 1930 her MS from the University of Georgia. She went on to Duke University for her continuing graduate work where she met my father, Samuel Ridley Tipton, a zoologist, and received her PhD in 1934. She and my father were married in 1935 in the throes of the Depression. My father managed to find a job, but my mother decided that she would be a mother and proceeded to have me and my three brothers. She returned to work 10 years later as a physicist, joining my father at the University of Tennessee where she garnered much acclaim. She was an excellent teacher and her research is still relevant. She published 30 articles in peer-reviewed journals and her papers have received 2500+ citations (25 in 2014 and 10 in 2015, reflecting that her work still has an impact today). In 1962 she became the coach for the College Bowl, a national television program that pitted school teams of four scholars against each other challenging them to answer difficult questions in all fields. The UT team consisted of Joe Gorman, Anne Dempster, David Rubin, and Harold Wimberly. This cracker-jack team managed to get to the last confrontation—which they lost. But my mother was often called "Coach of the Year" for that accomplishment. She was selected for the UT Alumni Association's Outstanding Teacher Award in 1966. After her retirement UT honored her by dedicating a Graduate Study Room in the UT Library to her.

I have set up a scholarship in her name at the University of Tennessee to help students in the physics department, primarily women. I do hope that you will join me with contributions in the name of Dr. Isabel Hanson Tipton.

Jennifer Tipton is an award-winning lighting director in New York. To contribute to the scholarship she has established honoring Dr. Tipton, please contact Don Eisenberg at (865) 974-2504 or don@utfi.org.

The Physics Top 10 List

In the Fall Of 2010, CrossSections began 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.

#1

Title: "First results from KamLAND: Evidence for reactor antineutrino disappearance

Authors: K. Eguchi et al.

Journal: *Physical Review Letters* **90** 21802 (2003)

Times Cited: 1,570 (as of 6/30/2015)

Summary

Courtesy of Dr. Bill Bugg, Professor Emeritus UT Physics and Astronomy

This seminal paper presented the first results from the KamLAND detector, demonstrating conclusively the disappearance of electron antineutrinos from well understood reactor sources and strengthening considerably the proposed neutrino oscillation solution of the "solar neutrino problem:" the apparent deficit of neutrinos emitted from the sun. Roughly speaking, the initial results were deduced from the observation of approximately one neutrino event/day compared to the expected rate of two events/day. Subsequent KamLAND measurements with greater statistical weight then conclusively confirmed in detail the predictions of the neutrino oscillation hypothesis and confirmed the non-zero mass of the neutrino. These measurements and the role of the UT High Energy Physics (UTHEP) group in the construction and operation of the KamLAND detector were discussed in the Spring/Summer 2014 issue of CrossSections.

UTHEP participation in the KamLAND experiment involved some rather unusual features. Detectors are normally built by experimental physicists with the hope of discovery and measurement of previously unobserved phenomena. One builds equipment, tests it, takes data for a preliminary period to pinpoint deficiencies and remedies them, and then continues with the experiment. The KamLAND experiment was a totally different experience. Due to its size and complex design, involving thousands of tons of buffer oil enclosed in an 18m diameter steel containment vessel--separated internally from 1000 tons of liquid scintillator by a thin plastic balloon and surrounded by over 1800 giant photomultipliers--access to its interior components after closure for repairs would have been almost impossible. The distinction from a normal physics experiment is analogous to building a car and an airplane. Cars may be recalled but an airplane has to work the first time. Therefore, KamLAND construction required over two years of advanced planning, selection of components, concern about long-term reliability and possible component interference. These considerations were complicated by the fact that the detector was to be located in a deep underground mine and buried in a water-filled cavern surrounded by an array of photomultipliers to veto external backgrounds. The challenges of safety and logistics constraints in this environment also were of key importance in the planning. Actual construction took over two years with contributions from large teams of professors, post-docs, students, and technicians from many institutions.

The success of these efforts is exemplified by the fact that KamLAND has run almost continuously for over 14 years without major difficulty, measuring neutrinos from nuclear reactors 100km to 800km away and improving the precision measurement of neutrino oscillation parameters. From the excitement of the initial disappearance results in this paper to the measurement of the total energy released by radioactive materials in the center of the Earth, KamLAND data has proved of great interest. Its future will involve the introduction of a Xe source into the center of the detector to study double Beta decay.

