

## Non-Coplanar Nuclei in Heavy-Ion Reactions

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**Abstract :** In recent times, we noticed an interesting and important role of non-coplanar degree-of-freedom ( $\Phi; \varphi = 00$ ) in heavy ion reactions. Using the dynamical cluster-decay model (DCM) with  $\Phi$ ; degree-of-freedom included, we have studied three compound systems  $^{246}\text{Bk}$  and  $^{164}\text{Yb}$  and  $^{105}\text{Ag}$ . Here, within the DCM with pocket formula for nuclear proximity potential, we look for the effects of including compact, non-coplanar configurations ( $\Phi; \varphi \neq 00$ ) on the non-compound nucleus (nCN) contribution in total fusion cross section  $\sigma_{\text{fus}}$ . For  $^{246}\text{Bk}$ , formed in  $^{11}\text{B}+^{235}\text{U}$  and  $^{14}\text{N}+^{232}\text{Th}$  reaction channels, the DCM with coplanar nuclei ( $\Phi; \varphi = 00$ ) shows an nCN contribution for  $^{11}\text{B}+^{235}\text{U}$  channel, but none for  $^{14}\text{N}+^{232}\text{Th}$  channel, which on including  $\Phi$ ; gives both reaction channels as pure compound nucleus decays. In the case of  $^{164}\text{Yb}$ , formed in  $^{64}\text{Ni}+^{100}\text{Mo}$ , the small nCN effects for  $\Phi; \varphi = 00$  are reduced to almost zero for  $\Phi; \varphi = 00$ . Interestingly, however,  $^{105}\text{Ag}$  for  $\Phi; \varphi = 00$  shows a small nCN contribution, which gets strongly enhanced for  $\Phi; \varphi \neq 00$ , such that the characteristic property of PCN presents a change of behaviour, like that of a strongly fissioning superheavy element to a weakly fissioning nucleus; note that  $^{105}\text{Ag}$  is a weakly fissioning nucleus and  $\Psi_{\text{surv}}$  behaves like one for a weakly fissioning nucleus for both  $\Phi; \varphi = 00$  and  $\Phi; \varphi \neq 00$ . Apparently,  $\Phi$ ; is presenting itself like a good degree-of-freedom in the DCM.

**Keywords :** dynamical cluster-decay model, fusion cross sections, non-compound nucleus effects, non-coplanarity

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