HK 7: Astroteilchenphysik

Zeit: Montag 11:00–12:30 Raum: HSZ-401

Gruppenbericht HK 7.1 Mo 11:00 HSZ-401

Statusbericht für das COBRA Experiment — •Jan Tebrügge für die COBRA-Kollaboration — Experimentelle Physik IV, TU Dortmund

Das COBRA Experiment sucht nach dem neutrinolosen doppel-beta Zerfall in CdZnTe Halbleiterdetektoren, insbesondere von Cd-116 und Te-130.

Der Nachweis dieses Zerfalls könnte klären, ob Neutrinos Dirac- oder Majorana-Teilchen sind, außerdem wäre die Bestimmung der effektiven Majorana-Masse der Neutrinos möglich.

Im Vortrag werden die beiden Detektortechnologien Coplanar Grid (CPG) und pixellierte Detektoren gezeigt, die parallel erforscht werden. Im aktuellen R&D Aufbau im Gran Sasso Untergrundlabor sind Coplanar Grid Detektoren seit längerem im Einsatz, außerdem sind verschiedene pixellierte Detektoren in Testaufbauten untersucht worden. Des Weiteren werden die Fortschritte des Experiments, u.a. der verbesserte Aufbau und die großen Potentiale der Untergrundreduktion bei Pixeldetektoren und durch Pulse Shape Analyse bei den CPG-Detektoren vorgestellt.

Abschließend werden in einem Ausblick die zu- künftigen Aktivitäten beschrieben.

HK 7.2 Mo 11:30 HSZ-401

Active volume studies with depleted and enriched BEGe detectors — •Katharina von Sturm for the GERDA-Collaboration — Eberhard Karls Universität Tübingen, Germany — Universitá degli Studi di Padova, Italy

The Gerda experiment is currently taking data for the search of the $0\nu\beta\beta$ decay in ^{76}Ge. In 2013, 30 newly manufactured Broad Energy Germanium (BEGe) diodes will be deployed which will double the active mass within Gerda. These detectors were fabricated from high-purity germanium enriched in ^{76}Ge and tested in the HADES underground laboratory, owned by SCK·CEN, in Mol, Belgium.

As the BEGes are source and detector at the same time, one crucial parameter is their active volume which directly enters into the evaluation of the half-life. This talk will illustrate the dead layer and active volume determination of prototype detectors from depleted germanium as well as the newly produced detectors from enriched material, using gamma spectroscopy methods and comparing experimental results to Monte-Carlo simulations. Recent measurements and their results will be presented and systematic effects will be discussed.

This work was partly supported by the German BMBF.

HK 7.3 Mo 11:45 HSZ-401

Computational studies of BEGe detectors — •Marco Salathe — Max Planck Institut für Kernphysik, Heidelberg, Germany

The GERDA experiment searches for the neutrinoless double beta decay within the active volume of germanium detectors. Simulations of the physical processes within such detectors are vital to gain a better understanding of the measurements. The simulation procedure follows three steps: First it calculates the electric potential, next it simulates the electron and hole drift within the germanium crystal and finally it generates a corresponding signal.

The GERDA collaboration recently characterized newly produced Broad Energy Germanium Detectors (BEGe) in the HADES underground laboratory in Mol, Belgium. A new pulse shape simulation library was established to examine the results of these measurements. The library has also proven to be a very powerful tool for other applications such as detector optimisation studies.

The pulse shape library is based on ADL 3.0 (B. Bruyneel, B. Birkenbach, http://www.ikp.uni-koeln.de/research/agata/download.php) and m3dcr (D. Radford, http://radware.phy.ornl.gov/MJ/m3dcr).

HK 7.4 Mo 12:00 HSZ-401

Consistency check of Pulse Shape Discrimination for Broad Energy Germanium Detectors using double beta decay data — •Heng-Ye Liao for the GERDA-Collaboration — Max-Planck-Institut für Physik, München

The Gerda (GERmanium Detector Array) experiment was built to study fundamental neutrino properties via neutrinoless double beta decay ($0\nu\beta\beta$). $0\nu\beta\beta$ events are single-site events (SSE) confined to a scale about millimeter. However, most of backgrounds are multi-site events (MSE). Broad Energy Germanium detectors (BEGes) offer the potential merits of improved pulse shape recognition efficiencies of SSE/MSE. They allow us to reach the goal of Phase II with a background index of 10^{-3} cts/(keV·kg·yr) in the ROI. BEGe detectors with a total target mass of 3.63 kg have been installed to the Gerda setup in the Laboratori Nazionali del Gran Sasso (LNGS) in July 2012 and are collecting data since. A consistency check of the pulse shape discrimination (PSD) efficiencies by comparison of calibration data and $2\nu\beta\beta$ data will be presented. The PSD power of these detectors is demonstrated.

HK 7.5 Mo 12:15 HSZ-401

Pulse shape discrimination studies of Phase I Ge-detectors — •Andrea Kirsch for the GERDA-Collaboration — MPI für Kernphysik, Saupfercheckweg 1, 69117 Heidelberg

The GERmanium Detector Array experiment aims to search for the neutrinoless double beta decay ($0\nu\beta\beta$) of ^{76}Ge by using isotopically enriched germanium crystals as source and detector simultaneously. The bare semiconductor diodes are operated in liquid argon at cryogenic temperatures in an ultra-low background environment.

In addition, Gerda applies different active background reduction techniques, one of which is pulse shape discrimination studies of the current Phase I germanium detectors. The analysis of the signal time structure provides an important tool to distinguish single site events (SSE) of the $\beta\beta$-decay from multi site events (MSE) of common gamma-ray background or surface events. To investigate the correlation between the signal shape and the interaction position, a new, also to the predominantly deployed closed-ended coaxial HPGe detectors applicable analysis technique has been developed.

A summary of the used electronic/detector assembly is given and will be followed by a discussion of the performed classification procedure by means of accurate pulse shape simulations of $0\nu\beta\beta$-like signals. Finally, the obtained results will be presented along with an evaluation of the relevance for the Gerda experiment.