

Does positive Q-value neutron transfer channels influence sub-barrier fusion?

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In heavy-ion induced reactions, sub-barrier fusion plays a crucial role in studying the static and dynamic properties of the nucleus and understanding the astrophysical processes in the stellar environment [1]. However, the sub-barrier mechanism is not yet fully explored due to insufficient systematic studies and experimental measurements [2,3]. To unravel the role of positive Q-value neutron transfer channels in sub-barrier fusion enhancement, the fusion cross-sections of $^{35,37}\text{Cl} + ^{130}\text{Te}$ systems have been measured from 10 % below to 15% above the barrier using Heavy-Ion Reaction Analyzer at Inter-University Accelerator Centre (IUAC), New Delhi, India. ^{130}Te targets were prepared by employing resistive evaporation techniques [4]. Experimentally measured fusion excitation functions of $^{35,37}\text{Cl} + ^{130}\text{Te}$ systems were compared to probe the role of neutron transfer channels in sub-barrier fusion. The comparison particularly interesting because $^{35}\text{Cl} + ^{130}\text{Te}$ system has six positive Q-value neutron transfer channels compared to none in $^{37}\text{Cl} + ^{130}\text{Te}$ system [5].

In comparison, it has been found that the reduced fusion excitation function of $^{35}\text{Cl} + ^{130}\text{Te}$ system shows a significant enhancement over the $^{37}\text{Cl} + ^{130}\text{Te}$ system at sub-barrier energies, which suggests the strong influence of positive Q-value of neutron transfer channels in sub-barrier fusion enhancement. Further, the analysis of the excitation functions, including inelastic excitations of interacting nuclei in coupled-channels calculations, indicates the importance of neutron transfer channels in sub-barrier fusion enhancement [6,7]. The experimental findings and detailed analysis of this work will be discussed during the presentation.

References:

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Field of your work

Experimental nuclear physics

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