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

Most neutron-deficient  $\alpha$ -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  $^{249}\text{No}$  isotope from the  $\alpha$ -decay of  $^{253}\text{Rf}$  [3] is theoretically investigated within the relativistic mean-field (RMF) framework [4,5] using the NL3\* parameter set [6]. The  $\alpha$ -decay chain of  $^{255}\text{Rf}$  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  $\alpha$ -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.

- [1] P. Hosmer et al. Phys. Rev. C 82, 025806 (2010). <https://doi.org/10.1103/PhysRevC.82.025806>
- [2] V.I. Zagrebaev, A. V. Karpov, I.N. Mishustin, W. Greiner, Phys. Rev. C 84 044617 (2011). <https://doi.org/10.1103/PhysRevC.84.044617>
- [3] J. Khuyagbaatar, H. Brand, R. A. Cantemir, Ch. E. Düllmann, F. P. Heßberger, E. Jäger, B. Kindler, J. Krier, N. Kurz, B. Lommel, B. Schausten, and A. Yakushev, Phys. Rev. C 104, L031303 (2021). <https://doi.org/10.1103/PhysRevC.104.L031303>
- [4] P. Ring, Prog. Part. Nucl. Phys. 37, 193 (1996). [https://doi.org/10.1016/0146-6410\(96\)00054-3](https://doi.org/10.1016/0146-6410(96)00054-3)
- [5] J. T. Majekodunmi, M. Bhuyan, D. Jain, K. Anwar, N. Abdullah, and Raj Kumar, Phys. Rev. C 105, 044617 (2022). <https://doi.org/10.1103/PhysRevC.105.044617>
- [6] G. A. Lalazisis, S. Karatzikos, R. Fossion, D. Pena Arteaga, A. V. Afanasjev and P. Ring, Phys. Lett. B 671, 36 (2009). <https://doi.org/10.1016/j.physletb.2008.11.070>

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