



Alpha Decay Half-lives of Heavy and Superheavy Nuclei within a Deformed Double Folding Model

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Abstract

The alpha decay half-lives of heavy and superheavy nuclei with $Z = 80 - 116$ are calculated by a deformed double folding model. To obtain the potential between alpha cluster and daughter nucleus, the R3Y-L1, R3Y-W, R3Y-Z, R3Y-HS, R3Y-NL2 and R3Y-NLSH nucleon-nucleon (NN) interactions from the relativistic mean field approach are used. Here, the deformation of the daughter nucleus is taken into consideration, while the alpha cluster is assumed to be spherical. The alpha cluster penetration probability has been determined using the Wentzel-Kramers-Brillouin (WKB) semiclassical approximation. By comparison between the calculated half-lives and the experimental ones, it is found that the R3Y-NLSH interaction has the highest accuracy. After establishing the best R3Y parametrizations for the deformed nuclei, they are then used to predict the alpha decay half-lives of unmeasured superheavy nuclei with $Z = 120$ and 122 . In this case, the Weizsäcker-Skyrme-type nuclear mass model with radial basis corrections (WS-type+RBF) was used to determine the Q_α values and preformation factors. The calculations suggest that $N = 184$ could be a magic number, a deduction that is consistent with previous theoretical calculations.

Keywords Alpha decay · Deformed nuclei · Double folding model · R3Y interactions

1 Introduction

The importance of alpha decay in probing nuclear structure information has been established [1–5], and an accurate theoretical calculation of alpha decay half-lives is essential. Therefore, there have been various theoretical models introduced to study the alpha decay half-lives of

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