Pairing – Quadrupole Connections in the Algebraic Shell Model Applied to sd-Shell Nuclear Systems

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We present some particular applications within the algebraic realization of the Pairing-plus-Quadrupole Model /PQM/ for realistic sd-shell nuclear systems. The PQM uses the framework of the Elliott's SU(3) Model. The probability distribution of the SU(3) basis states within the dynamical symmetries, corresponding to the isovector, isoscalar and total pairing eigenstates is obtained through a numerical diagonalization of the PQM Hamiltonian in each limit. This allows the investigation of the interplay between the pairing and quadrupole interactions in the Hamiltonian of the PQM. The relative strengths of the dynamically symmetric quadrupole quadrupole interaction with the considered types of pairing interactions are investigated systematically. Specifically, we illustrate the evolution of the importance of the isoscalar terms in the Hamiltonian by showing how it evolves in the chain of nuclei with 2 and 4 valence sd-shell particles going from the neutron-deficient to the neutron-rich part of the nuclear chart. The model space of two oscillator shells in a SU(3) - symmetry-adapted basis is also used for the energy spectrum calculations while the advantages of this choice over the one-shell approach are exemplified.