HK 33: Structure and Dynamics of Nuclei VII

Zeit: Mittwoch 14:00–15:45 Raum: HZO 80

Gruppenbericht HK 33.1 Mi 14:00 HZO 80

High-spin structures of transitional Xe nuclei in the $50 \leq Z, N \leq 82$ region — •Levent Kaya[1], Andreas Vogt[1], Peter Reiter[1], Marco Siciliano[2,3], Kasia Hadynska-Klek[2], Carl Wheldon[4], and J.J. Valiente-Dobón[2] — [1]IKP, Universität zu Köln — [2]INFN - LNL, Italy — [3]INFN Padova, Italy — [4]University of Birmingham, United Kingdom

The $50 \leq$ Z, N ≤ 82 region is a fertile testing ground for the predictions of modern shell-model calculations. Xe nuclei with $A \approx 130$ form an important link in the smooth evolution from spherical to deformed shapes. Transitional hard-to-reach Xe nuclei are investigated after multinucleon-transfer (MNT) employing the γ-ray tracking array AGATA coupled to the mass spectrometer PRISMA and after MNT employing the GAMMASPHERE spectrometer in combination with the gas-detector array CHICO. Furthermore, Xe isotopes were populated in fusion-evaporation reactions employing the HORUS γ-ray array at the University of Cologne. The high-spin level schemes of ^{131}Xe, ^{132}Xe and ^{133}Xe are considerably extended to higher energies. Evidence is found for a long-lived ($T_{1/2} \gg 1$ μs) isomer in ^{133}Xe. A pronounced backbending along the negative-parity band in ^{131}Xe is observed. Large-scale shell-model calculations employing the SN100PN, PQM130, GCN50:82, and realistic effective interactions reproduce the experimental findings and provide guidance to the interpretation of the observed high-spin features. Supported by the German BMBF (05P12PKFNE TP4, 05P15PKFN9), ENSAR-TNA03, BCGS.

HK 33.2 Mi 14:30 HZO 80

Reduced transition probabilities in ^{80,82,83}Se — •Julia Litzinger for the PRISMA AGATA Plunger-Collaboration — Institute for Nuclear Physics, Cologne (D)

Selenium nuclei in the vicinity of the neutron shell closure at N=50 are of particular interest as a change of the nuclear structure was experimentally observed on the one hand within the yrast cascade of ^{82}Se noticeable by an isomeric yrast 8^+_1 state and in addition between neighboring even-even isotopes ^{78,80,82}Se induced by the filling of $\nu g_{9/2}$ orbital. Transition probabilities from lifetimes of excited states give insight to nuclear structure information and allow to probe nuclear models, i.e. the nuclear shell model. We performed a RDDS experiment at the INFN, Legnaro, using the Cologne Plunger, the PRISMA magnetic spectrometer for the event-by-event particle identification and the AGATA demonstrator for the γ-ray detection and tracking. Using a ^{82}Se beam and a ^{238}U target ^{80,82,83}Se nuclei were produced via neutron transfer reactions and Coulomb excitation. Furthermore, shell model calculations using the effective interactions JUN45 and jj44b were performed and analyzed focussing on the nuclear structure of mainly yrast states by analyzing leading configurations constructed by protons and neutrons coupled to different spins in the wave functions. In addition the role of $\nu g_{9/2}$ orbital for yrast states of Selenium isotopes near N=50 was investigated.

Experimental results on transition probabilities in ^{80,82,83}Se isotopes will be presented and discussed in terms of the shell model calculations.

HK 33.3 Mi 14:45 HZO 80

^{148}Ce as a good X(5) candidate from EXILL&FATIMA campaign — •Pavlos Koseoglou[1,2], V. Werner[1,3], N. Pietralla[1], S. Ilieva[1], M. Thürauf[1], R. B. Cakirli[4], J. Jolie[5], T. Kröll[1], J.-M. Régis[5], and N. Saed-Samii[5] — [1]IKP TU-Darmstadt, Germany — [2]GSI, Germany — [3]Yale University, USA — [4]MPIK Heidelberg, Germany — [5]IKP University of Cologne, Germany

The structure of the neutron-rich nuclide ^{148}Ce was studied at the high-flux reactor of the Institut Laue Langevin, Grenoble, within the EXILL&FATIMA campaign. A hybrid spectrometer consisting of the EXILL (high-resolution HPGe) and the FATIMA (fast $LaBr_3$) detectors was used to investigate fission fragments of ^{235}U and ^{241}Pu. Lifetimes in the ps range were measured due to the fast $LaBr_3$ detectors and both the slope- and generalized centroid difference method. This kind of analysis serves as preparation for the FATIMA experiments at FAIR. ^{148}Ce sits on the low-Z boundary of the $N = 90$ phase transitional region. The even-even $N = 90$ isotones undergo a first order quantum phase transition which is characterized by a sudden change of the shape of the nucleus. Sensitive signatures of these kind of changes are the $R_{4/2} = E(4^+_1)/E(2^+_1)$ and the $B_{4/2} = B(E2; 4^+_1 \rightarrow 2^+_1)/B(E2; 2^+_1 \rightarrow 0^+_1)$ ratios. The experimentally measured ratios will be compared with the theoretical predictions of the X(5) symmetry. The analysis of ^{148}Ce will be presented together with the indicators which highlight this nucleus as a good X(5) candidate.

