HK 1: Structure and Dynamics of Nuclei I

Time: Monday 15:00–16:30 Location: HS 2 Physik

Group Report HK 1.1 Mon 15:00 HS 2 Physik

Systematic investigation of *E1* strength below S_n in the tin isotopic chain using the (d,pγ) reaction — •Markus Müllenmeister, Michael Weinert, Florian Kluwig, Tanja Schüttler, and Andreas Zilges — University of Cologne, Institute for Nuclear Physics, Germany

The evolution of the electric dipole ($E1$) response in various nuclei has been the subject of intense study for decades [1]. The structure of the so-called Pygmy Dipole Resonance, which emerges around and below the neutron separation energy of most medium- to heavy-mass nuclei, is of particular interest [2]. New insights into its origin can be gained through the well-established method of neutron transfer [3]. When combined with state-of-the-art analysis techniques, theoretical calculations, and comparative studies using different probes, the dipole strength can be examined across different nuclides to obtain detailed structural information [4].

In this contribution, a comparison for the tin isotopes, accessible via the $(d, p\gamma)$-reaction, will be presented and compared to real photon scattering data. Together, these methods highlight the dominance of single-particle excitations at lower energies, while more complex configurations become significant at higher energies.

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[1] A. Bracco *et al.*, Prog. Part. Nucl. Phys. **106** (2019) 360
[2] D. Savran *et al.*, Prog. Part. Nucl. Phys. **70** (2013) 210
[3] M. Weinert *et al.*, Phys. Rev. Lett. **127** (2021) 242501
[4] D. Savran *et al.*, Phys. Lett. B **786** (2018) 16

HK 1.2 Mon 15:30 HS 2 Physik

Photoabsorption Cross Sections of Tin and Calcium Isotopes — •Martin Baumann[1], Thomas Aumann[1,2], Maike Beuschlein[1], Isabelle Brandherm[1], Meytal Duer[1], Amrita Gupta[1], Phillip Imgram[1], Andrea Jedele[1], Liancheng Ji[1], Igor Jurosevic[1], Marco Knösel[1], Nikolina Wagner[1], Enis Lorenz[1], Hannes Mayr[1], Leandro Milhomes da Fonseca[1], Nikhil Mozumdar[1], Ann Rochele Netto[1], Oliver Papst[1], Thomas Pohl[1], Heiko Scheit[1], Gerhart Steinhilber[1], Sonja Storck-Dutine[1], Dmytro Symochko[1], Iyabo Usman[3], and Patrick van Beek[1] — [1]Institut für Kernphysik, TU Darmstadt, Germany — [2]GSI Helmholtzzentrum, Darmstadt, Germany — [3]University of the Witwatersrand, Johannesburg, South Africa

The photoabsorption setup of the NEPTUN photon tagger at the superconducting linear accelerator S-DALINAC has been used to investigate the photoabsorption cross sections of Sn-112,116,120,124 as well as Ca-40,48 in the region from 5 to 30 MeV using a beam of tagged photons. In this talk the measurement method as well as the current status of the data analysis will be presented.

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HK 1.3 Mon 15:45 HS 2 Physik

Probing the doubly-magic shell closure at ^{132}Sn by Coulomb excitation of neutron-rich ^{130}Sn — •Maximilian Droste[1], Peter Reiter[2], and Thorsten Kröll[2] for the IS702-Collaboration — [1]IKP, Universität zu Köln — [2]IKP, TU Darmstadt

Excited states of ^{130}Sn, the even-even neighbour of doubly-magic ^{132}Sn, were studied by safe Coulomb excitation using the highly-efficient MINIBALL array. The ^{130}Sn ions were accelerated to 4.4 MeV/u at the HIE-ISOLDE accelerator and collided with a ^{206}Pb target. Deexciting γ rays from excited states were detected in coincidence with scattered particles. In addition to γ rays from the first 2^+ state of ^{130}Sn, deexcitation from higher-lying states was observed, attributed to an isomeric ^{130}Sn $J^\pi = 7^-$ beam component. A new $B(E2; 0^+_{\text{g.s.}} \rightarrow 2^+_1)$ value is compared to recent theoretical results from state-of-the-art MCSM calculations which differ strongly from previous measurements [1,2]. These calculations also indicate a transition from a slightly oblate to a prolate configuration of the first excited 2^+ state across doubly magic ^{132}Sn. The high statistics of the performed experiment allows for an experimental investigation of the Q_{2^+} value.

