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Ab initio calculations for exotic nuclei (I)

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One of the recently developed approaches capable of describing both bound and scattering states in light nuclei simultaneously is the No-Core Shell Model with Continuum (NCSMC). This technique represents a state-of-the-art *ab initio* approach and combines the No-Core Shell Model (NCSM) description of short-range correlations with the clustering and scattering properties of the Resonating Group Method. Recent NCSMC calculations of the exotic structure of the ^{9}He nucleus will be presented. The properties of this system were investigated by analyzing the n+^{8}He continuum and using chiral interactions as the only input. Our analysis produced an unbound ^{9}He nucleus with two resonant states found above the n+^{8}He breakup threshold. In particular, no positive parity ground state was found, indicating the break-up of the parity-inversion mechanism found in the ^{11}Be and ^{10}Li nuclei of the same $N = 7$ isotonic chain. Finally, recent calculations for elastic proton-nucleus scattering will be presented too. The differential cross section and the analyzing power for several light target nuclei were computed using a microscopic optical potential constructed from new *ab initio* nonlocal densities obtained within the NCSM framework.

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