HK 7: Structure and Dynamics of Nuclei III

Time: Monday 16:45–18:15 Location: HS 2 Physik

HK 7.1 Mon 16:45 HS 2 Physik

Investigation of ^{168}W via lifetime measurement — •Felix Dunkel[1], Christoph Fransen[1], Kalle Auranen[2], Michael P. Carpenter[3], Tuomas Grahn[2], Paul Greenlees[2], Jan Jolie[1], Filip G. Kondev[3], Casper-David Lakenbrink[1], Claus Müller-Gatermann[3], Dariusz Seweryniak[3], Franziskus von Spee[1], and Nigel Warr[1] — [1]IKP, Univ. of Cologne, Germany — [2]JYFL, Jyväskylä, Finland — [3]Argonne Natl. Lab, Illinois, USA

In a cluster of neutron-deficient Os-W-Pt nuclei around A=170, an unexpectedly low ratio of B(E2) transition strengths within the yrast band, with ratios $B_{4/2} < 1$, has been observed. This cannot be explained in standard collective models. Only very recently, $B_{4/2} < 1$ in this region was reproduced with a strong band mixing within an extension of the consistent-Q IBM Hamiltonian [1]. Older lifetime data might suffer from assumptions on side feeding and for the 6_1^+ only a limit is given. We performed an experiment on ^{168}W with the RDDS technique at Argonne Natl. Lab. with the GAMMASPHERE spectrometer to determine transition strengths from level lifetimes using $\gamma\gamma$ coincidences. The measurement of yrast state lifetimes in ^{168}W will be presented. The new data yield that ^{168}W is just at the transition point from "normal" collectivity to the island of nuclei with $B_{4/2} < 1$. Furthermore, a ratio of $B_{6/4} < 1$ indicates that the phenomenon is not solely related to the structure of the 2_1^+ and 4_1^+ states.

Supported by the DFG, grant Nos. FR 3276/3-1.

[1] F. Pan et al., Phys. Rev. C 110, 054324 (2024)

HK 7.2 Mon 17:00 HS 2 Physik

Measurement of the lifetimes of excited states in 56Ti, 58Ti — •Wiktor Poklepa for the HiCARI-Collaboration — GSI Helmoltzzentrum für Schwerionenforschung GmbH, Planckstr. 1, 64291 Darmstadt, Germany

The neutron-rich Ti isotopes lie within the interests of nuclear physicists for several reasons. One of them is the region of validity of the new neutron magic numbers N=32,34 observed in the Ca isotopic chain. The other is approaching the island of inversion around N=40 with the most exotic Ti isotopes. The $E(2_1^+)$ energies for even-even Ti isotopes have been measured up to N=40 and, unlike in Ca and Ar isotopes with N=34, there is no rise of $E(2_1^+)$ for ^{56}Ti. At the same time the B(E2) values for this set of isotopes have been established only up to N=34. The currently known trend in B(E2) values in Ti isotopes shows staggering behaviour, but experimental uncertainties are too large to draw conclusions on the onset of collectivity towards N=40. Thus, further investigation is needed. In this experiment, the lifetimes of excited states in ^{56,58}Ti were studied employing proton knockout reactions from ^{57,59}V at the RIBF facility in Japan. The secondary beams produced from ^{70}Zn at 345 MeV/u were transported through the BigRIPS spectrometer. Gamma rays emitted by the reaction products were detected by the HiCARI HPGe detector array. The reaction products were identified using the ZeroDegree spectrometer. In this talk, the first preliminary results on the spectroscopy and lifetime measurements for ^{56,58}Ti will be presented.

HK 7.3 Mon 17:15 HS 2 Physik

Investigation of ^{172}Pt via lifetime measurement — •Casper-David Lakenbrink[1,2], Christoph Fransen[1], Claus Müller-Gatermann[2], Michael P. Carpenter[2], Felix Dunkel[1], Jan Jolie[1], and Franziskus von Spee[1] — [1]Institute for Nuclear Physics, University of Cologne, 50937 Cologne, Germany — [2]Physics Division, Argonne National Laboratory, Lemont, IL-60439, USA

The very neutron-deficient Pt, Os and W isotopes around $A = 170$ show an unexpected behavior of $B(E2)$ transition strengths within the yrast band with ratios $B_{4/2} < 1$, which cannot be explained with standard collective models. Shape coexistence lends itself as a possible explanation as this phenomenon is well established in the nearby mid-shell Pt isotopes. The backbending seen in the levelschemes of these nuclei could in this framework be interpreted as a crossing of two different configurations. A different approach was able to reproduce these anomalies without configuration mixing by including 3-body interactions in the IBM (F. Pan *et al.*, PRC **110**, 054324 (2024)).

Lifetimes up to the 8_1^+ state in ^{172}Pt were measured in this work to determine yrast $E2$ transition strengths to test these hypotheses. The experiment employed the recoil distance Doppler-shift (RDDS) method and was performed at Argonne National Laboratory.

This work was supported by the Deutsche Forschungsgemeinschaft (DFG) under contract number FR 3276/3-1 and by the U.S. Department of Energy, Office of Science, Office of Nuclear Physics, under contract number DE-AC02-06CH11357. It used resources of ANL's ATLAS facility, which is a DOE Office of Science User Facility.

