HK 31: Struktur und Dynamik von Kernen

Zeit: Dienstag 14:00–16:15 Raum: HSZ-301

Gruppenbericht HK 31.1 Di 14:00 HSZ-301

Probing the Character of the Pygmy Dipole Resonance — •Vera Derya[1], Janis Endres[1], Muhsin N. Harakeh[2], Deniz Savran[3,4], Mark Spieker[1], Heinrich J. Wörtche[2], and Andreas Zilges[1] — [1]Institut für Kernphysik, Universität zu Köln — [2]Kernfysisch Versneller Instituut, Rijksuniversiteit Groningen, The Netherlands — [3]ExtreMe Matter Institute EMMI and Research Division — [4]Frankfurt Institute for Advanced Studies

In neutron-rich atomic nuclei, a concentration of low-lying $E1$ strength, the electric pygmy dipole resonance (PDR), was observed below and around the neutron-separation threshold. Its character was studied systematically by using different probes and techniques. Complementary to photon scattering experiments, for a set of nuclei the isoscalar probe of α particles at E_α=136 MeV was used in α-γ coincidence experiments at the Big-Bite Spectrometer [1]. The results permit a separation of the PDR from more isovector parts [1,2]. Most recently, a p-γ coincidence experiment at E_p=80 MeV was performed on ^{140}Ce, previously studied by photons and α particles as a probe [2]. An overview of the particle-γ coincidence experiments and the systematics will be presented.

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[1] D. Savran *et al.*, Phys. Rev. Lett. **97** (2006) 172502.
[2] J. Endres *et al.*, Phys. Rev. Lett. **105** (2010) 212503.

HK 31.2 Di 14:30 HSZ-301

Zerfallsverhalten der Pygmy-Dipolresonanz in ^{130}Te — •Johann Isaak[1], Jacob Beller[2], Enrico Fiori[1], Milan Krticka[3], Bastian Löher[1], Norbert Pietralla[2], Christopher Romig[2], Deniz Savran[1], Marcus Scheck[2], Kerstin Sonnabend[4], Anton Tonchev[5], Werner Tornow[5], Henry Weller[5] und Markus Zweidinger[2] — [1]ExtreMe Matter Institute EMMI, GSI, Darmstadt — [2]Institut für Kernphysik, TU Darmstadt — [3]Faculty of Mathematics and Physics, Charles University, Prague, Czech Republic — [4]Institut für Angewandte Physik, Goethe-Universität Frankfurt am Main — [5]Department of Physics, Duke University, USA

In Kernresonanzfluoreszenz-Experimenten am Darmstadt High Intensity Photon Setup (DHIPS) und an der High Intensity $\vec{\gamma}$-Ray Source (HI$\vec{\gamma}$S) an der Duke University wurde die elektrische Dipolstärkeverteilung des Kerns ^{130}Te untersucht. Mit Hilfe von kontinuierlicher Bremsstrahlung am DHIPS war es möglich die absoluten Übergangsstärken von J=1 Zuständen bis zur Neutronenseparationsenergie zu bestimmen. Ergänzend konnte an HI$\vec{\gamma}$S mit quasi-monochromatischen linear polarisierten Photonen sowohl Paritäten als auch der totale Photoabsorptionswirkungsquerschnitt sowie das mittlere Verzweigungsverhältnis in den Grundzustand als Funktion der Anregungsenergie ermittelt werden. Die Ergebnisse werden präsentiert und mit ausführlichen Simulationen im Rahmen des Statistischen Modells mit Hilfe des DICEBOX Codes verglichen.

