

Overview on coherent elastic neutrino nucleus scattering and successful first detections

Wednesday 2 April 2025 14:45 (30 minutes)

Coherent elastic neutrino nucleus scattering (CEvNS) refers to the standard model process when the neutrino interacts with the nucleus as a whole. The cross section is enhanced by the neutron number squared of the target nucleus, which is ideal for a precision test of the standard model and to look for physics beyond the standard model. Neutrino energies below 50 MeV are required for a coherent interaction. The observable is the tiny recoil of the nucleus hit by the neutrino, which poses a huge challenge on the noise threshold of the detectors. A multitude of experiments with different technologies at different neutrino energies is desirable. The COHERENT collaboration was the first to observe CEvNS at the spallation neutron source at the Oak Ridge national laboratory, USA, with a CsI scintillating crystal in 2017. This was followed by two more successful observations, the most recent one in 2023 with high-purity germanium (HPGe) spectrometers. At lower neutrino energies, the CONUS collaboration also employs HPGe detectors at the Leibstadt power plant, Switzerland, to observe CEvNS for the first time at reactor site with the first data taking run concluded in 2024. The NUCLEUS experiment located at the Chooz reactor, France, and currently under commissioning aims at achieving the lowest energy threshold of these experiments with their cryogenic calorimeters. In my talk, I will present the current status of these experiments and achieved results followed by an outlook on the future.

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Session Classification: Invited Overview Talks / Hauptvorträge