HK 60: Astroparticle Physics VIII

Time: Thursday 17:30–18:30 Location: SR 0.03 Erw. Physik

Group Report HK 60.1 Thu 17:30 SR 0.03 Erw. Physik
First result of the CONUS+ experiment — •Nicola Ackermann for the Conus-Collaboration — Max-Planck-Institut für Kernphysik, Saupfercheckweg 1, 69117 Heidelberg

With the CONUS+ reactor antineutrino experiment, the coherent elastic neutrino nucleus scattering (CEνNS) on germanium nuclei is currently studied at the nuclear power plant in Leibstadt, Switzerland. Very low energy thresholds down to 160 eV were achieved in four 1 kg point contact germanium detectors equipped with electric cryocooling. The setup is positioned at a distance of about 20 m from the center of the reactor core. The detector performances and first CONUS+ results after few months of data taking will be presented. In November 2024 three detectors were replaced by newer models with higher Ge crystal masses of 2.4 kg each to further improve the sensitivity of the experiment.

HK 60.2 Thu 18:00 SR 0.03 Erw. Physik
Generating ultra-compact neutron stars with bosonic dark matter — •Sarah Louisa Pitz and Jürgen Schaffner-Bielich — Max-von-Laue Straße 1, D-60438 Frankfurt am Main

Neutron stars with admixed dark matter enable new possibilities in the description of unusal mass and radius measurements, such as e.g. HESS J1731-347. We are including bosonic, self-interacting dark matter with a sufficiently stiff self-interaction potential in the form of $V \propto \phi^n$ and find that these neutron stars become ultra-compact ($C \geq 1/3$). They are compact enough to have a stable photon orbit at their surface or even above, a property that is otherwise exclusively attributed to black holes or hypothetical boson stars. These ultra-compact neutron stars are characterized by small radii of the ordinary matter ($R < 7$ km) and masses of approximately $1.5\,M_\odot$. We furthermore study the stability of these configurations by investigating the onset of unstable radial modes.

HK 60.3 Thu 18:15 SR 0.03 Erw. Physik
Determination of the absolute nuclear transition energies of $^{83\mathrm{m}}$Kr using the gaseous krypton source of KATRIN — •Matthias Böttcher and Benedikt Bieringer — Institut für Kernphysik, Universität Münster

The KATRIN experiment aims to measure the electron neutrino mass m_ν with $0.3\,\mathrm{eV}/c^2$ (90% C.L.) sensitivity after 1000 measurement days in 2025, by measuring the T_2 β spectrum near its endpoint E_0, and performing a fit including parameters E_0 and m_ν^2. Since these are highly correlated, systematic effects influencing the obtained m_ν will also manifest in E_0 and the derived T_2 Q value. Comparing this with the $\mathrm{T}-{}^3$He mass difference from Penning-trap measurements is therefore valuable for cross checks of our experimental procedure. Determining the KATRIN Q value with high precision requires calibration of the experimental energy scale with $^{83\mathrm{m}}$Kr conversion electrons. This is limited by knowledge of $^{83\mathrm{m}}$Kr nuclear transition energies, being known to 0.3 eV precision in the literature. The excited nucleus of $^{83\mathrm{m}}$Kr decays via a two-step cascade of 32.2 keV and 9.4 keV highly converted γ transitions, and a weak direct transition. With a gaseous Kr source, a measurement of conversion electrons from all three transitions was performed in 2023 at KATRIN. Following the method described in ref. EPJ C 82 (2022) 700 the nuclear transition energies can be determined, which can allow for a reduction of the T_2 Q value uncertainty to 0.1 eV. In this talk, we present the analysis of the measurement. This work is supported by Helmholtz Association and BMBF (grant numbers ErUM-Pro 05A23PMA, 05A23PX2, 05A23VK2, and 05A23WO6).