INPC 2025
May 25-30, 2025
DCC, Daejeon, Korea

Contribution ID: **209** Type: **Contributed Poster Presentation**

Relaxation of shell effect in giant dipole resonance width away from magicity

The isovector giant dipole resonance (IVGDR) serves as a crucial tool for probing a wide range of phenomena, from r-process nucleosynthesis to the determination of the strength of gravitational waves. Generally, the width of the IVGDR (Γ_G) increases with temperature (T) in the range of 1 MeV
$lesssim T$
$lesssim 3$ MeV, with the possibility of saturation at higher temperatures [1]. However, in the low-temperature regime (T
$lesssim$ 1 MeV), studying Γ_G is particularly challenging due to the difficulty of achieving low excitation energies. Limited investigations in this regime suggest that the behavior of Γ_G is ambiguous, influenced by microscopic effects such as shell effects and pairing fluctuations, which hinder the expected thermal broadening of Γ_G [2, 3] .

Motivated by these challenges, we conducted a detailed study of Γ_G in the low-to-intermediate temperature range for nuclei near the $N = Z = 28$ shell closure, where detailed analyses are currently lacking. Our work elucidates the relative importance of neutron-to-proton ratio (N/Z), shell closure, and thermal fluctuations in shaping the temperature dependence of Γ_G for nuclei near the doubly magic ^{56}Ni. To isolate these effects, we studied ^{62}Zn and ^{68}Zn nuclei, populated via α-induced fusion reactions. High-energy γ-rays (E_γ >4 MeV) emitted from IVGDR decay were detected using the Large Area Modular BaF_2 Detector Array (LAMBDA) [4]. The measured spectra were analyzed using statistical model calculations implemented in TALYS.

A contrasting thermal behavior of Γ_G was observed for the two nuclei. For ^{68}Zn, the width (Γ_G) increases monotonically with temperature from its ground-state value. In contrast, ^{62}Zn exhibited a suppressed width at low temperatures, consistent with the behavior of nearby nuclei with neutron and/or proton numbers close to 28. This suggests that the suppression of Γ_G at low temperatures is not a universal feature but is influenced by proximity to magic numbers, rather than N/Z asymmetry.

Primary author: SEN, Chandrani (Variable Energy Cyclotron Centre, Kolkata, India)

Co-authors: Mr MONDAL, Debasish (Variable Energy Cyclotron Centre, Kolkata, India); Mr PANDIT, Deepak (Variable Energy Cyclotron Centre, Kolkata, India); Mr BANERJEE, Gourab (Saha Institute of Nuclear Physics, Kolkata, India); Mr SADHUKHAN, Jhilam (Variable Energy Cyclotron Centre, Kolkata, India); Mr ROY, Pratap (Variable Energy Cyclotron Centre, Kolkata, India); Ms SADHUKHAN, Saumanti (Variable Energy Cyclotron Centre, Kolkata, India); Mr MUKHOPADHYAY, Supriya (Variable Energy Cyclotron Centre, Kolkata, India); Mr PAL, Surajit (Variable Energy Cyclotron Centre, Kolkata, India)

Presenter: SEN, Chandrani (Variable Energy Cyclotron Centre, Kolkata, India)

Session Classification: Poster Session

Track Classification: Nuclear Structure