



Contribution ID: 55

Type: Talk

Precision probes of electroweak and BSM physics with coherent elastic neutrino-nucleus scattering: Insights from CONUS+ and prospects at the upcoming European spallation source

Tuesday 10 June 2025 14:44 (18 minutes)

With the rapid advancement of low-energy neutrino experiments, coherent elastic neutrino-nucleus scattering (CE ν NS) has become a powerful tool for precision studies in both Standard Model (SM) and beyond-the-Standard-Model physics. I will present our recent works based on recent and projected phenomenological studies of CE ν NS at two key facilities: the CONUS+ reactor experiment [1] and the upcoming European Spallation Source (ESS) [2]. From the latest CONUS+ data, which have recently detected reactor-based CE ν NS signal at 3.7σ significance [3], we have derived the constraints on the weak mixing angle and bounds on neutrino electromagnetic properties, including magnetic moment, charge radius, and electric millicharge. We also have investigated light mediators within the neutrino generalized interactions (NGIs) framework. For the ESS, we have performed a detailed sensitivity projection using its anticipated high-intensity neutrino flux and diverse proposed detector technologies. We have obtained precision estimates for SM parameters such as the weak mixing angle and neutron nuclear rms radii, as well as projected limits on NGI couplings across a wide range of mediator masses. Additionally, we have explored electromagnetic upscattering production of sterile neutral leptons via dipole portal scenarios. These results underscore the growing role of CE ν NS as a precision frontier in neutrino physics, with current measurements already yielding impactful constraints and future experiments poised to significantly expand the reach of both electroweak and new physics searches.

References:

- [1] A. Chattaraj, Anirban Majumdar, and R. Srivastava, “**Probing Standard Model and Beyond with Reactor CE ν NS Data of CONUS+ Experiment**,” *Physics Letters B*, Vol. 864 (2025), 139438, arXiv:2501.12441 [hep-ph].
- [2] A. Chattaraj, Anirban Majumdar, D. K. Papoulias, and R. Srivastava, “**Probing conventional and new physics at the ESS with coherent elastic neutrino-nucleus scattering**,” *Journal of High Energy Physics*, Vol. 05 (2025), 064, arXiv:2501.12443 [hep-ph].
- [3] [CONUS+ Collaboration], N. Ackermann et al., “**First observation of reactor antineutrinos by coherent scattering**,” arXiv:2501.05206 [hep-ex].

Authors: Mr CHATTARAJ, Ayan (Indian Institute of Science, Education & Research - Bhopal); Mr MAJUMDAR, Anirban (Indian Institute of Science, Education & Research - Bhopal); Dr PAPOULIAS, Dimitrios (Institut de Física Corpuscular (CSIC/Universitat de València)); Dr SRIVASTAVA, Rahul (Indian Institute of Science, Education & Research - Bhopal)

Presenter: Mr MAJUMDAR, Anirban (Indian Institute of Science, Education & Research - Bhopal)

Session Classification: Phenomenology 3