HK 49: Structure and Dynamics of Nuclei IX

Zeit: Donnerstag 14:00–16:00 Raum: HS 14

Gruppenbericht HK 49.1 Do 14:00 HS 14

Consequences of broken axial symmetry in heavy nuclei - observed for surprisingly many spectroscopic features in the valley of stability — •Eckart Grosse[1], Arnd R. Junghans[2], Ralph Massarczyk[3], and Jon N. Wilson[4] — [1]IKTP, TU Dresden — [2]IRP, Helmholtz-Zentrum Dresden-Rossendorf, 01314 Dresden — [3]LANL, New Mexico 87545, USA — [4]INP and CNRS/IN2P3, F-91406 Orsay, France

When about 80 years ago the hyperfine structure observed in atomic spectra suggested the concept of nuclear deformation no experimental information on nuclear axiality was available. This lead to the ad-hoc assumption of symmetry about one axis and as this concept results in large advantages for theoretical concepts and calculations it became widely used for heavy nuclei and triaxiality was considered - if at all - only for a few nuclides, like in studies for odd nuclei [e.g. Toki and Faessler, Nucl. Phys. A253 (1975) 231], on e-m transitions to nonyrast levels [e.g. Casten et al., PRC 60 (1999) 021304] and regarding the splitting of magnetic strength [Palumbo and Richter, PLB 158 (1985) 101]. But more recent work on dipole strength in the IVGDR [Junghans et al.,J.Kor.PhSoc 59 (2011) 1872; Grosse et al., EPJA53 (2017) 225] and of low spin level densities [Grosse et al., PLB739 (2014) 1] showed triaxiality as being non-negligible for more or less all heavy nuclei. Present studies extending such predictions to all spins without using VMI fits for the yrast sequences indicate a surprising result for many heavy nuclei: Allowing a breaking of axial symmetry leads to their reasonable description with spin-independent moments of inertia.

HK 49.2 Do 14:30 HS 14

Shape coexistence in ^{178}Hg — •Claus Müller-Gatermann, Christoph Fransen, Alfred Dewald, Thomas Braunroth, Alina Goldkuhle, Julia Litzinger, Marcel Beckers, Karl-Oskar Zell, Andrey Blazhev, and Jan Jolie — Institut für Kernphysik, Köln, Deutschland

Since the first application of isotope-shift measurements a sharp shape transition in the ground states of light odd-mass mercury isotopes was observed, and shape coexistence near the Z=82 shell has been an actively studied phenomenon. In neutron-deficient even-mass mercury isotopes a weakly deformed oblate ground-state band is found to coexist with a more deformed prolate band. The prolate states are interpreted as a π(4p-6h) excitation across the Z=82 shell gap. The energy of this prolate structure is lowest in ^{182}Hg and shows a parabolic trend of excitation energy as a function of the neutron number. So far ^{180}Hg is the most exotic nucleus for which lifetimes of excited states are known. These can be used to determine model-independent B(E2)-values and absolute values of deformation employing the rotor model. A breakdown of the shape-coexistence is predicted with further decreasing neutron number. We will present lifetime measurements of excited states in ^{178}Hg using the Recoil Distance Doppler-Shift (RDDS) method. The recoil-decay tagging (RDT) technique was applied to select the ^{178}Hg nuclei and associate the prompt γ-rays with the correlated characteristic ground state α-decay.

HK 49.3 Do 14:45 HS 14

New isomeric state and study of deformation of ^{200}Au — •P.R. John[1], J.J Valiente-Dobon[2], A. Dai[3], D. Mengoni[4,5], V. Modamio[1,6], S. Lunardi[4,5], C. Wheldon[7], D. Bazzacco[6], and N. Pietralla[1] — [1]Institut für Kernphysik, Technische Universität Darmstadt, Germany — [2]Laboratori Nazionali di Legnaro, Legnaro, Italy — [3]School of Physics, Peking University, China — [4]Dipartimento di Fisica e Astronomia, Universitá di Padova, Italy — [5]Istituto Nazionale di Fisica Nucleare, Sezione di Padova, Italy — [6]Department of Physics, University of Oslo, Norway — [7]School of Physics and Astronomy, University of Birmingham, United Kingdom

The neutron-rich nucleus ^{200}Au is investigated via isomeric decay γ-ray spectroscopy in order to study the evolution of the 5^+ isomeric states and the shape in the very neutron-rich gold isotopes. Multi-nucleon transfer reactions were used to populate excited states of ^{200}Au and the Advanced Gamma Ray Tracking Array (AGATA) detected the delayed γ-ray transitions. The binary-partner method was applied and the level scheme of ^{200}Au was extended. The results are compared to Total Routhian Surface calculations.

