HK 19: Structure and Dynamics of Nuclei V

Time: Tuesday 15:45–17:15 Location: HBR 19: C 5b

Group Report HK 19.1 Tue 15:45 HBR 19: C 5b

Lifetime measurements in the A≈100 mass region via the coincidence Doppler-shift attenuation method — •Anna Bohn, Elias Binger, Sarah Prill, Michael Weinert, and Andreas Zilges — University of Cologne, Institute for Nuclear Physics, Germany

The coincidence Doppler-shift attenuation method (CDSAM) is a powerful technique to determine nuclear level lifetimes in the sub-picosecond regime [1,2]. Several CDSAM experiments have been performed at the SONIC@HORUS setup [3] at the University of Cologne, including (p,p'γ) and (α,α'γ) experiments along the Zr, Ru, Sn and Te isotopic chains [4,5,6]. The combined SONIC@HORUS spectrometer enables coincident detection of γ rays and backscattered beam particles, thus, allowing for background reduction, precise transition selection and feeding exclusion, while several dozens of lifetimes can be determined from each data set.
Recent results on lifetime determination and spectroscopy benefitting from coincidence measurements will be presented within this contribution.
Supported by the DFG (ZI-510/9-2).
[1] A. Hennig *et al.* Nucl. Instr. Meth. A **794**, (2015) 171
[2] M. Spieker *et al.* Phys. Rev. C **97** (2018) 054319
[3] S. G. Pickstone *et al.* Nucl. Instr. Meth. A **875**, (2017) 104
[4] S. Prill *et al.* Phys. Rev. C **105** (2022) 034319
[5] A. Hennig *et al.* Phys. Rev. C **92** (2015) 064317
[6] S. Prill *et al.* Phys. Conf. Ser. **1643** (2020) 012157

HK 19.2 Tue 16:15 HBR 19: C 5b

Lifetime determination of yrast states of ^{170}W — •K.E. Ide[1], V. Werner[1], A. Goasduff[2,3], J. Wiederhold[1], P.R. John[1], D. Bazzacco[3], M. Beckers[4], J. Benito[5], M. Berger[1], D. Brugnara[2,3], M.L. Cortés[3], L.M. Fraile[5], C. Fransen[4], A. Gozzelino[3], E.T. Gregor[3], A. Illana[3], J. Jolie[4], L. Knafla[4], H. Mayr[1], R. Menegazzo[3], D. Mengoni[2,3], C. Müller-Gatermann[4,6], C.M. Nickel[1], O. Papst[1], G. Pasqualato[7], C.M. Petrache[8], N. Pietralla[1], F. Recchia[2,3], T. Stetz[1], D. Testov[2,7], J.J. Valiente-Dobón[3], and I. Zanon[2,3,9] — [1]IKP, TU Darmstadt — [2]U Padova, Italy — [3]INFN, LNL, Italy — [4]IKP, U Köln — [5]U Madrid, Spain — [6]ANL, USA — [7]INFN, Padova, Italy — [8]U Paris-Saclay, France — [9]U Ferrara, Italy

Nuclear quadrupole collectivity is identified from enhanced $E2$ decay rates. The $B(E2;2_1^+\rightarrow 0_1^+)$ value is obtained from the 2_1^+ state's lifetime, $\tau(2_1^+)$. Recent measurements of $\tau(2_1^+)$ of Hf and W isotopes revealed discrepancies to literature. We measured ^{170}W at LNL with the GALILEO array and plunger. Our $\tau(2_1^+)$ result of ^{170}W$_{96}$ confirms the $B(E2)$ literature value. The strongly different $B(E2)$ value for ^{172}W would imply a sudden $E2$ strength increase between $N=96$ and $N=98$ for W isotopes, in contrast to the gradual evolution in the Hf isotopes. After the initial $\tau(2_1^+)$ analysis, systematic effects have been investigated and the analysis of higher yrast band members was finalized. The results are compared to CBS model predictions.

