HK 50: Structure and Dynamics of Nuclei VIII

Time: Wednesday 16:00–17:45 Location: HK-H6

Group Report HK 50.1 Wed 16:00 HK-H6

Investigation of the low-lying dipole response in real photon-scattering experiments — •Miriam Müscher[1], Johann Isaak[2], Florian Kluwig[1], Deniz Savran[3], Ronald Schwengner[4], Werner Tornow[5], and Andreas Zilges[1] — [1]University of Cologne, Institute for Nuclear Physics — [2]Institute for Nuclear Physics, TU Darmstadt — [3]GSI, Darmstadt — [4]Helmholtz-Zentrum Dresden-Rossendorf — [5]Duke University and TUNL

The photoabsorption cross section of atomic nuclei has great impact on reaction rates in nucleosynthesis processes. For instance, the occurrence of additional dipole strength below and around the particle separation threshold, often denoted by Pygmy Dipole Resonance [1], can enhance reaction rates in the rapid neutron-capture process [2].
Real photon-scattering experiments are well suited to selectively study dipole excited states [3]. In these experiments, photoabsorption cross sections as well as spin and parity quantum numbers can be extracted in a model-independent way. Recent results of complementary (γ,γ') experiments with bremsstrahlung (at DHIPS [4] and γELBE [5]) and with quasi-monoenergetic photons (at HIγS [6]) will be presented.
This work is supported by the BMBF (05P21PKEN9).

[1] D. Savran *et al.*, Prog. Part. Nucl. Phys. **70** (2013) 210
[2] S. Goriely, Phys. Lett. B **436** (1998) 10
[3] U. Kneissl *et al.*, Prog. Part. Nucl. Phys. **37** (1996) 349
[4] K. Sonnabend *et al.*, Nucl. Instr. and Meth. A **640** (2011) 6
[5] R. Schwengner *et al.*, Nucl. Instr. and Meth. A **555** (2005) 211
[6] H.R. Weller *et al.*, Prog. Part. Nucl. Phys. **62** (2009) 257

HK 50.2 Wed 16:30 HK-H6

Status report on the progress on the analysis of the NewSUBARU data — •Nikolina Lalić[1], Thomas Aumann[1,2], Takashi Ariizumi[3], Patrick van Beek[1], Ioana Gheorghe[4], Heiko Scheit[1], Dmytro Symochko[5], and Hiroaki Utsunomiya[3] — [1]Technische Unitversität Darmstadt, Germany — [2]GSI Helmholtzzentrum, Germany — [3]Department of Physics, Konan University, Japan — [4]"Horia Hulubei" National Institute for R & D in Physics and Nuclear Engineering (IFIN HH), Romania — [5]Physikalisch-Technische Bundesanstalt (PTB), Germany

The photoneutron cross sections of ^{112}Sn, ^{116}Sn, ^{120}Sn and ^{124}Sn were measured in (γ,xn) reactions, where $x \in [1,4]$, using a quasi-monochromatic laser Compton-scattering γ-ray beam at the NewSUBARU facility. The goal of the experiment is to resolve the long-standing discrepancy of the total and partial cross sections measured by the Livermore and the Saclay groups. Measurements were done with γ energies from 8 MeV to 38 MeV. As a neutron counter a detector with a flat efficiency was used to take advantage of the direct neutron-multiplicity sorting technique. The (γ,xn) cross sections $x \in [1,4]$ will be determined as well as the total photo absorption cross sections.
In this report the experiment and the current state of the ongoing analysis will be presented.
Suported by HMWK (LOEWE centre "Nuclear Photonics") and DFG (SFB 1245).

HK 50.3 Wed 16:45 HK-H6

Observational indications for broken axial symmetry in heavy nuclei — •Eckart Grosse[1] and Arnd R. Junghans[2] — [1]IKTP Technische Universität Dresden — [2]Helmholtz-Zentrum Dresden-Rossendorf

Following the observation of quadrupole moments in atomic hyperfine structure it became a custom to consider most nuclei as axially symmetric; this assumption is still in wide use, albeit it was falsified in several cases. Giving up axiality the apparent shapes in very many giant dipole resonances agree much better to data [EPJA 53, 225 (2017)] and we started to examine other experimental observations with respect on their sensitivity to axiality. Here we had to acknowledge that the popular I(I+1)-rule for rotational energy is strictly connected to axial symmetry. This changes the interpretation of ground state bands e.g. in actinide nuclei. The widely known R42 values (ratios of low level excitation energies) very surprisingly correlate to gamma-triaxialities derived in HFB-calculations modified by a generator coordinate approximation. And these values together with the backshift between experimental and Thomas-Fermi ground state masses allow satisfactory predictions of neutron resonance spacings in quasi all heavy nuclei. As also average widths of such resonances are predicted quite well we consider our findings a falsification of assuming axiality and point out that recent calculations of MC-shell model type [PRC 97, 014315 (2018)] support this statement.

