HK 9: Structure and Dynamics of Nuclei I

Time: Monday 16:30–18:00 Location: SCH/A118

Group Report HK 9.1 Mon 16:30 SCH/A118

Studying the Low-Energy Electric Dipole Response With Different Hadronic Probes — •Michael Weinert, Florian Kluwig, Markus Müllenmeister, Miriam Müscher, Barbara Wasilewska, and Andreas Zilges — University of Cologne, Institute for Nuclear Physics

A concentration of electric dipole strength below the neutron separation threshold is known to be common in medium to heavy mass nuclei. The established picture of a neutron-skin oscillation being the single cause for this strength was questioned about 15 years ago, when comparing the excitation in bremsstrahlung experiments to results from a hadronic probe, i.e., $(\alpha, \alpha'\gamma)$ [1]. Recently, another experimental access was added to the repertoire by investigating the population of states via (d, p) reactions [2]. The strong single-particle character of excited states could be identified by combined experimental and theoretical efforts, describing various realistic observables with great accuracy [3]. This contribution presents an overview of the current status of the hadronic experiments on several nuclei with data taken with the SONIC@HORUS spectrometer at the University of Cologne. The comparison of ^{119}Sn$(d, p\gamma)$ data at $E_d = 8.5$ MeV and ^{120}Sn$(\alpha, \alpha'\gamma)$ data at $E_\alpha = 130$ MeV will be highlighted, as well as their theoretical comprehension within the Quasiparticle-Phonon-Model and corresponding reaction theory. Supported by the DFG (ZI 510/10-1).

[1] J. Endres *et al.*, Phys. Rev. C **80**, 034302 (2009)
[2] M. Spieker *et al.*, Phys. Rev. Lett. **125**, 102503 (2020)
[3] M. Weinert *et al.*, Phys. Rev. Lett. **127**, 242501 (2021)

HK 9.2 Mon 17:00 SCH/A118

Model-independent test of the Brink-Axel hypothesis — •O. Papst[1], J. Isaak[1], A. D. Ayangeakaa[2,3], T. Beck[1,4], S. W. Finch[3,5], U. Friman-Gayer[3,5,6], D. Gribble[2,3], X. James[2,3], R. V. F. Janssens[2,3], S. R. Johnson[2,3], J. Kleemann[1], F. Kluwig[7], P. Koseoglou[1], B. Löher[8], M. Müscher[7], N. Pietralla[1], D. Savran[8], V. Werner[1], and A. Zilges[7] — [1]TU Darmstadt — [2]UNC, Chapel Hill, NC, USA — [3]TUNL, Durham, NC, USA — [4]FRIB, MSU, East Lansing, MI, USA — [5]Duke U., Durham, NC, USA — [6]ESS, Lund, SE — [7]Univ. Köln — [8]GSI, Darmstadt

The Brink-Axel (BA) hypothesis states that the transition probability between two groups of states, described by the photon strength function (PSF) for a given multipolarity, only depends on the energy difference of the states. For ^{96}Mo, significant discrepancies between upward (excitation) and downward (deexcitation) PSF were found [1] with various experimental probes. A new method [2] allows for the simultaneous measurement of upward and downward PSF in a single nuclear resonance fluorescence (NRF) experiment. To test the discrepancies and BA hypothesis, NRF experiments on ^{96}Mo were performed at the High Intensity γ-ray Source (HIγS) and will be discussed.

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[1] D. Martin *et al.*, Phys. Rev. Lett. **119**, 182503 (2017)
[2] J. Isaak *et al.*, Phys. Lett. B **788**, 225 (2019)

HK 9.3 Mon 17:15 SCH/A118

Investigation of the dipole strength distribution in ^{70}Zn up to the particle threshold[a] — •J. Hauf[1], V. Werner[1], M. Beuschlein[1], R. Beyer[2], T. Hensel[2], J. Isaak[1], J. Kleemann[1], P. Koseoglou[1], C. Nickel[1], O. Papst[1], 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

The dipole strength distribution of the neutron-rich nucleus ^{70}Zn has been investigated up to its particle threshold of around 9.2 MeV. This study is motivated by shedding light on the E1 strength, typically attributed to the pygmy dipole resonance on top of the low-energy tail of the giant dipole resonance. A Nuclear Resonance Fluorescence (NRF) experiment was conducted at the γELBE-Setup at the Helmholtz- Zentrum Dresden-Rossendorf using a bremsstrahlung beam with an endpoint energy of 11.5 MeV. The experiment will be described. NRF spectra and the status of the data analysis, including integrated NRF cross sections and transition strengths, will be presented and discussed.

