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Effect of nuclear tensor force on ground-state properties in the rare-earth region within a Skyrme mean-field approach

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Recent years, there are several researches [1-3] studying on the effect of nuclear tensor force in nuclear structure. Few attempts [4-6] have been made to fit the phenomenological Skyrme parameterization with the inclusion of the nuclear tensor term. However, a complete and systematic work to examine the role of nuclear tensor force in the rare-earth region is still lacking. This work aims to examine the effect of nuclear tensor force in the ground-state properties of rare-earth even-even nuclei. This is done within a Skyrme-Hartree-Fock-plus-Bardeen-Cooper-Schrieffer (HF+BCS) framework. The pairing correlations are taken care with the BCS theory. The Skyrme interaction is used to approximate the nucleon-nucleon interaction with various sets of parameterizations. At the moment, this work only considered the parameterization fitted through the perturbative addition of nuclear tensor term. The parameterization considered herein are divided into two sets namely, Set A (SIII and SIII+T) and Set B (SLy5 and SLy5+T) to examine the effect of nuclear tensor force on the ground-state properties. The considered ground-state properties here are binding energy, two-nucleon separation energy, nuclear charge radii and intrinsic charge quadrupole moments. The inclusion of nuclear tensor force has a better agreement with the experimental data but not for all cases. The good agreement between calculated and experimental data are sometimes degraded when taking into account nuclear tensor force. However, the results from this work is still preliminary as one should employ a full refit of all Skyrme parameters such as the TIJ sets [5].

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Field of your work

Theoretical nuclear physics

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