HK 33.4 Mi 15:00 HZO 80

E2 Übergangsstärken in ^{112}Te — •Claus Müller-Gatermann, Dorothea Wölk, Alfred Dewald, Christoph Fransen, Julia Litzinger, Alina Goldkuhle, Thomas Braunroth, Marcel Beckers, Andrey Blazhev und Karl-Oskar Zell — Institut für Kernphysik, Universität zu Köln, Deutschland

Lebensdauern in ^{112}Te wurden mittels der Recoil Distance Dopplershift Methode unter Benutzung des Kölner Koinzidenzplungers und 12 HPGe-Detektoren bestimmt. Das Experiment wurde am Kölner FN Tandem Beschleuniger mit der Reaktion ^{92}Moa(^{23}Na,p2n)^{112}Te bei einer Strahlenergie von 81MeV durchgeführt. Die Differential Decay Curve Methode für Koinzidenzmessungen wurde benutzt um Lebensdauern für niedrigliegende yrast-Zustände zu extrahieren. Wie schon im Nachbarkern ^{114}Te verhalten sich die resultierenden E2 Übergangsstärken anormal im Vergleich zu den Vorhersagen gängiger kollektiver Modelle unter Berücksichtigung der Zustandsenergien, die einen vibrationsartigen Charakter zeigen.

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Formfaktoren der ersten angeregten Kernzustände von ^{129}Xe und ^{131}Xe* — •Philipp Christian Ries, Sergej Bassauer, Antonio D'alesion, Michaela Hilcker, Tobias Klaus, Michael Mathy, Peter von Neumann-Cosel, Norbert Pietralla, Maxim Singer, Gerhart Steinhilber und Volker Werner — Institut für Kernphysik, Technische Universität Darmstadt, 64289 Darmstadt

Flüssiges Xenon wird als Detektormaterial in der XENON100 Kollaboration zum Nachweis von bislang hypothetischen schwach wechselwirkenden massereichen Teilchen (WIMPs) eingesetzt. WIMPs gelten als Kandidaten für dunkle Materie und sollen über elastische und inelastische Stöße an den Xenonnukliden detektiert werden. Sollte die Wechselwirkung zwischen WIMPs und gewöhnlicher Materie spinabhängig sein, dominierten die Xenonisotope ungerader Massenzahl ^{129}Xe und ^{131}Xe diese. Aufgrund der niedrigen Anregungsenergien der beiden ersten angeregten Zustände von 40 bzw. 80 keV wird dabei ein erheblicher Beitrag durch inelastische Stöße erwartet. Diese Zustände werden am supraleitenden Darmstädter Elektronen-Lineabeschleuniger S-DALINAC mittels Elektronenstreuung vermessen, um Vorhersagen zu den Wellenfunktion der angeregten Zustände, die in eine Analyse der XENON100 Daten eingehen, zu testen.

*Unterstützt von der DFG im Rahmen des SFB 1245.

HK 33.6 Mi 15:30 HZO 80

Investigation of the photon strength function in ^{128}Te using the $(\gamma, \gamma'\gamma'')$ reaction* — •D. Savran[1], J. Isaak[2], B. Löher[3], T. Beck[3], M. Bhike[5], U. Gayer[3], FNU Krishichayan[5], N. Pietralla[3], M. Scheck[6], W. Tornow[5], V. Werner[3], A. Zilges[4], and M. Zweidinger[3] — [1]GSI, Darmstadt, Germany — [2]RCNP, Osaka, Japan — [3]IKP, TU Darmstadt, Germany — [4]IKP, Univ. zu Koeln, Germany — [5]Duke University, Durham NC, USA — [6]UWS, Paisley, UK

In most nucleosynthesis calculations the concept of photon strength functions (PSF) is used within the statistical model to describe the average EM decay properties of excited nuclei. The basis of this approach is the validity of the Brink-Axel hypothesis. The PSF's are assumed to be independent of the excitation energy and the specific properties of the involved excited states. Model-independent experimental data on the proof of this concept is still scarce. The new experimental technique of combining real photon scattering and coincidence γ-ray spectroscopy at the γ^3 setup [1] at HIγS allows to investigate the decay pattern of photo-excited states in great detail. Results on ^{128}Te will be presented, which show a clear discrepancy to the statistical model assumption of a constant PSF and thus disagrees with the Brink-Axel hypothesis for the presented case.

*Supported by DFG (SFB 1245, ZI 510/7-1) and EMMI.

[1] B. Löher et al., NIMA 723 (2013) 136-142