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New data release of GERDA Phase II: search for 0νββ decay of 76Ge

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The GERmanium Detector Array (GERDA) experiment at the INFN Gran Sasso Laboratory, Italy, is searching for the neutrinoless double beta (0νββ) decay of the isotope ^{76}Ge. High-purity germanium crystals enriched in ^{76}Ge, simultaneously used as source and detector, are directly deployed into ultra-pure cryogenic liquid argon, which acts both as cooling medium and shield against the external radiation. The signature of the 0νββ decay would be a mono-energetic peak at the $Q_{\beta\beta}$-value of the process, namely 2039 keV for ^{76}Ge.

Data from the first phase of GERDA (Phase I), collected between 2011 and 2013, gave no positive indication of the 0νββ decay of ^{76}Ge with an exposure of about 20 kg·yr and a background index at the $Q_{\beta\beta}$-value of 10^{-2} counts/(keV·kg·yr). A lower limit on the half-life of the process of $T_{1/2} > 2.1 \cdot 10^{25}$ yr (90% C.L.) was set.

The second phase of the experiment is taking data since end of 2015: newly developed custom-made BEGe-type Germanium detectors add 20 kg of mass and allow for a superior background rejection by pulse shape discrimination while the instrumentation of the cryogenic liquid surrounding the detectors acts as additional active veto and assures a further background suppression.

Initial results from Phase II with about 10 kg·yr exposure (published in Nature vol. 544, April 6th 2017) allow to improve the limit on the half-life of 0νββ decay of ^{76}Ge to $T_{1/2} > 5.3 \cdot 10^{25}$ yr (90% C.L.) and indicate that the target background of 10^{-3} counts/(keV·kg·yr) is achieved, thus making GERDA the first experiment in the field which will be "background free" up to the design exposure of 100 kg·yr. At present, while the data taking is in progress, a valid exposure of 34 kg·yr has been accumulated taking into account the runs until April 15th 2017. In this talk I will summarize the basic concept of the GERDA design, the data taking and the physics results obtained in Phase II. A special focus will be given to the background achieved at $Q_{\beta\beta}$ and to the analysis of the residual background components. I will then show the results of the data unblinding of June 2017 and the expected performances for the full 100 kg·yr exposure.

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