
SHAPE COEXISTENCE AT THE OUTER EDGES OF STABILITY

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Above $N=82$, the proton dripline follows closely the outer edge of the well deformed rare-earth region, and the ground states of nuclei lying close to the dripline are expected to have spherical or weakly deformed prolate shapes. Our recent experimental studies have concentrated in the upper portion of this region, namely the study of excited states in Os ($Z=76$) through Pb ($Z=82$) isotopes located in the vicinity of the proton dripline. One of our principle motivations has been to characterize the evolution of shape from the well studied deformed region to the near spherical ground states deduced for the proton emitters [1].

In-beam γ -ray studies of such heavy systems far from stability are hampered by the large fission cross sections associated with the heavy-ion fusion reactions which are used to produce these proton-rich nuclides. However, the use of recoil separators allows one to easily distinguish fusion-evaporation residues from fission products. In addition, all nuclides in this region which lie at the dripline or beyond, decay via charge particle radioactivity. As a result, the recoil decay tagging (RDT) technique can be utilized allowing for in-beam γ -ray studies of nuclides produced with sub- μb cross-sections. By coupling the Fragment Mass Analyzer (FMA) with Gammasphere, the high-spin structure of a number of nuclides in this Os-Pb region has been investigated. In addition, complimentary decay studies of these same nuclides have allowed, in several instances, spin/parity and excitation energy assignments for all observed states. These studies have allowed us to characterize the evolution of nuclear shapes as one approaches the proton drip line. In several isotopes, structures built on three distinct shapes at low excitation energy have been observed [2,3].

References

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