HK 8: Structure and Dynamics of Nuclei II

Time: Monday 14:00–15:30 Location: HK-H7

HK 8.1 Mon 14:00 HK-H7

New evidence for alpha clustering structure in the ground state band of ^{212}Po — •Martin von Tresckow for the IFIN-HH212Po-Collaboration — IKP TU Darmstadt

^{212}Po has two-protons and neutrons outside the doubly-magic nucleus ^{208}Pb and it may be assumed that the nuclear structure can be well described within the shell-model. But various experimental properties, such as the short-lived ground state, are better predicted by an α-clustering model. The B(E2) values of the decays of the low lying yrast-states are an important finger print to describe the structure of ^{212}Po. Especially the missing B(E2; $4_1^+ \rightarrow 2_1^+$) value are important in this discussion. We have performed an α-transfer experiment to excited ^{212}Po and determine the lifetimes using the ROSPHERE γ-ray detector array at IFIN-HH in Magurele, Romania. This array consisted of 15 HPGe detectors and 10 $LaBr_3$(Ce) scintillator detectors and was supplemented with the SORCERER particle detector system. The combination of γ-ray and the particle detectors was an important tool to determine the mean lifetimes of all ground state band levels up to the 8^+ state applying the fast-timing method [Ma. von Tresckow et al., PLB 821, 136624 (2021)]. I will present our lifetime analysis and discuss the results within the shell-model and α-clustering model. This work is financially supported by EURONS2, IFA via grant 04FAIR/2020, MCDI via grant PN19060102, UK-STFC via grant ST/P005101/1, Ministry of Science and Higher Education of the Russian Federation under contract No. 075-10-2020-117.

HK 8.2 Mon 14:15 HK-H7

The Systematic Study of Pygmy Dipole States in ^{40,44,48}Ca Induced in the (p,p′γ) Reaction — •Barbara Wasilewska, Anna Bohn, Sarah Prill, Michael Weinert, and Andreas Zilges — University of Cologne, Institute for Nuclear Physics, 50937 Cologne, Germany

The calcium nuclei form a unique isotopic chain. It is the only element with two stable doubly-magic isotopes and the masses spread over a wide range of N/Z ratios. The second feature is especially interesting for studies of the Pygmy Dipole Resonance (PDR). This additional E1 strength in the region of the neutron separation energy (S_n) has been shown to increase with the N/Z ratio, but its nature is a subject of discussion [1]. The recent progress in nuclear physics theory enabled *ab-initio* calculations in the medium-mass region [2], making calcium isotopes a perfect probe to examine the states forming the PDR. In a series of experiments at the Institute for Nuclear Physics, University of Cologne, the isotopes ^{40}Ca, ^{44}Ca and ^{48}Ca were studied in the (p,p′γ) reaction at $E_p = 12$, 15 MeV. Employment of the SONIC@HORUS setup allowed a high-precision measurement of the excitations near S_n. In the talk, the experimental set-up and the analysis process will be briefly described. The obtained relative excitation cross-sections close to S_n will be shown and compared with other experiments. The attempt to extract spins of observed states will also be discussed.
Supported by the DFG (ZI 510/10-1).
[1] D. Savran *et al.*, Prog. Part. Nucl. Phys. **70** (2013) 210.
[2] S.G. Pickstone *et al.*, Nucl. Inst. Meth. A**875** (2017) 104.

HK 8.3 Mon 14:30 HK-H7

Lifetimes of non-yrast states in ^{104}Mo — •Matthias Rudigier[1], Martin von Tresckow[1], Thorsten Kröll[1], Jan Jolie[2], Yung-He Kim[3], Ulli Köster[3], Kosuke Nomura[4], and Jean-Marc Regis[2] — [1]Institut für Kernphysik, Technische Universität Darmstadt, Darmstadt, Germany — [2]Institut für Kernphysik, Universität zu Köln, Köln, Germany — [3]Institute Laue Langevin, Grenoble, France — [4]Physics Department, University of Zagreb, Zagreb, Croatia

The region of neutron-rich nuclei around N=60 is well known for abrupt changes in nuclear structure from N=58 to N=60 for Zr and Sr. The deformation changes quickly and competing minima in the potential energy surface appear which result in shape coexistence. For the heavier isotopes Mo and Ru the evolution is much more smooth. Nuclear structure theory is capable of describing the ground state band of Mo isotopes in this mass region quite well. However, experimental data on non-yrast states is not reproduced similarly well. This is especially true for the first excited 0^+ state in the Mo isotopic chain. We performed an experiment at the Lohengrin mass separator at the ILL, to measure lifetimes of non-yrast states using the fast timing method with the goal to obtain more detailed information on the configurations present in ^{104}Mo. In particular the aim is to determine the lifetime of the first excited 0^+ state. Preliminary results will be discussed in comparison to neighbouring nuclei, as well as in terms of theoretical predictions on level energies and transition strengths.Funding support is acknowledged from the EURONS2 and HFHF.

