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The continuum of 17C and 19C studied via direct reactions

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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. However, to properly describe some of these nuclei within few-body models, additional effects must be considered, such as deformations and possible excitations of the core. This is the case of ^{17}C and ^{19}C, which can be approximately described as a deformed core and a weakly-bound neutron.

The carbon isotopes ^{17}C and ^{19}C are studied using the novel NAMD model resulting from the combination of the Nilsson and PAMD models from [Phys. Rev. C 108 (2023) 024613]. The proposed formalism follow the Nilsson model scheme but including microscopic information of the core based on Antisymmetrized Molecular Dynamics (AMD) calculations. The bound states wavefunctions obtained for ^{17}C have been already applied to the $^{16}\mathrm{C}(d,p)^{17}\mathrm{C}$ transfer reaction, providing a good agreement with the experimental data from [Phys. Lett. B 811 (2020) 135939].

The same transfer reaction is studied also populating unbound states in the continuum of ^{17}C.
In our calculations, the continuum spectrum of unbound states of the nucleus is discretized using the transformed harmonic oscillator basis (THO) [Phys. Rev. C 80 (2009) 054605], which has been successfully applied to the analysis of breakup and transfer reactions [Phys. Rev. Lett. 109 (2012) 232502]. The unbound states of ^{17}C and ^{19}C are also studied in breakup reactions $^{17}\mathrm{C}(p,p')^{16}\mathrm{C}+n$ and $^{19}\mathrm{C}(p,p')^{18}\mathrm{C}+n$. Promising results have been found in the comparison of the XCDCC calculations [Phys. Rev. C 95 (2017) 044611] using the NAMD model with the experimental data from [Phys. Lett. B 660 (2008) 320].

Abstract

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