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Investigation of isospin excited and mixed-symmetry states in even–even $N = Z$ nuclei

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Mixed-symmetry and isospin excited states are typical of the interacting boson model with isospin (IBM-3). With a view to look for such states, levels scheme of the IBM-3 dynamical symmetry is discussed. A systematic investigation in the proton and neutron degrees of freedom of the energy levels has been carried out. A sequence of isospin excitation bands has been identified. We have analyzed the wave functions and given the symmetrical labeling of the states. The transition probabilities between the isospin excitation states of model limits are analyzed in terms of isoscalar and isovector decompositions. The present calculations suggest that a combination of isospin excitation and mixed-symmetry states can provide substantial information on the structure of nuclear states. Calculations for $^{88}_{44}$Ru and $^{92}_{46}$Pd nuclei are presented and compared with the results of the shell model and available experimental data.

Keywords: Nuclear structure; isospin; mixed symmetry states; $N = Z$ nuclei; 92Pd; 88Ru.

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1. Introduction

The $N \simeq Z$ nuclei exhibit many attractive properties which enable ideal testing of nuclear models. Plenty of experimental data have accumulated over the recent years in support of nn and pp pairs, but there is little information about np pairing owing to the experimental difficulties in studying intermediate mass $Z = N$ nuclei.[1,2] In the np pairing, the neutron and the proton can be coupled both to isospin $T = 0$ and $T = 1$. The energy spectra of the mirror nuclei show that the $n - n$ force is the same as the $p - p$ force. A strong isovector proton–neutron pairing whose strength is fixed by an isospin conservation has been also investigated by the shell model.[3,4] The research in Ref. 5 shows that the three isovector components are speedily quelled by increasing the angular momentum. The studies[6–8] show that