HK 49.4 Do 15:00 HS 14

RDDS Lifetime Measurement on Zr-98 - Fixing the Critical Point of the Quantum Phase Transition — •W. Witt[1,2], V. Werner[1], N. Pietralla[1], C. Costache[1,3], T. Glodariu[3], P. John[1], R. Kern[1], P. Koseoglou[1,2], N. Marginean[3], R. Mihai[3], A. Mitu[3], S. Pascu[3], P. Petkov[3], L. Stan[3], A. Turturica[3], S. Ujeniuc[3], and J. Wiederhold[1] — [1]IKP TU Darmstadt, Darmstadt, Deutschland — [2]GSI, Darmstadt, Deutschland — [3]IFIN-HH, Magurele, Rumänien

Recent theoretical work emphasizes the contribution of the tensor interaction between nucleons to the structural evolution in nuclei [1]. The Zr isotopic chain was suggested as example of the predicted shape phase transition. Our previous experimental results [2] established the nucleus Zr-98 as closest to the critical point in this uniquely-abrupt structural change. The presented follow-up RDDS level lifetime measurement on Zr-98 significantly improves on the accuracy of the previous results and agrees with other recent result [3]. It allows further interpretation in the frame of type-II shell evolution and corresponding state-of-the art shell-model calculations.

[1] T. Togashi et al., Phys. Rev. Lett. 117, 172502 (2016)
[2] W. Witt et al., Phys. Rev. C 98, 041302(R) (2018)
[3] P. Singh et al., Phys. Rev. Lett. 121, 192501 (2018)

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Yrast transition strengths in ^{116}Te — •Christoph Fransen, Marcel Bast, Marcel Beckers, Thomas Braunroth, Alfred Dewald, Alina Goldkuhle, Jan Jolie, Julia Litzinger, and Claus Mueller-Gatermann — Institut für Kernphysik, Universität zu Köln

An anomalous behaviour of the $B(E2, 2^+_1 \to 0^+_1)$ and $B(E2, 4^+_1 \to 2^+_1)$ values was found in Sn isotopes below mid-shell. However, the puzzling $B(E2; 2^+_1 \to 0^+_1)$ systematics around $N = 60$ was understood very recently in state-of-the-art Monte-Carlo shell model calculations [1] by activating protons in the $1g_{9/2}$ orbit and a second-order quantum phase transition from the moderately deformed phase to the pairing (seniority) phase that occurs around $N = 66$. But a sharp drop of the $B(E2, 4^+_1 \to 2^+_1)$ values below $N = 66$ leading to unusual small $B(E2; 4^+_1 \to 2^+_1)/B(E2; 2^+_1 \to 0^+_1)$ values is not understood so far. In neighboring Te isotopes a similar situation seems to be present, where especially data on $B(E2; 4^+_1 \to 2^+_1)$ values are lacking that would allow a clear conclusion. In this framework ^{116}Te$_{64}$ represents an interesting case as it is just at the edge of the shape transition observed in neighboring Sn isotopes as is also supported by experimental data on ^{112,114}Te. Therefore, we determined $B(E2)$ values between the lowest states in ^{116}Te from level lifetimes measured with the recoil distance Doppler-shift method. We will present these results and relate them both to the systematics along the Te isotopic chain and to the interpretation of the Sn isotopes.

[1] T. Togashi et al., Phys. Rev. Lett. 121, 062501 (2018)

HK 49.6 Do 15:30 HS 14

High-spin structures of transitional Xe and Ba nuclei in the $50 \le Z, N \le 82$ 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 $\le$ Z, N $\le$ 82 region is a fertile testing ground for the predictions of modern shell-model calculations. Xe and Ba nuclei with $A \approx 130$ form an important link in the smooth evolution from spherical to deformed shapes. Transitional hard-to-reach Xe and Ba nuclei are investigated after multinucleon-transfer employing the γ-ray tracking array AGATA coupled to the mass spectrometer PRISMA and in several fusion-evaporation reactions employing the HORUS γ-ray array at the University of Cologne. The high-spin level schemes of ^{133}Xe, ^{135}Ba and ^{136}Ba are considerably extended. The identification of $J^\pi = 23/2^+$ isomers in the millisecond range in ^{133}Xe and ^{135}Ba closing a gap in the systematics along the $N = 79$ 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. Large-scale shell-model calculations employing the SN100PN, GCN50:82, and a realistic effective interaction 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.

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Lifetime measurement on ^{177}Hf using the EXILL&FATIMA spectrometer — •Lukas Knafla[1], Jean-Marc Régis[1], Jan Jolie[1], Ulli Köster[2], Gabriela Thiamova[3], and Petr Alexa[4] for the EXILL-FATIMA-Collaboration — [1]Institut für Kernphysik, Universität zu Köln — [2]Institut Laue-Langevin, Grenoble — [3]LPSC Grenoble — [4]VŠB-Technical University of Ostrava

Lifetimes of high spin states in the odd-A nucleus ^{177}Hf were measured using the EXILL&FATIMA spectrometer equiped with eight HPGe-clover detectors and 16 fast-timing $LaBr_3$(Ce) detectors [1]. For the determination of lifetimes in the pico- to nanosecond regime, the well established Generalized Centroid Difference (GCD) method was used [2]. Lifetimes of ten states were measured including seven lifetimes that were determined for the first time. From these lifetimes reduced transition probabilities were extracted and compared to particle-rotor model (PRM) calculations and quasiparticle-phonon model (QPM) calculations.

[1] J.-M. Régis et al., Nucl. Instrum. Methods Phys. Res. A 763 (2014)
[2] J.-M. Régis et al., Nucl. Instrum. Methods Phys. Res. A 726 (2013)