Karlsruher Institut für Technologie

Master thesis at IAP

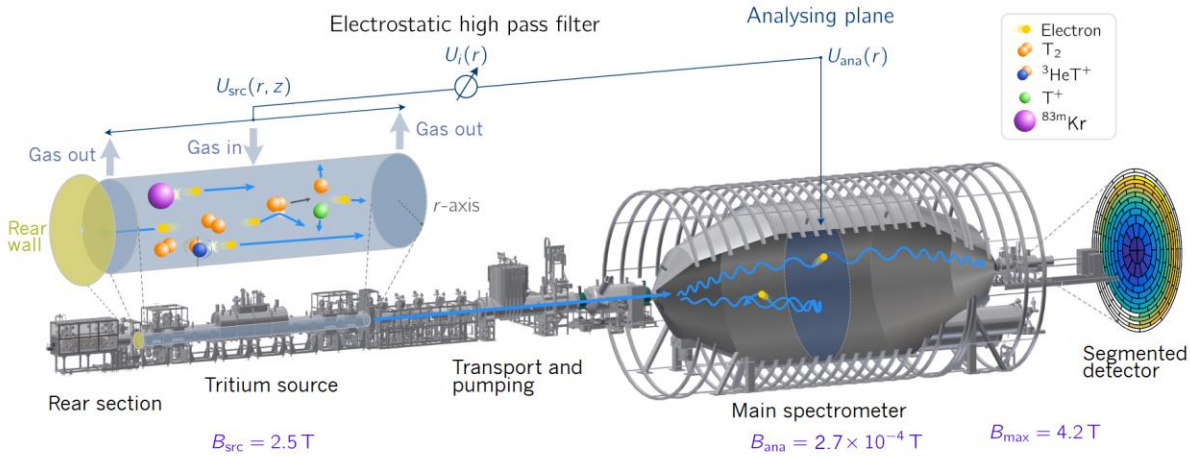
Measurement and analysis of high-precision krypton spectra for the determination of the KATRIN source potential

Motivation

Precision spectroscopy of the electron spectrum of the tritium beta-decay near the kinematic endpoint is a direct method to determine the effective electron antineutrino mass. The KArlsruhe TRItium Neutrino (KATRIN) experiment aims to determine this quantity with a sensitivity of better than 0.3 eV (90% C.L.). An inhomogeneous electric potential in the tritium source of KATRIN can lead to distortions of the beta-spectrum, which directly impact the neutrino mass observable. This major systematic effect can be quantified through precision spectroscopy of the conversion-electron spectrum of co-circulated metastable Krypton gas.

Therefore, dedicated, two multi-week measurement campaigns have been performed within the KATRIN data taking schedule and analysed. However, the difference observed between the two krypton campaigns let us question the long-term reliability of the source potential estimates. Currently, work function drifts are being considered as the main origin of this effect. In 2025, a concluding set of Kr measurements will help us to understand the physical processes and their effect on the observables, allowing reliable estimates for the final KATRIN analysis.

The suggested thesis project will focus on the data taking and analysis of this new Krypton measurement campaign. The outcome will be highly important for KATRIN and will be visible in the international KATRIN collaboration.



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