HK 14: Structure and Dynamics of Nuclei III

Time: Tuesday 15:45–17:15 Location: HBR 14: HS 1

HK 14.1 Tue 15:45 HBR 14: HS 1

Isoscalar Properties of the Pygmy Dipole Resonance in ^{120}Sn — •Michael Weinert, Florian Kluwig, Markus Müllenmeister, Miriam Müscher, 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]. The evolution of the so-called *isospin splitting* previously found in ^{124}Sn was recently investigated via a ^{120}Sn$(\alpha,\alpha'\gamma)$ experiment at $E_\alpha = 130$ MeV. The experiment was performed at the CAGRA+GR setup at RCNP, Osaka, and is sensitive to both isoscalar properties and the surface character of excitations in the Pygmy Dipole Resonance (PDR) region. This contribution presents the analyzed data set as well as recent theoretical efforts from two state-of-the-art EDF+QPM and RQTBA models coupled to reaction theory. Since the PDR in ^{120}Sn is also known to have significant single-particle character [2], the new theoretical results allow to study the connection between microscopic nuclear structure effects and the macroscopic surface mode probed in the $(\alpha,\alpha'\gamma)$ experiment. Supported by the DFG (ZI 510/10-1).

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

HK 14.2 Tue 16:00 HBR 14: HS 1

Level densities and γ strength function of ^{90}Zr from the Oslo Method — •Isabelle Brandherm[1], Johann Isaak[1], Ann-Cecilie Larsen[2], Maria Markova[1], and Peter von Neumann-Cosel[2] — [1]Institut für Kernphysik, TU Darmstadt, Germany — [2]Department of Physics, University of Oslo, Norway

The Oslo method was developed to determine level densities and γ strength functions (GSF) of nuclei up to the particle separation threshold. Particle-γ coincidence data are used to generate a primary γ-ray matrix, which allows a simultaneous extraction of both observables in an iterative procedure.

In this talk preliminary results on ^{90}Zr are presented. This nucleus is of particular interest, since it allows comprehensive tests of the Brink-Axel hypothesis (similar to [1]) and of the shape method for a model-independent extraction of the GSF [2]. Two experiments were performed at the Oslo Cyclotron laboratory using (p,p'γ) and $(\alpha,\alpha'\gamma)$ reactions. Particle-γ coincidence data were taken with the Silicon Ring (SiRi) consisting of $\Delta E - E$ telescopes and the Oslo Scintillation Array (OSCAR) of large-volume (3"x8") $LaBr_3$:Ce detectors.

[1] M. Markova et al., Phys. Rev. Lett. 127, 182501 (2021).
[2] M. Wiedeking et al., Phys. Rev. C 104, 014311 (2021).

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

HK 14.3 Tue 16:15 HBR 14: HS 1

The dipole response of ^{64}Ni below the neutron-separation threshold — •Miriam Müscher[1], Johann Isaak[2], Florian Kluwig[1], Deniz Savran[3], Tanja Schüttler[1], Ronald Schwengner[4], and Andreas Zilges[1] — [1]University of Cologne, Institute for Nuclear Physics, Germany — [2]TU Darmstadt, Institute for Nuclear Physics, Germany — [3]GSI, Darmstadt, Germany — [4]Helmholtz-Zentrum Dresden-Rossendorf, Germany

Real-photon scattering is an ideal method to study the dipole response of atomic nuclei due to the low angular-momentum transfer of photons [1]. Systematic investigations of dipole-excitation modes along isotopic and isotonic chains aim for a better understanding of their underlying structures. The $Z = 28$ isotopic chain is well suited for this purpose due to its four stable, even-even isotopes. Therefore, real-photon scattering experiments have already been conducted on ^{58,60,62}Ni [2-5].

To complete these studies, two complementary (γ,γ') experiments were performed on ^{64}Ni to extract absolute cross sections and to distinguish electric and magnetic dipole transitions up to the neutron-separation threshold $S_n = 9.7$ MeV. In this contribution, experimental details and results 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] T. Schüttler, Bachelor's Thesis, University of Cologne (2023).

HK 14.4 Tue 16:30 HBR 14: HS 1

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 University, Durham, NC, USA — [6]ESS, Lund, SE — [7]University of Cologne — [8]GSI, Darmstadt

According to the Brink-Axel hypothesis, the photon strength function (PSF) is independent of the detailed structure of initial and final states, and thus independent of level energies, spins, and parities involved. Upward (excitation) and downward (deexcitation) PSF are thus expected to be the same. However, for ^{96}Mo, significant discrepancies were observed [1] in several experiments. To study the observed discrepancies, we performed an experiment on ^{96}Mo at HIγS using a new method [2] that allows for the simultaneous measurement of upward and downward PSF in a single nuclear resonance fluorescence experiment with $\gamma\gamma$ coincidences. First results will be discussed.

