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Instrumentation for Resolving Nuclear Recoils in Argon Based TPCs

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Novel detection methods for nuclear recoil (NR) imaging have the potential to allow one to resolve weak signatures from Coherent Elastic Neutrino Nucleus Scattering (CEνNS) as a method to probe an exciting frontier of attractive new physics. CEνNS is postulated to be a critical background to future dark matter (DM) searches and measurements of these interactions in LAr targets may serve as a way to explore fundamental properties of neutrinos, lepton unitarity, sterile neutrino candidates, and the existence of new mediator particles. In this poster, we present our work at the University of California, Santa Barbara in the development of low threshold detectors using LArCADe anode geometries as well as nuclear recoil tracking in argon gas. LArCADe is a project being pursued jointly with colleagues at Fermilab aimed at increasing the scope of single-phase LArTPCs to be sensitive to nuclear recoil ionization signatures by means of charge amplification devices. In principle, this is achieved by using anodes with tip-like structures to create electric field amplification in highly localized regions. We present Monte Carlo predictions of stable charge amplification in LAr using this method with a microphysics simulation of electron transport in LAr across a range of anode configurations. The second component of our poster is an exploration of our abilities to resolve O(10-100) μm tracks originating from O(10-100s) keV sources with a GAr TPC. We will present details and available simulation studies of a potential apparatus that uses GEM-based readout electronics.

Early Career

No

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