

ηN interactions in the nuclear medium and η -nuclear bound states

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Collaboration

Abstract content

Recent calculations of η -nuclear bound states in few-body, as well as many-body systems are reviewed [1,2,3]. Underlying energy-dependent ηN interactions are derived from coupled-channel models that incorporate the $S_{11} N^*(1535)$ nucleon resonance.

The role of self-consistent handling of the subthreshold, strongly energy-dependent ηN interactions is thoroughly discussed. Due to relatively large downward energy shift and rapid decrease of the ηN amplitudes, our calculations impose stronger constraints than ever on the onset of η -nuclear binding. Binding energies and widths of η -nuclear bound states were calculated within several ηN interaction models for nuclei across the periodic table. No ηNN bound states were found in models where $Rea_{\eta N} \leq 1$ fm, with $a_{\eta N}$ the ηN scattering length, i.e., in the majority of coupled-channel models of the $N^*(1535)$ resonance. For ηNNN , a weakly bound and relatively broad state was found within the GW model [4] where $Rea_{\eta N} \approx 1$ fm. Bound states of the η meson in ^{12}C are unlikely in models with $Rea_{\eta N} \leq 0.5$ fm, and $Rea_{\eta N} \approx 0.9$ fm is required to reproduce the η bound-state candidate in ^{25}Mg from the COSY-GEM experiment [5].

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