

Plenarvortrag

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An Improved Value of the Atomic Mass of the Proton —

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In combination with the neutron and the electron, the proton is one of the basic building blocks of atomic matter. The precise knowledge of its properties, e.g. its mass, is of utmost importance for tests of fundamental physics and the clarification of 3 to 4 sigma discrepancies between high-precision mass measurements of various light atoms.

Therefore, a new cryogenic five-fold Penning trap setup was constructed. The measurement principle is based on a phase-sensitive comparison of the proton's cyclotron frequency to that of a bare carbon

nucleus. In order to measure both frequencies in the same electric and magnetic field configuration, both single ions are transported alternately into an ultra-harmonic Penning trap, consisting of seven cylindrical electrodes. Exactly the same electric field configuration for both ions with different charge/mass ratio requires two separate, precisely tuned axial resonators for non-destructive frequency detection.

At this conference, the new experimental setup will be introduced and the latest result on the atomic mass of the proton will be presented. This new value is 3 times more precise than the current literature value and reveals a disagreement of about 3 standard deviations to it [1]. Aiming for relative precisions of a few parts per trillion the next upgrade will be discussed.

[1] F. Heiße et al., Phys. Rev. Lett. 119, 033001 (2017)