

Talley Selected for Computational Physics Workshop

March 1, 2013



Graduate Student Kemper Talley is well aware that the nucleus is not merely a fascinating subatomic model with no connection to the larger world. He works with UT Physics Professor Witek Nazarewicz and Mark Williams of Oak Ridge National Laboratory, and his interest lies in building on fundamental science to solve real-world problems, particularly in the field of energy. He'll have the opportunity to expand his computational physics portfolio this summer when he attends the 10-week Computational Physics Student Summer Workshop at Los Alamos National Laboratory (LANL), beginning in June. Among this year's workshop topics are turbulence modeling, algorithms for shock hydrodynamics, and energy minimization for nuclear fission. Talley will receive a generous fellowship from LANL to attend and is one of 24 students accepted to the program following a competitive selection process.

Talley is a member of the inaugural class of graduate students enrolled at UT through the Bredesen Center for Interdisciplinary Research and Graduate Education, a joint venture between the university and ORNL. The Bredesen Center's goal is to advance science, technology, engineering, and mathematics research related to energy, and it offers doctoral fellowships to exceptional applicants to pursue those efforts through their graduate studies. This approach persuaded Talley to come UT, as did the influence of Physics Professor and Bredesen Center Director Lee Riedinger.

"This is really what I want to be doing: interdisciplinary research that ties fundamentals in physics to real world problems of nuclear engineering," Talley explained. "I think this program facilitates that process in a way I could never have anticipated."

Talley's work with Nazarewicz and Williams involves nuclear theory and data as related to energy problems, specifically with **SCALE** (<http://scale.ornl.gov/>): a comprehensive modeling and simulation program for nuclear safety analysis and design. The project's capabilities include radiation shielding and reactor physics, with applications in areas like materials processing and fuel fabrication, recycling, and transportation. Talley is updating neutron codes and tables for SCALE to add missing data and results from new measurements and theoretical models. The more complete this catalog, the more valuable it will become for future considerations such as new reactor design and testing. His theoretical work at UT is focused on beta decay of nuclides produced in fission of actinide nuclei. When a heavy nucleus such as uranium overcomes the strong nuclear force that holds it together, it splits into two smaller nuclei. This is the phenomenon behind nuclear reactors, as well as the atomic bomb. Talley's thesis entails gaining a clearer picture of nuclear processes in a reactor by creating a model incorporating the pre-fission nucleus to the delayed neutron emission of daughter nuclei. His project is computationally intensive and it will be carried out on ORNL's TITAN and UT's KRAKEN supercomputers.

To this end, Talley anticipates the LANL workshop will expand his knowledge of computational physics in a variety of areas. At Los Alamos, he will also have the opportunity to discuss with his colleagues and local scientists his fission-related work.

The relationship of nuclear physics and engineering is not Talley's first experience working on interdisciplinary research through UT. As an undergraduate at Clemson University, he was part of a Research Experiences for Undergraduates program in biophysics, where he worked with UT Professor

Engin Serpersu and his graduate student Adrienne Norris in Biochemistry and Cellular and Molecular Biology. This group studies the interaction of antibiotics with enzymes that modify them and eliminate their antibacterial effects.

Selection to the LANL workshop is the latest of several honors Talley has garnered in his academic career. In 2011, he was awarded a National Science Foundation Graduate Research Fellowship. As an undergraduate, he was named Outstanding Senior in both the College of Engineering and Science and the Department of Physics and Astronomy. He graduated from Clemson University with a bachelor's degree in physics in 2011 and joined the Bredesen Center graduate program that fall.