HK 45: Structure and Dynamics of Nuclei VIII

Time: Thursday 14:00–16:00 Location: J-HS E

Group Report HK 45.1 Thu 14:00 J-HS E

High-spin structures of transitional Xe and Ba nuclei in the $50 \leq Z, N \leq 82$ region — •L. Kaya[1], A. Vogt[1], P. Reiter[1], M. Siciliano[2,3], and A. Gargano[4] — [1]IKP, Universität zu Köln — [2]INFN - LNL, Italy — [3]INFN Padova, Italy — [4]INFN Napoli, Italy

The 50 ≤ Z, N ≤ 82 region is a fertile testing ground for the predictions of modern shell-model calculations. Xe and Ba nuclei with $A \approx 135$ form an important link in the smooth evolution from spherical to deformed shapes and were investigated after multinucleon-transfer employing the γ-ray tracking array AGATA coupled to the mass spectrometer PRISMA and in complementary fusion-evaporation reactions employing the HORUS γ-ray array at the University of Cologne. Pronounced proton and neutron alignments in the yrast bands of ^{131}Xe and ^{134}Ba were identified. The discoveries of $J^\pi = 19/2^+$ and $J^\pi = 23/2^+$ isomers in ^{133}Ba, ^{133}Xe and ^{135}Ba are closing gaps in the systematics along the $N = 77$ and $N = 79$ isotones towards the proton subshell-closure at $Z = 64$. Exploiting angular-correlation investigations, the ground-state band in ^{136}Ba was found to be interrupted by negative-parity states only a few hundred keV above the $J^\pi = 10^{(+)}$ isomer. Results on the first spectroscopy of high-spin states above the $J^\pi = 8^-$ isomeric bandhead in the odd-odd isotope ^{130}I are presented. Large-scale shell-model calculations employing the GCN50:82, SN100PN, PQM130, and a realistic effective interactions reproduce the experimental findings and provide guidance to the interpretation of the observed high-spin features. Supported by the German BMBF (05P15PKFN9 TP1, 05P18PKFN9 TP1) and ENSAR-TNA03.

HK 45.2 Thu 14:30 J-HS E

Lifetime measurement of excited states in octupole candidate ^{144}Ce — •Marcel Beckers, Claus Müller-Gatermann, Alfred Dewald, Christoph Fransen, Alina Goldkuhle, and Franziskus von Spee — Institut für Kernphysik, Köln

In the N≈88, Z≈56 region several nuclei exhibit characteristics that are related to octupole correlations. With both neutron and proton numbers very close to these values, ^{144}Ce is a good candidate for examining octupole deformation as well and indeed the literature reports a low-lying negative parity band which is attributed to this kind of deformation. To shed further light on the general structure, we performed a RDDS measurement to determine lifetimes of excited states in ^{144}Ce. To populate the nucleus of interest the transfer reaction ^{142}Ce(^{18}O,^{16}O) was used. The analysis which will be presented yielded a verification of the 2_1^+ state lifetime as well as the first measurement of the lifetime of the 4_1^+ and 6_1^+ state and a lifetime limit for the 3_1^- state. B(E2) values deduced from these lifetimes were used to compare them to shell model predictions. Furthermore B(E1) values for interband transitions have been determined to get indications about possible octupole deformation.

HK 45.3 Thu 14:45 J-HS E

Lifetime measurements above the N=82 closed neutron shell in ^{141,142,143}La — •Lisa Marie Gerhard[1], Arwin Esmaylzadeh[1], Felix Dunkel[1], Jan Jolie[1], Yung-Hee Kim[2], Lukas Knafla[1], Ulli Koester[2], and Jean-Marc Régis[1] — [1]Institut für Kernphysik, Universität zu Köln — [2]Insitut Laue-Langevin, Grenoble

Lifetimes of low-lying excited states in ^{141,142,143}La were determined using the fast-timing technique [1]. The experiment was performed at the Institut Laue-Langevin in Grenoble. Its high intensity research reactor is used to produce the nuclei of interest via neutron induced fission of ^{239}Pu. The fission fragments are separated with the Lohengrin spectrometer to select specific isotopes [2]. During this experiment, barium isotopes were used to produce the odd-Z ^{141,142,143}La via β decay. These isotopes lie above the N=82 closed neutron shell where the evolution from nearly spherical to a strongly deformed shape is investigated. Preliminary results will be presented in comparison to theoretical calculations.

[1] J.-M. Régis et al., Nucl. Instrum. Methods Phys. Res. 726C (2013)

[2] P. Armbruster et al., Nucl. Instrum. Methods 139 (1976)

HK 45.4 Thu 15:00 J-HS E

Nuclear structure study in 138Ce via γ-γ fast-timing — •Kerstin Schomacker, Jean-Marc Regis, Vasil Karayonchev, and Jan Jolie — Institut für Kernphysik, Universität zu Köln, Zülpicherstr.77, 50937 Köln, Germany

Good agreement between shell model calculated and experimental level scheme from 138Ce up to the 10+ state [1] motivated the measurement of transition strengths for the 6+, 8+ and 10+ level decays in this nucleus. This was done by lifetime measurements via the γ-γ fast-timing technique.