HK 7.4 Mon 17:30 HS 2 Physik

Measurements on ^{178}Yb — •Pavlos Koseoglou[1], Theodoros J. Mertzimekis[1], Margarita Efstathiou[1], Polytimos Vasileiou[1], Hannes Mayr[2], Clemens Nickel[2], Norbert Pietralla[2], Volker Werner[2], Andrey Blazhev[3], Arwin Esmaylzadeh[3], Julia Fischer[3], Christoph Fransen[3], Jan Jolie[3], Mario Ley[3], Aaron Pfeil[3], Franziskus Spee[3], Kalin Gladnishki[4], Diana Kocheva[4], Georgi Rainovski[4], and Dennis Bonatsos[5] — [1]Department of Physics, National and Kapodistrian University of Athens, Greece — [2]Technische Universität Darmstadt, Department of Physics, Institute for Nuclear Physics, Germany — [3]Universität zu Köln, Institut für Kernphysik, Germany — [4]Faculty of Physics, St. Kliment Ohridski University of Sofia, Bulgaria — [5]Institute of Nuclear and Particle Physics, NCSR "Demokritos", Greece

All even-even Yb isotopes with mass number 160≤A≤176 are known to present deformation to some extent. The ^{178}Yb isotope (the most neutron-rich Yb isotope with measured excited states) shows signs of high deformation. An experiment was performed in the 10 MV FN Tandem accelerator of the Institut für Kernphysik at the University of Cologne in order to study ^{178}Yb. The excitation function of the ^{176}Yb(^{18}O,^{16}O)^{178}Yb two-neutron transfer reaction was studied during the experiment over several beam energies below and above the Coulomb barrier of the reaction and will be presented in this contribution. Gamma-spectroscopy finds will be presented as well. This work is funded by the German Research Foundation - 539757749.

HK 7.5 Mon 17:45 HS 2 Physik

Lifetime Measurements in odd-A Yttrium Isotopes — •Aaron Pfeil[1], Arwin Esmaylzadeh[1], Mario Ley[1], Jean-Marc Régis[1], Jan Jolie[1], Ulli Köster[2], Yung Hee Kim[2], and Jean-Michel Daugas[2] — [1]Institute for Nuclear Physics, University of Cologne — [2]Institut Laue-Langevin, Grenoble, France

Measurements were performed with neutron-rich nuclides produced by thermal neutron induced fission of ^{235}U and mass-separated with the LOHENGRIN recoil spectrometer at the Institut Laue-Langevin in Grenoble, France. Lifetimes of low-lying excited states in the nuclei ^{95}Y, ^{97}Y, ^{99}Y, and ^{101}Y are determined using the fast-timing technique [1]. Investigating odd-A nuclei is of special interest for improving the development of theoretical models. In particular, the range from ^{95}Y to ^{101}Y offers valuable insight as these isotopes lie near the rapid shape transition at $N = 59$ and the critical point of the intertwined quantum phase transition. Furthermore, yttrium lies between strontium and zirconium, which are often considered as boson cores. Thus, it is interesting to determine which core is more appropriate, as this provides information about the character of the single particle energies. Experimental values are compared with calculations performed within the framework of the interacting boson-fermion model [2]. Work supported by DFG grant JOL391/18-2.

[1] J.-M. Régis et al., Nucl. Instrum. Methods Phys. Res. 726, 191 (2013)

[2] N. Gavrielov et al., Phys. Rev. C 106, L051304 (2022)

HK 7.6 Mon 18:00 HS 2 Physik

Lifetime measurements of the A=108 beta decay chain — •Senuri Dantanarayana[1], Arwin Esmaylzadeh[1], Mario Ley[1], Jan Jolie[1], J.-M. Régis[1], Aaron Pfeil[1], Ulli Köster[2], Jean-Michel Daugas[2], and Luis M. Fraile[3] — [1]Universität zu Köln, Institut für Kernphysik — [2]Institut Laue-Langevin — [3]Universidad Complutense de Madrid

Neutron-rich isobars in the β-decay chain of $A = 108$ fission fragments were investigated following thermal neutron-induced fission of a ^{241}Pu target and mass separation with the LOHENGRIN recoil separator at Institut Laue-Langevin. Lifetimes of excited nuclear states were measured using the fast-timing technique [1]. The focal plane of the spectrometer was equipped with one clover detector with four Ge

crystals, four cylindrical $1.5'' \times 1.5''$ $LaBr_3(Ce)$ scintillator detectors and one plastic scintillator for beta detection [2]. The studied Ru-Pd region is known for gamma-softness where the spatial deformation of the nuclear density distribution shows large fluctuations around the equilibrium value [3]. The results of this work will be discussed in the context of gamma-softness.

[1] J.-M. Régis et al. , Nucl. Instrum. Meth. A- 955 (2019),- 163258.
[2] P. Armbruster et al. Nucl. Instrum. Meth.- 139 (1976),- 213.
[3] N. Nazir et al., Phys. Rev. C-,107 (2023) , L021303.