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THE WEIGHT OF THE NEUTRINO

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Since the discovery of neutrino oscillations we know that neutrinos have non-zero masses, but we do not know the absolute neutrino mass scale, which is as important for cosmology as for particle physics. The direct search for a non-zero neutrino mass from endpoint spectra of weak decays is complementary to the search for neutrinoless double beta-decay and analyses of cosmological data. Today the most stringent direct limits on the neutrino mass originate from investigations of the electron energy spectra of tritium beta-decay.

The next generation experiment KATRIN, the Karlsruhe Tritium Neutrino experiment, is improving the sensitivity of 2 eV/c^2 from previous experiments by one order of magnitude, probing the region relevant for structure formation in the Universe. KATRIN uses a strong windowless gaseous molecular tritium source combined with a huge electron spectrometer. To achieve the sensitivity, KATRIN had to put many technologies at their limits. Since early 2019, KATRIN is taking high statistics tritium data hunting for the neutrino mass with its 70 m long experimental setup.

In this talk we will introduce the necessity to determine the neutrino mass and the status of the field, and will present the KATRIN experiment and the results from its first science run. The new results are already bringing KATRIN into the lead position of the field. In the outlook I will present the perspectives of KATRIN for the coming years and new technologies to potentially further improve the sensitivity on the neutrino mass.