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Penning Trap Experiments with the Most Exotic Nuclei on Earth: Precision Mass Measurements of Halo Nuclei M. BRODEUR, T. BRUNNER, S. ETTENAUER, A. LAPIERRE, R. RINGLE, P. DELHEIJ, J. DILLING, TRIUMF, TITAN COLLABORATION — Exotic nuclei are characterized with an extremely unbalanced protons-neutrons ratio (p/n) where for instance, the halo isotopes of He and Li have up to 3X more n than p (compared to $p/n = 1$ in ^{12}C). The properties of these exotic halo nuclei have long been recognized as the most stringent tests of our understanding of the strong force. ^{11}Li belongs to a special category of halos called Borromean, bound as a three-body family, while the two-body siblings, ^{10}Li and 2 n, are unbound as separate entities. Last year, a first mass measurement of the radioisotope ^{11}Li using a Penning trap spectrometer was carried out at the TITAN (Triumf's Ion Trap for Atomic and Nuclear science) facility at TRIUMF-ISAC. Penning traps are proven to be the most precise device to make mass measurements, yet until now they were unable to reach these nuclei. At TRIUMF we managed to measure the mass of ^{11}Li to an unprecedented precision of $dm/m = 60$ ppb, which is remarkable since it has a half-life of only 8.8 ms which it the shortest-lived nuclide to be measured with this technique. Furthermore, new and improved masses for the 2 and 4 n halo ^{6,8}He, as well has the 1 n halo ^{11}Be have been performed. An overview of the TITAN mass measurement program and its impact in understanding the most exotic nuclei will be given.

Maxime Brodeur
TRIUMF

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