

Anomalous Large Deformation in Some Medium and Heavy Nuclei

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Abstract: We investigate the properties of the Ce isotopes with neutron number $N=60\sim 90$ and the properties of the heavy nuclei near ^{242}Am within the framework of deformed relativistic mean-field (RMF) theory. A systematic comparison between theoretical results and experimental data is made. The calculated binding energies, two-neutron separation energies, and two-proton separation energies are in good agreement with experimental ones. The variation trend of experimental quadrupole deformation parameters on the Ce isotopes can be approximately reproduced by the RMF model. It is found that there exists an abnormally large deformation in the ground state of proton-rich Ce isotopes. This phenomenon can be the general behavior of proton-rich nuclei on the neighboring isotopic chains such as Nd and Sm isotopes. For the heavy nuclei near ^{242}Am the properties of the ground state and superdeformed isomeric state can be approximately reproduced by the RMF model. The mechanism of the appearance of anomalously large deformation or superdeformation is analyzed and its influence on nuclear properties is discussed. Further experiments to study the anomalously large deformation in some proton-rich nuclei are suggested.

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Key words: superdeformation, proton-rich Ce nuclei, isomeric state of ^{242}Am , constraint relativistic mean-field calculation

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