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Decay properties of $^{253,255}\text{Rf}$ using the Relativistic Mean-Field Framework.

Most neutron-deficient α -emitters are known to be of great relevance to the astrophysical rapid neutron-capture process (r-process) in superheavy nuclei [1, 2]. Thus, in this work, the decay properties of the newly observed ^{249}No isotope from the α -decay of ^{253}Rf [3] is theoretically investigated within the relativistic mean-field (RMF) framework [4,5] using the NL3* parameter set [6]. The α -decay chain of ^{255}Rf is also considered. The RMF densities are folded with the R3Y NN potential to deduce the nuclear interaction potential between the decaying fragments. A balanced understanding of the penetration of an α -particle across the nuclear-Coulomb barrier gives an outstanding credence to the assumptions of quantum mechanics. The presence of shell/sub-shell closure is indicated by the formation of peaks along the decay chain and found to alter the conventional scaling factor of the preformed cluster-decay model (PCM) [5]. The calculated half-lives are in close agreement with the recent experimental measurement. The sensitivity of the nuclei around the shell closures can provide valuable information about the r-process abundance in this mass region.

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