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Searching for Majorana neutrinos with nEXO

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Despite tremendous progress in understanding the fundamental properties of neutrinos over the past decades, several key questions remain unanswered. In particular, we do not yet know if neutrinos are Majorana particles, i.e., are neutrinos and antineutrinos identical? The most sensitive experimental probe of the Majorana nature of the neutrino is to search for the lepton-number violating neutrinoless double-beta decay (0νββ). A positive observation of this decay mode would confirm that neutrinos are Majorona particles and demonstrate physics that is not explained by the Standard Model. Several collaborations worldwide are searching for 0νββ in different isotopes with various detector technologies, yet, an observation is still outstanding. Sensitivity limits on the half-life of this decay are on the order of 10^25 to 10^26 years.
In order to increase the sensitivity to 0νββ decays the nEXO collaboration is developing a time-projection chamber with 5 tonnes of liquid xenon, enriched in the isotope Xe-136. Events inside the detector create ionization charges and scintillation light that are being recorded by a segmented anode and a photon sensor array, respectively. This simultaneous measurement allows a full reconstruction of an event's location, multiplicity, and energy. The anticipated energy resolution is 1% at the Q-value. The nEXO detector is being designed to improve the current 0νββ decay half-life measurement by almost two orders of magnitude, and it is anticipated to be located at the CryoPit at SNOLAB.

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