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Measurements of Backward Angle Quasi-Elastic Scattering in ^{28}Si + ^{158}Gd: Sensitivity of β_2, β_4, and 2n Transfer

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In recent times, it is quite complex to determine various nuclear characteristics, e.g., shape, mass, quadrupole (β_2) and hexadecapole (β_4) deformations, which is the fundamental interest of contemporary research. In this context, sd-shell nuclei (^{20}Ne, ^{28}Si, ^{24}Mg, and ^{32}S) are of special interest as their deformation parameters vary in sign and magnitude with a significant uncertainty. Recently, fusion barrier distribution (FBD) via backward angle quasi-elastic (QEL) scattering has been initiated as a probe to precisely determine β_2 and β_4 parameters. In reactions where transfer channels are favourable, they can affect the extracted values of such parameters. Hence, an attempt has been made to determine the deformation parameters of ^{28}Si via FBD through backward angle QEL scattering.

Thus, an experiment has been performed to measure the QEL excitation functions (EFs) for ^{28}Si + ^{158}Gd system at energies around the Coulomb barrier using the Heavy-Ion Reaction Analyzer (HIRA) at IUAC, New Delhi, India. The measured QEL EFs and derived FBD have been analyzed within the coupled channel (CC) calculations framework with β2 and β4 parameters. Furthermore, the impact of 2n transfer on FBD has been studied. The results obtained from CC calculations with an oblate shape of ^{28}Si in its ground state are in good agreement with experimental data, and the extracted values and sign of β_2 and β_4 are in accordance with those of different inelastic scattering experiments. A detailed analysis and the obtained results will be presented during the conference.

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