HK 21: Astroparticle Physics I

Time: Monday 16:00–17:30 Location: HK-H10

Group Report HK 21.1 Mon 16:00 HK-H10

The Search for Neutrinoless Double-Beta Decay with LEGEND — •Michael Willers for the LEGEND-Collaboration — Physik-Department, Technische Universität München, Germany

The **L**arge **E**nriched **G**ermanium **E**xperiment for **N**eutrinoless $\beta\beta$ **D**ecay (LEGEND) is a ton-scale, ^{76}Ge-based, neutrinoless double-beta ($0\nu\beta\beta$) decay experimental program with a discovery potential at half-lifes longer than 10^{28} years.

LEGEND employs a phased approach that enables the collaboration to gradually increase the detector mass and exposure, and at the same time reduce the background in the signal region of interest. The first, 200 kg, phase of the experiment (LEGEND-200) is being actively commissioned at the Gran Sasso underground laboratory (Laboratori Nazionali del Gran Sasso, LNGS) in Italy and data taking will start in 2022. The ton-scale phase of the experiment (LEGEND-1000) is currently in the conceptual design stage and construction is projected to start as early as 2025.

In this contribution, the ongoing commissioning activities at LNGS and the potential of LEGEND-200 will be presented and the prospects for the future ton-scale phase LEGEND-1000 will be discussed.

This work is supported in part by the German Research Foundation via the collaborative research center *SFB1258* and the cluster of excellence *ORIGINS*, the German Federal Ministry for Education and Research, and the Max-Planck Society.

Group Report HK 21.2 Mon 16:30 HK-H10

Detecting CEνNS and beyond with the CONUS reactor neutrino experiment — •Aurelie Bonhomme for the CONUS-Collaboration — Max Planck Institut für Kernphysik (MPIK), Heidelberg

The detection of neutrinos through coherent elastic neutrino-nucleus scattering (CEνNS) process opens a new window to study the fundamental properties of this elusive particle and to probe physics beyond the Standard Model. The CONUS experiment - operational since April 2018 - is located at 17m from the 3.9GW$_{\mathrm{th}}$ core of the nuclear power plant Brokdorf (Germany) and aims to detect CEνNS in the fully coherent regime with four 1 kg-sized HPGe point-contact detectors with a $\sim$300eV$_{\mathrm{ee}}$ energy threshold. The full spectral analysis of the first CONUS dataset allowed to set the current best limit on CEνNS with reactor antineutrinos and to bring competitive limits on physics beyond the standard model, such as non-standard neutrino interactions or neutrino magnetic moment. These new results will be presented in this talk. Furthermore, a special emphasis will be put on the strategy followed by the collaboration to further reduce the uncertainties, in particular via a dedicated measurement of the ionization quenching factor of nuclear recoils in germanium.

HK 21.3 Mon 17:00 HK-H10

New results on the ^{76}Ge double beta decay with neutrinos and exotic decay modes from GERDA Phase II — •Elisabetta Bossio for the GERDA-Collaboration — Physik Department, Technische Universität München, Garching, Germany

Two-neutrino double beta ($2\nu\beta\beta$) decays are amongst the rarest nuclear processes ever observed. Precision studies of the electron sum energies require ultra-low background and an excellent understanding of the experiment's response. Both are key features of the Germanium Detector Array (GERDA) experiment, which searched for neutrino-less double beta ($0\nu\beta\beta$) decay with enriched high purity germanium detectors in Liquid Argon at Laboratori Nazionali del Gran Sasso (LNGS) in Italy. The measurement of the Standard Model $2\nu\beta\beta$ decay half-life of ^{76}Ge was performed with unprecedented precision, profiting from the high signal-to-background ratio and the small systematic uncertainties. It provides essential inputs for nuclear structure calculations, that benefit the interpretation of $0\nu\beta\beta$ decay results. Furthermore, the search for distortions of the $2\nu\beta\beta$ decay spectrum allows exploring new physics, like $0\nu\beta\beta$ decay with Majorons emission, Lorentz invariance, or search for sterile neutrinos. The new results of the ^{76}Ge $2\nu\beta\beta$ decay half-life and improved limits on exotic decay modes will be presented in this talk. This research is supported by the BMBF through the Verbundforschung 05A20WO2 and by the DFG through the Excellence Cluster ORIGINS and the SFB1258.

HK 21.4 Mon 17:15 HK-H10

Constraining the $^{77(m)}$Ge Production with GERDA Data and Implications for LEGEND-1000 — •Moritz Neuberger[1], Luigi Pertoldi[1], Stefan Schönert[1], and Christoph Wiesinger[1,2] for the GERDA-Collaboration — [1]Physik-Department E15, Technische Universität München — [2]Max-Planck-Institut für Physik (Werner-Heisenberg-Institut) Föhringer Ring 6 80805 München

The delayed decay of $^{77(m)}$Ge, produced by neutron capture on ^{76}Ge, is a potential background for the next-generation neutrino-less double-beta decay experiment LEGEND-1000, especially when considering the alternative LNGS site. Based on Monte Carlo simulations, various mitigation strategies and suppression techniques have been proposed to tackle this background [1,2]. In this talk we will present first results on $^{77(m)}$Ge searches in the full GERDA data. Given the very similar configuration - bare germanium detectors in liquid argon - it serves as a benchmark for our LEGEND-1000 predictions. This research was supported by the BMBF through the Verbundforschung 05A20WO2 and by the DFG through the SFB1258 and Excellence Cluster ORIGINS.

[1] C. Wiesinger et al., Eur. Phys. J. C (2018) 78: 597

[2] LEGEND-1000 pCDR, arXiv 2107.11462