THEORETICAL STUDIES OF RARE-EARTH NUCLEI LEADING TO $^{50}\text{Sn}$-DAUGHTER PRODUCTS AND THE ASSOCIATED SHELL EFFECTS

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Summary

Cluster decays of rare-earth nuclei are studied with regard for neutron magic shells for $^{50}\text{Sn}$ nucleus as a daughter product always. The $^{100}\text{Sn}$ and $^{132}\text{Sn}$ radioactivities are studied to find the most probable cluster decays and the possibility, if any, of new neutron shells. For a wide range of parent nuclei considered here (from Ba to Pt), $^{12}\text{C}$ and $^{78}\text{Ni}$ from the $^{112}\text{Ba}$ and $^{210}\text{Pt}$ parents, respectively, are predicted to be the most probable clusters (minimum decay half-life) referring to $^{100}\text{Sn}$ and $^{132}\text{Sn}$ daughters. The $^{22}\text{Mg}$ decay of $^{122}\text{Sm}$ is indicated at the second best possibility for the $^{100}\text{Sn}$-daughter decay. In addition to these well-known magic shells ($Z = 50$, $N = 50$ and 82), a new magic shell at $Z = 50$, $N = 66$ ($^{116}\text{Sn}$ daughter) is indicated for the $^{64}\text{Ni}$ decay from the $^{180}\text{Pt}$ parent.