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HK 19.3 Tue 16:30 HBR 19: C 5b

Shape Coexistence Near Doubly-Magic ^{78}Ni — •Lukas Nies for the ISOLTRAP and JYFLTRAP-Collaboration — CERN, 1211 Geneva, Switzerland — Universität Greifswald, Germany

Nuclear magic numbers are associated with sudden changes in nuclear observables between neighboring isotopes, such as binding energies, charge radii, transition strengths, etc. Furthermore, shape coexistence is often found in nuclei where intruder states across shell gaps lead to a large amount of deformation [1], indicating nearby magicity. Indication for shape coexistence in ^{79}Zn with $N = 49$ and $Z = 30$ has previously been found through laser spectroscopy experiments [2] and in ^{80}Ga with $N = 49$ and $Z = 31$ through electron-conversion spectroscopy [3]. The latter, however, was disproven in a follow-up experiment [4]. In this contribution, we present further evidence for shape coexistence in ^{79}Zn through the first direct excitation energy measurements of the $1/2^+$ isomeric state, firmly establishing the $1/2^+$ and $5/2^+$ state ordering [5]. Using discrete nonorthogonal shell model calculations, we find low-lying deformed intruder states, similar to other $N = 49$ isotones, and investigate similarities in shapes between excited states in ^{79,80}Zn and ^{78}Ni. [1] Garrett, Zielińska, and Clement, Prog. Part. Nucl. Phys. 124, 103931 (2022) [2] Yang et al., PRL 116, 182502 (2016) [3] Gottardo et al., PRL 116, 182501 (2016) [4] Garcia et al., PRL 125, 172501 (2020) [5] Nies et al., PRL 131, 222503 (2023)

HK 19.4 Tue 16:45 HBR 19: C 5b

Coulomb excitation and lifetime measurements in $^{84-86}$Ge with relativistic radioactive ion beams — •U. Ahmed[1,2], V. Werner[1,2], F. Browne[3], M. L. Cortés[4], N. Pietralla[1], P. Doornenbal[4], and K. Wimmer[5] for the HiCARI-Collaboration — [1]IKP, TU Darmstadt, Germany — [2]HFHF, GSI Darmstadt, Germany — [3]CERN, Geneva, Switzerland — [4]RIKEN, Wako, Japan — [5]GSI, Darmstadt, Germany

Coulomb excitation cross sections of $^{84-86}$Ge nuclei and level lifetimes were investigated through reactions of Ge and As beams on heavy and light targets. The cross sections of these reactions will be determined from the ratio of incoming and outgoing particles and de-excitation γ-ray peak areas as measured by the High-resolution Cluster Array (HiCARI) at RIKEN-RIBF in Japan. The ongoing gamma-ray analysis aims at the measurement of the $E2$ transition probabilities of the lowest excited 2^+ states to chart the evolution of collectivity in the Ge chain above the $N = 50$ neutron shell closure. The particle identification for the incoming particles from the BigRIPS fragment separator and the outgoing particles in the ZeroDegree spectrometer will be presented. The lineshape analysis of Doppler-corrected gamma-ray spectra based on the reconstructed velocity of incoming ions with simulated response functions will be shown and first lifetimes will be discussed.

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HK 19.5 Tue 17:00 HBR 19: C 5b

First measurement of the lifetime of the 2_1^+ state of ^{200}Pt — •C.M. Nickel[1], V. Werner[1], P.R. John[1], U. Ahmed[1], C. Costache[2], K.E. Ide[1], N.M. Mărginean[2], H. Mayr[1], C. Mihai[2], R.E. Mihai[2,3], N. Pietralla[1], T. Stetz[1], A. Weber[1], and R. Zidarova[1] — [1]IKP, TU Darmstadt — [2]IFIN-HH, Bucharest-Măgurele — [3]IEAP, CTU Prague

Shape transitions between oblate, prolate, γ-soft and spherical shapes occur in the region of the W, Os, Pt and Hg isotopes [1]. For the neutron-rich Pt isotopes, the $R_{4/2}$ ratio indicates a γ-soft shape transitioning towards sphericity when approaching the neutron shell closure at $N = 126$. In the vicinity of shell closures, a decrease of quadrupole collectivity is expected. Quadrupole collectivity is quantified by the $B(E2;2_1^+ \rightarrow 0_{\rm gs}^+)$ transition strength, which is inversely proportional to the lifetime of the 2_1^+ state. ^{200}Pt is the lightest neutron-rich Pt isotope without a known $B(E2;2_1^+ \rightarrow 0_{\rm gs}^+)$ value but could mark the transition between a γ-soft and a spherical shape in the Pt isotopic chain. Therefore, the ^{198}Pt(^{18}O,^{16}O)^{200}Pt* two-neutron transfer reaction was studied at the IFIN-HH at Bucharest-Măgurele using the ROSPHERE array equipped with a plunger device and the SORCERER particle detector. After correcting for contaminants and by applying the Recoil-Distance Doppler-Shift method, the lifetime of the 2_1^+ state of ^{200}Pt was determined for the first time.

[1] Z. Podolyák et al., Phys. Rev. C 79 031305 (2009).

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