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GERDA: Phase I results & upgrade for Phase II

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The Germanium Detector Array (GERDA) experiment, located underground in the Gran Sasso National Laboratory of INFN, Italy, is searching for the neutrinoless double beta decay (0nbb) of Ge-76. It uses a new shielding concept by operating bare Ge diodes enriched in Ge-76 in 64 m^3 of liquid argon supplemented by a 3m thick layer of water. The experiment aims at exploring the 0nbb decay up to a half life of 1.4x10^26 yr in two phases:

Phase I of the experiment has been concluded last year. No signal is observed and the so far best limit is derived for the half life of the 0nbb decay of Ge-76, T1/20n > 2.1x10^25 yr (90% C.L.), after an exposure of 21.6 kg yr. The result refutes an earlier claim of discovery with high probability. The background index of 1x10^-2 cts/(keV kg yr) is lower by about one order of magnitude compared to previous experiments.

The upgrade to GERDA PhaseII is in progress. It strives for a further reduction of background by another order of magnitude to a level of 10^-3 cts/(keV kg yr). The detector mass will be increased by ~20 kg of new Broad Energy Germanium (BEGe) detectors from enriched Ge-76, which exhibit superior pulse shape discrimination and hence background rejection power. Low mass detector holders, cold front-end electronics, contacting and cabling schemes are redesigned for ultra low mass and radiopurity. In addition, a retractable liquid argon veto system will be installed to efficiently suppress backgrounds that induce scintillation light in the liquid argon. A hybrid solution of photomultipliers and silicon photomultipliers coupled to scintillating fibers was chosen. This talk gives an account of the results and the challenging modifications to meet our design goals.

Primary author: Ms WEGMANN, Anne (Max-Planck Institut für Kernphysik)

Presenter: Ms WEGMANN, Anne (Max-Planck Institut für Kernphysik)

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