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The LEGEND Experiment for Neutrinoless Double Beta Decay

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Elucidating the Majorana-Dirac nature of the neutrino remains a long-standing question, a discovery of which would provide unique and powerful insight into the building blocks of our Universe. The LEGEND (Large Enriched Germanium Experiment for Neutrinoless double beta Decay) experiment is designed to answer this very question. Using a large array of high-purity germanium (HPGe) detectors enriched in the candidate isotope of Ge-76, LEGEND will search for neutrinoless double beta decay in a phased approach. These detectors are operated in a bath of LAr, from which scintillation light is detected via optical fibers connected to Si photomultipliers (SiPMs) to veto external backgrounds. The first phase is LEGEND-200, which is currently taking data and uses up to 200 kg HPGe detectors at LNGS in the existing GERDA cryostat. The next phase is the next-generation LEGEND-1000, which will employ 1000 kg of HPGe detectors in a quasi-background free environment, thanks to excellent radiopurity of components, high energy resolution of the HPGe detectors, and the utilization of underground-sourced LAr. The experiment will run at a to-be-determined underground facility, where we expect to have less than one background count in the neutrinoless double beta decay region-of-interest and to lead to an unambiguous discovery in the case of the inverted hierarchy of neutrino masses. In this talk, I will discuss the underlying principles of the LEGEND experiment, the current status of LEGEND-200, and the prospects of LEGEND-1000.

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