HK 5: Structure and Dynamics of Nuclei I

Time: Monday 16:45–18:15 Location: HBR 19: C 5a

Group Report HK 5.1 Mon 16:45 HBR 19: C 5a

Investigating the Pygmy Dipole Resonance: A multi-messenger approach — •Markus Müllenmeister, Michael Weinert, Florian Kluwig, Miriam Müscher, and Andreas Zilges — University of Cologne, Institute for Nuclear Physics, Germany

The enhanced dipole (*E1*) response below and around the neutron separation energy of heavy and medium mass nuclei is known as the Pygmy Dipole Resonance (PDR). The historical perspective of a neutron skin oscillation being the sole cause of these excitations has been challenged in recent decades [1]. Despite continued research efforts, the structure, emergence, and evolution of the PDR remain largely unknown [2]. To access this information, systematic studies encompassing different probes on a variety of target nuclei, as well as comparable results in similar mass regions, are needed [3]. Recently, efforts have been undertaken to single out specific phenomena using complementary experiments with hadronic and electromagnetic probes [4], as well as neutron transfer reactions [5]. This contribution will outline the experimental methods used and highlight results from the complementary approaches. Supported by the DFG (ZI 510/10-1).

[1] J. Endres *et al.*, Phys. Rev. C **80** (2009) 034302.
[2] A. Bracco *et al.*, Prog. Part. Nucl. Phys. **106** (2019) 360.
[3] D. Savran *et al.*, Phys. Lett. B **786** (2018) 16.
[4] M. Müscher *et al.*, Phys. Rev. C **102** (2020) 014317.
[5] M. Weinert *et al.*, Phys. Rev. Lett. **127** (2021) 242501.

HK 5.2 Mon 17:15 HBR 19: C 5a

Investigation of the dipole strength distribution in ^{70}Zn up to the neutron threshold[a] — •J. Hauf[1], V. Werner[1], M. Beuschlein[1], R. Beyer[2], A. Gupta[1], T. Hensel[2], J. Isaak[1], A. Junghans[2], J. Kleemann[1], P. Koseoglou[1], E. Masha[2], C. Nickel[1], O. Papst[1], M. Pichotta[2], N. Pietralla[1], K. Prifti[1], K. Römer[2], K. Schmidt[2], R. Schwengner[2], S. Turkat[2], J. Vogel[1], A. Wagner[2], and A. Yadev[2] — [1]IKP, TU Darmstadt — [2]Helmholtz-Zentrum Dresden-Rossendorf

We perform a series of experiments to study the dipole strength distribution of the neutron-rich isotope ^{70}Zn, up to its neutron threshold of about 9.2 MeV. ^{70}Zn is of particular interest due to its location on the N=40 harmonic oscillator shell and in view of shape coexistence in this region. The main goal of the present study is in particular to obtain information on the E1 strength distribution, typically attributed to the pygmy dipole resonance, and possible M1 strength embedded in the dipole response. Following our initial nuclear resonance fluorescence bremsstrahlung experiment at γELBE with a maximum energy of 11.5 MeV, we now measured at a lower maximum energy of 7.5 MeV, in order to resolve ambiguities in the assignments of observed transitions and excited states. The present status of the analysis and an outlook on further planned experiments will be given.

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HK 5.3 Mon 17:30 HBR 19: C 5a

Dipole strength distribution of ^{96}Mo: Electric and magnetic contributions* — •V. Skibina[1], O. Papst[1], J. Isaak[1], A. D. Ayangeakaa[2,3], T. Beck[1,4], R. Beyer[5], A. Boeltzig[5], M. L. Cortés[1,6], S. W. Finch[3,7], U. Friman-Gayer[3,7,8], D. Gribble[2,3], M. Heumüller[1], X. James[2,3], R. V. F. Janssens[2,3], S. Johnson[2,3], A. Junghans[5], J. Kleemann[1], F. Kluwig[9], P. Koseoglou[1], T. Lossin[5], B. Löher[10], M. Müscher[9], M. Pichotta[5], N. Pietralla[1], K. Prifti[1], G. Rusev[11], K. Römer[5], D. Savran[10], K. Schmidt[5], R. Schwengner[5], A. Thees[5], A. Wagner[5], V. Werner[1], A. Yadav[5], and A. Zilges[9] — [1]IKP, TU Darmstadt — [2]UNC, NC, USA — [3]TUNL, NC, USA — [4]MSU, MI, USA — [5]HZDR, Dresden — [6]RIKEN, JP — [7]Duke U., NC, USA — [8]ESS, SE — [9]University of Cologne — [10]GSI, Darmstadt — [11]LANL, USA

