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Precise Measurement of the 7Be and 163Ho Electron Capture Q-value for Neutrino Studies

At Central Michigan University (CMU), we are developing the CMU High Precision Penning trap (CHIP-TRAP) with the aim of performing high-precision mass measurements on stable and long-lived radioactive isotopes. The major goals of the CHIP-TRAP are to measure ^{163}Ho EC Q-value to $\sim$1eV to aid direct neutrino mass determination experiments with ^{163}Ho, such as HOLMES and EcHO, and to measure the ^{7}Be EC Q-value to $<\sim$100 meV to aid the BeEST experiment that is searching for the signature of sterile neutrinos using ^{7}Be EC. CHIP-TRAP utilizes a laser ablation source to produce ions from solid samples. We plan to make 7Be+ and 163Ho+ using the LAS to ablate small quantities of these ions from solutions in which they are dissolved in HCl and then dried on a backing holder. To investigate this production method, we have made 165Ho+ ions in this way and are investigating the production of 9Be+. This will replicate our anticipated production method for ^{163}Ho (which has a half-life of 4570 yrs and must be synthesized) and ^{7}Be (which is radioactive with a half-life of $\sim$53 days) ions and enable us to determine the minimum number of respective atoms necessary to perform the measurement. The goal was to find a backing material that minimized contaminant ions from the backing material and maximized the number of Ho+ and Be+ ions compared to, for example, HoO+ ions and BeO+, that also minimized the amount of Ho and Be atoms required.

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