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FACHBEREICH PHYSIK

Graduiertenkolleg 2149
Research Training Group

Allgemeines Physikalisches Kolloquium

Donnerstag, 07.01.2021 um 16 Uhr c.t.
Online-Kolloquium

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The quest for Majorana neutrinos with GERDA and LEGEND

Since neutrinos have no electric charges, they may be their own antiparticles, referred to as Majorana neutrinos, and thus violate lepton number conservation. Neutrinoless double beta decay ($0\nu\beta\beta$) would be a direct consequence, and the search for this decay mode is the most sensitive method to unravel the Majorana nature of neutrinos. By operating bare germanium diodes, enriched in Ge-76, in an active liquid argon shield, GERDA achieved an unprecedently low background index of 5.2×10^{-4} counts/keV kg yr in the signal region and met the design goal to collect an exposure of 100 kg yr in a background-free regime. When combined with the result of Phase I, no signal is observed after 127.2 kg yr of total exposure. A limit on the half-life of $0\nu\beta\beta$ decay in Ge-76 is set at $T_{1/2} > 1.8 \times 10^{26}$ yr at 90% C.L. [1], which coincides with the sensitivity assuming no signal. Majorana neutrino masses are therefore are constrained to $m_{\beta\beta} < 79–180$ meV at 90% C.L..
The new LEGEND Collaboration was founded in 2016 to develop a phased, Ge-76-based double-beta decay experimental program with discovery potential a half-life beyond 10^{28} years, using existing resources as appropriate to expedite physics results. Its first stage, LEGEND-200, is currently under preparation, re-purposing the GERDA experimental infrastructures at LNGS, Italy, and is scheduled to go into commissioning in 2021. In parallel, we are preparing the design for the ton-scale LEGEND-1000 stage of the experiment. In this talk, I will present the final results of GERDA and discuss the preparatory works and plans for LEGEND.

[1] Final Results of GERDA on the Search for Neutrinoless Double β Decay,
https://journals.aps.org/prl/pdf/10.1103/PhysRevLett.125.252502

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Passwort: Phys20-21