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The final result of GERDA and the physics potential of LEGEND

Hidden by their tiny mass, neutrinos may carry a profound secret with far-reaching consequences for both particle physics and cosmology. Given zero electric charge and no color, they may be Majorana particles - fermions which are their own anti-particles. Double beta decay offers a unique probe for this hypothesis. Finding solely two electrons sharing the full available decay energy, would prove lepton number non-conservation and reveal the Majorana character of neutrinos. The superb spectroscopic performance of high-purity germanium detectors provides exceptional discovery potential for the mono-energetic peak and separates it from the standard-model allowed continuum. The Germanium Detector Array (GERDA) experiment has searched for this decay, operating 40 kg of enriched germanium in an instrumented low-background liquid argon environment. In a total exposure of more than 100 kg·yr, taken under record-low background conditions, no signal was found. The corresponding half-life limit is $>1.8 \cdot 10^{26}$ yr at 90% C.L., and coincides with the median sensitivity for the null hypothesis. Under standard assumptions and given the most recent nuclear structure calculations for Ge-76, the effective Majorana neutrino mass is constrained to $<[79,180]$ meV. The Large Enriched Germanium Experiment for Neutrinoless double beta Decay (LEGEND) is about to carry on with this search. The initial 200-kg phase, LEGEND-200, is currently under construction and is going to reach a half-life sensitivity one order of magnitude above the current limits, while LEGEND-1000 will have sensitivity beyond 10^{28} yr and probe the full parameter space spanned by the inverted ordering scenario. I will present major building blocks of the final GERDA result, provide the status of the LEGEND experimental program and discuss the implications for the field.

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