Type: Poster

COHERENT's New Tonne-Scale Nal Detector

Wednesday 22 March 2023 16:18 (3 minutes)

The COHERENT collaboration operates a multi-target suite of low-threshold neutrino detectors at the Spallation Neutron Source (SNS) at Oak Ridge National Laboratory. These detectors are uniquely equipped to observe the dominant low-energy ($E_{\nu} \sim 10$ s of MeV) interaction of coherent elastic neutrino-nucleus scattering (CE ν NS). The only experimental trace is a nuclear recoil of mere tens of keV. To probe the distinctive neutron-number-squared scaling of CE ν NS's Standard Model cross sections, COHERENT invokes the spice of life: variety. The CE ν NS detector targets thus far range across CsI, LAr, Ge, and NaI.

The COHERENT program is expanding, and a large scintillating NaI[Tl] detector—christened NaI Neutrino Experiment TonnE-scale (NaI ν ETe)—is among the new generation. Tasked with measuring CE ν NS on the relatively light ²³Na nucleus, its design capitalizes on a custom dual-gain PMT base to facilitate simultaneous measurements of CE ν NS on ²³Na and of charged-current interactions on ¹²⁷I. Each of the five modules will contain 63 of the 7.7-kg crystals, a total mass of over 2.4 T. The first test module (470kg) of NaI ν ETe is configured for a CE ν NS search and taking production data. Adding to this successful deployment, subsequent modules are in construction and will be deployed in 2023.

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