HK 38: Structure and Dynamics of Nuclei VIII

Time: Wednesday 15:45–17:15 Location: HBR 14: HS 4

Group Report HK 38.1 Wed 15:45 HBR 14: HS 4

R3B Developments towards the FAIR Early Science campaign — •Lukas Ponnath for the R3B-Collaboration — Technische Universität Darmstadt

The R3B (Reactions with Relativistic Radioactive ion Beams) experiment, as a major instrumentation of the NUSTAR collaboration at the research facility FAIR in Darmstadt, is designed to tackle a wide range of fundamental questions in modern nuclear physics. The large geometric acceptance, the bending power of its superconducting magnet GLAD, and its versatile high-resolution detector components allow for kinematically complete studies of reactions with high-energy radioactive beams.

This presentation includes an introduction to the experiment and its key components and will give an overview of various experiments recently performed during the FAIR Phase-0 campaign. Most recent developments will outline the strategy to run the first NUSTAR experiments in the early science program using the FAIR Super-FRS facility.

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HK 38.2 Wed 16:15 HBR 14: HS 4

PRISMA analysis of heavy Ne isotopes — •Floris Drent for the LNL EXP 015-Collaboration — GSI Helmholtzzentrum für Schwerionenforschung

In 1975, mass measurements on sodium isotopes ^{30,31,32}Na showed a significant difference between the measured mass excess and the calculated mass excess using various nuclei models. This was the first voyage towards discovering a phenomenon in nuclear physics called the Island of Inversion. The Island of Inversion is a group of nuclei at N = 20 shell closure whereby the ground states are characterised by particle-hole configurations with excitations across the shell gap. These configurations are counterintuitive compared to naively filling the shell as expected. Such configurations also give rise to intruder states which are also present in the nuclei surrounding the Island. Investigating these intruder states can give information on the borders of the Island. In april 2023, a ^{22}Ne upon ^{238}U beam experiment was performed to perform spectroscopy and lifetime measurements on ^{23,24,25}He using AGATA+PRISMA. This was also a pilot experiment to get familiar with using PRISMA for light ions and to prepare for future experiments using ^{28}Mg and ^{30}Si beams. In this presentation, I will give an overview of the ^{22}Ne-experiment, discuss the modification we apply to the PRISMA analysis procedure regarding the light ions and give an outlook of the ^{28}Mg-beam experiment.

HK 38.3 Wed 16:30 HBR 14: HS 4

Projectile fragmentation cross-sections of 1 GeV/u ^{208}Pb on ^{9}Be measured at the FRS — •Suraj Kumar Singh for the S450-Collaboration — GSI Helmholtzzentrum für Schwerionenforschung GmbH, Darmstadt, Germany — Justus-Liebig-Universität Gießen, Germany

Studies of nuclei far from the valley of stability are of interest because they provide insight into nuclear reactions and nuclear structure relevant for various fields of physics ranging from fundamental physics, nuclear astrophysics up to applications in medicine. Therefore, it is important to produce and study such exotic nuclides at the edges of stability to get an inside of their sometimes new or unexpected properties. The rate and yield estimates for studies of the exotic isotopes are based on their production cross-sections. As calculations are difficult, production cross-section measurements are the first step towards research with isotopes far away from the valley of stability and the knowledge of accurate production cross-sections is essential for each proposal for new experiments. In this contribution, the evaluation and first results of production cross-sections of exotic nuclei in the vicinity of isotones with "magic number" N=126, produced in fragmentation of a 1 GeV/u ^{208}Pb beam on a ^{9}Be target and separated in-flight at fragment separator FRS at GSI, will be presented.

HK 38.4 Wed 16:45 HBR 14: HS 4

Investigation of low-lying states in ^{214}Po and ^{214}Bi — •Arwin Esmaylzadeh[1], Mario Ley[1], Vasil Karayonchev[2], Lukas Knafla[1], Andreas Harter[1], Franziskus von Spee[1], Christoph Fransen[1], Andrey Blazhev[1], Jan Jolie[1], and Casper-David Lakenbrink[1] — [1]Universität zu Köln, Institut für Kernphysik — [2]Argonne National Laboratory

Lifetimes of low-energy excited states in even-even nuclei in the region around and above ^{208}Pb are difficult to measure, because most of the nuclei in this region cannot be populated by fusion evaporation reactions. Therefore, a seven-day measurement of the standard ^{226}Ra source was performed at the HORUS spectrometer equipped with eight HPGe and six LaBr detectors. In this measurement, the lifetimes 2_1^+, 4_1^+, 3_1^-, 2_2^+, 0_2^+, 2_5^+ ^{214}Po and the 1^- state in ^{214}Bi were determined employing the fast-timing method. Furthermore, upper limits for the 2_3^+ and 1_1^+ states in ^{214}Po and for the $(0_1^-, 1_1^-)$ state in ^{214}Bi were obtained. The lifetimes and upper limits were used to calculated transition strengths to explain structural phenomena in these nuclei. The transition strengths were also compared to shell model calculations using the appraisal of Kuo-Herling interaction [1]

[1] E. K. Warburton and B. A. Brown, Phys. Rev. C 43, 602 (1991)

HK 38.5 Wed 17:00 HBR 14: HS 4

Test of the prolate-oblate transition: the 2_1^+ lifetime of ^{190}W — E. Sahin[1,2,3], •V. Werner[1,3], A.K. Mistry[1,2,3], M. Rudigier[1], K. Nomura[4], J. Jolie[5], N. Pietralla[1], and P.H. Regan[6,7] for the S452-Collaboration — [1]TU Darmstadt — [2]GSI — [3]HFHF Darmstadt — [4]Hokkaido U, Japan — [5]U Cologne — [6]U Surrey, UK — [7]NPL, UK

The region of isotopes toward the doubly-magic ^{208}Pb has been discussed as a candidate region to observe the (phase) transition from prolate to oblate structures. ^{190}W has been identified as an isotope for potentially being close to the transition point (e.g., Refs. [1-3]), having a maximal γ-soft structure. Within the DESPEC, FAIR Phase-0 experiment S452 ^{190}W in its isomeric state has been implanted into the AIDA active stopper, surrounded by the FATIMA array and complementary EUROBALL Cluster detectors. The lifetime of its first excited 2^+ state has been determined through a fast-timing analysis and is brought into context by comparison to an EDF-IBM model approach [4].

[1] J. Jolie and A. Linnemann, Phys. Rev. C **68**, 031301 (2003).
[2] P.J.R. Mason *et al.*, Phys. Rev. C **88**, 044301 (2013).
[3] N. Alkhomashi *et al.*, Phys. Rev. C **80**, 064308 (2009).
[4] K. Nomura *et al.*, Phys. Rev. C **83**, 054303 (2011).