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Microscopic structure of the low-lying collective states in ^{152}Sm

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Abstract

The proton-neutron symplectic shell-model approach [1–5] is used to determine the microscopic structure of the low-lying collective states of ground and first few excited bands of positive and negative parity in ^{152}Sm. For this purpose, the model Hamiltonian is diagonalized in a U(6)-coupled basis, restricted to state space spanned by the fully symmetric U(6) vectors of the lowest even and odd irreducible representations of Sp(12,R). In this way, the positive- and negative-parity collective bands are treated on equal footing within the framework of the microscopic symplectic-based shell-model scheme without the introduction of additional degrees of freedom inherent to other approaches to odd-parity nuclear states. A good description of the excitation energies of the considered bands is obtained. The microscopic structure of low-lying collective states in ^{152}Sm shows that practically there are no admixtures from the higher shells and hence the presence of a very good U(6) dynamical symmetry. Additionally, the structure of the collective states under consideration shows also the presence of a good SU(3) quasi-dynamical symmetry. The intraband ground band $B(E2)$ and interband $B(E1)$ transition strengths between the states of ground and $K^\pi = 0^-_1$ bands are reproduced without the use of an effective charge.

References

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