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ABSTRACT

Theory at the Intersection of Direct and Compound Nuclear Reactions

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The last decade has seen much progress in the development of theory tools that allow us to achieve more accurate calculations for both direct and compound (statistical) nuclear reactions. Integrated nuclear structure and reaction descriptions provide the basis for making cross-section predictions and enable indirect determination of cross sections that are difficult to measure directly. This is particularly important for applications involving reactions with unstable nuclei, such as astrophysics simulations. I will discuss advances at the intersection of direct and compound reactions, focusing on reactions that populate doorway states and provide insights on the formation and decay of compound nuclei. The reaction descriptions require the integration of nuclear-structure information that is not part of typical reaction calculations and accounts for higher-order reaction processes. The theory developments have enabled the successful extraction of neutron-capture cross sections from measurements of transfer reactions with stable beams. I will discuss the use of inelastic scattering as an additional indirect (surrogate) mechanism, the feasibility of determining (n,n'), (n,2n), and other desired cross sections, and possible experiments at radioactive-beam facilities.

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