How good is the frozen-halo approximation when there is core absorption ?

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Halo nuclei are often described by few-body models which identify separate halo and core degrees of freedom. In addition, many of the theories for the elastic scattering of halo nuclei from stable targets assume that the incident projectile energy is sufficiently high that the halo degrees of freedom vary slowly over the collision time—the *adiabatic* or *frozen-halo* approximation [1].

Qualitative estimates for the range validity of the adiabatic approximation have been obtained [2], which take into consideration the mean breakup energies of the projectile that contribute to the elastic scattering. By comparison with more accurate calculations, the range of validity of the adiabatic approximation for the elastic scattering of halo nuclei goes beyond what we would expect from these qualitative arguments.

Explicit expressions have been obtained [3] for the leading non-adiabatic corrections to the elastic scattering matrix in a model in which the interaction of the valence nucleons with the target is neglected.

We will present an evaluation of these non-adiabatic corrections for the elastic scattering of halo nuclei. They are expected to be greatest at large momentum transfers, i.e., large scattering angles. However, we will show that the corrections are smaller than expected because of the key role played by strong core absorption at low impact parameters. We derive a new estimate for the accuracy of the adiabatic approximation when the valence-target interaction is neglected and there is strong core absorption.

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[2] R. C. Johnson, in *Proc. Eur. Conf. On Advances in Nuclear Physics and Related Areas, Thessaloniki, Greece, July 8-12, 1997*, edited by D. M. Brink, M. E. Grypeos, and S. E. Massen (Giahoudi-Giapouli, Thessaloniki, 1999), p. 297.

[3] R. C. Johnson, J. Phys. G: Nucl. Part. Phys. **24**, 1583 (1998); N. C. Summers, Ph.D. thesis, University of Surrey, 2001, unpublished.