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Investigating the Giant Dipole Resonance of ^{164}Dy using Nuclear Resonance Fluorescence

The giant dipole resonance (GDR) represents one of the most fundamental nuclear excitations and dominates the photoresponse of virtually all nuclei. Its geometrical viewing is an isovector oscillation of the proton against the neutron body. This model also provides predictions for the γ-decay behavior of the GDR in elastic photon and 2_1^+ Raman scattering reactions.
To rigorously test these for the first time, recently a photonuclear experiment was performed on the GDRs of the spherical and deformed nuclides ^{140}Ce and ^{154}Sm, respectively, at the High Intensity γ-ray Source (HIγS) at TUNL, USA [1]. HIγS's quasi-monochromatic, polarized, and tunable photon beam was employed to selectively photoexcite energy slices of the GDR and subsequently measure their γ-decay. The results are in stunning agreement with the geometrical model predictions and provide new insights on the shapes of the nuclei, in particular the degree of triaxiality of the deformed ^{154}Sm nucleus.
To first determine the ratio of cross sections for elastic photon scattering versus Smekal-Raman scattering to the first excited state of the ground-state rotational band in the strongly deformed nucleus ^{164}Dy, a similar nuclear resonance fluorescence experiment was conducted on the GDR of ^{164}Dy in 2023. ^{164}Dy is of particular interest due to its suspected higher degree of triaxiality. Experimental γ-ray spectra and the current status of the data analysis will be presented.

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