

Referee report to the 49th PAC at JINR on “GERDA project”

GERDA experiment searches for neutrinoless double β -decay of ^{76}Ge , which is in particular motivated by the question on whether neutrino is Majorana or Dirac particle. Neutrinoless double β -decay violates lepton number conservation and, hence Standard Model (SM) of particle physics forbids its existence; thus, one might go beyond SM in this experiment.

^{76}Ge detectors are immersed into liquid argon; scintillations in liquid argon serve also to veto background events. The expected background within ROI is lower than one event up to the design exposure of 100 kg·year, thus providing first background-free experiment on neutrinoless double β -decay. The project assumes a staged approach with the detector mass increasing from one experiment to another, thus increasing the experiment sensitivity, also the energy resolution and pulsed shape discrimination capability. The stages are GERDA Phase I (performed), GERDA Phase 2 (has been started), and the next-generation project previewed in two stages LEGEND-200 and LEGEND-1000.

The project goals are ambitious and realistic. The plan of their implementation is sound. The feasibility of realization of the proposed experimental program is confirmed by the progress done with the first steps and the sound record of publications in high-ranked journals so far.

As there could not be many analogous expensive international experiments of such a scale, it will have a few competitors. This uniqueness of the setup has two sides. First, an evidently correct focus of the team on the main experiment. Second, this(ese) setup(s) could be probably used for other sensitive/precision experiments after completion of the main program. I propose (optionally) to consider possible other applications of this unique setup(s).

With their major contribution to GERDA, the JINR and JINR scientists have a leading role in this project. I strongly support the project.

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