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Frequency-Comb Based Optical Isotope Shift Measurement of Be-12

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Charge radii measurements of the lightest elements are benchmark tests for nuclear structure calculations. In this part of the nuclear chart, ab-initio models that treat the nuclei as consisting of individual nucleons which interact via nucleon-nucleon and three-nucleon forces are available. Moreover, the appearance of the so-called halo nuclei, having an extended nuclear matter distribution due to weakly bound nucleons, makes this region particularly interesting.
After the successful isotope shift measurements of Be-7,9,10,11 in 2008, we could now extend the measurements to the isotope Be-12 and cope with the low production rates using optical detection combined with the ion-photon coincidence technique. This isotope is interesting because Be-11 is the prototype of a one-neutron halo nucleus and also Be-14 is known to have halo character, whereas the information about the structure of Be-12 is still vague. First results of the charge radius measurement from the recent beam time at COLLAPS will be presented. Besides the isotope shift measurement of Be-12, several systematic effects were tested during the beamtime, e.g. ion beam deceleration or acceleration by the resonant laser light. High accuracy atomic structure calculations allow us to extract a preliminary nuclear charge radius from the measured optical isotope shift very accurately.

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