HK 49: Astroparticle Physics II and Applications

Zeit: Donnerstag 14:00–15:30 Raum: HZO 100

Gruppenbericht HK 49.1 Do 14:00 HZO 100

Latest results from the GERDA experiment and status of the LEGEND experiment — •Bernhard Schwingenheuer — Max-Planck-Institut Kernphysik, Heidelberg

Since the discovery of neutrinos more than 60 years have passed. Despite intensive research many if their properties are still unknown. Especially relevant for particle physics and cosmology is the question whether neutrinos are their own anti-particles. In this case, neutrinoless double beta decay should exist: (A,Z) –> (A,Z+2) + 2e-. Because of its relevance there are many experimental programs ongoing searching for this decay. One isotope of interest is Ge-76. The GERDA collaboration is operating germanium detectors made out of material with enriched Ge-76 isotope fraction, i.e. source and detector are identical. The experimental signature is a line at the Q value of the decay. Germanium detectors offer currently the best energy resolution and GERDA reaches the lowest background if normalized by the energy resolution at the Q value. This motivates the extension of the program which is pursued by the LEGEND collaboration. This talk reviews the latest results from GERDA and the status of the planned LEGEND experiment.

Gruppenbericht HK 49.2 Do 14:30 HZO 100

Status of the COBRA Experiment — •Robert Temminghoff for the COBRA-Collaboration — TU Dortmund, Lehrstuhl für Experimentelle Physik IV, Otto-Hahn-Straße 4, 44227 Dortmund

The COBRA collaboration searches for neutrinoless double beta-decay ($0\nu\beta\beta$) which, if it exists, could give insights in physics beyond the Standard Model. COBRA uses commercially available room-temperature CdZnTe semiconductor detectors which are operated at the LNGS underground laboratory in Italy.

In the current demonstrator phase of the experiment, 64 detectors with a total mass of about 400 g are installed. This array has been used to set limits on the $0\nu\beta\beta$-decay of several isotopes. In a dedicated low-threshold run, the fourfold-forbidden non-unique single-beta decay of ^{113}Cd is currently under investigation. The spectral shape of this decay is closely connected to the effective value of axial vector coupling strength g_A.

In 2018, the COBRA demonstrator will be upgraded with nine additional detectors of larger size, nearly doubling the total detector mass. In this so called Extended Demonstrator (XDEM) phase, several techniques will be implemented that could result in a lower background and enhance the physics performance compared to the demonstrator setup.

In this talk, the results from the COBRA demonstrator will be summarized and an overview of the status of the XDEM will be presented.

HK 49.3 Do 15:00 HZO 100

The electron capture in ^{163}Ho experiment - ECHo — •Loredana Gastaldo for the ECHo-Collaboration — Kirchhoff-Institut für Physik, Universität Heidelberg

Direct determination of the electron neutrino m(ν_e) and anti-neutrino mass m($\bar{\nu}_e$) can be obtained by the analysis of electron capture and beta spectra respectively. In the last years, experiments analysing the ^{3}H beta spectrum reached a limit on m($\bar{\nu}_e$) of 2 eV. The upper limit on m(ν_e) is still two orders of magnitudes higher, at 225 eV. The Electron Capture in ^{163}Ho experiment, ECHo, is designed to investigate m(ν_e) in the sub-eV region and reach the same sensitivity as foreseen for m($\bar{\nu}_e$) in new ^{3}H-based experiments. In ECHo, high sensitivity on a finite m(ν_e) will be reached by the analysis of the endpoint region in high statistics and high resolution calorimetrically measured ^{163}Ho spectra. To perform this experiment, high purity ^{163}Ho source will be enclosed in a large number of low temperature metallic magnetic micro-calorimeters which are readout using the microwave multiplexing technique. This approach allows for a very good energy resolution, below $\Delta E_{\mathrm{FWHM}} < 5$ eV and for a fast time resolution well below 1 μs. Thanks to the modular approach, the ECHo experiment is designed to be stepwise up-graded. The first on-going phase, ECHo-1k, is characterized by a ^{163}Ho activity of about 1 kBq enclosed in about 100 pixels. The statistics of 10^{10} events in the ^{163}Ho spectrum will allow to improve the limit on m(ν_e) by more than one order of magnitude. In this talk, the present status of the ECHo-1k experiment will be discussed as well as the plans for the next phase, ECHo-100k.

HK 49.4 Do 15:15 HZO 100

Non-destructive studies using a new Neutron Depth Profiling instrument at the Heinz Maier-Leibnitz Zentrum in Garching near Munich — •Markus Trunk[1], Roman Gernhäuser[2], Bastian Märkisch[1], Zsolt Revay[3], Lukas Werner[1], Hubert Gasteiger[4], Morten Wetjen[4], and Ralph Gilles[3] — [1]TU München, LS Elementarteilchen bei niedrigen Energien — [2]TU München, Zentrales Technologielabor — [3]TU München, Heinz Maier-Leibnitz Zentrum — [4]TU München, LS Technische Elektrochemie

Neutron Depth Profiling is a non-destructive, isotope specific, high-resolution nuclear analytical technique, which is sensitive to several light isotopes like He-3, B-10, Li-6, N-14, O-17. Upon neutron capture the investigated nuclei undergo nuclear reactions and emit charged particles. The energy loss through matter is correlated to depth information and a depth profile of elemental concentrations are obtained. We present the first material measurements at the recently established N4DP setup at the NL4b beamline, where cold neutrons are used to irradiate the samples with a flux of up to 3E10 s-1cm-2. We introduce the method, show applications in different material science branches and present results from an ex situ study of new electrode coating materials for lithium-ion batteries. Special interest here is the formation of passive solid-electrolyte-interfaces (SEI), where NDP offers the opportunity to monitor the depth dependent SEI evolution. This project is supported by BMBF No. 05K16WO1.