Radioactivity of the new nuclides ^{160}Os and ^{156}W

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Alpha (α) radioactivity is the principal decay mode of the most neutron deficient isotopes of even-Z elements from plutonium (Z=94) down to osmium (Z=76). Q_α values increase steadily with increasing neutron deficiency down to N=84 and consequently half-lives decrease rapidly. Beyond N=84 a sudden drop in Q_α-values is observed as a result of the neutron shell closure at N=82. For this reason ^{160}Os$_{84}$ is expected to be the lightest osmium isotope for which α emission is the dominant ground-state decay mode.

The yrast 8^+ states in the neighbouring even-even N=84 isotones ^{156}Hf and ^{158}W are at lower excitation energies than their respective 6^+ states and as a result they are isomeric [1, 2]. With an E2 cascade no longer allowed, decays from these states proceed via α decays that carry large amounts of orbital angular momentum. This isomerism is attributed to the attractive monopole interaction between $h_{11/2}$ protons and $h_{9/2}$ neutrons. The decays of ^{160}Os allow for this interaction to be further investigated as the $h_{11/2}$ proton orbital is filled. In addition to decay by α-particle emission, a two-proton emission decay branch from this isomer is also possible, since the ground state of ^{160}Os is predicted to be unbound with $Q_{2p} = 0.75$ MeV [3]. This value is likely too small for $2p$ emission to be observed from the ground state but the feasibility of observing this decay mode from the isomer will depend on how much the excitation energy of the isomer adds to the Q_{2p} value, versus the additional hindrance arising from the larger spin change involved in the decay.

Producing nuclei so far from stability is challenging due to very small production cross-sections. Our study took advantage of the MARA recoil separator [4], which due to its unparalleled selectivity provides the ability to successfully study nuclei that were hitherto not within reach. Results of the decays of ^{160}Os and the daughter of its α decay, ^{156}W, will be presented and discussed alongside state of the art theoretical interpretations.

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