Probing the neutrino mass scale with KATRIN

Neutrino properties, in particular the still unknown scale of the neutrino rest mass, bear a fundamental relevance for current research topics in cosmology, theoretical particle physics, and astroparticle physics.

From neutrino oscillation experiments we know that neutrinos must have a non-zero rest mass – but also that neutrino masses are tiny compared to any other elementary particle we know. Precision measurements of the kinematics of weak decays offer the only model independent (direct) approach to determine the neutrino mass scale in a laboratory experiment.

The KATRIN (Karlsruhe Tritium Neutrino) experiment, which is poised to start data taking in 2018 after an extensive construction and commissioning phase, will search for the minute imprint of the neutrino mass in the beta-decay spectrum of tritium. KATRIN employs a high-intensity gaseous molecular tritium source combined with a high-resolution electrostatic filter to achieve a neutrino-mass sensitivity of 0.2 eV/c2, thus improving on the previous generation of direct neutrino mass experiments by an order of magnitude.

In this talk I will present results of the first physics run with KATRIN after beamline completion, in which conversion electrons from 83mKr were used to demonstrate the precision spectroscopy performance and stability of the overall system. I will furthermore report on the current final steps towards bringing the KATRIN apparatus online for first runs with tritium and towards preparing the neutrino-mass analysis chain.