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Interior and Exterior Contributions to Transfer Cross Sections

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There has been much recent debate concerning what precisely is measured by (d,p) transfer reactions on nuclei. Do experiments measure spectroscopic factors or asymptotic normalization coefficients? This question is related to the relative importance for the transfer amplitudes of the interior and exterior contributions of the target bound-state wave functions. In order to probe this in more detail, for a wide range of transfer reactions we examine the effects of cutting off the lower or upper radial regions of those bound states. We find that the exterior contributions to prior amplitudes are usually very small and hardly affect the cross sections. We find that the interior contributions to the post amplitudes are small, though give rise to some interference effects in the cross sections. The scheme of [Phys. Rev C 84, 044616 (2011)] decomposes the total amplitude into a sum of the interior post part, the exterior prior part, and a surface integral between. Our results indicate the surface integral will be the dominant contribution. Since that integral depends on the exterior R-matrix parameters of the bound state, the total cross section can be largely written in terms of the exterior properties of the bound-state wave function. This work was performed within the TORUS collaboration under the auspices of the U.S. Department of Energy by Lawrence Livermore National Laboratory under Contract DE-AC52-07NA27344.

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