HK 48: Structure and Dynamics of Nuclei XI

Time: Thursday 15:45–17:15 Location: HS 2 Physik

HK 48.1 Thu 15:45 HS 2 Physik

Constraining Double Beta Decay: Detailed Spectroscopy of ^{136}Ba — •Jelena Bardak[1,2], Giacomo Colombi[3], Corinna Henrich[4], Ilja Homm[4], Nikola Jovancevic[2], Ulli Koester[5], Thorsten Kroell[4], Caterina Michelagnoli[5], Erin Peters[6], Matthias Rudigier[4], Marcus Scheck[7], Kathrin Wimmer[1], and S. W. Yates[8] — [1]GSI Helmholtzzentrum für Schwerionenforschung — [2]Department of Physics, University of Novi Sad — [3]University of Guelph — [4]IKP TU Darmstadt — [5]Institut Laue-Langevin, Grenoble — [6]Department of Chemistry, University of Kentucky — [7]School of Engineering, UWS, Paisley — [8]Department of Physics and Astronomy, Lexington

Neutrinoless double beta decay ($0\nu\beta\beta$) is a rare process predicted by theories beyond the Standard Model, offering insights into neutrinos as Majorana particles with non-zero mass. The decay of ^{136}Xe to ^{136}Ba is a key candidate for $0\nu\beta\beta$ studies. Nuclear matrix elements (NMEs) are crucial for extracting neutrino properties from decay rates, but their values vary between theoretical models.This study investigates the nuclear structure of ^{136}Ba through spectroscopy with the FIPPS detector at ILL. Coincidence analysis will refine the level scheme, and gamma-ray angular correlations will assign spins, parities, and mixing ratios. Lifetimes will be measured to reduce uncertainties and provide new data. The vibrational and mixed-symmetry properties of ^{136}Ba will also be explored, enhancing understanding of its collective dynamics. These results aim to reduce NME uncertainties, advance knowledge of $0\nu\beta\beta$, and contribute to broader nuclear structure studies.

HK 48.2 Thu 16:00 HS 2 Physik

Electron-Nucleus Cross-Section Measurements at MAMI for Neutrino Physics — •Luca Wilhelm, Maximilian Littich, and Luca Doria — Institute for Nuclear Physics, Johannes Gutenberg-University Mainz, Germany

Electron scattering experiments are powerful tools for studying problems in nuclear physics. Recently, theoretical *ab-initio* methods extended their reach to medium-mass nuclei opening up new opportunities for precise electron scattering experiments. Such experiments can elucidate the role of different effects in the nuclear dynamics, ranging from excited states to collective phenomena and nucleon resonances in the nuclear medium. Furthermore, neutrino physics needs precise nuclear physics input for reaching the ambitious goals set by next-generation long-baseline experiments. Due to the similarity between electrons and neutrinos, theoretical models and neutrino generators can be tested and improved through the comparison to precise electron scattering experiments. At the MAMI accelerator, we performed and inclusive cross-section measurements on different nuclei relevant for neutrino physics: ^{12}C, ^{16}O, ^{40}Ar. The collected data will be used to test the predictions of different theoretical calculations and generators.

HK 48.3 Thu 16:15 HS 2 Physik

Measurement of the ^{71}Ge half-life using a silicon drift detector — •Hans F. R. Hoffmann, Jonas Koch, Björn Lehnert, and Kai Zuber — Technische Universität Dresden, Germany

In the search for possible explanations for the discrepancy between the measured and expected neutrino flux in gallium-based radiochemical neutrino detectors, known as the gallium anomaly, the half-life of ^{71}Ge plays a crucial role. While new theories in neutrino physics are being explored, variations in the ^{71}Ge half-life could also influence this discrepancy and its statistical significance. To evaluate the current literature value, a disc-shaped sample of germanium with natural isotope abundance was measured. The germanium disc was irradiated with thermal neutrons at the TRIGA reactor at Johannes Gutenberg University in Mainz. The actvated sample was brought to Dresden where K_α and K_β X-rays from the decay of ^{71}Ge were measured over several months using a silicon drift detector. The resulting count rate was fitted with an exponential decay curve, from which the half-life was determined. The result is compared to other ^{71}Ge half-life measurements and placed in the context of the gallium anomaly.

