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Theory & Modeling for Surrogate Reactions

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Obtaining reliable cross sections for reactions involving unstable nuclei remains a formidable task, and direct measurements have to be complemented by theoretical predictions and indirect methods. Indirect approaches come with their own challenges, as experimental observables have to be related to the quantity of interest. The surrogate method, for instance, aims at determining cross sections for compound-nuclear reactions on unstable targets by producing the compound nucleus via an alternative (transfer or inelastic scattering) reaction and observing the subsequent decay via γ emission, particle evaporation, or fission. A complete theoretical treatment involves integrating descriptions of direct and compound-nucleus reactions, including modeling of compound-nuclear decays. This presentation will give an outline of the surrogate approach and the challenges involved in extracting cross sections from the measurements. Progress made in understanding and describing the nuclear processes involved in a surrogate reaction will be discussed, and applications to neutron-induced fission, neutron capture, and (n,2n) reaction will be presented. Open questions and prospects will be considered.