Wanda Ferrell didn't plan a career in climate research, but her penchant for following new opportunities led her down that path to a successful tenure at the U.S. Department of Energy.

Dr. Wanda Ferrell (left) accepts the 2015 Physics Distinguished Alumnus Award from Dr. Hanno Weitering.

Ferrell, a 1985 Ph.D. graduate from UT Physics, joined the DOE Atmospheric Radiation Measurement (ARM) Program management team in 1994. She was program manager of the ARM Climate Research Facility as well as the Climate Information & Data Management group. She was a strong supporter of interagency and international collaborations, including field research sites in the Azores, Manus, Papua New Guinea, Australia, Alaska, Oklahoma, and mobile facilities at sites both in the U.S. and abroad. Data from these endeavors have contributed to numerous significant advances in climate models.

In 2013 the American Meteorological Society awarded Ferrell the prestigious Cleveland Abbe Award for Distinguished Service to Atmospheric Sciences, which also made her a fellow of the AMS. This April the department named her the 2015 Distinguished Alumnus in recognition of exemplary leadership and distinguished service to atmospheric sciences and climate research (see more about our Spring Honors on page 10). Here, she answers questions about her background and career.

Q. Where are you from originally?

A. I grew up in the Shenandoah Valley of Virginia near Staunton.

Q. Were you always interested in physics?

A. My mother worked with chemists at DuPont so I was interested in chemistry until I had physics in high school. After that I was hooked.

Q. What led you to Clemson for your master's degree?

A. After receiving my bachelor's from Bridgewater College, I examined my options for graduate school. I decided that Clemson University was a good option for physics, and the full fellowship was a key factor. I enjoyed the classes and the social atmosphere of Clemson and completed a theoretical thesis. I was the first woman in the graduate physics program. I taught at the Greenville campus of Clemson University for two years following my master's and taught classes in Boone (at Appalachian State University) during the year before I started at UT.

Q. What was the UT Physics Department like during your grad school days?

A. The faculty were excellent scientists but also had strong teaching skills. Professors Richard Present, Ed Harris, and Paul Huray gave crisp lectures and rigorous exams. My time at UT was divided between classes and the graduate carrels that promoted interactions among the students. Senior graduate students were engaged in their research and mentored many of the entering students.

Q. Did you work primarily at Oak Ridge National Laboratory or were you on campus for your research?

A. My research project was at ORNL in Sam Hurst's group. My official advisor was Rufus Ritchie, a surface state physicist; Dr. Ritchie had a joint appointment with UT. When I first started at ORNL I was working with Winston Chen, but then moved to work with Ray Garrett and Marvin Payne.

Q. What was your first appointment after finishing the Ph.D.?

A. My first appointment was a postdoc at ORNL. I was offered a job at the Department of Energy before finishing the postdoc.

Q. What drew you to the DOE and work in atmospheric sciences?

A. I moved to the Washington area a few years after joining DOE and was fortunate to be one of the original members of the U.S. Global Change Research Office. The USGCRP was codified by Congress through the Global Change Research Act of 1990 and was a vibrant federal program when I joined the office. During my tenure at the office I broadened my resume to include climate research.

Q. You carried a great deal of responsibility with the ARM Climate Research Facility. What was your first major task when you started? What do you consider the greatest rewards from working with the program, and what are you most proud of?

A. In six years of managing the science program, I was able to steer the direction of the science and interact with incredible scientists. As the program manager of the facility, I was able to shape the tools for scientific investigation that have resulted in scientific advances. I am very proud of leading a program that grew and evolved over the years and that met the challenge of always keeping the science vibrant and relevant. I was very honored to become a fellow of the American Meteorological Society and to receive the Cleveland Abbe award for distinguished service to atmospheric science. I was fortunate to have a job that was very rewarding and never boring.

Q. How do you like to spend your time now, following your June 2014 retirement?

A. I retired to spend more time with my family, primarily my daughter and three grandsons. This has been my major focus, but I am also interested in photography and genealogy. I am still in transition from work to retirement.

Q. If you were advising a beginning student in physics (or any other field), what advice would you offer?

A. The future is an exciting adventure with many interesting challenges and many opportunities to tackle exciting problems. The skills and knowledge that you will develop at UT will prepare you to excel in your chosen career. Never settle for the mundane but always strive to keep your research fresh and vital and be open to new challenges.

