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Variation approach for pair determination in nucleon pair approximation

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In this talk, we would like to suggest a pair-condensation variation approach, which can be a priors and quantitative guide for NPA calculations. Such variation has particle-number conservation, and thus can more accurately describe transitional nuclei, which the NPA is mostly applied to. It also includes all the two-body-configuration degrees of freedom. Therefore, it works for asymmetric deformed nuclei and is enabled to estimate the importance of negative-parity collective pairs. We also propose that such a variation has three self-consistent symmetries.

We perform a trial calculation for ^{132}Ba, which is a typical transitional nucleus. The proposed variation approach is expected to improve the NPA calculation for ^{132}Ba, as we have demonstrated. In detail, the variation more efficiently establishes the γ softness of this nucleus, by imposing pairing correlation. This reveals the ability of our variation approach to describe the asymmetric deformation. It suggests SD pairs, the neutron H pair, and proton G, I pairs for the NPA calculations. Following NPA calculations successfully and self-consistently describe the yrast level scheme and the $I = 10$ backbending with lower energy. We also explain why negative-parity pairs seem to work for the backbending, but are still not recommended within the framework of our variation. We also observe a rough positive correlation between the pair weights in optimized pair condensation with cranking, and the pair number expectation values of the eigenstates in the following NPA calculations, which provides preliminary evidence on the validity of our variation approach.

Summary

We proposed a pair-condensation variation approach to evaluate the importance of collective pairs, and determine their structure in low-lying states. With the trial calculation for transitional ^{132}Ba, we exemplify the ability of our variation approach. In our following work, we will study the possible parity mixture in the optimized pair condensation, extensively verify the validity of our variation approach from wave-function-overlap and electromagnetic-property points of view, and then apply it to more realistic NPA calculations.

Abstract Type

Talk

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