HK 48.4 Thu 16:30 HS 2 Physik

The low-lying dipole response of ^{62}Ni — •Tanja Schüttler[1], Florian Kluwig[1], Miriam Müscher[1], Deniz Savran[2], Ronald Schwengner[3], and Andreas Zilges[1] — [1]University of Cologne, Institute for Nuclear Physics, Germany — [2]GSI, Research Division, Darmstadt, Germany — [3]Helmholtz-Zentrum Dresden-Rossendorf, Germany

Systematic studies along isotopic and isotonic chains are fundamental for investigating the properties of the low-lying dipole response of atomic nuclei, and can shed light on, e.g., the effects of shell structure and neutron excess on dipole strength. The semi-magic nickel (Z=28) isotopic chain is ideally suited for a systematic study, because of its four stable, even-even isotopes covering a wide range of N/Z ratios. The dipole response of ^{58}Ni, ^{60}Ni, and ^{64}Ni has already been studied in (γ, γ') experiments [1-4], making the investigation of ^{62}Ni one of the last missing steps to complete the systematics. Therefore, a (γ, γ') bremsstrahlung experiment on ^{62}Ni up to a maximum photon energy of $E_{\max} = 8.7\,\mathrm{MeV}$ was performed at the γELBE facility at the Helmholtz-Zentrum Dresden-Rossendorf [5]. First results of this experiment will be presented. This work has been supported by the BMBF (05P21PKEN9).

[1] F. Bauwens *et al.*, Phys. Rev. C **62** (2000) 024302.
[2] M. Scheck *et al.*, Phys. Rev. C **88** (2013) 044304.
[3] M. Scheck *et al.*, Phys. Rev. C **87** (2013) 051304(R).
[4] M. Müscher *et al.*, Physical Review C **109** (2024) 044318.
[5] R. Schwengner *et al.*, Nucl. Instr. and Meth. A **555** (2005) 211.

HK 48.5 Thu 16:45 HS 2 Physik

Deviations from the Porter-Thomas distribution due to non-statistical gamma decay — •Johann Isaak[1], Oliver Papst[1], Volker Werner[1], Deniz Savran[2], Norbert Pietralla[1], Maike Beuschlein[1], Sean Finch[3], Robert Janssens[3,4], Jörn Kleemann[1], Miriam Müscher[5], Werner Tornow[3], and Andreas Zilges[5] — [1]TU Darmstadt, IKP, Darmstadt, Germany — [2]GSI, Darmstadt, Germany — [3]TUNL, Durham, USA — [4]UNC, Chapel Hill, USA — [5]Universität zu Köln, IKP, Köln, Germany

Fluctuations of partial transition widths in nuclear reactions are usually considered following the so-called Porter-Thomas (PT) distribution [1]. While fluctuations have been studied extensively for thermal neutron resonances, partly with inconclusive results, the region below particle thresholds is untouched so far [2].
In this contribution, we introduce a new method for the study of fluctuations of partial transition widths based on nuclear resonance fluorescence experiments with quasimonochromatic linearly-polarized photon beams below particle separation thresholds.
Results for ^{150}Nd will be presented and discussed. The data suggest deviations from the PT distribution, which can be explained by non-statistical effects in the γ-decay channel.

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[1] Porter and Thomas, PR 104, 483 (1956).
[2] Weidenmüller and Mitchell, RMP 81, 539 (2009).

HK 48.6 Thu 17:00 HS 2 Physik

First temperature-dependent relative self-absorption measurement at the S-DALINAC — •K. Prifti[1], V. Werner[1], N. Pietralla[1], U. Ahmed[1], M. Baumann[1], M. Beuschlein[1], J. Bormans[1,2], I. Brandherm[1], M. L. Cortes[1], B. Götz[1], A. Gupta[1], J. Hauf[1], B. Hesbacher[1], M. Heumüller[1], K. E. Ide[1], J. Isaak[1], I. Jurosevic[1], J. Kleemann[1], P. Koseoglou[1], J. Lu[1], H. Mayr[1], A. R. Netto[1], C. M. Nickel[1], O. Papst[1], T. Ramaker[1], M. Rech[1], D. M. Richter[1], T. M. Sebe[3,4], T. Stetz[1], and R. Zidarova[1] — [1]IKP, TU Darmstadt — [2]GSI, Darmstadt — [3]ELI-NP, IFIN-HH, Romania — [4]Politehnica Bucharest, Romania

The temperature-dependent relative self-absorption (TRSA) technique enables the disentanglement of the Doppler broadening contribution to the total width of the self-absorption line from that of the zero-point motion of atoms in the target material. The first TRSA measurement was conducted at the Darmstadt High-Intensity Photon Setup (DHIPS) at the superconducting Darmstadt linear electron accelerator (S-DALINAC) on the nucleus ^{27}Al using a bremsstrahlung photon beam with an endpoint energy of 5.5 MeV. The present work aims at measuring the level width of the 3957 keV level with high precision and simultaneously determine the Debye temperature of the target mate-

rial. Measurements were performed with and without the absorbing target at three different temperatures, 77 K, 320 K, and 600 K. The data, their analysis and first results will be presented and discussed.

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