[a]This work was supported by DFG project number 279384907-SFB 1245

HK 9.4 Mon 17:30 SCH/A118

Investigation of the low-lying dipole strength in ^{62}Ni — •Tanja Schüttler[1], Florian Kluwig[1], Miriam Müscher[1], Ronald Schwengner[2], and Andreas Zilges[1] — [1]University of Cologne, Institute for Nuclear Physics — [2]Helmholtz-Zentrum Dresden-Rossendorf

Systematic studies within isotopic and isotonic chains are essential to investigate the properties of the low-lying dipole strength below and around the neutron-separation threshold. The nickel (Z = 28) isotopic chain is a well-suited candidate for this purpose because it consists of four stable, even-even isotopes covering a large range of N/Z ratios. Since photons just transfer small angular momenta, (γ,γ') experiments are ideally suited to study the dipole response in atomic nuclei [1]. The isotopes ^{58,60,64}Ni have already been measured in (γ,γ') experiments [2-5]. To complete the systematics, ^{62}Ni was investigated using energetically continuous bremsstrahlung with a maximal photon energy of $E_{\text{max}} = 8.7$ MeV at the γELBE facility [6]. First results of this experiment will be presented.

This work is supported by the BMBF (05P21PKEN9)

[1] A. Zilges *et al.*, Prog. Part. Nucl. Phys. **122** (2022) 103903
[2] F. Bauwens *et al.*, Phys. Rev. C **62** (2000) 024302
[3] M. Scheck *et al.*, Phys. Rev. C **88** (2013) 044304
[4] M. Scheck *et al.*, Phys. Rev. C **87** (2013) 051304(R)
[5] M. Müscher, private communication (2022)
[6] R. Schwengner *et al.*, Nucl. Instr. and Meth. A **555** (2005) 211

HK 9.5 Mon 17:45 SCH/A118

Parity-quantum numbers and branching ratios of ^{96}Mo dipole-excited states* — •V. Skibina[1], O. Papst[1], J. Isaak[1], A. D. Ayangeakaa[2,3], T. Beck[1,4], M. L. Cortés[1,5], S. W. Finch[3,6], U. Friman-Gayer[3,6,7], D. Gribble[2,3], X. James[2,3], R. V. F. Janssens[2,3], S. Johnson[2,3], J. Kleemann[1], F. Kluwig[8], P. Koseoglou[1], B. Löher[9], M. Müscher[8], N. Pietralla[1], D. Savran[9], V. Werner[1], and A. Zilges[8] — [1]IKP, TU Darmstadt — [2]UNC, NC, USA — [3]TUNL, NC, USA — [4]MSU, MI, USA — [5]RIKEN, JP — [6]Duke U., NC, USA — [7]ESS, SE — [8]IKP, U. Köln — [9]GSI, Darmstadt

Photonuclear reactions are well-suited to provide fundamental spectroscopic quantities of nuclei such as γ-ray transition energies, spin and parity quantum numbers [1]. The present work focuses on the study of the dipole strength distribution, its disentanglement into electric and magnetic contributions, and the decay behavior of excited states of ^{96}Mo. For that purpose, Nuclear Resonance Fluorescence (NRF) experiments were performed at the High Intensity Gamma-ray Source (HIγS) with linearly-polarized, quasi-monochromatic photon beams to assign parity quantum numbers and determine branching ratios of observed states. In this contribution, first results will be presented.

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[1] A. Zilges et al., Prog. Part. Nucl. Phys. **122**, 103903 (2022).