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Nuclear shape and orientation effect on the heavy-ion fusion cross-section

The low-energy heavy ion fusion reactions play a crucial role in elucidating various aspects of nuclear physics as well as astrophysics. The dynamics of these heavy-ion fusion reactions depend upon the internal structure properties such as the deformations of the interacting target and projectile nuclei [1]. This study aims to explore the influence of nuclear shape degrees of freedom on the fusion mechanism within the relativistic mean-field (RMF) approach [2]. The nuclear interaction potential is obtained by folding the well-known M3Y effective nucleon-nucleon (NN) potential with the axially deformed RMF densities [2]. The fusion barrier characteristics such as the barrier position and height are obtained at different orientations for the deformed ^{154}Sm target nucleus fused with spherical ^{16}O projectile. The fusion and/or capture cross-section is obtained within the Wong model [3] and the results are compared with the available experimental data [4]. The barrier characteristics and consequently the cross-section is observed to be significantly affected by the quadrupole deformation as well as the orientation of the target nucleus.

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Authors: Ms RANA, Shilpa (School of Physics and Materials Science, Thapar Institute of Engineering and Technology, Patiala 147004, India); Dr BHUYAN, Mrutunjaya (Department of Physics, Faculty of Science, University of Malaya, Kuala Lumpur 50603, Malaysia); Dr KUMAR, Raj (School of Physics and Materials Science, Thapar Institute of Engineering and Technology, Patiala 147004, India)

Presenter: Ms RANA, Shilpa (School of Physics and Materials Science, Thapar Institute of Engineering and Technology, Patiala 147004, India)