Status of Precision Mass Measurements of Light Atomic Nuclei at the LIONTRAP Experiment

Sangeetha Sasidharan[a,b], Olesia Bezrodnova[a], Sascha Rau[a] , Wolfgang Quint[b], Sven Sturm[a], Klaus Blaum[a]

[a] *Max Planck Institute for Nuclear Physics, Heidelberg, Germany*

[b] *GSI Helmholtzzentrum, Darmstadt, Germany*

Atomic masses with high precision can be obtained by Penning-trap mass spectrometry. The LIONTRAP experiment is one such high-precision mass spectrometer that can achieve relative mass uncertainties of the order of 10^{-11} and is dedicated to light ions. The results at LIONTRAP include the atomic mass measurements of the proton [1], the deuteron and the HD^+ molecular ion [2]. The deuteron mass was measured to a relative precision of 8.5 ppt [2]. Our results show an excellent agreement with values that were extracted from laser spectroscopy of HD^+ [3]. This comparison is currently limited by the precision of the electron's mass in atomic mass units (amu), derived from a measurement of the bound electron g-factor in $^{12}C^{5+}$ [4]. ^4He is a prime candidate for a future improvement, as it is far less sensitive to higher-order terms of quantum electrodynamics (QED) and to the charge radius of the nucleus. Currently, we are measuring the atomic mass of ^4He to support such a determination of the electron mass in amu. Furthermore, an ultra-precise measurement of the mass difference of ^3He and ^3T will provide an important crosscheck of the determination of the electron anti-neutrino mass with the KATRIN experiment [5]. Moreover, ^3He to ^{12}C mass ratio could further clarify the so-called 'puzzle of the light masses', which is an inconsistency in the values of light masses from different world-leading experiments [2]. In this contribution, the present status of the experiment will be discussed.

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