Description of low-lying collective states in osmium isotopes in the boson expansion theory

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Neutron-rich nuclei with A$\sim$190 provide a characteristic testing ground for microscopic theories of nuclear structures. There are quite a few indications that a prolate-oblate shape transition takes place at around N = 116 in this region [1,2].

The boson expansion theory (BET) is a promising method for microscopic description of anharmonicities in nuclear quadrupole collective motions, in terms of the fermion degrees of freedom, if the coupling to non-collective states is faithfully included in the calculation [3,4]. It allows us to take into account higher-order terms neglected in the RPA, and the adiabatic condition for particle motions can be avoided.

In this work, the low-lying collective states in osmium isotopes are investigated microscopically by means of the BET with the self-consistent effective interactions [5,6]. The Kishimoto-Tamura method of normal-ordered linked-cluster expansion of the modified Marumori boson mapping [3] is applied to construct the microscopic boson image of the fermion Hamiltonian and that of the E2 operator. The potential energy surfaces and the structures of boson wave functions for some relevant low-lying collective states are illustrated [7]. Calculated level structures and electromagnetic properties are compared with the available experimental data.

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