HK 50.4 Wed 17:00 HK-H6

One-nucleon removal from ^{14}O at 100 MeV/nucleon with a thin hydrogen target — •Thomas Pohl, Yelei Sun, Alexandre Obertelli, and SAMURAI 31 Collaboration — TU Darmstadt

Direct reactions at intermediate energies are an important tool for nuclear structure studies, but some reaction mechanisms are still not understood. One debated phenomenon is the asymmetric parallel momentum distribution (PMD) of the residual nucleus occuring occasional in one nucleon removal reactions[1-3]. Recent theoretical calculation of (p,pN) reactions with ^{14}O at 100 MeV/nucleon with the distorted-wave impulse approximation (DWIA) predicted a large asymmetric PMD [4]. The low momentum tail is due to the attractive potential between the residues and the outgoing nucleons and the steep falloff on the high momentum side is due to the energy and momentum conservation. Still, comparison with experimental data is necessary for validation and will be a basis for further spectroscopic factor studies. We have performed ^{14}O$(p,pn)^{13}$O and ^{14}O$(p,2p)^{13}$N reactions at 100 MeV/nucleon with a thin solid hydrogen target at SAMURAI at RIKEN. Momentum of the residues were extracted from the SAMURAI spectrometer. Details of the data analysis and preliminary results of the cross section and PMD will be presented.

[1] A. Gade *et al.*, Phys. Rev. C 71, 051301(R)(2005).
[2] K.L. Yurkewicz *et al.*, Phys. Rev. C 74, 024304 (2006).
[3] F. Flavigny *et al.*, Phys. Rev. Lett. 108, 252501 (2012).
[4] K. Ogata *et al.*, J. Phys. Rev. C 92, 034616 (2015).

HK 50.5 Wed 17:15 HK-H6

Correlation experiments in photofission — •Vincent Wende[1], Marius Peck[1], Joachim Enders[1], Sean W. Finch[2], Alf Göök[3], Calvin R. Howell[2], Maximilian Meier[1], Andreas Oberstedt[4], Stephan Oberstedt[5], Norbert Pietralla[1], Jack A. Silano[6], Anton P. Tonchev[6], and Werner Tornow[2] — [1]Institut für Kernphysik, TU Darmstadt, Darmstadt, Germany, — [2]Triangle Universities Nuclear Laboratory, Duke University, Durham, NC, USA, — [3]KTH Stockholm, Stockholm, Sweden, — [4]ELI-NP, IFIN-HH, Magurele, Romania, — [5]EC-JRC Geel, Belgium — [6]Lawrence Livermore National Laboratory, Livermore, CA, USA

Photon-induced reactions provide precision data on nuclear fission due to their selectivity on excitations of low multipolarity. Quasi-monochromatic polarized photon beams allow one to extract information about the transition states and channels through which the fission proceeds. To this end, the masses, total kinetic energy, and polar as well as azimuthal angular distributions of the fission fragments were measured simultaneously in a position-sensitive twin Frisch-grid ionization chamber [1]. We present first results of a pioneering ^{238}U(γ,f) experiment at the High-Intensity γ-Ray Source (HIγS) at an excitation energy of 11.2 MeV [2].
[1] A. Göök et al., Nucl. Instrum. Methods A 830, 366 (2016); M. Peck et al., EPJ Web of Conferences 239, 05011 (2020).
[2] M. Peck, Dissertation, TU Darmstadt (2020).
Supported by DFG (05P18RDEN9) and HMWK (LOEWE Cluster Nuclear Photonics).

HK 50.6 Wed 17:30 HK-H6

Temperature-dependent relative self absorption measurements in ^{27}Al at DHIPS — •P. Koseoglou, M. L. Cortes, J. Isaak, V. Werner, O. Papst, J. Kleemann, M. Beuschlein, N. Pietralla, U. Ahmed, K. E. Ide, I. Jurosevic, C. Nickel, M. Spall, T. Stetz, and R. Zidarova — Institut für Kernphysik, Technische Universität Darmstadt, 64289 Darmstadt, Germany

Self-absorption measurements probe the photoexcitation process of nuclear resonances and, thus, provide direct sensitivity to ground-state transition widths [1-3]. First temperature-dependent relative self-absorption (T-RSA) in nuclear resonance fluorescence measurements on ^{27}Al were performed at the Darmstadt High Intensity Photon Setup (DHIPS) of S-DALINAC. A technique was tested in which measure-

ments are done at multiple absorber temperatures. The advantage of this technique, over the regular RSA, is the possibility to overcome the need for theory input on the effective temperatures, which can be complicated for compound materials, and the uncertainties that they introduce in the measured level widths [2]. The technique and the preliminary results of the first measurements will be presented.

This work was supported by the State of Hesse under grant "Nuclear Photonics" within the LOEWE program.

[1] N. Pietralla et al., Phys. Rev. C **51** 1021 (1995).
[2] U. Friman-Gayer et al., Phys. Rev. Lett. **126** 102501 (2021).
[3] A. Zilges, D. L. Balabanski, J. Isaak, N. Pietralla, Prog. Part. Nucl. Phys. **122** 103903 (2022).