

Generalization of α -Decay Cluster-Model to Nuclei Near Spherical and Deformed Shell Closures

XU Chang¹ and REN Zhong-Zhou^{1,2}

¹ Department of Physics, Nanjing University, Nanjing 210008, China

² Center of Theoretical Nuclear Physics, National Laboratory of Heavy-Ion Accelerator, Lanzhou 730000, China

(Received: 2004-2-25; Revised:)

Abstract: The cluster model of α -decay is extended to the regions around doubly magic spherical nucleus ^{208}Pb and around deformed shell closure ^{270}Hs , respectively. The effects of spherical shell closures ($N=126$ and $Z=82$) on α -decay are investigated by introducing an N -dependent α -preformation factor and a Z -dependent one inspired by a microscopic model. Good agreement between the theoretical α -decay half-lives and the measured ones is obtained for the spherical nuclei near the doubly magic nucleus ^{208}Pb , where the nuclear shell effect is included in the expression of α -preformation factor. The cluster model is also generalized for the decay of deformed nuclei. The branching ratios of α -decays from the ground state of a parent nucleus to the ground state (0^+) of its deformed daughter nucleus and to the first excited state (2^+) are calculated in the framework of the cluster model. The results indicate that a measurement of α spectroscopy is a feasible method to extract the information of nuclear deformation of superheavy nuclei around the deformed nucleus ^{270}Hs .

PACS: 23.60.+e, 21.10.-k, 21.60.-n

Key words: cluster model, alpha decay, deformation

[\[Full text: PDF\]](#)

Close