PHYSICS AND ASTRONOMY COLLOQUIUM

William Peters , Ph.D.

Oak Ridge National Laboratory

The Positives of Detecting Neutral Particles: From Astrophysics to Nuclear Security

The stellar nucleosynthesis r-process is thought to produce over half of the elements above iron. The explosive rp-process that is believed to power X-ray bursts is responsible for producing many elements below mass 100. Experiments that require neutron detection can measure important quantities for both of these processes. In addition, nonproliferation agencies detect neutrons for monitoring and accountability. For instance, one of the most promising non-destructive assay (NDA) methods on UF6 containers, used as part of the Uranium Fuel Cycle, consists of measuring gross neutron rates induced by uranium-decay alpha particles reacting with the fluorine. This method, however, currently lacks reliable nuclear data on the 19F(α,n) reaction cross section to determine an accurate neutron yield rate for a given sample of UF6.

Indeed, the utility of neutrons is just as extensive as their charged siblings. Generally, neutrons are more difficult to detect with high efficiency, especially in tight geometries required for nuclear physics experiments. The Versatile Array of Neutron Detectors at Low Energy (VANDLE), of which I lead the development, opens doors to a variety of new neutron-ejecting experiments at current and future nuclear physics facilities. I will discuss some of the unique capabilities of VANDLE and highlights from my current research efforts with it including: beta-delayed neutron spectroscopy to study the r-process; a pioneering proton-transfer experiment on 56Ni to study a waiting point of the rp-process; and an ambitious two-part experiment to fully characterize the 19F(α,n) cross section for the National Nuclear Security Agency.

TUESDAY, MARCH 3, 2015 | 4:00 PM | HAWKING AUDITORIUM