

New Windows on Fundamental Physics: from tabletop devices to large scale detectors



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NuBits and QuBits with Single Molecule Fluorescence

Wednesday, 21 January 2026 15:00 (30 minutes)

Determining the nature of the neutrino mass is an extremely difficult technological problem that appears likely to require unconventional solutions. To this end, our group has been developing single-molecule fluorescence imaging based sensors to tag the individual Ba²⁺ ions produced in the decay of xenon-136 through integrated photonic chips with organic sensing monolayers. Such structures can not only help to illuminate the nature of the neutrino, but may also serve as substrates for quantum memory, if and only if a robust connection can be provided between nuclear spin degrees of freedom and molecular fluorescence. This interdisciplinary challenge requires coordinated advances in molecular engineering, device fabrication and ODMR-enhanced optical microscopy. I will discuss the applications of these techniques in both the contexts of both neutrino physics and quantum memory.

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