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Ab initio Gamow in-medium similarity renormalization group with resonance and continuum

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Resonance is a general phenomenon which can happen in classic or quantum systems. An unbound many-body quantum system can undergo a self-resonant process. It has long been a challenge how to describe unbound many-body open quantum systems in resonances.

We have developed an ab initio Gamow in-medium similarity renormalization group (IM-SRG) method capable of describing resonance and non-resonance continuum properties of weakly-bound or unbound nuclear systems. To include the continuum effect, the Gamow-Berggren representation has been employed into the IM-SRG framework for the first time. We extend IM-SRG to the complex-energy plane by using the Gamow Hartree-Fock basis. This basis treats bound, outgoing Gamow resonant and non-resonant continuum states on an equal footing. Carbon and oxygen isotopes have been calculated with chiral effective field theory two- and three-nucleon forces, giving well descriptions of both bound and resonant excited states. The halo structure of the Borromean nucleus 22C is clearly seen by the density calculation, in which continuum s-waves play a crucial role. Further, we predict low-lying resonant excited states in 22C.

Summary

The Gamow IMSRG provides tractable ab initio calculations of weakly-bound or unbound open quantum systems.

Abstract Type

Talk

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