[1] D. Rosiak *et al.* Phys. Rev. Lett. 121, 252501 (2018)
[2] T. Togashi *et al.* Phys. Rev. Lett. 121, 062501 (2018)

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HK 1.4 Mon 16:00 HS 2 Physik

Lifetimes of excited states in ^{116,118}Sn — •Sarah Prill, Elias Binger, Anna Bohn, Tobias Langel, Michael Weinert, and Andreas Zilges — University of Cologne, Institute for Nuclear Physics, Germany

The proton-magic tin isotopic chain has the highest number of stable isotopes and is therefore an ideal candidate to study nuclear properties in a wide range of nuclei. Lifetimes of excited states in the femtosecond range have already been determined in Cologne for ^{112}Sn and ^{114}Sn [1] using the Coincidence Doppler-Shift Attenuation Method (CDSAM) [2,3]. The study was continued for the nuclei ^{116}Sn and ^{118}Sn, using not only inelastic proton scattering but also alpha particles as the beam.

Coincidence data were recorded with the SONIC@HORUS setup [4] at the tandem accelerator of the University of Cologne. Combining particle and γ-ray detection allowed the reconstruction of the reaction kinematics and enabled the analysis of single levels without feeding contributions.

This presentation will show the lifetime results for ^{116}Sn and ^{118}Sn and discuss the influence of different beam particles.

Supported by the DFG (ZI 510/9-2).

[1] M. Spieker *et al.*, Phys. Rev. C **97**, 054319 (2018).
[2] A. Hennig *et al.*, Nucl. Instr. Meth. A **758**, 171 (2015).
[3] S. Prill *et al.*, Phys. Rev. C **105**, 034319 (2022).
[4] S. G. Pickstone *et al.*, Nucl. Instr. Meth. A **875**, 104 (2017).

HK 1.5 Mon 16:15 HS 2 Physik

Determination of the energy-resolvable $E1$- and $M1$-strength distribution in ^{70}Zn — •J. Hauf[1], V. Werner[1], A. D. Ayangeakaa[2,3], D. Balabanski[4,5], M. Beuschlein[1], R. Beyer[6], S. W. Finch[2,7], A. Gupta[1], D. Gribble[2,3], T. Hensel[6], M. Heumüller[1], F. E. Idoku[2,3], J. Isaak[1], X. James[2,3], R. V. F. Janssens[2,3], S. R. Johnson[2,3], A. Junghans[6], J. Kleemann[1], P. Koseoglou[1], T. Kowalewski[2,3], A. Kusoglu[4], J. Lu[1], E. Masha[6], C. M. Nickel[1], O. Papst[1], M. Pichotta[6], N. Pietralla[1], K. Prifti[1], K. Römer[6], A. Saracino[2,3], P.-A. Söderström[4], K. Schmidt[6], R. Schwengner[6], A. Thees[6], S. Turkat[6], J. Vogel[1], A. Wagner[6], and A. Yadev[6] — [1]TU Darmstadt, IKP — [2]TUNL — [3]University of North Carolina — [4]ELI-NP — [5]Horia Hulubei National Institute — [6]Helmholtz-Zentrum Dresden-Rossendorf — [7]Duke University

Nuclear resonance fluorescence experiments with bremsstrahlung and quasi-monoenergetic photon beams have been conducted on ^{70}Zn at γELBE and HIγS. The investigation of the most neutron-rich stable zinc isotope aims to achieve a better understanding of nuclear structure phenomena, such as shape coexistence and the Pygmy dipole resonance, at the $N = 40$ harmonic oscillator shell closure. The status of the analysis, including spectra and preliminary results for the $E1$- and $M1$-strength distributions, are shown and discussed.

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