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HK 31.3 Di 14:45 HSZ-301

Photoneninduzierte γ-γ Koinzidenzmessungen mit dem γ^3-Setup an HIγS* am TUNL — •B. Löher[1], T. Aumann[4], J. Beller[4], C. Bernards[5], N. Cooper[5], V. Derya[2], J. Endres[2], A. Hennig[2], E. Fiori[1], J. Kelley[3], N. Pietralla[4], R. Raut[3], C. Romig[4], G. Rusev[3], D. Savran[1], M. Scheck[4], A. Tonchev[3], W. Tornow[3], V. Werner[5] und A. Zilges[2] — [1]ExtreMe Matter Institute EMMI and Research Division, GSI Helmholtzzentrum, Darmstadt, Germany — [2]Institut für Kernphysik, Universität zu Köln, Köln — [3]Department of Physics, Duke University, Durham, USA — [4]Institut für Kernphysik, Technische Universität Darmstadt, Darmstadt — [5]WNSL, Yale University, USA

Die Methode der Kernresonanzfluoreszenz wird zur Untersuchung von Zuständen mit Spin = 1, 2 unterhalb der Teilchenschwellen verwendet. Bisherige Messungen waren meist nicht sensitiv genug, um Übergänge geringer Intensität in angeregte Zustände zu beobachten. Eine Messung von γ-γ Koinzidenzen erhöht deutlich die Sensitivität und ermöglicht die Analyse der entsprechenden Übergangswahrscheinlichkeiten, sowie die direkte Messung der γ-*ray strength function*. Das γ^3-Setup besteht aus einer Kombination von $LaBr_3$- und hochauflösenden HPGe-Detektoren, mit besonders hoher Effizienz wurde an der High Intensity γ-ray Source installiert. Erste Erkenntnisse über das Zerfallsverhalten der Pygmy-Dipolresonanz von ^{140}Ce werden präsentiert.

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HK 31.4 Di 15:00 HSZ-301

Gamma spectroscopy of neutron rich actinide nuclei — •Benedikt Birkenbach, Kerstin Geibel, Andreas Vogt, Herbert Hess, Peter Reiter, Tim Steinbach, and David Schneiders for the AGATA-Collaboration — IKP, Universität zu Köln

Excited states in neutron-rich actinide Th and U nuclei were investigated after multi nucleon transfer reactions employing the AGATA demonstrator and PRISMA setup at LNL (INFN, Italy). A primary ^{136}Xe beam of 1 GeV hitting a ^{238}U target was used to produce the nuclei of interest. Beam-like reaction products of Xe- and Ba isotopes after neutron transfer were selected by the PRISMA spectrometer. The recoil like particles were registered by a MCP detector inside the scattering chamber. Coincident γ-rays from excited states in beam and target like particles were measured with the position sensitive AGATA HPGe detectors. Improved Doppler correction and quality of the γ-spectra is based on the novel γ-ray tracking technique which was successfully exploited. First results on the collective properties of various Th and U isotopes will be discussed.

HK 31.5 Di 15:15 HSZ-301

SONIC - Combining γ and particle spectroscopy in Cologne — •Simon G. Pickstone, Vera Derya, Janis Endres, Andreas Hennig, Jan Mayer, Lars Netterdon, Sorin Pascu, Anne Sauerwein, Philipp Scholz, Mark Spieker, Tina-Mareike Streit, and Andreas Zilges — Institut für Kernphysik, Universität zu Köln

To gain additional information on nuclear structure from particle-induced reactions, the new silicon detector array SONIC consisting of up to eight ΔE-E-telescopes was installed inside the existing HPGe-detector array HORUS in Cologne. Because of the high resolution of the silicon detectors, light ejectiles (p, d, t, and α) can be easily distinguished. The main purpose of this detector array will be the study of inelastic scattering using p, d and α beams delivered by a 10 MV Tandem accelerator. Two test experiments have already been performed. Gating on the excitation of a specific level in ^{140}Ce(p,p'γ) improved the peak-to-background ratio in the γ-ray spectrum and gave access to additional nuclear structure information. In ^{172}Yb(d,$X\gamma$), where X=p, d', or t, clear discrimination of the ejectiles was achieved. The results of these first test experiments will be presented in detail as well as future improvements of the setup and upcoming experiments.

