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Photographing the Nucleus: Photon-Scattering on its Giant Dipole Resonance

The response of atomic nuclei to external, harmonically oscillating electric fields, i.e., their photoresponse [1], is dominated by their isovector Giant Dipole Resonance (GDR). The existence of the GDR is known for almost a century [2]. Although it is often considered as the archetype of a collective nuclear mode, a variety of fundamental questions to its very nature is still unanswered: What is the lifetime of the GDR? What is the relation of its width to the probability for photon emission? How does the branching ratio between electromagnetic and hadronic decay evolve with energy over the GDR?

We will address these fundamental questions in our presentation. We will discuss our recent data from photonuclear reactions that provide new evidences. The GDRs of the nuclides 140Ce, 154Sm, 164Dy, 208Pb, and 232Th have been studied with quasimonochromatic photon beams of energies between 11 and 17 MeV at the High Intensity γ–ray Source (HIγS) at the Triangle Universities Nuclear Laboratory (TUNL). Nuclear Resonance Fluorescence of the GDR and Smekal-Raman scattering to the first excited state have been measured quantitatively and first results have been published already [3].
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