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## **Beta-delayed Neutron Spectroscopy with VANDLE, Evidence for Gamow-Teller Decay of $^{78}\text{Ni}$ Core**

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The beta-delayed neutron emission of neutron-rich isotopes near  $^{78}\text{Ni}$  and  $^{132}\text{Sn}$  regions were studied using the neutron time-of-flight technique with Versatile Array of Neutron Detectors at Low Energies (VANDLE). We have measured neutron energy spectra, which showed emission from states at excitation energies high above neutron separation energy. This effect was previously not observed in the beta-decay of mid-mass nuclei. For the example cases of  $^{83,84}\text{Ge}$ , large decay strength deduced from the observed intense neutron emission is a signature of Gamow-Teller transformation and was interpreted as evidence for allowed beta-decay to core-excited states of  $^{78}\text{Ni}$ . To describe the observed features of this decay, we have developed shell model calculations in the proton  $\text{fpg}9/2$ , and neutrons extended  $\text{fpg}9/2+\text{d}5/2$  valence space using realistic interactions. Enhanced and concentrated beta-decay strength for neutron-unbound states may be common for very neutron-rich nuclei and would lead to intense beta-delayed high-energy neutrons or multi-neutron emission probabilities that in turn will affect astrophysical nucleosynthesis models.

**Primary author:** Prof. GRZYWACZ, Robert (University of Tennessee)

**Presenter:** Prof. GRZYWACZ, Robert (University of Tennessee)