HK 40: Structure and Dynamics of Nuclei VI

Time: Wednesday 14:00–15:30 Location: HK-H6

Group Report HK 40.1 Wed 14:00 HK-H6

The Microscopic Structure of the Low-Energy Electric Dipole Response of ^{120}Sn — •Michael Weinert, Florian Kluwig, Markus Müllenmeister, Miriam Müscher, Barbara Wasilewska, and Andreas Zilges — University of Cologne, Institute for Nuclear Physics, 50937 Cologne, Germany

The low-energy electric dipole response of ^{120}Sn was studied in a ^{119}Sn(d,pγ)^{120}Sn experiment, using the SONIC@HORUS setup at the University of Cologne. Unprecedented access to the single-particle structure of excited $J^\pi=1^-$ states below and around the neutron-separation threshold was obtained by comparing experimental data to a novel theoretical approach that combines detailed nuclear structure input from energy-density functional (EDF) plus quasiparticle-phonon model (QPM) theory with reaction theory. The EDF+QPM approach correctly predicts the energies of the relevant neutron single-particle levels in ^{120}Sn and especially the fragmentation of the observed spectroscopic strength [1]. Furthermore, the EDF+QPM approach predicts the increasing contribution of complex configurations to states at higher excitation energies, which has been recently suggested as a cause for the discrepancy between (γ,γ') and (p,p') experiments [2,3]. This contribution will present the combined efforts and discuss possible connections between the spectral fragmentation observed in ^{119}Sn(d,pγ) and ^{120}Sn(α,α'γ). Supported by the DFG (ZI 510/10-1).

[1] M. Weinert *et al.*, Phys. Rev. Lett. **127**, 242501 (2021)
[2] S. Bassauer *et al.*, Phys. Rev. C **102**, 034327 (2020)
[3] M. Müscher *et al.*, Phys. Rev. C **102**, 014317 (2020)

HK 40.2 Wed 14:30 HK-H6

Electric dipole polarizability in ^{58}Ni from forward angle proton scattering — •Isabelle Brandherm[1], Peter von Neumann-Cosel[1], Hiroaki Matsubara[2], and Atsushi Tamii[2] — [1]Institut für Kernphysik, TU Darmstadt, Germany — [2]RCNP, Osaka, Japan

Inelastic proton scattering at very forward angles is an excellent tool for studying the dipole response in nuclei [1]. A (p, p') experiment on ^{58}Ni was performed at the Research Center for Nuclear Physics (RCNP) in Osaka, using a proton beam with 295 MeV and scattering angles close to 0°. With the present setup the electric dipole response is accessible over a wide excitation energy range. This enables the extraction of photoabsorption cross sections as well as the electric dipole polarizability. The latter is correlated to the neutron skin thickness and thus to the symmetry parameter of the equation of state. In addition the isovector spin-flip M1-response can be observed, which forms an isospin analogon to Gamow-Teller transitions. Electric and magnetic dipole contributions to the total experimental cross section were separated by performing a multipole decomposition analysis based on DWBA calculations.

[1] P. von Neumann-Cosel and A. Tamii, Eur. Phys. J. A 55, 110 (2019).

Supported by the Deutsche Forschungsgemeinschaft (DFG, German Research Foundation) - Project-ID 279384907 - SFB 1245.

HK 40.3 Wed 14:45 HK-H6

γ-decay of the Pygmy Dipole Resonance of ^{150}Nd — •O. Papst[1], J. Isaak[1], N. Pietralla[1], D. Savran[2], V. Werner[1], G. Battaglia[3], T. Beck[1,4], M. Beuschlein[1], S. W. Finch[5,6], U. Friman-Gayer[1,5,6], E. Hoemann[7], K. E. Ide[1], R. V. F. Janssens[6,8], N. Kelly[9], J. Kleemann[1], FNU Krishichayan[5,6], D. R. Little[6,8], B. Löher[2], M. Müscher[7], E. E. Peters[10], P. C. Ries[1], M. Scheck[9], J. Sinclair[9], M. Spieker[4], W. Tornow[5,6], S. W. Yates[10], R. Zidarova[1], and A. Zilges[7] — [1]IKP, TU Darmstadt — [2]GSI, Darmstadt — [3]U. Strathclyde, Glasgow, UK — [4]MSU, East Lansing, MI, USA — [5]Duke U., Durham, NC, USA — [6]TUNL, Durham, NC, USA — [7]IKP, U. Köln — [8]UNC, Chapel Hill, NC, USA — [9]UWS, Paisley, UK — [10]UKY, Lexington, KY, USA

