High precision atomic data for halo nuclei and related nuclear structure

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Abstract. The interest on high-accuracy atomic data of short-lived isotopes of the lightest elements has grown strongly during recent years. This is related to new possibilities to extract nuclear data from such measurements by combining their results with high-accuracy atomic physics calculations, as will be discussed in the talk by Gordon Drake. Few-nucleon systems, up to about ^{12}C are the only nuclei for which *ab-initio* nuclear structure calculations are currently available. These calculations start out from N nucleons and try to construct the corresponding nucleus based on realistic two- and three-nucleon interactions. For these theories, nuclear data extracted from atomic physics measurements provides some the most reliable benchmark tests available.

Isotope shifts, hyperfine structure splitting and absolute transition frequencies have been determined for all isotopes of helium, lithium and beryllium with the exception of the isotope ^{14}Be in several experiments at various on-line facilities world-wide. Among these isotopes, the so-called halo nuclei ^{6,8}He, ^{11}Li and ^{11}Be are of special importance since they exhibit one of the most intriguing nuclear structures of all known nuclei, namely the formation of a “halo” of dilute nuclear matter surrounding a compact core with the usual nuclear matter density. Atomic physics measurements have considerably contributed to our knowledge and our picture of these exotic systems.

In my talk I will provide an overview on the experimental techniques that have been applied and the obtained accuracy for the atomic and nuclear observables extracted from the measurements. Finally, an outlook will be given how a technique similar to that used for beryllium could be employed to perform high-accuracy measurements on the proton-halo nucleus ^{8}B.