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Linking Nuclear Reactions and Nuclear Structure on the Way to the Drip Line[1]

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The present understanding of the role of short- and long-range physics in determining proton properties near the Fermi energy for stable closed-shell nuclei has relied on data from the (e,e'p) reaction. Hadronic tools to extract such spectroscopic information have been hampered by the lack of a consistent reaction description that provides unambiguous and undisputed results. The dispersive optical model (DOM), originally conceived by Claude Mahaux, provides a unified description of both elastic nucleon scattering and structure information related to single-particle properties below the Fermi energy. The DOM provides the starting point to provide a framework in which nuclear reactions and structure data can be analyzed consistently to provide unambiguous spectroscopic information including its asymmetry dependence. Recent extensions of this approach include the treatment of non-locality to describe experimental data like the nuclear charge density based on information of the spectral density below the Fermi energy, the application of the DOM ingredients to the description of transfer reactions, a comparison of the microscopic content of the nucleon self-energy based on Faddeev-RPA calculations emphasizing long-range correlations with DOM potentials, and a study of the relation between a self-energy which includes the effect of short-range correlations with DOM potentials. The most recent Dom implementation currently in progress abandons the constraint of local potentials completely to allow an accurate description of various properties of the nuclear ground state.

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