A study of nuclear reaction mechanics at low energies

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The study of pre-compound emission in α-induced reactions, particularly at the low incident energies, is of considerable interest as the pre-compound emission is more likely to occur at higher energies. With a view to study the competition between the compound and the pre-compound emission processes in α-induced reactions at different energies and with different targets, a systematics for neutron emission channels in targets ^{51}V, ^{55}Mn, ^{93}Nb, ^{121,123}Sb and ^{141}Pr at energy ranging from astrophysical interest to well above it, has been developed.

The off-line γ-ray-spectrometry based activation technique has been adopted to measure the excitation functions. The experimental excitation functions have been analysed within the framework of the compound nucleus mechanism based on the Weisskopf-Ewing model and the pre-compound emission calculations based on the geometry dependent hybrid model. The analysis of the data shows that experimental excitation functions could be reproduced only when the pre-compound emission, simulated theoretically, is taken into account.

The strength of pre-compound emission process for each system has been obtained by deducing the pre-compound fraction. Analysis of data indicates that in α-induced reactions, the pre-compound emission process plays an important role, particularly at the low incident energies, where the pure compound nucleus process is likely to dominate.

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