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COHERENT's New Tonne-Scale NaI Detector

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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 ($E_\nu \sim$ 10s of MeV) interaction of coherent elastic neutrino-nucleus scattering (CEνNS). The only experimental trace is a nuclear recoil of mere tens of keV. To probe the distinctive neutron-number-squared scaling of CEνNS's Standard Model cross sections, COHERENT invokes the spice of life: variety. The CEνNS 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 (NaIνETe)—is among the new generation. Tasked with measuring CEνNS on the relatively light ^{23}Na nucleus, its design capitalizes on a custom dual-gain PMT base to facilitate simultaneous measurements of CEνNS on ^{23}Na and of charged-current interactions on ^{127}I. 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 NaIνETe is configured for a CEνNS 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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