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Dark Matter Searches with the LEGEND Experiment

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The LEGEND (Large Enriched Germanium Experiment for Neutrinoless Double beta decay) is a phased approach for the detection of neutrinoless double beta decay (0vBB) in the Ge-76 candidate isotope for this rare decay. The experimental concept is to deploy high-purity germanium detectors enriched in Ge-76 underground, operated in a bath of liquid argon, which acts as both a shield and a veto mechanism via scintillation. The current phase, LEGEND-200, consists of 140 kg of HPGe detectors (with more to be installed later this year) and is in stable data taking mode at LNGS, with an exposure goal of 1 ton-year. The future LEGEND-1000 phase will consist of 1 ton of HPGe detectors operated in a bath of underground-sourced liquid argon, which will have drastically reduced cosmogenic backgrounds originating from the argon, leading to a quasi background-free spectrum at the ROI for 0vBB (2.039 MeV) after 10 ton-years of exposure.

The scientific results expected from LEGEND encompass more than 0vBB, but a wide range of beyond-standard-model (BSM) physics, including various dark matter (DM) candidates. The precursor experiments, Majorana and GERDA, have had a strong history of BSM searches, and we will continue these efforts in LEGEND. Majorana, for instance, has recent results on searches for exotic dark matter models, from sterile neutrino DM, absorption of fermionic DM, to bosonic DM. With the larger exposure and lower backgrounds expected in the LEGEND experiment as compared to Majorana and GERDA, many of the previous DM searches are expected to be improved upon, as well as having sensitivity to other recently investigated DM models, such as multiple interacting ultraheavy DM. In this talk, I will review the LEGEND experimental concept, predicted backgrounds, and various dark matter candidates that the experiment is well-poised to detect for both the current LEGEND-200 phase and the next-generation LEGEND-1000 phase.

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