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Pauli blocking in deformed two-boy models applied to weakly-bound exotic nuclei

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The study of reactions involving weakly-bound exotic nuclei is an active field due to advances in radioactive beam facilities. Many of these nuclei can be approximately described by a model consisting of an inert core and one or more valence nucleons. For some of these nuclei, the quadrupole deformation is especially relevant and should be included in the structure models. This is the case of ^{11}Be and ^{17}C, which can be approximately described as a core and a weakly-bound neutron.

Two different deformed two-body models have been used to described these nuclei, and their results have been compared [Phys. Rev. C 108 (2023) 024613]: the semi-microscopic particle-plus-AMD (PAMD) model from [Phys. Rev. C 89 (2014) 014333] and the Nilsson model. We now explore a new model built as a combination of these two. Furthermore, Pauli blocking effects of deformed single-particle Nilsson states are considered, applying the Bardeen–Cooper–Schrieffer (BCS) formalism. The bound states wavefunctions obtained for ^{17}C have been tested by applying them to the $^{16}\mathrm{C}(d,p)^{17}\mathrm{C}$ transfer reaction, using as reaction framework the Adiabatic Distorted Wave Approximation (ADWA). The results are consistent with the data from [Phys. Lett. B 811 (2020) 135939], Pauli blocking effects significantly improve the agreement.

In our calculations, the continuum spectrum of the weakly-bound nuclei is discretized using the transformed harmonic oscillator basis (THO) [Phys. Rev. C 80 (2009) 054605]. The THO has been successfully applied to the discretization of the continuum of two-body and three-body weakly bound nuclei for the analysis of break up and transfer reactions [Phys. Rev. Lett. 109 (2012) 232502, Phys. Rev. C 94 (2016) 054622]. Therefore, our structure models can be used to study processes such as transfer to the continuum or Coulomb dissociation.

Abstract

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