Ab initio calculations of nuclear structure and reactions

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The description of nuclei starting from the constituent nucleons and the realistic interactions among them has been a long-standing goal in nuclear physics. In addition to the complex nature of nuclear forces with two-nucleon, three-nucleon and possibly even four-nucleon components, one faces the quantum-mechanical many-nucleon problem governed by an interplay between bound and continuum states. In recent years, significant progress has been made in ab initio nuclear structure and reaction calculations based on input from QCD employing Hamiltonians constructed within chiral effective field theory. I will overview *ab initio* many-body approaches capable of describing both bound and scattering states in nuclei. I will discuss results of bound state calculations for p-shell and light sd-shell nuclei as well as for nucleon scattering on ^{4}He and ^{40}Ca, for resonances of exotic nuclei, e.g., ^{6,7}He, for reactions important for astrophysics, such as ^{7}Be$(p,\gamma)^8$B radiative capture, and for ^{3}H$(d,n)^4$He fusion.

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