Scattering as a tool to study nuclear structure towards the drip lines

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Interest in low- and intermediate-energy nucleon-nucleus optical potentials has increased recently due to advances in the construction of the so-called folding models. At low energies, the optical potential plays a pivotal role in the calculation of nucleon-induced reactions, which are important in the understanding of nucleosynthesis. Central to that is the underlying nuclear structure, especially of nuclei beyond the valley of stability. Understanding the structures of those exotic nuclei has been one of the aims of radioactive beam experiments, where the scattering of exotic nuclei from hydrogen at intermediate energies translates to proton scattering from those systems. One may gain much nuclear structure information from those data with analyses based on modern microscopic optical potentials. I shall review the current state of play of the g-folding optical potentials, based on coordinate space representations of the NN g matrices, and how one may gain insight into the structures of light exotic nuclei. As examples, I will mention scattering from ^{6,8}He, and ^{9,11}Li. Complementary to nucleon scattering is the use of electron scattering to study exotic systems to gain understanding of changes in the charge density as one approaches the neutron drip line. I will discuss predictions of such in light of proposed electron-ion colliders at RIKEN and GSI. I shall also review calculations of elastic and inelastic nucleon scattering that have been made for ^{208}Pb, which shows promise for the study of heavy exotic nuclei using these methods.

Another recent development has been the use of Skyrme-Hartree-Fock models in the descriptions of exotic nuclei. Much effort has been devoted to the descriptions specifically of sd-shell exotic nuclei in the understanding of novel structures that may emerge as one reaches the drip lines. I will discuss the use of such structure models in proton scattering studies and highlight a possible new signature of exotic structures.