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Cluster decay of 208-238Th isotopes

Cluster decay is a kind of radioactivity in which the emitted nuclei are heavier than alpha particle but lighter than the binary fission fragments. This is one of the famous phenomena which have been predicted theoretically before to be confirmed experimentally. This is because this type of decay occurs in nuclei that decay primarily by alpha emission. The branching ratios relative to alpha decay is less than 10-10.
Since cluster decay is an intermediate process between alpha decay and fission, both alpha and fission-like approaches could be used to investigate cluster emission. In the present work, the cluster radioactivity of 208-238Th is studied by using a fission-like model taking interacting potential as the sum of coulomb and proximity potentials. The emission of the particle is considered as a quantum tunneling penetration of the potential barrier in the semi-classical WKB approximation. The released energy is deduced from the new table of atomic mass evaluation (AME12) and from the Finite Range Droplet Model. The obtained decay half-lives are compared with the few available experimental values and those of other models. The effect of the multipole deformation and orientation of nuclei on the half-life is discussed.

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