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Microscopic Coupled Cluster approach to Neutron Rich Nuclei

GAUTE HAGEN, DAVID DEAN, Oak Ridge National Laboratory, MORTEN HJORTH-JENSEN, UiO, THOMAS PAPENBROCK, ORNL — Building nuclei from the ground up starting with the bare nucleon-nucleon interaction is a major challenge in nuclear structure today. We present results starting with the fully microscopic Coupled Cluster approach. Coupled Cluster theory builds correlation on a given reference state through an exponential correlation operator acting on the reference state. We have implemented Coupled Cluster with two- and three-body forces and present ab-initio calculations of O16 starting with a two- and three-body low-momentum interaction. Further, we have extended the Coupled Cluster technique to the complex energy plane using a complex single-particle basis where bound, resonant and continuum states are treated on equal footing. This allows for an ab-initio description of nuclei far from the valley of stability, and results of the various ground-states of the Helium isotopes, starting with a realistic nucleon-nucleon interaction are presented. Within this formalism we are able to reproduce basic properties of these nuclei, such as He5 unbound and He6 bound in its ground state.

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