Colloquium

How to Get a Better Non-Destructive Assay; Enrichment Detection with Neutrons

Dr. William A. Peters
University Tennessee

Wednesday, March 20 ❖ 4:00 P.M. ❖ 118 NSH

Refreshments at 3:30 P.M. in 202 NSH

The detection of enriched uranium and other fissile material is of particular importance to nonproliferation monitoring and radiological clean-up efforts around the globe. Fluorine (^{19}F) is commonly used with actinide compounds (e.g., UF_6, UF_4, PuF_4) in the nuclear fuel cycle and for long term storage. The $^{19}F(\alpha,n)^{22}Na$ reaction, driven by the α particles from actinide-decay, generates a neutron signal that can be used to determine the quantity of enriched material inside a container. The accuracy of this measurement depends linearly on the poorly-known $^{19}F(\alpha,n)^{22}Na$ cross section. One goal of our new grant from the National Nuclear Security Administration is to measure the $^{19}F(\alpha,n)^{22}Na$ cross section using the Versatile Array of Neutron Detectors at Low Energy (VANDLE) with both fluorine and α beams. We plan to completely characterize this reaction by measuring the neutron spectrum and improve upon the previous cross section measurements. This work is a collaborative effort including Idaho National Laboratory, Oak Ridge National Laboratory, Rutgers University, the University of Tennessee, and the University of Notre Dame. Details of our plans as well as recent test results for this project will be presented. I will also discuss the unique capabilities of VANDLE and future plans for other applied research, plus display preliminary data from an experiment concerning the $^{56}Ni(p,\gamma)$ bottle-neck reaction in the *rp* process of nucleosynthesis.

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