HK 61: Astroparticle Physics II

Time: Friday 11:00–12:30 Location: J-HS L

Group Report HK 61.1 Fri 11:00 J-HS L

Measurement of weak couplings in neutron beta decay — •Bastian Märkisch[1], Hartmut Abele[2], Dirk Dubbers[3], Holger Mest[3], Michael Klopf[2], Alexander Petoukhov[4], Christoph Roick[1], Heiko Saul[1], Torsten Soldner[4], Xiangzun Wang[2], and Dominik Werder[3] — [1]Physik-Department, Technische Universität München, Germany — [2]Technische Universität Wien, Atominstitut, Austria — [3]Physikalisches Institut, Universität Heidelberg, Germany — [4]Institut Laue-Langevin, Grenoble, France

We present the most precise determination of the nucleon axial coupling from a measurement of the beta asymmetry in the decay of polarized neutrons. The instrument Perkeo III was installed at the PF1b beamline at the Institut Laue-Langevin, Grenoble, France. Leading sources of systematic error are eliminated or controlled by using a pulsed cold neutron beam. This measurement confirms previous results by Perkeo II and UCNA with improved precision. From it we determinate the CKM matrix element V_{ud}, and derive constraints on tensor interactions and a best limit on the Fierz interference term b from neutron decay. We conclude by presenting the status of the follow-up facility PERC at the FRM II, Garching.

HK 61.2 Fri 11:30 J-HS L

Measurement of the Fierz interference term with PERKEO III — •Max Lamparth[1], Karina Bernert[1], Hartmut Abele[3], Andreas Doblhammer[3], Erwin Jericha[3], Jens Klenke[4], Annabel Kropf[1], Kathrin Lehmann[4], Martin Losekamm[1], Heiko Saul[1], Ulrich Schmidt[5], Torsten Soldner[2], Lukas Werner[1], and Bastian Märkisch[1] — [1]TUM Physik-Department, Garching b. München, Deutschland — [2]Institut Laue-Langevin, Grenoble, Frankreich — [3]Atominstitut Wien, Wien, Östereich — [4]FRM, Garching b. München, Deutschland — [5]Physikalisches Institut Universität Heidelberg, Heidelberg, Deutschland

Neutron beta decay is an excellent system to test the structure of the charged weak interaction. The Fierz interference term b is sensitive to hypothetical scalar and tensor interactions and absent in the Standard Model. The signature of a non-zero Fierz term in neutron beta decay is an extra energy-dependent phase-space contribution. Major systematic effects are hence related to the detector response: calibration, temporal stability, spatial uniformity and non-linearity effects.

The spectrometer PERKEO III was installed at the Institute Laue-Langevin, Grenoble, France, with the aim to determine the Fierz interference term with a precision of 5×10^{-3} from the beta spectrum. We present the measurement and discuss the status of the analysis.

HK 61.3 Fri 11:45 J-HS L

Atomic Tritium Production and Trapping for Neutrino Mass Measurement in Project 8 — •Alec Lindman for the Project 8-Collaboration — PRISMA+ Cluster of Excellence, JGU Mainz

Project 8 is a phased experiment using tritium β-decay to investigate the absolute neutrino mass. Good energy precision, high statistics, and well-controlled systematics are required to reach an electron antineutrino mass limit of $\leq$ 40 meV. Our technique, Cyclotron Radiation Emission Spectroscopy (CRES), has achieved eV-scale resolution at 17.8 keV, near the tritium endpoint. Project 8 will be the first laboratory neutrino mass experiment to use atomic tritium (T). Decay of a T_2 molecule excites rovibrational states that smear the observed energy by $\approx$ 1 eV. The decay of T, however, has an energy smearing of $\leq$ 0.1 eV. Our baseline calls for trapping 30 mK atomic tritium in a 2-T-deep, 10+-m^3 superconducting magnetic bottle. I will discuss our approach to this large-volume atomic CRES experiment, focusing on production and handling techniques for recombination-prone tritium atoms.

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HK 61.4 Fri 12:00 J-HS L

Investigation of coating methods for radon background reduction in liquid xenon experiments — •Mona Piotter, Florian Jörg, Hardy Simgen, and Guillaume Eurin — Max-Planck-Institut für Kernphysik, Heidelberg

Several cosmological and astrophysical observations hint that a large fraction of the energy density of today's universe is present in the form of non-luminous matter. One candidate for this so-called dark matter is the WIMP (weakly interacting massive particle). Liquid xenon detectors can be used to detect their rare interactions with baryonic matter for which a very low background is necessary. The biggest source of background in these experiments originates from radon. To reduce this background studies are carried out investigating the radon mitigation properties of surface coatings. The coating methods that are considered include: electrodeposition, physical vapor deposition (PVD), chemical vapor deposition (CVD) and epoxy coatings.

The coatings are done on thoriated tungsten welding rods containing ^{232}Th which decays to ^{220}Rn. Therefore these rods are useful because they are a strong enough radon source. Previous studies already showed that electrodeposition can offer a significant reduction in radon emanation. Now the different parameters of coating were systematically analyzed. Additionally studies on PVD and CVD are done especially of multilayer coatings and diamond like carbon coatings.

The results of these investigations will be discussed as part of the talk.

HK 61.5 Fri 12:15 J-HS L

Antimatter Coscmic Ray Simulation — •Laura Serksnyte, Laura Fabbietti, Stephan Paul, Thomas Pöschl, and Maximilian Horst — Technical University of Munich (TUM)

The existence of dark matter has been well established by the galaxy rotation curves, the Bullet cluster and many other observational experiments. But no dark matter particle has been detected yet. The indirect dark matter search is looking for the dark matter annihilation and decay signals in cosmic rays. The antimatter cosmic rays have the smallest background for such studies. The antiproton cosmic ray flux simulation requires knowledge of the propagation of cosmic rays in the galaxy and the heliosphere as well as the antiproton production cross sections in the cosmic ray collisions with the interstellar medium. In this talk we show our propagation scheme using GALPROP for the propagation in the galaxy and HelMod for the propagation in the heliosphere. We implemented several options for antiproton production cross sections including parametrizations and event generator, such as GiBUU and EPOS, output. We will show how the antiproton cosmic ray flux depends on the antiproton production cross sections as the final result.