The sensitivity of the Giant Dipole Resonance to axial nuclear deformation results in a separation into two parts (K-splitting). For heavy nuclei, low-lying E1 strength called Pygmy Dipole Resonance [1], often attributed to a semi-collective oscillation of a neutron skin, is expected to exhibit a similar sensitivity. Mean properties of the dipole strength of ^{150}Nd were studied using a new high-resolution mode of the High Intensity γ-ray Source (HIγS) in photon scattering experiments with polarized γ-ray beams below separation thresholds. For the first time for a heavy deformed nucleus, different mean decay branches to the ground-state band could be resolved individually in the Pygmy-region.

* Supported by the State of Hesse under grant "Nuclear Photonics" within the LOEWE program.

[1] D. Savran *et al.*, Prog. Part. Nucl. Phys. **70**, 210 (2013)

HK 40.4 Wed 15:00 HK-H6

Dipole response in ^{144}Nd — •Florian Kluwig[1], Miriam Müscher[1], Ronald Schwengner[2], Mark Spieker[3], Werner Tornow[4], and Andreas Zilges[1] — [1]University of Cologne, Institute for Nuclear Physics — [2]Helmholtz-Zentrum Dresden-Rossendorf — [3]Department of Physics, Florida State University — [4]Department of Physics, Duke University and TUNL

For several years, the so-called Pygmy Dipole Resonance (PDR) has been a research topic of great interest [1,2]. It occurs as a concentration of electric dipole strength around and below the neutron separation energy. Systematic studies are essential to improve the knowledge of this excitation mode. For this purpose, the Nd isotopic chain is well-suited due to its wide range of stable, even-even isotopes. Therefore, two complementary (γ,γ') experiments on the rare-earth nucleus ^{144}Nd have been performed at the γELBE facility at the Helmholtz-Zentrum Dresden-Rossendorf [3] using a continuous bremsstrahlung beam and with quasi-monoenergetic γ rays at HIγS [4]. The results of these experiments will be presented in this contribution.

This work is supported by the BMBF (05P21PKEN9).

[1] D. Savran *et al.*, Prog. Part. Nucl. Phys. **70** (2013) 210
[2] A. Bracco *et al.*, Prog. Part. Nucl. Phys. **106** (2019) 360
[3] R. Schwengner *et al.*, Nucl. Instr. and Meth. A **555** (2005) 211
[4] H.R. Weller *et al.*, Prog. Part. Nucl. Phys. **62** (2009) 257

HK 40.5 Wed 15:15 HK-H6

γ-decay Behavior of the Giant Dipole Resonances of ^{154}Sm and ^{140}Ce — •J. Kleemann[1], U. Friman-Gayer[2,3], J. Isaak[1], N. Pietralla[1], V. Werner[1], A. D. Ayangeakaa[2,4], T. Beck[1,5], M. L. Cortés[1], S. W. Finch[2,3], M. Fulghieri[2,4], D. Gribble[2,4], K. E. Ide[1], X. James[2,4], R. V. F. Janssens[2,4], S. R. Johnson[2,4], P. Koseoglou[1], FNU Krishichayan[2,3], O. Papst[1], D. Savran[6], N. Sensharma[2,4], W. Tornow[2,3], and A. Williams[2,4] — [1]IKP, TU Darmstadt — [2]TUNL, Durham, NC, USA — [3]Duke University, Durham, NC, USA — [4]UNC, Chapel Hill, NC, USA — [5]FRIB, MSU, East Lansing, MI, USA — [6]GSI, Darmstadt

The giant dipole resonance (GDR) is one of the most fundamental nuclear excitations and dominates the dipole response of all nuclei. Yet, its γ-decay behavior, despite being a key property, is still mostly unknown. Recently, novel data on the γ-decay of the GDR of the well-deformed nuclide ^{154}Sm and the spherical nuclide ^{140}Ce were obtained through photonuclear experiments at the HIγS facility. Individual regions of the GDR were selectively excited by HIγS' intense, linearly-polarized and quasi-monochromatic γ-ray beam. This enables an excitation-energy resolved determination of the GDR's γ-decay behavior. For ^{154}Sm in particular, the obtained data allow for a first experimental test of the commonly accepted K-quantum-number assignments to the double-humped GDR observed in deformed nuclei.

This work was supported by the State of Hesse under the grant *Nuclear Photonics* within the LOEWE program and within the Research Cluster *ELEMENTS*.