HK 50: Structure and Dynamics of Nuclei X

Time: Wednesday 17:30–19:00 Location: SCH/A215

Group Report HK 50.1 Wed 17:30 SCH/A215

Measuring Photo-Absorption Cross Sections with Tagged Photons at NEPTUN — •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 Lalic[1], Enis Lorenz[1], Hannes Mayr[1], Leandro Milhomens 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 photon tagger NEPTUN at the superconducting linear electron accelerator S-DALINAC has been upgraded to enable high precision measurements of nuclear photo-absorption cross sections in the energy region up to 35 MeV, covering the giant dipole resonance region using tagged bremsstrahlung with a single configuration. For this purpose a new focal plane detector LARISSA and a rapid target changer PROTEUS have been commissioned. This setup has recently been used to measure the photo-absorption cross sections of the isotopes Sn-112,116,120,124,Ca-40 and Ca-48. In this talk the method will be outlined and performance characteristics of the setup will be shown as well as preliminary data from the recent beam time.
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HK 50.2 Wed 18:00 SCH/A215

Self-absorption experiments with quasi-monochromatic photon beams: Model-independent level widths with high precision — •D. Savran[1], J. Isaak[2], A.D. Ayangeakaa[3,4], M. Beuschlein[2], S.W. Finch[4,5], D. Gribble[2], A. Gupta[2], J. Hauf[2], R.V.F. Janssens[3,4], S.R. Johnson[3,4], P. Koseoglou[2], T. Kowalewski[3,4], B. Löher[1], O. Papst[2], N. Pietralla[2], A. Saracino[3,4], N. Sensharma[3,4], and V. Werner[2] — [1]GSI, Darmstadt — [2]IKP, TU Darmstadt — [3]UNC, Chapel Hill, NC, USA — [4]TUNL, Durham, NC, USA — [5]Duke U., Durham, NC, USA

We have developed a novel variation of the relative self-absorption (RSA) technique in order to adapt this method to quasi-monochromatic photon beams produced via Laser-Compton Backscattering (LCB) [1]. The approach combines the advantages of LCB beams with the model-independent determination of level widths via the RSA method. In this contribution the method itself as well as preliminary results of its pioneering application to measure the B(E2, $0_1^+ \rightarrow 2_1^+$) transition strength of the first excited state in ^{12}C to a precision of better than 2% will be presented.
Supported by the State of Hesse, grant "Nuclear Photonics" (LOEWE program) and the Research Cluster ELEMENTS (Project-ID 500/10.006), the Deutsche Forschungsgemeinschaft (DFG, German Research Foundation) - Project-ID 279384907 - SFB 1245 and the U. S. DOE Grant No. DE-FG02-97ER41041 and No. DE-FG02-97ER41033.
[1] D. Savran and J. Isaak, Nucl. Inst. and Meth. A 899, 28 (2018).

HK 50.3 Wed 18:15 SCH/A215

Self-absorption experiments with quasi-monochromatic photon beams: A new approach to nuclear level densities — •J. Isaak[1], D. Savran[2], A.D. Ayangeakaa[3,4], M. Beuschlein[1], S.W. Finch[4,5], A. Gupta[1], D. Gribble[3,4], J. Hauf[1], R.V.F. Janssens[3,4], S.R. Johnson[3,4], P. Koseoglou[1], T. Kowalewski[3,4], B. Löher[2], O. Papst[1], N. Pietralla[1], A. Saracino[3,4], N. Sensharma[3,4], and V. Werner[1] — [1]IKP, TU Darmstadt — [2]GSI, Darmstadt — [3]UNC, Chapel Hill, NC, USA — [4]TUNL, Durham, NC, USA — [5]Duke U., Durham, NC, USA

