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Nuclear Input Parameters in Neutron-Induced Reactions on Short-Lived Nuclei

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Neutron-induced reactions on short-lived nuclei are of critical importance in both fundamental and applied nuclear science, with implications for nucleosynthesis processes, next-generation reactor systems, and the transmutation of long-lived radioactive waste. Given the experimental challenges associated with studying unstable isotopes, theoretical modeling becomes indispensable. The Hauser-Feshbach statistical model remains a cornerstone for describing compound nuclear reactions; however, its predictive reliability hinges on key nuclear input parameters—such as level densities (NLD), optical model potentials (OMP), and gamma-ray strength functions (γSF)—which are often poorly constrained for nuclei far from stability.

In this presentation, selected hypotheses and experimental results that probe NLD and OMP behavior away from the valley of stability will be reviewed. These results might reveal significant deviations from commonly used global parameterizations, underscoring the limitations of standard models in exotic regions of the nuclear chart. The findings highlight the necessity for localized or microscopic adjustments to input parameters to ensure accurate modeling. Ultimately, this emphasizes the critical role of targeted experimental investigations and parameter studies in enabling reliable Hauser-Feshbach predictions for neutron-induced reactions on short-lived nuclei.

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