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Direct Dark Matter detection with RES-NOVA cryogenic detectors using archaeological-Pb

The quest to understand dark matter (DM) continues to be a driving force in astrophysics and particle physics. This talk discusses the potential of the RES-NOVA project, envisioned for detecting astrophysical neutrinos via Coherent Elastic Neutrino-Nucleus Scattering (CEvNS), to also serve as a DM observatory. Leveraging the array of cryogenic detectors made from archaeological Pb, known for its ultra-high radiopurity, RES-NOVA is uniquely positioned to detect both neutrino and DM interactions via nuclear recoils. The use of Pb significantly enhances the interaction cross-section for neutrinos and DM, making it an ideal candidate for astrophysical phenomena investigation. By extending the operational principles and sensitivity of CEvNS-based detectors, RES-NOVA may also be capable of observing DM particles from our galactic halo.

This talk will present the theoretical implications of using RES-NOVA as a dual-purpose detector for both neutrino and dark matter studies, covering its design, expected sensitivity, and preliminary background model tailored to identifying potential DM signals. We will also discuss sensitivity studies that extend beyond traditional spin-independent DM interactions to include spin-dependent interactions, leveraging the unique properties of Pb isotopes. This capability positions RES-NOVA as a powerful tool for a comprehensive DM search within the galactic halo.

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