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Ab initio no-core shell model with continuum[1]

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The *ab initio* no-core shell model (NCSM) is a many-body approach to nuclear structure of light nuclei. The NCSM adopts an effective interaction theory to transform fundamental inter-nucleon interactions into effective interactions for a specified nucleus in a selected harmonic oscillator basis space [1]. The method is capable of predicting nuclear structure from inter-nucleon forces derived from quantum chromodynamics by means of chiral effective field theory [2]. NCSM extensions to the microscopic description of nuclear reactions are now under development. In my talk, I will first discuss our recent calculations of the ^{4}He total photo-absorption cross section using two- and three-nucleon interactions from chiral effective field theory [3]. I will then outline our effort to augment the NCSM by the resonating group method (RGM) technique to develop a new method capable of describing simultaneously both bound states and nuclear reactions on light nuclei [4]. This approach, which preserves translational symmetry and the Pauli principle, will allow us to calculate cross sections of reactions important for astrophysics and describe weakly-bound systems from first principles. I will present our first phase shift results for neutron scattering off ^{3}H, ^{4}He and ^{7}Li and proton scattering off ^{3}He, ^{4}He and ^{7}Be using realistic nucleon-nucleon potentials.

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