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The Quest for No Neutrinos: Probing the Majorana Nature with LEGEND-200

Thursday, October 2, 2025 3:00 PM (25 minutes)

The LEGEND collaboration aims to uncover the fundamental nature of neutrinos, specifically whether they are Majorana particles, by searching for neutrinoless double-beta ($0\nu\beta\beta$) decay in ^{76}Ge ($Q_{\beta\beta} = 2039$ keV). In the currently operating phase, LEGEND-200, up to 200 kg of isotopically enriched high-purity germanium (HPGe) detectors are deployed bare in a liquid argon (LAr) cryostat. To identify and suppress backgrounds, the LAr is instrumented to detect scintillation light signals, which are guided by wavelength-shifting fibers to silicon photomultiplier (SiPM) detector units. By combining high-radiopurity components, detector pulse-shape discrimination, and the liquid argon anti-coincidence system, world-leading background levels in the field of $0\nu\beta\beta$ are achieved in the region of interest. In this talk, we present the latest results from LEGEND-200 [arXiv:2505.10440], including the limits on the half-life of neutrinoless double-beta decay in ^{76}Ge and the corresponding effective Majorana mass range. The performance of the HPGe detectors - especially of the newly developed inverted-coaxial designs - will be discussed. The impact of the instrumented LAr environment and its interplay with optically active components will be highlighted. Finally, an outlook on the future of the experiment will be provided.

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