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HK 31.6 Di 15:30 HSZ-301

Preparations for an optical access to the lowest excited nuclear state in ^{229}Th — •L. v.d.Wense[1,2], P.G. Thirolf[1], D. Kalb[1], and M. Laatiaoui[3] — [1]Ludwig-Maximilians-Universität München — [2]Max-Planck-Institut f. Quantenoptik — [3]GSI Helmholtzzentrum für Schwerionenforschung GmbH

The isomeric lowest excited nuclear level of ^{229}Th has been indirectly measured to be 7.6 ± 0.5 eV (163 ± 11 nm). In order to improve the accuracy as prerequisite of an all-optical control, ^{229m}Th is populated via a 2% decay branch in the α decay of ^{233}U. The Thorium ions are extracted and cooled with the help of a buffer gas stopping cell and an RFQ-cooler. In order to suppress accompanying α decay chain products other than ^{229}Th, a quadrupole mass spectrometer (QMS) has been constructed. First measurements of extraction and transmission efficiency were made, newest results will be presented. Following the QMS, the Thorium isomers will be collected on a 50μm collection surface. The decay of these isomers can then be detected using deep UV optics, presently under construction based on extensive simulation. The sensitivity is predicted to be large enough to lead to a verification of the isomeric transition even in the presence of a significant nonradiative decay branch.[1]

[1] L.v.d.Wense et al., Towards a direct transition energy measurement of the lowest nuclear excitation in ^{229}Th, arXiv:1211.0710 [nucl-ex]

HK 31.7 Di 15:45 HSZ-301

Angular Distributions of Low-Spin States in ^{240}Pu by Means of the ^{242}Pu(p,t)^{240}Pu Reaction — •Mark Spieker[1], Dorel Bucurescu[2], Janis Endres[1], Thomas Faestermann[3], Ralf Hertenberger[4], Sorin Pascu[1], Hans-Friedrich Wirth[4], Nicolae-Victor Zamfir[2], and Andreas Zilges[1] — [1]Institut für Kernphysik, Universität zu Köln — [2]Horia Hulubei National Institute of Physics and Nuclear Engineering, Bucharest, Romania — [3]Physik Department, Technische Universität München — [4]Fakultät für Physik, Ludwig-Maximilians-Universität München

Since recent experimental and theoretical studies revealed the importance of octupole correlations in the actinide region and especially in ^{240}Pu, a ^{242}Pu(p,t)^{240}Pu experiment has been conducted at the Q3D magnetic spectrograph of the Maier-Leibnitz laboratory in Munich. Excited states in ^{240}Pu were investigated up to an excitation energy of 3 MeV. Angular distributions have been measured at 9 laboratory angles between 5° and 40°. The comparison of the experimental angular distributions with DWBA calculations allowed the assignment of several low-spin states. Most of them were seen for the first time. The experimental data, especially the data on the 21 $J^\pi = 0^+$ states, will be presented and discussed in the framework of the *spdf*-version of the Interacting Boson Model.

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HK 31.8 Di 16:00 HSZ-301

Investigation of low-energy dipole modes in the heavy deformed nucleus ^{154}Sm via inelastic polarized proton scattering at zero degree * — •Andreas Krugmann[1], Dirk Martin[1], Peter von Neumann-Cosel[1], Norbert Pietralla[1], Iryna Poltoratska[1], Vladimir Ponomarev[1], Atsushi Tamii[2], Chihiro Iwamoto[3], and Kenichi Yoshida[4] for the E350-Collaboration — [1]Institut für Kernphysik, TU Darmstadt — [2]RCNP, Osaka University, Japan — [3]Konan University, Japan — [4]Niigata University, Japan

Polarized proton scattering has been measured on the heavy deformed nucleus ^{154}Sm at extreme forward angles with 300 MeV protons at RCNP, Osaka. The aim is to investigate the impact of ground state deformation on the properties of the pygmy dipole resonance (PDR) and the spin M1 resonance claimed to show a double-hump structure in heavy deformed nuclei. The (p,p') cross sections can be decomposed into $E1$ and $M1$ parts in two independent ways based either on a multipole decomposition of the cross sections or spin transfer observables [1]. The analysis of polarization transfer observables shows dominant non-spinflip cross sections in the excitation energy region 5-9 MeV with a resonance structure interpreted as the PDR, while the spinflip M1 strength shows a broad distribution between 5 and 10 MeV.

[1] A. Tamii, et al., Phys. Rev. Lett. 107, 062502 (2011).

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