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Ab initio structure and reactions of light nuclei (Invited)

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Advances in the fundamental description of the interaction among nucleons in many-body techniques and in scientific computing have opened new avenues for modeling low-energy light-ion structure and reactions on an equal footing. Starting from chiral effective interactions, which provide a systematic and improvable scheme based on the underlying theory of QCD, and equipped with an *ab initio* method, we are now able to arrive at accurate evaluations of crucial reaction data for nuclear astrophysics, fusion-energy research, and other applications, and, further provide a realistic description of reactions involving exotic nuclei. I will present in this talk the No-Core Shell Model with Continuum formalism 1, which combines square-integrable A-nucleon eigenstates and continuous binary and ternary cluster states [2,3]. This method can accurately describe reactions in systems with more than four nucleons starting from two- and three-nucleon interactions. I will briefly review the physics cases recently unraveled by the method such as the impact of three-nucleon forces on low-energy structure and reactions. I will illustrate the method with the most comprehensive study of the A=5 and A=6 continuum (N-^{4}He and d-^{4}He elastic collisions [4,5] and the $d(t,\alpha)n$ transfer channels 6). Finally, I will show the importance of the three-nucleon force for the description of nuclei close to the drip line, which will be exemplified with the differential cross-section of $^{10}\mathrm{C}(p,p)^{10}\mathrm{C}$.

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