



Alpha decay study of Thorium isotopes using double folding model with NN interactions derived from relativistic mean field theory

W.A. Yahya^{a,*}, B.J. Falaye^b

^a *Department of Physics and Materials Science, Kwara State University, Malete, Nigeria*

^b *Department of Physics, Federal University of Lafia, Nigeria*

Received 6 June 2021; accepted 5 September 2021

Available online 8 September 2021

Abstract

The alpha decay half-lives of some Thorium isotopes have been calculated within the framework of the WKB semi-classical approximation, with the inclusion of the Bohr-Sommerfeld quantization condition. The effective potentials used are the double folding nuclear potential, Coulomb potential, and centrifugal potential. Apart from using the famous M3Y-Reid and M3Y-Paris nucleon-nucleon (NN) interactions, the microscopic NN interaction derived from relativistic mean field theory Lagrangian (R3Y), with different parametrizations, has also been used. The results obtained using the R3Y potentials are compared to the phenomenological M3Y-Reid and M3Y-Paris NN interactions. The R3Y based interactions are found to perform slightly better than the M3Y based interactions for density-independent double folding model. When density-dependence of the double folding model is used, the M3Y-Paris and R3Y-W give the best descriptions of the α -decay half-lives of the Thorium isotopes, while the M3Y-Reid gives the highest deviation from experimental data.

2021 Elsevier B.V. All rights reserved.

Keywords: Alpha decay; Half-life; Double folding model; Relativistic mean field theory

* Corresponding author.

E-mail address: wasiu.yahya@gmail.com (W.A. Yahya).