Radar engineers lead the installation of the scanning ARM cloud radar at the Atmospheric Radiation Measurement (ARM) Mobile Facility site in Hyytiala, Finland, in 2014. During her tenure in ARM management, Wanda Ferrell (Ph.D., 1985) was a strong supporter of mobile facilities like these. Data from such studies have contributed to numerous significant advances in climate models.

(Photo courtesy of DOE/ARM)

Spring 2015 Honors

When physics students accepted their accolades at this year's Honors Day celebration on April 20, many shook hands with Dr. Björn Jonson, who has some experience handing out scientific honors considering he's the former chairman of the Nobel Committee for Physics.

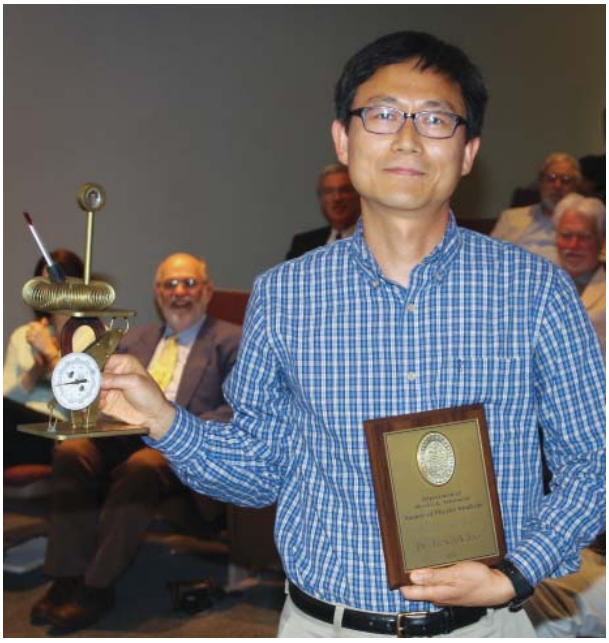
Jonson was in town to give talks at UT and Oak Ridge National Laboratory, but was kind enough to assist as undergraduate and graduate students were recognized for their academic, research, leadership, and service contributions at the April 20 affair. The guest of honor, however, was **Dr. Wanda Ferrell** (Ph.D., 1985), who won the Distinguished Alumni Award (see profile on page 8).

Ferrell delivered the Honors Day talk, outlining her path from UT to the U.S. Department of Energy, where she was program manager for the Atmospheric Radiation Measurement (ARM) Climate Research Facility, as well as the Climate Information and Data Management Group. ARM's mission is to improve climate and earth models, and Ferrell described her post as "the best job in the federal government." Over the course of her tenure, ARM used data from permanent and later mobile and aerial sites to create ever-more sophisticated climate models. She retired in 2014 after 20 years in leadership. Success, Ferrell told the students, is in the eye of the beholder. For her, it was the opportunity to make a difference.

"I had the hand on the helm and was able to steer the big ship," she said.

In 2013 the American Meteorological Society honored Ferrell with the Cleveland Abbe Award for Distinguished Service to Atmospheric Sciences, which also made her a Fellow of the American Meteorological Society. The department named her the 2015 Distinguished Alumnus "for exemplary leadership and distinguished service to atmospheric sciences and climate research."

Thirteen student awards, along with the Teacher of Year Award and the induction of new members into Sigma Pi Sigma, the Physics Honor Society, comprised the heart of the program. New this year was the **James E. Parks Award**, named for the Director of Undergraduate Laboratories and Associate Department Head. Physics alumnus **Richard Manley** (B.S., 2001; M.S., 2003) **and his wife Melissa** established this award in early 2015 to honor Dr. Parks' commitment to hands-on, innovative physics teaching in a laboratory setting.



Dr. Jaewook Joo (left) was the 2015 Society of Physics Students Teacher of the Year. Dr. Björn Jonson, Professor Emeritus with the Department of Fundamental Physics at Chalmers University of Technology in Sweden, was a guest presenter at the Honors Day ceremony (he's pictured above, right, with Fowler-Marion Awardee Matthew Bailey).

