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Low Threshold Germanium Detectors for Neutrino-Nucleus Elastic Scattering and the Studies of its Quantum-Mechanical Coherency Effects

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Neutrino Nucleus Elastic Scattering (νA_{el}) offers a unique laboratory to study Quantum Mechanical superpositions in electroweak interactions, towards which several experimental programs are being actively pursued. In the TEXONO experiment, we are currently focused to measure the νA_{el} cross-section for the reactor neutrinos (E_ν <10 MeV) at Kuo-Sheng Reactor Neutrino Laboratory (KSNL) [1]. We are using the state-of-art point contact Germanium detector technology with the advance pulse-tube electro-cool mechanism to probe this small nuclear recoil process. We will report our status and plan for achieving low threshold & background with Germanium detectors at KSNL. We also identified a new parameter (α) to describe the degree of coherency in νA_{el}, which depends on incoming neutrino energy, detector threshold, and target nucleus [2]. The description of νA_{el} process in terms of α is complementary to the conventional descriptions with nuclear form factors based on the many-body physics in the nucleon-nucleus interplay. We derive three possible formulations to measure α, based on (a) Nuclear Physics (b) Quantum Mechanical description and (c) Data driven description [3]. We found that coherency is mostly complete (α >95%) for νA_{el} with reactor and solar neutrinos for Xe/CsI, Ge and Ar targets, whereas coherency is only partial for DAR-π and weak for atmospheric neutrinos. Accordingly, studies of νA_{el} with different neutrino sources provide complementary information and cover the transitions from completely coherent to decoherent states. We also exclude the complete coherency and decoherency conditions for COHERENT (CsI) data and project the sensitivity for reactor νA_{el} with Ge detector.

1. Research program towards observation of neutrino-nucleus coherent scattering., H. T. Wong et al., J. Conf. Ser. 39, 266 (2006).
2. Coherency in neutrino-nucleus elastic scattering., S. Kerman et al., Phys. Rev. D93, 113006 (2016).
3. Studies of quantum-mechanical coherency effects in neutrino-nucleus elastic scattering. V. Sharma et al., Phys. Rev. D 103, 092002 (2021).

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