Precision Measurement of the Isotope Shift in Neutral Boron

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The 2p-3s ground-state transition in the atomic five-electron system of neutral Boron has been measured using Resonance Ionization Mass Spectroscopy (RIMS). A stable Boron atom beam was overlapped perpendicular with two laser beams. While one laser was frequency-scanned over the atomic resonance, it was simultaneously monitored with a frequency comb, providing an accurate reading for the absolute frequency. The second laser was used for non-resonant ionization out of the previously excited 3s state. Ions were extracted from the ionization region and guided into a quadrupole mass spectrometer and finally detected by a channeltron. The mass selection provided almost background-free single-ion detection. The acquired spectra allowed us to extract absolute transition frequencies and the isotope shift of ^{10}B and ^{11}B with high precision.

The resulting values show significant improvements in precision compared to previously published values. With these results, the five-electron system wave function calculations which were carried out recently [1] can be tested. In particular, they allow to extract the change in mean-square nuclear charge radius from the isotope shift in a nuclear model-independent way. This observable can be tested against recent ab-initio nuclear model calculations as well as experimental results for stable boron.

Furthermore, we strive to extend these isotope shift measurements along the boron isotopic chain to the short-lived (770 ms) proton-halo candidate ^{8}B. The most decisive observable to confirm its halo character, the nuclear charge radius, can be extracted from such measurements.

In this presentation, the results of the offline experiment will be presented. Also, a status and outlook of our efforts towards the measurement of the ^{8}B mean-square nuclear charge radius at Argonne National Laboratory will be given.

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[1] Puchalski, M. *et al.*, Phys. Rev. A **92** 062501 (2015)