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Applications of the Algebraic Microscopic Pairing-plus-Quadrupole Shell Model to Medium-Mass Nuclei

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Abstract

Our study is focused on $sd-$ and $pf-$shell even-even systems with up to 6 valence particles. The model space is constructed from orbits which belong to one or the two oscillator shells.

We present results for the excitation spectra and transition probabilities from calculations performed in the symmetry-adapted basis of the Algebraic Microscopic Pairing-plus-Quadrupole Shell Model. Besides the quadrupole and the pairing (isoscalar and isovector) interactions, the Hamiltonian also includes the single-particle terms for the studied nucleus. As an application of this approach, we describe the phase transition phenomenon in nuclei by exploring the interplay between the four terms of our interaction. Furthermore, in its two-shell extension, the build-up of collectivity in nuclei from the upper-sd shell (like the isotopes ^{32}Si, ^{32}S, and ^{32}Ar) and the appropriate values of the effective charges for various choices of the model space are also investigated.

Our outcome gives a rather good description of the experimental data by taking into account both short- and long-range correlations in these medium-mass nuclei.