

Collective states in the pairing-plus- quadrupole shell model for $N \sim Z$ sd - and pf -shell nuclei

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Abstract

Results from calculations of low-lying collective states performed in the pairing-plus-quadrupole shell model, realized in the framework of Elliott $SU(3)$ scheme in a single oscillator shell, are presented for some $N \sim Z$ sd - and pf -shell even-even nuclei. The Hamiltonian includes the harmonic oscillator mean field as well as all relevant single-particle effects, such as the spin-orbit and orbit-orbit terms. It also has a residual two-body part composed of the quadrupole-quadrupole interaction plus the full pairing (isovector plus isoscalar) interaction. We examine the complementarity and competition of these terms in determining the shape of the systems. Relevant measures for nuclear deformation are reviewed as the nuclear shape is interpreted in terms of the deformation parameter β and the triaxiality parameter γ . We compare our outcome with some previous studies where only proton and neutron pairing terms have been used. Finally, we examine how well our description can be achieved in a truncated basis of selected states.