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Development of the Detector Array for Energy Measurement of Neutrons (DAEMON)

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As one moves away from stable isotopes and deeper into the neutron-rich region, the likelihood of β-delayed neutron (βn) emission decay increases. The ability to understand the neutron emission probabilities and the neutron energy spectrum can reveal highly sensitive detail of the nuclear structure that a conventional β-decay study using only γ-ray detection cannot. We propose to build the Detector Array for Energy Measurements of Neutrons (DAEMON) that will employ the time-of-flight technique to enable high-resolution energy measurements of the neutrons emitted following βn emission. The initial trials, performed at the University of Guelph, testing the rudimentary geometries of EJ200 plastic scintillators and various electronic parameters of silicon photomultiplier (SiPM) arrays for the foundation of DAEMON will be presented. Upon successful comparison of tests with gamma sources with simulations data, the DAEMON prototype will be tested with the monoenergetic neutron beam at the University of Kentucky Accelerator Laboratory. Used in conjunction with the GRIFFIN Decay Station at TRIUMF in Vancouver, BC, DAEMON will establish a frontier for βn studies currently non-existent at the facility and therefore initiating a road to strong international collaborations. From shaping the abundance curve of the astrophysical rapid neutron capture process, as well as controlling the neutron induced fission in nuclear reactions, the building of a neutron detector will address a broad arena of physics.

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