Magnetic and isospin properties of deformed odd-mass nuclei within the Higher Tamm-Dancoff approximation

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In beyond mean-field approaches, the description of odd-mass nuclei requires to break the time-reversal invariance of the underlying one-body hamiltonian, inducing a polarization of the even-even core to which the odd nucleon is added. We study the effect of this core polarization on the resulting splitting of the Kramers degenerate single-particle states, the magnetic dipole moment and the isospin mixing in the ground state. This study is performed for well-deformed odd-mass nuclei first in the Hartree-Fock approximation using the Skyrme energy density functional (SIII and SLy4 parametrizations), then within the Higher Tamm-Dancoff approximation allowing to include pairing correlations (in $T = 1$ and $T = 0$ channels) using a residual delta interaction without breaking the particle-number symmetry. Regarding the magnetic properties, we find a correction to the unified-model description due to the core polarization involving mostly spin degrees of freedom. This correction is able to reproduce the phenomenologically observed quenching (amounting to about 30%) of the effective spin gyromagnetic factors from the free values. As for isospin mixing in the ground state, we estimate the mixing parameter assuming negligible contributions from T-values above $|T_z|+1$. For well-deformed $|T_z| = 1$ nuclei in the $A = 25$ and $A = 50$ mass regions, we find isospin-mixing parameters below 1%.

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