2015 Honors Day Awardees

Outstanding First Year Student	Grant Bruer
Robert Talley Award for Outstanding Undergraduate Research	Meg Stuart
Robert Talley Award for Outstanding Undergraduate Leadership	Louis Varriano
James W. McConnell Award for Academic Excellence	Matthew Murphy
Douglas V. Roseberry Award	Allison Sachs
Robert W. Lide Citation	Matthew Murphy
Outstanding GTA Award	Eric Stacy and Eleftherios Moschandreou
Outstanding Tutor Award	Meg Stuart
Colloquium Award	Ganesh Pokharel
Stelson Fellowship for Beginning Research	Nirav Patel
Stelson Fellowship for Professional Promise	Thomas Papatheodore
Fowler-Marion Award	Matthew Bailey
James E. Parks Award (introduced this year)	Eleftherios Moschandreou
Society of Physics Students Teacher of the Year Award	Jaewook Joo
Sigma Pi Sigma Inductees	Kristen Beard, Spencer Beloin, Amos Manneschmidt, Allison Sachs, and Meg Stuart

The 2015 Honors Day ceremony introduced the James E. Parks Award, established by physics alumnus Richard Manley and his wife Melissa to honor Dr. Parks (above), Director of the Undergraduate Laboratories, for his dedication to innovative teaching laboratory development.

For more on Honors Day, including a photo album and award citations, visit: https://tiny.utk.edu/physhonors2015

Chancellor's Honors

The Physics Department claimed a number of Chancellor's Honors on April 8 at the annual spring banquet. **The Society of Physics Students** was recognized for Extraordinary Community Service for their outreach efforts, including the Saturday Science Club program at Pond Gap Elementary School and physics demos on Market Square. Undergraduate **Meg Stuart** was a double honoree, claiming honors for both Extraordinary Academic Achievement and Extraordinary Professional Promise. In the latter category, the department had six students recognized. In addition to Stuart, **Eduardo Antonio Coello, Zhiling Dun, Oliver Hamil, David Morse, and David Surmick** were all honored.

News from the Physics Family

Faculty

As of February 1, **Professor George Siopsis** is Director of the Governor's School for Sciences and Engineering. Serving the top high school students in Tennessee, the program dates to 1985 and offers a four-week noncredit program. Students enroll in two courses taught by university faculty. In the Governor's School for the Sciences, they take Thinking and Communicating Scientifically, as well as an elective from biology, chemistry, mathematics, or physics. The Governor's School for Engineering focuses on materials science and engineering. With that post the department welcomes **Jessica Brannon** to our front office. She is the program coordinator for the program and a graduate of UT Chattanooga. She has worked with UT Knoxville since 2008 and began her current job with the Governor's School in 2013.

Students

Congratulations to our Spring 2015 graduates!

Bachelor's Degrees

- **David Byron Butterfield**
- **Kennon Andrew Carlisle**
- **Jimmy Phillip Caylor**
- **Jacob James Dean**
- **Matthew Douglas Murphy**
- **Aaron Christian Partin**
- **Derek Russell Partington**
- **Allison Morgan Sachs**

Graduate Degrees

- **Mohammad Faleh M. Al Shudifat (PhD)**
- **Noah Watson Birge (MS)**
- **Joshua Brian Braverman (PhD)**
- **Mark Miller Foerster (MS)**
- **Michael Jonathan Witte (MS)**
- **Yuen Yiu (PhD)**

Congratulations to graduate students **Kayla Craycraft and Cody Wiggins** on winning prestigious fellowships. Craycraft was awarded a Jefferson Science Associates/ Jefferson Lab Graduate Fellowship. She is working with **Assistant Professor Nadia Fomin**. Wiggins won an Integrated University Program (IUP) fellowship from the U.S. Department of Energy Nuclear Energy University Program. He will be doing research with Professor Arthur Ruggles in Nuclear Engineering on positron emission particle tracking for flow measurements.

It's been a busy year for undergraduate physics major **Meg Stuart**. In January she won a best presentation award at the American Physical Society Conference for Undergraduate Women in Physics and this spring she was awarded two Chancellor's Honors (see page 11). This summer she's working at the Large Hadron Collider at