HK 8.4 Mon 14:45 HK-H7

Spectroscopy of ^{94}Pd — •Aleksandrina Yaneva for the DESPEC-S480-Collaboration — GSI Helmholzzentrum für Schwerionenforschung GmbH, Darmstadt, Germany — IKP, Univerity of Cologne, Cologne, Germany

In March 2020 the first formally approved DESPEC experiment (part of the FAIR phase-0 campaign) was performed at GSI Helmholtzzentrium für Schwerionenforschung. This experiment was focused on the measurement of electromagnetic transition rates between yrast excited states in the ^{94}Pd nucleus. The goal was to measure the lifetimes of the $I^\pi=6^+$ and 8^+ states in this N=Z+2 isotope, which would provide insight into the evolution of the wave function around the ^{100}Sn region.

The nuclei of interest were produced, identified and transported through the Fragment Separator to be implanted into the AIDA (Advanced Implantation Detector Array) active stopper. AIDA was surrounded by the FATIMA ($LaBr_3$) and GALILEO (HPGe) detector arrays, which provided the fast-timing and precise energy information respectively.

The data obtained from the measurements is currently being analyzed by looking for correlations between ion implantation in AIDA and isomeric decays in FATIMA. In order to measure isomeric lifetimes in FATIMA the prompt response of the detectors has been determined. Similarly precise energy and timing information are being extracted after proper calibration and drift corrections. I will present the current analysis status of the experimental data.

HK 8.5 Mon 15:00 HK-H7

Lifetime measurement in ^{50}Cr with a new compact differential 3-foil Plunger — •Marcel Beckers[1], Christoph Fransen[1], Alfred Dewald[1], Claus Müller-Gatermann[2], Franziskus von Spee[1], Peter Reiter[1], Jan Jolie[1], and Casper Lakenbrink[1] — [1]Institute for Nuclear Physics, University of Cologne — [2]Argonne National Laboratoy

A a new, multi-purpose differential 3-foil plunger has been commissioned. It can be used together with several gamma-ray spectrometers and charged-particle detectors, due to its compact size. As a commissioning experiment, level lifetimes of the 2_1^+ and the 4_1^+ excited states of ^{50}Cr have been measured, using the Differential Decay Curve (DDC) method for 3-foil plungers. This experiment was conducted at the Cologne FN Tandem Accelerator, using the reaction ^{24}Mg(^{32}S,4p2n)^{50}Cr. Results of this measurement with special respect to the performance of the 3-foil plunger device are presented. This project was supported by the BMBF under the contract number 05P18PKFN9.

HK 8.6 Mon 15:15 HK-H7

Erste direkte Lebensdauerbestimmung des 2_1^+-Zustandes von ^{210}Pb — •C. M. Nickel[1], M. Beckers[2], D. Bittner[2], A. Esmaylzadeh[2], B. Falk[2], C. Fransen[2], J. Garbe[2], L. Gerhard[2], K. Geusen[2], A. Goldkuhle[2], K. E. Ide[1], P. R. John[1], J. Jolie[2], V. Karayonchev[2], R. Kern[1], E. Kleis[2], L. Klöckner[2], M. Ley[2], G. Rainovski[3], F. Spee[2], M. Steffan[2], T. Stetz[1] und V. Werner[1] — [1]TU Darmstadt — [2]U Köln — [3]U Sofia

Die Untersuchung des Übergangs vom 2_1^+- in den Grundzustand in Kernen nahe dem doppelt-magischen ^{208}Pb erlaubt die Anpassung von Parametern in Kernmodellen, wie z.B. die effektiven Ladungen im Schalenmodell. Besonders wichtig sind hierbei Kerne mit zwei Valenznukleonen [1], deren elementare Anregungen die niedrigliegenden Kernzustände bilden, wie ^{210}Pb. Am 10 MV FN Tandem-Beschleuniger des Instituts für Kernphysik der Universität zu Köln wurde der 2_1^+-Zustand von ^{210}Pb in einer Zwei-Neutronen-Transferreaktion direkt bevölkert und seine Lebensdauer mithilfe des Kölner Plungers unter Nutzung der Recoil-Distance Doppler-shift-Methode gemessen. Dabei wurden HPGe-Detektoren zur Detektion der Gammastrahlung und Silizium-

Detektoren zur Messung der bei der Kernreaktion rückgestreuten Teilchen genutzt. Somit wurde die Lebensdauer des 2_1^+-Zustandes von ^{210}Pb erstmalig direkt bestimmt, verträglich mit, aber deutlich genauer als, der einzige bekannte Literaturwert aus Triton-Streuung [2].

[1] D. Kocheva et al., Eur. Phys. J. A 53, 175 (2017).
[2] C. Ellegaard et al., Nucl. Phys. A 162, 1 (1971).
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