Nuclear Seminar

Neutron Spectroscopy without Time-of-Flight: (d,n) and (^{3}He,n) Measurements Using DSP-based Deuterated Scintillators

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Room 124 Nieuwland Science Hall

Deuterated liquid scintillation detectors have shown promising results as neutron spectrometers for nuclear science and other applications. Unlike normal hydrogen-based scintillators, they can provide neutron spectroscopic information without time-of-flight (ToF), allowing for close proximity to the neutron source for good angular coverage and absolute detector efficiency. Likewise DC-beams can then be used with higher intensity than a typical pulsed beam, resulting in a significant advantage. We have developed, extensively evaluated and fully characterized an array of such detectors (The University of Michigan Deuterated Scintillator Array: UM-DSA). Digital Pulse-Shape Discrimination (DPSD) using fast waveform digitizers (1-2 GS/s) is employed to permit not only separation of neutron and gamma events but also various recoils from nuclear reactions within the scintillator with subsequent improvements in the neutron spectra extracted. The instrumental techniques and detector developmental program will be discussed, along with applications in homeland security and nuclear non-proliferation in addition to nuclear science measurements. Finally, a series of (d,n) and (^{3}He,n) experiments performed recently at the UND Nuclear Structure Laboratory will be used to illustrate the advantage of these detectors for nuclear reaction measurements, including those using exotic beams. This work supported by US NSF and US DHS.

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