SPS Accolades

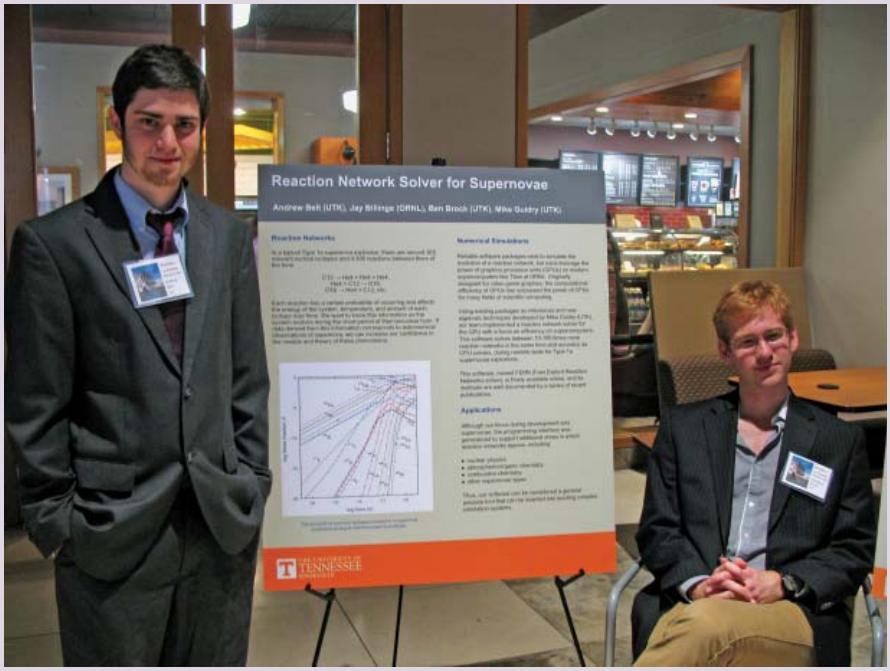
The Society of Physics Students continues to gain attention for their enthusiasm and outreach activities. Their Market Square demos got a nod in the national SPS magazine, and earlier this summer they won a Blake Lilly Prize from the national organization. This is the second such honor for UT's chapter, which won the award in 2004 for TECOP, the Tennessee Cosmic ray Observatory Project. The prize recognizes SPS chapters who "make a genuine effort to positively influence the attitudes of school children and the general public about physics." The honor was established in 1996 by the family of the late Blake Lilly, a student at Georgia Tech, and is given in his honor. SPS was also recognized with a Chancellor's Honor this year for Extraordinary Community Service.

National SPS attention has been commonplace for the UT chapter in recent years. They've been recognized as an Outstanding Chapter three times since 2011, with one Honorable Mention. Learn more about SPS at their website: http://www.utksps.org/.

SPS helped start a "Saturday Science Club" at Pond Gap Elementary School to encourage kids' interest in science.

Posters at the Library

When February's weather prevented undergraduates from Tennessee from heading to Posters at the Capitol in Nashville to showcase their work, improvisations were quickly made. Instead, students from UT's Knoxville campus (eight in all; three working with physics professors) attended Posters at the Library at Hodges Library. **Andrew Belt, Benjamin Brock, (pictured at right) and Louis Varriano** presented their posters and answered questions about their research. Belt and Brock both worked with **Professor Mike Guidry** and ORNL's **Jay Jay Billings** (M.S., 2008), while Varriano worked with **Professor Yuri Kamyshkov**. A description of their projects is available online: http://ugresearch.utk.edu/posters-at-the-capitol-2015/.



CERN as part of her research with the Relativistic Heavy Ion Physics Group. Read more about the department's involvement with the LHC's second run at http://www.phys.utk.edu/news/2015/news-04162015-lhc.html.

Gifts in Action

The importance of our scholarship program was evident with the department's impressive showing at EURēCA: the Exhibition of Undergraduate Research and Creative Achievement in April, where three physics scholarship students won the following awards:

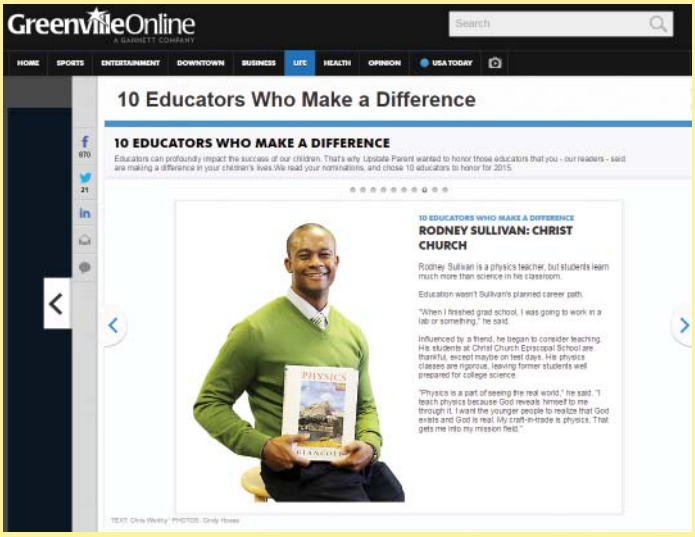
- **David Morse** (College Scholars Honors): Phi Kappa Phi Best of Show; Gold ORE Award in Natural Sciences; 1st Place, Cellular, Molecular, and Microbiology, College of Arts and Sciences
- **Amos Manneschmidt**: 1st Place, Physical Sciences, College of Arts & Sciences
- **Louis Varriano**: 1st Place, Physical Sciences, College of Arts and Sciences

