HK 62: Astroparticle Physics I

Time: Thursday 14:00–15:15 Location: SCH/A252

Group Report HK 62.1 Thu 14:00 SCH/A252

Probing the Standard Model in Free Neutron Decay — •Karina Bernert, Max Lamparth, and Bastian Märkisch — Technische Universität München, Germany

(For the PERKEO and PERC consortia) Measurements of free neutron decay enable a variety of tests of the Standard Model of particle physics. Among the observables are the parity-violationg beta asymmetry A, and the Fierz interference term b. From precision measurements of A and the neutron lifetime, the CKM matrix element V_{ud} is determined without nuclear corrections. It serves as input for the first-row unitarity test of the CKM matrix and the current Cabibbo-angle anomaly. A non-zero Fierz term b would signal the existence of novel scalar and tensor interactions.

With its unique measurement technique, PERKEO III delivers the currently most precise values of A and b using a polarized neutron beam. We present the status of the data analysis of the most recent campaign at the ILL PF1b beam line in Grenoble, France, with the aim to extract an improved limit for the Fierz term b from the electron spectrum.

Meanwhile, the new PERC (Proton Electron Radiation Channel) facility is being set up at the research reactor FRM II of the Heinz Maier-Leibnitz Zentrum in Garching, with the aim to measure correlation coefficients one order of magnitude more precisely.

HK 62.2 Thu 14:30 SCH/A252

Measurement of the nuclear transition energies of ^{83m}Kr using the condensed krypton source of KATRIN — •Matthias Böttcher and Benedikt Bieringer for the KATRIN-Collaboration — Institut für Kernphysik, WWU Münster

The KATRIN experiment aims to measure or exclude the effective electron neutrino mass m_ν down to 0.2 eV/c^2 (90 % C.L.) by measuring the tritium beta spectrum near its endpoint E_0, and performing a fit including the parameters E_0 and m_ν^2. Since these are highly correlated, a systematic shift influencing the obtained neutrino mass would be visible in the endpoint and thus the tritium Q value. The KATRIN Q value can be determined by absolute calibration with ^{83m}Kr conversion electron lines. This is however limited by the nuclear gamma transition energy uncertainties of ^{83m}Kr to $0.5-0.6$ eV accuracy. The excited nucleus of ^{83m}Kr decays in a two-step cascade of 32.2 eV and 9.4 eV highly converted gamma transitions. In a new four weeks measurement campaign performed at KATRIN, a large set of conversion electron lines including a new line was measured extensively with a condensed krypton source. Following the method described in ref. EPJ C 82 (2022) 700, the ^{83m}Kr nuclear transition energies can be determined, which can allow for a reduction of the Q value uncertainty to below 100 meV. In this talk the principle, measurements, and analyses for improving the ^{83m}Kr transition energy uncertainties are presented. This work is supported by BMBF under contract number 05A20PMA.

HK 62.3 Thu 14:45 SCH/A252

Towards the biggest germanium detectors ever grown — •Tommaso Comellato and Stefan Schönert — Technical University of Munich, Garching bei München, Germany

The Legend experiment searches for the neutrinoless double-beta decay of ^{76}Ge, a second order weak process which, if observed, would provide evidence of beyond the standard model physics. It is presently being commissioned in the upgraded Gerda infrastructure at LNGS (Italy) and in its first stage it will operate 200 kg of High Purity Germanium (HPGe) detectors. The baseline detector geometry is the inverted coaxial, which combines the excellent pulse shape discrimination performance of previous generation experiments with a up to a factor 4 larger mass per detector. This yields as a result a reduction of a similar factor of backgrounds from close-by parts as cables and holders. In this talk, detailed field modeling of big detectors will be given, and preliminary results on the experimental characterization of one of them will be presented. This work has been supported in part by the European Research Council (ERC) under the European Union's Horizon 2020 research and innovation programme (Grant agreement No. 786430 - GemX)

HK 62.4 Thu 15:00 SCH/A252

Development of a cosmic muon and neutron veto system for IAXO and BabyIAXO — •Dhruv Chouhan, Elisa Ruiz-Chóliz, and Matthias Schott — Johannes Gutenberg University of Mainz, Germany

The International Axion Observatory (IAXO) experiment is a large-scale helioscope aimed at searching for axions and axion-like particles (ALPs) produced in the Sun. As a first step, the BabyIAXO was proposed as a smaller scale helioscope that will reach a sensitivity on the axion-photon coupling of 1.5*10-11 GeV-1 for masses up to 0.25 eV, covering a very interesting region of the parameter space. To detect the axion signal, a very low background x-ray detector design is required. This talk will focus on the development of the BabyIAXO veto system for cosmic rays based on light-guided organic plastic scintillators with Silicon Photo Mutiplier sensors.