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Investigation of New Approaches to Ultra-cold Neutron Production at IUCF

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Ultra-cold neutrons (UCN) can be produced beyond the thermal limits using superfluid He and solid deuterium. We have started systematic investigations into other systems that could potentially be an efficient UCN converter at the Indiana University Cyclotron Facility (IUCF). The candidate material needs to have a large density of states which allows the incident cold neutrons to couple to leading to fast downscattering, and more importantly, the source needs to have a small neutron absorption that allows the number density of UCN to accumulate. Our team has recently demonstrated experimentally that solid oxygen can be used to produce UCN through mechanisms different from the previous sources. In this talk, I will first summarize the experimental results, and then address the seemingly different physics of UCN production in the low-temperature magnetic phases of solid oxygen. The contrast between the alpha and beta phases strongly suggests the magnetic origin of the UCN production in solid oxygen.