

Benjamin Jones – Colloquium – October 9, 2025  
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**Title:** Single Barium Ion Identification Technologies for Background-Free Neutrinoless DoubleBeta Decay Searches

**Abstract:** The goal of future neutrinoless double beta decay experiments is to establish whether neutrino is its own antiparticle, by searching for an ultra-rare decay process with a half life that may be more than  $10^{28}$  years. Such a discovery would have major implications for cosmology and particle physics, but requires multi-ton-scale detectors with backgrounds below 0.1 counts per ton per year. This is a formidable technological challenge that seems likely to require unconventional solutions. In this talk I will discuss new technologies emerging at the interfaces between nuclear physics, microscopy, AMO physics, and biochemistry that aim to identify the single  $^{136}\text{Ba}$  daughter nucleus produced in double beta decays of the isotope  $^{136}\text{Xe}$ . If these atoms or ions can be collected and imaged with sufficiently high efficiency, the radiogenic backgrounds limiting the sensitivity of all existing technologies could be entirely mitigated. This would enable a new class of large scale, ultra-low background neutrinoless double beta decay experiments.