Contribution ID: **352** Type: **not specified**

Search for neutrinoless double beta decay with GERDA

Tuesday, 4 June 2019 17:30 (20 minutes)

The GERDA experiment searches for the neutrinoless double beta decay ($0\nu\beta\beta$) of ^{76}Ge. It uses HPGe detectors enriched in the isotope ^{76}Ge, which are directly immersed into liquid argon (LAr). In Phase II, the radio-pure cryogenic liquid acts not only as cooling medium for the detectors and passive shielding but also as active shielding. Due to the active veto system detecting LAr scintillation light, the superior energy resolution and an improved background recognition, already the initial release of Phase II showed a background rate in the energy region of interest (ROI), after pulse shape discrimination and liquid argon veto cuts, in the range of a few counts/(ROI·ton·yr). This made GERDA the first $0\nu\beta\beta$ experiment being background free up to its design exposure of 100 kg·yr.

With the latest data release in mid 2018, comprising a total exposure of 82.4 kg·yr, GERDA remained in the background free regime. It is the first experiment to surpass a median sensitivity on the half-life of 10^{26} yr for $0\nu\beta\beta$ decay. No signal has been observed and a lower limit of $0.9 \cdot 10^{26}$ yr (90 % C.L.) has been derived. Meanwhile the experiment has been upgraded by deploying also a new type of germanium detector and by improving the LAr instrumentation. In this talk we will present the basic concept of the GERDA design and the present physics results. Moreover, we will focus on the background contributions at $Q_{\beta\beta}$. Results on the performance of the upgraded experimental setup will be discussed.

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Abstract Title

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Session Classification: Parallel Session Neutrinos