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Progress and future of neutrino-less double-beta decay search by the KamLAND-Zen experiment

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Neutrino-less double-beta (0νββ) decay is a rare nuclear process with profound implications for verifying the Majorana nature of neutrinos and determining their masses. The Majorana nature of neutrinos is crucial for understanding neutrino properties and the origin of the matter-dominant universe.

The KamLAND-Zen experiment, located at the Kamioka underground laboratory in Japan, has been at the forefront of the search for 0νββ decays for more than a decade. The experiment started a search for 0νββ decay of xenon-136 nuclei in 2011 (KamLAND-Zen 400), which was upgraded in 2019 by doubling the number of xenon nuclei and a tenfold reduction in uranium and thorium contamination (KamLAND-Zen 800). In addition, many new analytical technics has been developed, including particle identification with neural network. A combined analysis of the KamLAND-Zen 400 and 800 dataset has provided the world's most stringent limits on the effective Majorana neutrino mass of 36-156 meV with different nuclear matrix elements. This result establishes KamLAND-Zen as a pioneering effort in the global pursuit to unravel the fundamental properties of the neutrino.

The KamLAND-Zen collaboration has taken the next step forward: The upcoming phase of KamLAND-Zen, KamLAND2-Zen, will employ a new high light-yield liquid scintillator, light collecting mirror, high quantum efficiency photomultipliers and new readout electronics to increase sensitivity.

This poster presentation aims to outline the current status and future directions of research and development for the KamLAND2-Zen experiment.

Poster prize

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