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Microscopic optical potential for proton elastic scattering off light exotic nuclei

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A microscopic optical potential for intermediate energies is derived using ab initio translationally invariant nonlocal one-body nuclear densities computed within the no-core shell model approach utilizing two- and three-nucleon chiral interactions. The optical potential is obtained at first-order within the spectator expansion of the non-relativistic multiple scattering theory by adopting the impulse approximation. The nuclear density and the nucleon-nucleon t matrix are the two basic ingredients underlying the computation of the optical potential and are both obtained using the same chiral interaction, that represents the only input of our calculations. The ground state local and nonlocal densities of several unstable nuclei are calculated and applied to optical potential construction. The differential cross sections and the analyzing powers for the elastic proton scattering off these nuclei are then calculated for different values of the incident proton energy. The model is first tested on 4He, 12C, and 16O, and then is used to compute and compare the results for the scattering observables with the existing experimental data for 6He and 8He halo nuclei. Finally, predictions for the same observables will be also presented for proton elastic scattering off other unstable nuclei like 10Be, 10C, 14C, and 14O.

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