HK 37: Hauptvorträge II

Zeit: Donnerstag 8:30–10:30 Raum: F 1

Hauptvortrag HK 37.1 Do 8:30 F 1

Direct Neutrino Mass Measurements — •Susanne Mertens for the KATRIN-Collaboration — Max Planck Institute for Physics Föhringer Ring 6, 80805 München — Technical University Munich, James Frank Straße, 85748 Garching.

With a mass at least six orders of magnitudes smaller than the mass of an electron – but non-zero – neutrinos are a clear misfit in the Standard Model of Particle Physics. On the one hand, its tiny mass makes the neutrino one of the most interesting particles, one that might hold the key to physics beyond the Standard Model. On the other hand this minute mass leads to great challenges in its experimental determination. Three approaches are currently pursued: An indirect neutrino mass determination via cosmological observables, the search for neutrinoless double β-decay, and a direct measurement based on the kinematics of single β-decay. In this talk the latter will be discussed in detail and the status and scientific reach of the current and near-future experiments will be presented.

Hauptvortrag HK 37.2 Do 9:10 F 1

Precision Nuclear Mass Measurements for Neutrino Physics Studies — •Sergey Eliseev — MPIK, Heidelberg, Germany

This contribution will give a brief overview of the extended and diverse experimental campaign carried out with the Penning-trap mass spectrometer SHIPTRAP for neutrino physics and present a physical program for the next generation Penning-trap mass spectrometer PENTATRAP. The contribution is structured as follows: First, the results of our search for the nuclide with the largest probability for neutrinoless double-electron capture are summarized. The Q-values of a large number of potentially suitable nuclides have been determined with SHIPTRAP, which has resulted in the discovering of two resonantly enhanced transitions in 152Gd and 156Dy. Second, the Q-values of the beta decay in 187Re and electron capture in 163Ho - ones of the most suitable processes for the determination of the neutrino mass - have been determined with an uncertainty of about 30 eV, which is a significant contribution to the development of the ECHo project. Finally, the novel Penning trap mass spectrometer PENTATRAP is introduced and a future measurement program is presented.

Hauptvortrag HK 37.3 Do 9:50 F 1

Few-neutron resonances and their impact on neutron-rich nuclei — •Joel Lynn — Institut für Kernphysik, Technische Universität Darmstadt, Germany — ExtreMe Matter Institute EMMI, GSI Helmholtzzentrum für Schwerionenforschung GmbH

The possibility of few-neutron structures has long intrigued the theoretical and experimental nuclear physics community. In addition to the inherent interest in the existence of such systems, reproducing them theoretically will likely impose strong constraints on the $T = 3/2$ component of three-nucleon interactions, which in turn are critical to the description of neutron-rich nuclei. Thus, the existence of few-neutron resonances will have an important impact on neutron-rich nuclei. In this talk, I describe the historical situation up until now before turning to our recent quantum Monte Carlo calculations of few-neutron systems confined in external potentials based on local chiral interactions at next-to-next-to-leading order in chiral effective field theory. These systems are calculated in different external Woods-Saxon potentials and we assume that their extrapolation to zero external-potential depth provides a quantitative estimate of three- and four-neutron resonances. The validity of this assumption is demonstrated by benchmarking with an exact diagonalization in the two-body case. We find that the extrapolated trineutron resonance is lower than the tetraneutron resonance energy. This suggests that a three-neutron resonance exists below a four-neutron resonance in nature and is potentially measurable. We confirm that the relative ordering of the resonances is not an artifact of the external confinement, by demonstrating that the odd-even staggering in the helium isotopic chain is reproduced within this approach.

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