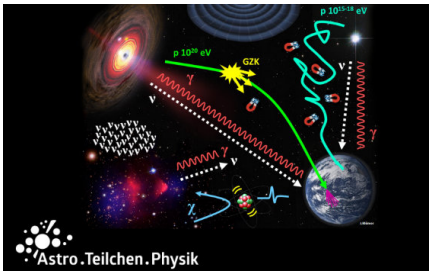

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High energy resolution with a Transverse Energy Compensator for time-of-flight spectroscopy at KATRIN++

Wednesday, October 16, 2024 5:25 PM (2 minutes)

The R&D project KATRIN++ is investigating the extension of the neutrino mass experiment KATRIN in order to achieve a sensitivity of <50 meV and thus be able to reliably determine the neutrino mass in the laboratory if neutrinos have an inverted mass order. To achieve this, a differential measurement method will be applied to significantly increase the statistics and reduce the background rate, while at the same time significantly improving the energy resolution to <0.5 eV. Furthermore, an atomic tritium source would avoid the rotational-vibrational energy broadening of the THe+ molecules in the final state with a standard deviation of about 0.4 eV.

High-resolution differential tritium-beta spectroscopy could be realised with KATRIN++ in two steps: First, the development of a minimally invasive electron marker for the KATRIN beam line is required, e.g. based on the CRES method from project 8 or a quantum sensor method, to determine the start times of the beta electrons. This would then allow the differential measurement of the beta spectrum of tritium in the endpoint region using time-of-flight spectroscopy [1]. Second, to enable the spectroscopy with the energy resolution required for KATRIN++ in the sub-eV range, a novel transverse energy compensator (TEC) [2] is proposed that improves the energy resolution of the KATRIN spectrometer by almost an order of magnitude.

This poster presents the principle of high-resolution differential time-of-flight electron spectroscopy for KATRIN++ and, in particular, the innovative idea of the transverse energy compensator.

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[1]: N. Steinbrink, V. Hannen, E. L. Martin, R. G. H. Robertson, M. Zacher and C. Weinheimer, New J. Phys. 15 (2013) 113020.

[2] This idea from C. Weinheimer has been submitted as a provisional patent application under the number 10 2024 126 381 by the University of Münster.

Summary

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