Studying the Dynamic Polarization Potential for Halo-nucleus Scattering Potentials Using Inversion

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The interaction between nuclei cannot be said to be understood without an understanding of the dynamic polarization potential, DPP, component. Different approaches to finding the DPP are in disagreement. We show the power of the coupled-channel plus inversion method to evaluate the DPP using the example of proton scattering from the halo nucleus ^{6}He at about 25 MeV/u by applying the IP inversion method [1] for $S \rightarrow V$ to CDCC S-matrix elements. The model for ^{6}He is that of Rusek *et al* [2]; while simplified in some respects, it is rich enough to enable us to: (i) Establish the breakup DPP for p + ^{6}He within a specific model, evaluating the contribution of different multipolarities and the importance of continuum-continuum coupling and establish generic properties of the DPP, in particular show that the common practise of uniformly renormalising folding model potentials is invalid; (ii) demonstrate the validity of the IP method for closely defining the DPP even when there are relatively few partial waves; (iii) show the failure of the weighted trivially equivalent (WTE) method in specific cases. Concerning (i), the DPP is very non-uniform, affects the rms radius of the potential and therefore nuclear size estimates from elastic scattering and is very sensitive to both L-transfer and to continuum-continuum coupling. There is evidence of departures from the generic behaviour of the DPP found for other examples of breakup DPPs. Concerning (ii), the method works well providing certain precautions are taken. Concerning (iii), the WTE fails badly in the present cases.

References:

[1]S G Cooper, V I Kukulin, R S Mackintosh and V N Pomerantsev, Nucl. Phys. **A677** (2000) 187

[2]K Rusek, K W Kemper and R Wolski, Phys. Rev. **C64** (2001) 044602