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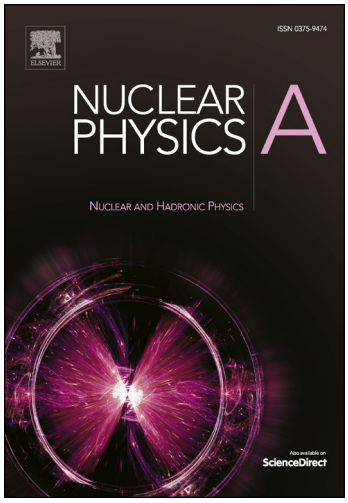

Tensor force effect on the evolution of single-particle energies in some isotopic chains in the relativistic Hartree-Fock approximation

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Tensor force effect on the evolution of single-particle energies in some isotopic chains in the relativistic Hartree-Fock approximation

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Abstract

Within a nonlinear relativistic Hartree-Fock approximation combined with the BCS method, we study the effect of the nucleon-nucleon tensor force of the π-exchange potential on the spin- and pseudospin-orbit doublets along the Ca and Sn isotopic chains.

We show how the self-consistent tensor force effect modifies the splitting of both kinds of doublets in an interdependent form, leading, quite generally, to opposite effects in the accomplishment of the spin and pseudospin symmetries (the one is restored, the other one deteriorates and vice versa). The ordering of the single-particle energy levels is crucial to this respect.

Also, we observe a mutual dependence on the evolution of the shell closure gap Z=50 and the energy band outside the core, along the Sn chain, as due to the tensor force. In fact, when the shell gap is quenched the outside energy band is enlarged, and vice versa. A reduction of the strength of the pion tensor force with respect to its experimental value from the nucleon-nucleon scattering is needed to get results closer to the experiment. Pairing correlations act to some extent in the opposite direction of the tensor term of the one-pion-exchange force.

Keywords: pion tensor force, spin-orbit and pseudospin-orbit energy splittings, gaps, relativistic Hartree-Fock approximation
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