Ab initio investigation of the proton-rich light nuclei ^{7}Be, ^{8}B, ^{10}C, ^{13}O, ^{15}F

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A realistic description of atomic nuclei, in particular light nuclei characterized by clustering and low-lying breakup thresholds, requires a proper treatment of continuum effects. We have developed an approach, the No-Core Shell Model with Continuum (NCSMC) [1,2], capable of describing both bound and unbound states in light nuclei in a unified way. With chiral two- and three-nucleon interactions as the only input, we can predict structure and dynamics of light nuclei and, by comparing to available experimental data, test the quality of chiral nuclear forces.

We will review applications of NCSMC to the ^{3}He+α scattering, structure of ^{7}Be, and the ^{3}He(α,γ)^{7}Be reaction, as well as the p+^{7}Be scattering, structure of ^{8}B, and the ^{7}Be(p,γ)^{8}B reaction [3]. Both these radiative capture reactions are important for nuclear astrophysics and neutrino physics. We will also present our ongoing calculations of the structure of ^{10}C considering the p+^{9}B continuum. This study is a part of our effort to compute the nuclear structure corrections needed for the extraction of the V_{ud} matrix element of the CKM matrix. Finally, we will review our NCSMC investigation of the ^{13}O isotope that was a subject of a recent experiment at NSCL [4] and of the unbound ^{15}F investigated at GANIL [5].

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