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Effective quadruple deformation of $^{128-160}_{60}\text{Nd}$ isotopic chain

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Abstract

The aim of this paper is to calculate the effective quadruple deformation of different levels in the Nd isotopic chain in the framework of the boson interaction model. For this purpose, by labeling the selected states in the form of the dynamic limit of U(5), the expectation value of the quadruple interaction operator is calculated and the quadruple shape invariant and the effective quadruple deformation of levels are obtained and compared to the corresponding experimental values; the effective boson charge for each isotope has been determined. The results show the existence of some overlap in the values of the effective quadruple deformation of 0_3^+ and 2_1^+ levels in this isotopic chain. Also, a certain relationship is observed between the effective quadruple deformation values and the effective boson charge and the spacing of the levels. The existence of this dependence for the Nd isotopic chain and the overlap of quantities can be regarded as the signs of shape coexistence in ^{140}Nd and ^{142}Nd and ^{146}Nd isotopes.

Keywords: quantum shape-phase transition (QPT), electric quadruple deformation, shape coexistence, interacting boson model (IBM)

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