Staff

Astronomy Outreach Director **Paul Lewis** (pictured at left) hosted solar observations and planetarium programs for the Destination Imagination visitors who came to campus for the global finals in June. Destination Imagination (DI) is a non-profit organization dedicated to fostering students' curiosity, courage and creativity through open-ended STEM, fine arts and service learning challenges.

Remember that "The Roof" of the Nielsen Physics Building is open for telescope observations on the first and third Fridays of every month, weather permitting. Be sure to check out the schedule at: http://www.phys.utk.edu/trdc/telescope.html.

Physics Family



Alumni

Nasrin Mirsaleh-Kohan (Ph.D., 2008), assistant professor in the Texas Woman's University Department of Chemistry and Biochemistry, and her student Sidrah Khan showcased their research on understanding interaction of anticancer drugs with DNA during the 2015 "Texas Undergraduate Research Day at the Capitol" March 4 in Austin.

Olga Ovchinnikova (B.S., 2005; Ph.D., 2011) has joined the Center for Nanophase Materials Sciences at Oak Ridge National Laboratory. She will combine her expertise in chemical imaging and laser spectroscopy with chemical functionality activities and research across the Nanomaterials Synthesis and Functional Assembly area.

Congratulations to **Rodney Sullivan** (Ph.D. in Chemical Physics, 2004) on being voted one of "10 Educators Who Make a Difference" by Upstate Parent, part of *The Greenville News* in South Carolina (see left). Rodney teaches physics at Christ Church Episcopal School in Greenville.

In Memoriam

The department was deeply saddened by the passing of **Sara Harris and Tina Riedinger**.

Sara Harris, widow of the late **Professor Ed Harris,** passed away on February 27 at the age of 89. She was a graduate of Knoxville High School who married her high school sweetheart and moved to Texas, where she helped work his way through medical school. She was widowed early and returned to Knoxville, where she majored in English and French at UT and met Dr. Harris. She later returned to school to pursue her passion for Anthropology. Even after Ed's retirement, she and Dr. Harris remained beloved members of the physics family.

Professor Ed Harris and Sara Harris

Tina Riedinger passed away on March 6 at the age of 71 following a battle with cancer. She graduated with a bachelor's degree from Villa Madonna College (now Thomas More College) in 1965 and earned a master's degree in physics at Vanderbilt University in 1967. She won a Woodrow Wilson Fellowship, which required her to give a lecture to demonstrate her communication and potential teaching skills and in doing so she discovered a true gift for teaching. She taught physical science and astronomy courses at UT from 1973 until 2003, earning tremendous respect as a superb educator. She took that love for astronomy and teaching with her when she served on the Semester at Sea faculty in spring 2010. She was also heavily involved with public astronomy outreach as well as departmental and university service. Riedinger was known for her wide range of interests, including hiking, dancing, sports and travel. She and her husband, **Physics Professor and Bredesen Center Director Lee Riedinger**, were known for the generous hospitality they offered faculty, students, colleagues, and visitors. She will be greatly missed.

Tina Riedinger

Thanks to our Donors

The department is pleased to acknowledge the generosity of our donors for their support:

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(Gift records forwarded to the department dated November 1, 2014 to May 31, 2015.)

Giving Opportunities

Thank you for your interest in supporting the Department of Physics and Astronomy. You can "help where it's needed most" by giving to the Physics Enrichment Fund, which funds a range of priorities. You can also contribute to a specific scholarship, fellowship, or other support fund. See our website for opportunities at http://www.phys.utk.edu/alumni-physics/giving.html.

If you'd like to explore more options for supporting students, faculty, equipment or other priorities in Physics, Don Eisenberg would welcome your call at 865-974-2504 or your e-mail at don@utfi.org. You can also donate online by going to http://artsci.utk.edu/ and clicking on "Give to the College of Arts and Sciences."

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