

Title: Advancing (d,p) reaction theory as a surrogate for neutron capture measurements

Abstract: Determining cross sections for reactions on short-lived nuclei is a major challenge for nuclear physics and nuclear astrophysics. The surrogate nuclear reaction (d, p) is an indirect method for determining the cross section. A theory for computing cross sections for inclusive $A(d, p)X$ processes has been previously developed [1], which includes direct neutron transfer to bound states, transfer to the continuum, as well as inelastic processes. Therein, local optical potentials are used to describe the nucleon-target interaction. This framework is extended to investigate the effects of nonlocality in the optical potentials for $A(d, p)X$ reactions populating neutron bound and scattering states. Neutron wave functions are obtained for nonlocal interactions of the Perey-Buck type within the R-matrix method [2]. In this talk, an overview of the reaction mechanisms and the theoretical framework to interpret surrogate measurements will be provided. The sensitivity of the results to particular details of the input interactions will also be discussed. Finally, the impact of our study on a specific application of the method will be addressed.

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- [1] G. Potel, F. M. Nunes, and I. J. Thompson, "Establishing a theory for deuteron-induced surrogate reactions," *Phys. Rev. C*, vol. 92, p. 034611, Sep 2015.
- [2] P. Descouvemont and D. Baye, "The R-matrix theory," *Reports on Progress in Physics*, vol. 73, no. 3, p. 036301, 2010.