HK 41: Astroparticle Physics II

Zeit: Mittwoch 16:30–18:15 Raum: S1/01 A02

Gruppenbericht HK 41.1 Mi 16:30 S1/01 A02

Status and Prospects of the COBRA $0\nu\beta\beta$ Experiment — •Robert Temminghoff for the COBRA-Collaboration — TU Dortmund, Exp. Physik IV

COBRA is a next-generation low-background experiment aiming to search for neutrinoless double beta-decay ($0\nu\beta\beta$) based on commercially available CdZnTe semiconductor detectors operated at room temperature.

COBRA is currently in its demonstrator phase. 64 coplanar-grid (CPG) detectors with a total mass of about 400 g are in operation at the LNGS underground laboratory. To reduce the background as much as possible, COBRA relies on passive shielding, the use of radio-pure materials and pulse-shape analysis techniques.

While in principle a total of nine $0\nu\beta\beta$ candidates can be observed in CdZnTe, the main isotope of interest is ^{116}Cd with a Q-value of 2814 keV which is well above the highest naturally occurring γ-line. A high precision measurement of the fourfold forbidden non-unique beta-decay of ^{113}Cd is also possible with the COBRA demonstrator.

This talk will give an overview of the current status and latest results of the COBRA experiment. These include new half-life limits of several candidate isotopes and investigations on the long-term stability of CdZnTe detectors. Plans for using larger detectors in the near future will also be discussed.

Gruppenbericht HK 41.2 Mi 17:00 S1/01 A02

Status of the Gerda Phase II experiment — •Andrea Lazzaro for the GERDA-Collaboration — Physik-Department and Excellence Cluster Universe, Technische Universität München, Germany

The Gerda experiment searches for the neutrinoless double beta decay ($0\nu\beta\beta$) in ^{76}Ge. The first phase of the experiment collected 21.6 kg· yr of exposure with a background index (BI) of 0.01 cts/(keV· kg · yr). No signal was observed and a lower limit for the $0\nu\beta\beta$ half-life was set to $T^{0\nu\beta\beta}_{1/2} < 2.1 \cdot 10^{25}$ yr (90% C.L).

The apparatus has now been upgraded to the Phase II configuration. In Phase II 38 *kg* of HPGe detectors will be operated to reach an exposure of 100 kg· yr. The goal of Gerda Phase II is to lower the BI to 10^{-3} cts/(keV·kg·y), in order to reach the sensitivity for $T^{0\nu\beta\beta}_{1/2} = \mathcal{O}(10^{26})$ yr.

The additional target mass is constituted of 30 custom made BEGe detectors with higher energy resolution and better pulse shape discrimination performance. The detectors are operated in new radio-pure low-mass holders. The liquid argon surrounding the detectors has been instrumented to veto the background events which produce scintillation light.

In this talk the current status and the performance of the Gerda Phase II will be presented.

This work has been partially funded by BMBF.

HK 41.3 Mi 17:30 S1/01 A02

Search for neutrinoless double beta decay beyond GERDA — •Stefan Schönert — Physik-Department, E15, Technische Universität München

The observation of neutrinoless double beta decay (NLDBD) would be an explicit violation of lepton number conservation and indicate that neutrinos are their own antiparticles (Majorana particles). The study of NLDBD is therefore viewed as addressing one of the key questions in neutrino physics today. NLDBD of Ge-76 is being studied with the ongoing experiment GERDA, which has the lowest background of all experiments in the field. The proposed experimental program beyond GERDA is presented.

HK 41.4 Mi 17:45 S1/01 A02

Performance of the LAr scintillation veto of Gerda Phase II — •Mark Heisel for the GERDA-Collaboration — Max-Planck-Institut für Kernphysik, Heidelberg

Gerda is an experiment to search for the neutrinoless double beta decay of ^{76}Ge. Results of Phase I have been published in summer 2013 and Gerda has been upgraded to Phase II. To reach the aspired background index of $\sim 10^{-3}$ cts/(keV·kg·yr) for Phase II active background-suppression techniques are applied, including an active liquid argon (LAr) veto. It has been demonstrated with the LArGe test facility that the detection of argon scintillation light can be used to effectively suppress background events in the germanium detectors, which simultaneously deposit energy in the LAr. The light instrumentation consisting of photomuliplier tubes (PMT) and wavelength-shifting fibers connected to silicon photomultipliers (SiPM) has been installed in Gerda. In this talk the low-background design of the LAr veto and its performance during the Phase II start-up will be reported.

HK 41.5 Mi 18:00 S1/01 A02

Characterization of large volume CdZnTe detectors with a quad-grid structure for the COBRA experiment — •Katja Rohatsch for the COBRA-Collaboration — TU Dresden, Institut für Kern- und Teilchenphysik, 01069 Dresden, D

The COBRA experiment uses room temperature semiconductor detectors made of Cadmium-Zinc-Telluride, which contains several double beta isotopes, to search for neutrinoless double beta-decay. To compensate for poor hole transport in CdZnTe the detectors are equipped with a coplanar grid (CPG) instead of a planar anode.

Currently, a demonstrator setup consisting of 64 1 cm^3 CPG-detectors is in operation at the LNGS in Italy to prove the concept and to determine the long-term stability of the detectors and the instrumentation. For a future large scale experiment it is planned to use larger CdZnTe detectors with a volume of 6 cm^3, because of the better surface-to-volume ratio and the higher full energy detection efficiency. This will also reduce the background contribution of surface contaminations.

Before the installation at the LNGS the new detector design is validated and studied in detail. This talk presents a laboratory experiment for the characterization with γ-radiation of 6 cm^3 CdZnTe quad-grid detectors. The anode of such a detector is divided into four sub-CPGs. The characterization routine consists of the determination of the optimal working point and two-dimensional spatially resolved scans with a highly collimated γ-source.