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Unveiling the excitation modes of ^{28}Si in interpreting the barrier distribution data

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Abstract

Barrier distribution is a very sensitive tool for understanding fusion process in the presence of various possible channel couplings. There exist two experimental methods for investigating barrier distributions: (i) by the measurement of fusion excitation function and (ii) by the measurement of quasi-elastic excitation function. Among the two methods of measurements, the measurement involving category (ii) is relatively easier to carry out in the laboratory and provides additional advantages over the measurement under category (i). Our very recent published work [1,2,3] deals with quasi-elastic excitation function measurements (method (ii)) in and around the Coulomb barrier regime for the ^{28}Si + ^{142,150}Nd systems and the corresponding barrier distributions have subsequently been extracted. The data were collected simultaneously by a number of detectors at back-angles using narrow binning of incident beam energies. The experiment was carried out using the facilities available at IUAC, New Delhi. The experimental data have been interpreted invoking different possible channel couplings. Projectile excitations and ground state deformations (quadrupole as well as hexadecapole deformations) of the targets seem to play a dominant role in generating the observed barrier distributions. However, there remain unanswered questions about the low-lying excitation modes of the projectile, ^{28}Si. Hence, extensive channel coupling calculations have further been undertaken. The ambiguities prevailing in the low-lying excitation modes of the projectile, ^{28}Si will be highlighted in the conference following the results from detail channel coupling calculations and making comparisons of the barrier distribution data at the near barrier energies available for several systems involving ^{28}Si projectile and other suitable targets.

References:
1. Saumyajit Biswas et al., Phys. Rev. C 102, 014613 (2020)
2. Saumyajit Biswas et al., Indian Journal of Pure & Applied Physics 58, 409-414 (2020)
3. Saumyajit Biswas et al., Proceedings of the DAE Symp. on Nucl. Phys. 64 (2019) 439 (http://www.sympnp.org/proceedings/)

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