We performed a Nuclear Resonance Fluorescence experiment on ^{96}Mo at the γELBE facility with a 7.8 MeV endpoint energy bremsstrahlung beam. The experiment follows studies with 13 MeV endpoint energy [1], which were sensitive mainly up to the neutron-separation threshold. The present analysis focuses on intermediate energies, yields cross sections, branching ratios and, in combination with HIγS data, parities of dipole-excited states.

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[1] G. Rusev *et al.*, Phys. Rev. **C 79**, 061302(R) (2009).

HK 5.4 Mon 17:45 HBR 19: C 5a

Nuclear structure studies in ^{96}Ru using electron-gamma coincidence reactions at the S-DALINAC — •Bastian Hesbacher, Jonny Birkhan, Isabelle Brandherm, Johann Isaak, Igor Jurosevic, Norbert Pietralla, Maxim Singer, Maximilian Spall, and Gerhart Steinhilber — Institut für Kernphysik, Technische Universität Darmstadt

The all-electromagnetic $(e, e'\gamma)$ reaction had first been used for nuclear structure measurements in the 1980s [1]. Since then very few experiments were based on this reaction. One of the challenges of this measurement technique lies in the coincident bremsstrahlung, which - apart from the angular distribution - cannot be distinguished from the γ-radiation of decaying nuclei after excitation by inelastic electron scattering. In 2021 a successful ^{96}Ru$(e, e'\gamma)$ measurement was performed at the S-DALINAC with coincidence-resolution improved by two orders of magnitude [2]. The scattered electrons were registered with the QCLAM spectrometer. The γ-radiation was detected by 6 $LaBr_3$:Ce detectors. Two methods for the subtraction of the bremsstrahlung background will be applied to the ^{96}Ru$(e, e'\gamma)$ data allowing for the extraction of ground-state γ-decays of excited states. Preliminary results on γ-decays of ^{96}Ru will be presented.

This work is supported by the Collaborative Research Center 1245.

[1] C. N. Papanicolas et al., Phys. Rev. Lett. **54**, 26 (1985).
[2] G. Steinhilber, Doctoral thesis, TU Darmstadt (2023).

HK 5.5 Mon 18:00 HBR 19: C 5a

Investigation of angular distributions in nuclear reactions using a new particle-γ coincidence setup — •Gloria Huppelsberg, Michael Weinert, Markus Müllenmeister, and Andreas Zilges — University of Cologne, Institute for Nuclear Physics, Germany

To gain a better understanding of nuclear reactions populating states in the region of the Pygmy Dipole Resonance (PDR), angular correlation data is needed.[1] For this purpose, a new particle-γ coincidence setup was developed at the 10 MeV FN-Tandem accelerator laboratory at University of Cologne. This setup allows the investigation of particle angular distributions using, eg., (p,p'γ), (α,α'γ) and (d,pγ) reactions. Up to twelve ΔE-E Silicon detectors can be mounted next to each other on a rotatable plate inside a scattering chamber which makes it possible to effortlessly adjust the detection angle. For the precise identification of the excited states through particle-γ coincidences, a high purity germanium detector is mounted on top of the chamber. The commissioning experiment of the chamber is intended to investigate the single particle character of the Pygmy Dipole Resonance [2,3] in lighter nuclei employing the particle angular distributions of excited states. This contribution presents the new setup, reports on first experiments and outlines a road map for future measurements.

Supported by DFG (ZI 510/10-1).

[1] M. Spieker *et al.*, Phys. Rev. C **108**, 014311 (2023)
[2] M. Spieker *et al.*, Phys. Rev. Lett. **125**, 102503 (2020)
[3] M. Weinert *et al.*, Phys. Rev. Lett. **127**, 242501 (2021)