The modeling of the elemental abundances in the universe requires, among others, information on the nuclear level density (NLD) of isotopes across the nuclear chart from stable to unstable nuclides. While it can be determined at the lowest excitation energies and from neutron resonances, it is a difficult quantity to access at intermediate excitation energies. In fall 2022, a pioneering experiment with ^{88}Sr was performed at HIγS exploiting the combination of the self-absorption technique with quasi-monoenergetic photon beams. A novel approach is introduced enabling the extraction of the NLD of dipole-excited states with photonuclear reactions and first results for the case of ^{88}Sr are presented.
Supported by the State of Hesse, grant "Nuclear Photonics" (LOEWE program) and the Research Cluster ELEMENTS (Project-ID 500/10.006), the Deutsche Forschungsgemeinschaft (DFG, German Research Foundation - Project-ID 279384907 - SFB 1245 and the U. S. DOE Grant No. DE-FG02-97ER41041 and No. DE-FG02-97ER41033.

HK 50.4 Wed 18:30 SCH/A215

Lifetime measurements of excited states in ^{59}Ni and ^{57}Fe — •Ramona Burggraf, Erik Gassmus, Peter Reiter, Konrad Arnswald, Andrey Blazhev, Maximilian Droste, Christoph Fransen, and Hannah Kleis — IKP, Universität zu Köln

Lifetime measurements of excited states in nuclei along the $N = 31$ chain were used to corroborate the $N = 32$ sub-shell closure [1], as done previously in ^{55}Cr [2]. Systematic studies including the neighboring $N = 31$ isotones suffer from imprecise experimental values. Excited states in ^{59}Ni and ^{57}Fe have been populated in ^{51}V(^{12}C, $p3n$) and ^{51}V(^{12}C, $pn\alpha$) fusion-evaporation reactions at a beam energy of 55 MeV at the FN tandem accelerator of the University of Cologne. The Cologne plunger device, surrounded by an efficient γ-ray detector array was employed to determine lifetimes with the recoil-distance Doppler-shift method and the differential decay-curve method. Lifetimes and reduced transition strengths for several excited states in ^{59}Ni and ^{57}Fe were determined. Considerable deviations from previous experimental findings were observed. Comparison with results from new shell-model calculations employing the GXPF1A interaction show remarkable agreement with the present values.
[1] D. Steppenbeck et al., Nature 502, 7470 (2013)
[2] H.Kleis et al., Phys. Rev. C 104, 034310 (2021)

HK 50.5 Wed 18:45 SCH/A215

Lifetime Measurement of the 2_1^+ and 4_1^+ states in ^{60}Ni using the RDDS method — •Marcel Beckers[1], Claus Müller-Gatermann[2], Konrad Arnswald[1], Alfred Dewald[1], Felix Dunkel[1], Christoph Fransen[1], Lisa Kornwebel[1], Casper-David Lakenbrink[1], and Franziskus von Spee[1] — [1]Institut für Kernphysik, Universität zu Köln — [2]Argonne National Lab, USA

At ^{60}Ni and surrounding Ni isotopes one can find a quite confusing situation regarding the existing experimental results. There are several data sets giving quadrupole transition strengths for the $2_1^+ \rightarrow 0_1^+$ and the $4_1^+ \rightarrow 2_1^+$ transitions that are in disagreement with each other and would lead to different physical interpretations.
Therefore, a high-precision γ-γ coincidence Recoil Distance Doppler-Shift measurement has been carried out on ^{60}Ni to re-measure the lifetime of the 2_1^+ and 4_1^+ states. The new lifetime of the 2_1^+ state supports the adopted NNDC value but disagrees with the results of two more recent Doppler-Shift Attenuation Method measurements, which suggested a longer lifetime. The new result for the 4_1^+ state's lifetime is significantly shorter than the one recommended in the latest NNDC compilation while also reducing its uncertainty. It therefore resolves an unclear situation, where an unexpected drop in transition strength appeared from ^{58}Ni to ^{60}Ni. Both values match very well with recently applied shell model calculations using the GXPF1A interaction.
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