Contribution ID: **92** Type: **Oral presentation**

Energy-Resolved Photoresponse of the Nuclear Giant Dipole Resonance: Circumstantial Evidence for its Sub-Zeptosecond Lifetime

Wednesday, October 8, 2025 9:55 AM (20 minutes)

The giant dipole resonance (GDR) of atomic nuclei dominates their response to an oscillating electromagnetic radiation field. It represents the archetype of a collective nuclear mode. It is particle unbound and decays predominantly by particle emission. Its (small) probability for internal decay by gamma-ray emission is proportional to the maximum of its photon absorption cross section.
Our group has recently conducted photon-scattering spectroscopy on the GDR of heavy spherical nuclei (Ce-140 and Pb-208) and deformed nuclei (Sm-154, Dy-164, and Th-232). For the first time, the data utilize quasimonochromatic gamma-ray beams and cover the entire energy range of the GDR. Our data show that exclusively its photon decay is sensitive to the very character of this collective mode and provide circumstantial evidence that the GDR decays on a sub-zeptosecond timescale into compound states as it was conjectured by Niels Bohr [2] more than 80 years ago.

[1] J.Kleemann, NP, et al. Phys. Rev. Lett. 134, 022503 (2025); J. Kleemann, *Probing the Giant Dipole Resonance Using Nuclear Resonance Fluorescence* (Dissertation, Technische Universität Darmstadt 2024),10.26083/tuprints-00027008.
[2] Niels Bohr, Nature 141, 326 (1938).

This work has been supported by DFG Project No. 279384907–SFB 1245, 499256822-GRK 2891 “Nuclear Photonics”, and U.S. Department of Energy, Office of Science, Office of Nuclear Physics, under Grants No. DE-FG02-97ER41041 (UNC), and No. DE-FG02-97ER41033 (Duke, TUNL).

Primary author: PIETRALLA, Norbert (TU Darmstadt)

Co-authors: ISAAK, J. (Physics Dept., Institute for Nuclear Physics, TU Darmstadt, Darmstadt, Germany); KLEEMANN, J. (Institute for Nuclear Physics, TU Darmstadt, Germany); KUTSCHE, Justin; PRIFTI, Kiriaki (Institut für Kernphysik, TU Darmstadt); HEUMÜLLER, Marc (Institut für Kernphysik, TU Darmstadt); V. F. JANSSENS, Robert (Department of Physics and Astronomy, University of North Carolina at Chapel Hill, Chapel Hill, North Carolina 27599, USA and Triangle Universities Nuclear Laboratory, Durham, North Carolina 27708-0308, USA); WERNER, V. (Institute for Nuclear Physics, TU Darmstadt, Germany)

Presenter: PIETRALLA, Norbert (TU Darmstadt)

Session Classification: In memoriam of Prof. Sydney Gales