Towards an Atomic Mass Measurement of the ^{3}He Nucleus with Parts-per-trillion Precision

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The most precise mass measurements of light nuclei today are performed using Penning traps. Together, these measurements provide a network of essential parameters for fundamental physics. For example, the mass difference of T and ^{3}He is used as a consistency check for the model of systematics in the KATRIN experiment, which studies the endpoint of the tritium β-decay spectrum to set a limit on the $\bar{\nu}_e$ mass [1].

Recently performed high-precision mass measurements of the lightest nuclei, including ^{3}He, have revealed considerable inconsistencies between tabulated values reported by different world-leading experiments. This discrepancy is known as the "light ion mass puzzle". In order to provide an independent cross-check, the multi-Penning-trap mass spectrometer LIONTRAP has obtained the masses of the proton [3], the deuteron and the HD^+ molecular ion [4]. These measurements are in excellent agreement with the results of the Florida State University [5] [6], as well as HD^+ spectroscopy. However, there is a disagreement with the values reported by the University of Washington group [7] [8].

Present activities of the experiment are directed at the atomic mass measurement of the ^{3}He nucleus with a relative uncertainty lower than 10 parts-per-trillion. This contribution presents the status of the ongoing measurement campaign.

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