Isospin and Mixed Symmetry Excitations in $^{60-66}$Zn Isotopes*

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Abstract The level structure of $^{60-66}$Zn isotopes is studied within the framework of interacting boson model-3 (IBM-3). The mixed symmetry states are investigated in these nuclei by analyzing the wave functions. The isospin excitation states are identified for ^{60}Zn ($N = Z$) nucleus. The calculated energy levels and transition probabilities are compared with available experimental data. The results obtained and the values of parameters used in this calculation indicated that the Zn isotopes are in the transition from vibrational to γ-unstable nuclei.

Key words IBM-3, isospin, mixed symmetry states, $^{60-66}$Zn isotopes

1 Introduction

The symmetry concept has been very productive in investigating nuclear structure and provides a simple interpretation of excitation energies. This concept has been used in the interacting boson model. First introduced by Arima and Iachello[1—3], nuclear properties are described in terms of pairs of nucleons paired to angular momentum $L = 0$ (s-boson) and $L = 2$ (d-boson). The six possible boson states are classified according to the irreducible representation $[N]$ of the group $U(6)$ and its subgroups. In its original version (IBM-1), only one kind of boson is considered. In IBM-2, a relation among the IBM and the underlying shell model has been established by including the proton and neutron degree of freedom[4]. In lighter nuclei the valence protons and neutrons are filling the same major shell, isospin must be introduced. Within the IBM with isospin (IBM-3)[5], the neutron-proton pair must be included in addition to the two other types of bosons in the IBM-2 to form an isospin triplet.

There have been intensive interests in the collective motions in the medium and light nuclei[6—8]. Even-even Zn nuclei have been the subject of extensive experimental and the oretical investigations[9—14]. A number of studies[15—17] have explored the structure of these nuclei and it has been shown that their structure cannot be explained by the simple vibrational mode. It is therefore interesting to carry out a systematic comparison of the experimental data with IBM-3 model calculations. In a recent work[18] we have studied the ^{48,50}Cr isotopes in the framework of IBM-3. This study provides information on the mixed symmetry states and isospin excitation ($T > T_z$), as well as electromagnetic transitions. A good agreement with available experimental data has been obtained. We will extend the analysis to the Zn isotopes in this work. The aim of the present work, is to carry out a systematic IBM-3 calculations of the even-even Zn nuclei with $A = 60$—66. Special attention will be given to the identification of isospin and symmetric structure in the low-lying energy levels.

2 The IBM-3 hamiltonian

The microscopic picture of the interacting boson model is given in terms of collective pairs of nucleon. The

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