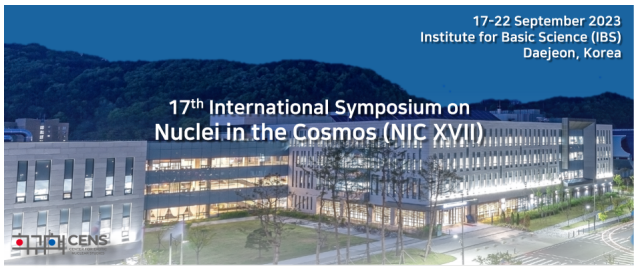

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Realistic fission transmission coefficients in the statistical Hauser-Feshbach compound-nucleus reaction theory

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Albeit recent development of dynamical approaches to the nuclear fission phenomena has been significantly improving our understanding of this complex nuclear reaction mechanism, conventional fission models in the statistical Hauser-Feshbach theory remain the extremely simplified fission barrier model with the WKB approximation. Due to the inherent deficiencies in calculating nuclear fission probabilities (fission transmission coefficients), it is very difficult to reduce uncertainties in predicting reaction rates both for β-delayed and neutron-induced fissions in the astrophysical environments. As the first step to overcome the existing deficiencies such as the WKB approximation, we solve the Schroedinger equation for an arbitrary one-dimensional potential energy to calculate the transmission coefficient in the fission channel of compound nucleus reactions, and incorporate the calculated transmission coefficients into the statistical Hauser-Feshbach model. Some calculated results are given to neutron induced reactions on stable actinides, where experimental fission cross section data are abundant. We show that a resonance-like structure appears in the transmission coefficient as well as in the fission cross section when a double-humped fission barrier shape including an intermediate well is adopted. This is understood to be a quantum mechanical effect in the fission channel, since the resonance-like structure is remarkably enhanced when the penetration and reflection waves are in phase.

Primary author: Dr KAWANO, Toshihiko (LANL)

Presenter: Dr KAWANO, Toshihiko (LANL)

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