Contribution ID : **262** Type : **Oral talk**

Evolution of the phenomenologically determined collective potential along the chain of zr isotopes

Wednesday, 30 November 2022 19:30 (15)

The properties of the collective low-lying states of Zr isotopes indicate that some of these states are mainly spherical and the other are mainly deformed ones. In our previous works [1,2], it was shown that the structure of low-lying collective states of ^{96}Zr can be satisfactorily described within the framework of a geometric collective model based on the Bohr Hamiltonian with a potential that supports the existence of various forms of the nucleus. Based on these results, the question arises about the possibility of investigating the properties of low-lying collective states of $^{92-102}$Zr on the basis of a five-dimensional geometric quadrupole collective model. The quadrupole-collective Bohr Hamiltonian depending on both β and γ shape variables with a potential having spherical and deformed minima, is applied. The relative depth of two minima, height and width of the barrier, rigidity of the potential near both minima are determined so as to achieve the best possible description of the observed properties of the low-lying collective quadrupole states of $^{92-102}$Zr. Satisfactory agreement with the experimental data on the excitation energies and the E2 reduced transition probabilities is obtained. The evolution of the collective potential with increase of A is described and the distributions of the wave functions of the collective states in $\beta - \gamma$ plane are found. It is shown that the low-energy structure of $^{92-102}$Zr can be described in a satisfactory way within the Geometrical Collective Model with the Bohr Hamiltonian. The β-dependence of the potential energy is fixed to describe the experimental data in a best possible way. The resulting potential evolves with ⊠ increase from having only one spherical minimum in ^{92}Zr, through the potentials having both spherical and deformed minima, to the potential with one deformed minimum in ^{102}Zr. A β-dependence of the wave functions is presented in a set of figures illustrating their distribution over β [3].

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Session Classification : Nuclear Physics

Track Classification : Nuclear physics