Contribution ID: **113** Type: **Oral**

Non-Standard Neutrino Interactions with Coherent Elastic Neutrino-Nucleus Scattering at TEXONO

Wednesday 27 August 2025 18:20 (20 minutes)

Coherent Elastic Neutrino-Nucleus Scattering (CEνNS) is a tree-level neutral-current process described within the Standard Model (SM). CEνNS serves as a crucial channel for testing the SM of electroweak theory and exploring potential new physics at low energies. Since its first detection[1], significant efforts, including the TEXONO experiment, have focused on detecting and improving our understanding of this process. The TEXONO Collaboration conducts an intensive research program on low-energy neutrino physics at the Kuo-Sheng Nuclear Power Plant in Taiwan, detecting low-energy electron antineutrinos with high-purity germanium (Ge) detectors[2].
We present the first comprehensive NSI analysis of TEXONO CEνNS data, using both nPC-Ge(2016) and the recently upgraded pPC-Ge(2025)[3] detectors, which have threshold energies of 300 eV and 200 eV, respectively. Our study explores all possible NSI types –vector (V), axial-vector (A), scalar (S), pseudoscalar (P), and tensor (T) –through both a simplified model with light mediators and model-independent approaches. We demonstrate that TEXONO pPC-Ge data significantly improve the sensitivity over the earlier nPC-Ge data, and offer competitive constraints compared to other reactor neutrino experiments[4]. Our results highlight the critical role of CEνNS experiments in advancing neutrino physics and probing interactions beyond the SM.

References

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[3] S. Karmakar et al. [TEXONO Collaboration], "New Limits on Coherent Neutrino Nucleus Elastic Scattering Cross Section at the Kuo-Sheng Reactor Neutrino Laboratory.", Physical Review Letters, 134(12), 121802.

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Collaboration you are representing

TEXONO

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Session Classification: Neutrino Physics and Astrophysics

Track Classification: Neutrino Physics and Astrophysics