The MAJORANA DEMONSTRATOR is a neutrinoless double-beta decay experiment using enriched germanium as source and detector. The DEMONSTRATOR is currently operating underground at the 4850’ level of the Sanford Underground Research Facility.

The goals for the DEMONSTRATOR are:
1) Demonstrate background levels low enough to justify building a tonne scale experiment.
2) Establish the feasibility of constructing & fielding modular arrays of Ge detectors.
3) Search for additional physics beyond the Standard Model, such as solar axions and dark matter.

Energy resolution of 2.5 keV FWHM @ 2039 keV is the best of any ββ-decay experiment.

- Background Goal in the ββ-peak after analysis cuts with the achieved resolution: 2.5 counts/(FWHM yr)
- Projected backgrounds based on assay results ≤ 2.2 counts/(FWHM yr)

- 44.1 kg of Ge detectors
- 29.7 kg of 88% enriched 66Ge crystals
- 14.6 kg of 76Ge
- Detector Technology: P-type, point-contact.
- 2 independent cryostats
- Ultra-clean, electroformed Cu
- 22 kg of detectors per cryostat
- Naturally scalable
- Ultra-low-activity components and construction
- Compact Shield
- Low-background passive Cu and Pb shield with active muon veto

MAJORANA PPC HPGe Detector
Advantages

- Sub-keV energy thresholds possible (< 100 eV)
- Excellent energy resolution (0.4 keV FWHM at 0.4 keV)
- Excellent pulse shape discrimination
- Ultra-low background components, including underground electroformed Cu
- Reduced cosmogenic activation in our enriched detectors from surface exposure control

Majorana Experimental Setup

Current Limits and Sensitivity Projections for Selected Rare Event Searches

- Projections for vector and pseudoscalar bosonic dark matter based on previous results, which correspond to data in blue in the energy spectrum in Figure 4, and current background levels.
- 4106 kg-d of enriched exposure corresponds to all open data up to March 2017, 12208 kg-d corresponds to the estimated exposure of all low-background open and blind data through December 2017, including natural detectors.

Vector Dark Matter

Pseudoscalar Bosonic Dark Matter

Low-Mass WIMPs

References

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