Excited states of 138Ce were populated in a fusion-evaporation reaction at the FN Tandem Accelerator at the Institute für Kernphysik at the Universität zu Köln. Accurate results were obtained by investigating triple gamma cascades using HPGe-LaBr(Ce)-LaBr(Ce) coincidences. The deduced transition strengths are compared with shell-model calculations.

[1] T. Alharbi et al., Phys. Rev. C 87, 014323 (2013)

HK 45.5 Thu 15:15 J-HS E

Lifetime measurement of excited states in ^{120}Te — •Franziskus von Spee, Alfred Dewald, Claus Müller-Gatermann, Christoph Fransen, Alina Goldkuhle, Marcel Beckers, and Casper Lakenbrink — Institut für Kernphysik, Köln, Deutschland

The nuclear structure of tellurium isotopes at Z=52 and the evolution of collectivity are of special interest due to the close proximity of the closed shell at Z=50 in the even-even neighbor Sn. A recoil distance Doppler-shift (RDDS) experiment was performed to investigate absolute transition probabilities in ^{120}Te. Excited states in ^{120}Te were populated using the ^{110}Pd(^{13}C,3n)^{120}Te reaction at the FN-Tandem accelerator facility located at the IKP of Cologne. The $\gamma - \gamma$ coincidence data were analysed with the differential decay-curve method (DDCM) eliminating problems related to feeding and absolute distances. Lifetimes of excited states in the yrast band up to the 8^+ state were measured and the corresponding B(E2) values were calculated. In this contribution we will present the results and compare these with known data from Coulomb excitation experiments.

HK 45.6 Thu 15:30 J-HS E

Direct Lifetime Measurement in ^{104}Pd — •Maximilian Droste, Konrad Arnswald, Rouven Hirsch, Levent Kaya, Lars Lewandowski, Claus Müller-Gatermann, Peter Reiter, Michael Seidlitz, and Burkhard Siebeck — Institut für Kernphysik, Universität zu Köln

A precise lifetime measurement, as a complementary approach to determine reduced transition strengths in ^{104}Pd, was performed at the FN Tandem accelerator of the IKP Cologne employing the Recoil-Distance Doppler-Shift method. Excited states of ^{104}Pd were populated via the fusion evaporation reaction ^{96}Zr(^{12}C,4n)^{104}Pd at 55 MeV. The B(E2; $2^+ \rightarrow 0^+$) value of the first excited state in ^{104}Pd has so far only been investigated via Coulomb excitation. Information on complementary, model-independent approaches like lifetime measurements, to determine reduced transition strengths in ^{104}Pd, are lacking. New lifetime values, which deviate strongly from the evaluated values, will be presented and reduced transition probabilities will be compared to previous results and shell model calculations. Due to its low excitation energy of the 2^+ state at 556 keV and its enhanced collectivity the mid-shell nucleus ^{104}Pd is used as target material in Coulomb-excitation experiments at, e.g., radioactive ion-beam facilities. For these experiments precise knowledge of the reduced E2 transition probabilities and the correlated quadrupole moments of the target materials are mandatory.

HK 45.7 Thu 15:45 J-HS E

Lifetime measurements in ^{102}Ru via the Doppler-shift attenuation method using pγ coincidences — •Vera Everwyn[1], Anna Bohn[1], Michelle Färber[1], Florian Kluwig[1], Pavel Petkov[2,1], Sarah Prill[1], Philipp Scholz[1], Michael Weinert[1], Julius Wilhelmy[1], and Andreas Zilges[1] — [1]Institute for Nuclear Physics, University of Cologne — [2]National Institute for Physics and Nuclear Engineering, Bucharest, Romania

The chain of stable ruthenium isotopes is well suited to study the evolution of nuclear structure, like mixed-symmetry states, along shape-transitional paths in the $A = 100$ mass region from spherical (^{96,98}Ru)

to deformed shapes (^{104}Ru). Transition probabilities are a key component for understanding nuclear structure and can be deduced from lifetimes, branching, and multipole mixing ratios. However, the information on level lifetimes in ^{102}Ru is scarce. Therefore, an inelastic proton-scattering experiment on ^{102}Ru was performed using the SONIC@HORUS setup at the University of Cologne [1]. Lifetimes of excited states were measured via the Doppler-shift attenuation method, which benefits from the exclusion of feeding contributions due to the acquired pγ-coincidence data [2]. First results of this experiment will be presented and compared to the neighboring nuclei ^{96,98,100}Ru.

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[1] S. G. Pickstone *et al.*, Nucl. Instr. and Meth. A **875** (2017) 104-110
[2] A. Hennig *et al.*, Nucl. Instr. and Meth. A **794** (2015) 171