Alpha and Cluster Decay Investigation of Even-Even Actinide Nuclei

M.R. Oudih, R. Belhaddouf, M. Fellah, N.H. Allal

Laboratoire de Physique Théorique, Faculté de Physique, USTHB BP 32, El Alia, 16111 Bab Ezzouar, Algiers, Algeria

Using the semiclassical WKB approximation, the alpha and cluster decay half-lives of even-even actinides are calculated within the unified fission model. The emitted particle is considered to be tunneled through a potential barrier obtained by the sum of the Coulomb potential, the Woods-Saxon nuclear potential and the centrifugal potential [1–3]. The calculations are performed by inputting the experimental *Q*-values. In the case where experimental values are not known, they are evaluated using the mass excesses of the Weizscker-Skyrme model (WS4) whose predictive power has been recently improved by Gao et al. [4] using an efficient machine learning algorithm. The calculated half-lives of the present work are compared with those of a semi-empirical formula as well as the available experimental data [5]. Further, the calculated alpha and cluster decay half-lives are compared to those of spontaneous fission and β -decay obtained by analytical formulas [6,7] in order to identify the most likely decay mode in the actinide region.

References

- [1] M.R. Oudih, M. Ouhachi, M. Fellah, N.H. Allal, Int. J. Mod. Phys. E31 (2022) 2250009.
- [2] F. Saidi, M.R. Oudih, M. Fellah, N.H. Allal, Mod. Phys. Lett. A30 (2015) 1550150.
- [3] M.R. Oudih, M. Fellah, N.H. Allal, Bull. Russ. Acad. Sci. Phys. 84 (2020) 1022.
- [4] Z.P. Gao, Y.J. Wang, H.L. Lü et al., Nucl.Sci. and Tech. 32 (2021) 1.
- [5] https://www-nds.iaea.org/relnsd/vcharthtml/VChartHTML.html.
- [6] G. Saxena, A. Jain, P.K. Sharma, Phys. Scr. 96 (2021) 125304.
- [7] X. Zhang, Z. Ren, Q. Zhi, Q. Zheng, J. Phys. G: Nucl. Part. Phys. 34 (2007) 2611.