Supported by the BMBF, grant No. 05P21RDEN9, the Deutsche Forschungsgemeinschaft (DFG, German Research Foundation) – Project-ID 499256822 – GRK 2891, and the U. S. DOE, grant No. DE-FG02-97ER41041, No. DE-FG02-97ER41033, and No. DE-SC0023010.

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

HK 14.5 Tue 16:45 HBR 14: HS 1

The isovector spin-$M1$ response of ^{90}Zr and ^{92}Mo — •A. Gupta[1], V. Werner[1], K. E. Ide[1], A. D. Ayangeakaa[2,3], M. Beuschlein[1], S. W. Finch[3,4], U. Friman-Gayer[3,4,5], D. Gribble[2,3], J. Hauf[1], J. Isaak[1], X. James[2,3], R. V. F. Janssens[2,3], S. R. Johnson[2,3], J. Kleemann[1], P. Koseoglou[1], T. Kowalewski[2,3], B. Löher[6], O. Papst[1], N. Pietralla[1], A. Saracino[2,3], D. Savran[6], and N. SenSharma[2,3] — [1]IKP, TU Darmstadt — [2]UNC, Chapel Hill, NC, USA — [3]TUNL, Durham, NC, USA — [4]Duke University, Durham, NC, USA — [5]ESS, Lund, SE — [6]GSI, Darmstadt

Nuclei near N=50, above Z=28 [1], play a significant role in core-collapse supernovae scenarios through their electron capture rates, which depend on the corresponding Gamow-Teller (GT) transitions. GT transitions are the weak analogue of isovector spin-flip M1 (IVSM1) transitions. The nuclide ^{92}Mo features two extra protons in the proton $g_{9/2}$ orbital beyond the closed pf shell which may cause additional IVSM1 strength as compared to ^{90}Zr. The dipole response in both isotones in a nuclear resonance fluorescence experiment using the hybrid array of HPGe Clover and $LaBr_3$ detectors at the HIγS facility have been studied and will be presented. Measuring asymmetries of ground-state transitions in an integral approach will be used to obtain the overall M1/E1 ground-state transition strength up to 10 MeV. Supported by DFG Project No.279384907-SFB 1245 and the U.S. DOE Grant Nos. DE-FG02-97ER41041 and DE-FG02-97ER41033.

[1] K. Langanke *et al.*, Rep. Prog. Phys. **84**, 066301 (2021)

HK 14.6 Tue 17:00 HBR 14: HS 1

^{232}Th($\vec{\gamma}$,f) reaction measured by quasi-monochromatic photon beams* — •Annabel Ibel[1], Dimiter Balabanski[2], Joachim Enders[1], Sean W. Finch[3], Alf Göök[4], Calvin R. Howell[3], Ronald C. Malone[5], Maximilian Meier[1], Andreas Oberstedt[2], Stephan Oberstedt[6], Marius Peck[1], Norbert Pietralla[1], Jack A. Silano[5], Gerhart Steinhilber[1], Forrest Q. L. Friesen[3], Anthony P. D. Ramirez[5], Anton P. Tonchev[5], Werner Tornow[3], and Vincent Wende[1] — [1]Institut für Kernphysik, Fachbereich Physik, TU Darmstadt, Darmstadt, Germany — [2]ELI-NP, IFIN-HH, Magurele, Romania — [3]Triangle Universities Nuclear Laboratory, Duke University, Durham, NC, USA — [4]Uppsala Universitet, Uppsala, Sweden — [5]Lawrence Livermore National Laboratory, Livermore, CA,

USA — [6]EC-JRC Geel, Belgium

High-precision photon-induced ^{232}Th($\vec{\gamma}$,f) experiments give access to information about the fission process from measuring the kinetic energy, the mass and the angular distribution of the fission fragments using a Frisch-Grid Ionization Chamber. This contribution will show data from an experimental campaign conducted at the High Intensity Gamma-ray Source facility using quasi-monochromatic photon beams between 6.2 MeV and 13 MeV. A comparison of the measured mass distributions to previous experiments using bremsstrahlung will be presented.

*Supported by DFG (GRK 2891, project ID 499256822)