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From Quarks to Cosmos

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The effect of rotation on α-decay half-lives even-even ^{254,256}Rf isotopes using different semi-empirical formulae

The present work is a theoretical study on the α-decay half-lives of the even-even ^{254,256}Rf isotopic chains using six different semi-empirical formulae, namely, the Viola-Seaborg semi-empirical formula (VSS), Modified Brown formula (mB1), Semiempirical formula based on fission theory (SemF IS2), Royer Formula (R), Wang Formula (wang), and Modified YQZR formula (MYQZR)[1]. The predictive accuracy of each of these formulae is evaluated by comparing them to the experimental data[2]. The decay energies (Q_α) for the alpha decay chain are calculated from the relativistic mean field (RMF) formalism [3] using the PC-PK1 parameter set [4]. Furthermore, the effect of rotation on the stability of these neutron-deficient nuclei is separately appraised. Our calculation reveals that the relative dependency of the employed formulae is hinged on their constituents. Thus, the modified YQZR formula of α-decay half-lives gives a closer agreement with the experimental measurement due to its inclusion of the asymmetry terms. The relevance of this study in the superheavy region to astrophysics is concisely discussed.

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