NUCLEAR SEMINAR SERIES

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4:00 pm - Rm 184 NSH

Surrogate reactions: Doorways to cross sections for unstable isotopes

Obtaining reliable data for nuclear reactions on unstable isotopes remains an extremely important task and a formidable challenge. Cross sections for neutron-induced reactions – crucial ingredients for models of astrophysical processes and for applied science – are particularly elusive, as both projectile and target in the reaction are unstable. Various methods have been proposed for determining unknown cross sections from indirect measurements. The 'surrogate reaction method' [1] uses inelastic scattering or transfer ('surrogate') reactions to produce the compound nucleus of interest and measure its sub- sequent decay. This data provides constraints for the models describing the decay of the compound nucleus, which dominate the uncertainties of the cross section calculations.

Key to a successful determination of the desired reaction cross section is a proper theoretical description of the surrogate reaction mechanisms. I will demonstrate the approach for (p,d) and (d,p) transfer reactions on isotopes in the Zr-Y-Mo region and present indirectly extracted cross sections for both known (benchmark) and unknown capture reactions [2,3]. The method makes no use of auxiliary constraining quantities, such as neutron resonance data, or average radiative widths, which are not available for short-lived isotopes; thus it can be applied to isotopes away from stability.

[1] Escher et al, RMP 84, 353 (2012).
[2] Escher et al, PRL 121, 052501 (2018)
[3] Ratkiewicz et al, PRL, in press (2019).

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