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Searching for the neutrinoless double beta decay with GERDA

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Neutrinoless double beta ($0\nu\beta\beta$) decay is a lepton-number violating process which is predicted by many extensions of the Standard Model.
It could be the key to understand the nature of the neutrino. If observed, it would prove its Majorana nature and the half-life of the decay would be
a direct measure of the yet unknown absolute scale of the neutrino-mass,
assuming the massive neutrino exchange as the dominant process.

The GERmanium Detector Array (GERDA) experiment at the INFN,
Gran Sasso Laboratory, Italy, is searching for the $0\nu\beta\beta$ decay of the
isotope ^{76}Ge. High-purity germanium crystals enriched in ^{76}Ge are
the source and the detector simultaneously. The key design feature of
GERDA is that detectors are deployed directly into an ultrapure cryogenic liquid (liquid argon), acting both as cooling medium
and radiation shield against the external radiation.

After a major detector upgrade a second Phase (Phase II) of the experiment started
in December 2015.
Newly developed, custom-made BEGe-type
germanium detectors made out of enriched material were deployed in
the setup, allowing for a superior background rejection
by pulse shape discrimination. The background
suppression was further improved thanks to an active veto which detects the liquid argon scintillation light.

This presentation will summarize the basic concept of the GERDA
design, the recent physics results from Phase II, the status and future perspectives
of the $0\nu\beta\beta$ decay search using ^{76}Ge.

Primary author: Prof. BRUGNERA, Riccardo (Padova University and INFN Padova)

Presenter: Prof. BRUGNERA, Riccardo (Padova University and INFN Padova)

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