HK 59: Structure and Dynamics of Nuclei XI

Time: Thursday 14:00–15:30 Location: SCH/A118

Group Report HK 59.1 Thu 14:00 SCH/A118

Commissioning of Miniball@HIE-ISOLDE and first results from Coulomb excitation of ^{130}Sn — •Maximilian Droste[1], Peter Reiter[1], and Thorsten Kröll[2] for the MINIBALL IS702-Collaboration — [1]IKP, Universität zu Köln, Germany — [2]Institut für Kernphysik, TU Darmstadt, Germany

The high-resolution Miniball germanium array has been recommissioned at the HIE-ISOLDE facility at CERN in 2022. After successful campaigns at RIKEN, Japan and PSI, Switzerland the cryostats and capsules of the HPGe crystals have been redesigned and rebuilt. A new data acquisition system, based on FEBEX digitizers, was used for the commissioning of the array. Coulomb excitation of ^{130}Sn was the first experiment after LS2 at CERN. A beam of 4.4 $\frac{\mathrm{MeV}}{\mathrm{u}}$ was delivered onto a ^{206}Pd target. Dexciting γ-rays from target and projectile nuclei were recorded in coincidence with scattered particles. The experiment aims to investigate the evolution of nuclear structure around the magic-shell closure at N=82 tin isotopes by determining the $B(E2; 0^+_{\mathrm{g.s.}} \rightarrow 2^+_1)$ value. Most advanced SM calculations using realistic interactions predict enhanced collectivity in the neighbouring isotopes of ^{132}Sn [1]. Moreover, a puzzling discrepancy between previous measurements in ^{130}Sn and latest theoretical results [2] needs to be resolved.

[1] D. Rosiak *et al.* Phys. Rev. Lett. 121, 252501 (2018)
[2] T. Togashi *et al.* Phys. Rev. Lett. 121, 062501 (2018)

Supported by BMBF Projects 05P18PKCI1, 05P21PKCI1 and European Unions Horizon Europe Framework research programm (Grant Agreement No. 101057511)

HK 59.2 Thu 14:30 SCH/A118

Investigation of SRC in exotic nuclei at R3B/GSI — •Enis Lorenz[1,2], Thomas Aumann[1,2], Meytal Duer[1,2], Anna Corsi[3], Or Hen[4], Julian Kahlbow[4], Aldric Revel[3], Andrea Jedele[1,2], Andrea Lagni[3], Manuel Xarepe[5,1], Hang Qi[4], Nikhil Mozumdar[1,2], and Antoine Barriere[6] for the R3B-Collaboration — [1]Technische Universität Darmstadt — [2]GSI Helmholtz Zentrum — [3]CEA Saclay — [4]Massachusetts Institute of Technology — [5]University of Lisbon — [6]Grand Accélérateur National d'Ions Lourds

Short-Range Correlations (SRC) are two-body components of the nuclear wave function with high relative momentum and low center-of-mass momentum relative to the Fermi momentum. These high-momentum states are overpopulated relative to a simple free-Fermi gas. During the nuclear reaction, SRC pairs are temporarily formed due to the presence of high-density fluctuations between 2-5 times the saturation density. The formation of the SRC pairs gives an unique opportunity to explore the interaction of cold nuclear matter at extreme densities. The first measurement of SRCs in inverse kinematics with radioactive ion beams has been performed at R3B as part of the FAIR Phase-0 experimental program in Spring 2022. In this talk I will give an overview on the status of the analysis. This work is funded and supported by the State of Hesse within the Research Cluster ELEMENTS (Project ID 500/10.006), by the German Federal Ministry for Education and Research (BMBF) under contract number 05P21RDFN2 and the GSI-TU Darmstadt cooperation.

HK 59.3 Thu 14:45 SCH/A118

Overview of CALIFA in FAIR-Phase-0 Experiments at R^{3}B — •Leyla Atar[1], Christian Sürder[1], Thorsten Kröll[1], Roman Gernhäuser[2], and Philipp Klenze[2] for the R3B-Collaboration — [1]Institut für Kernphysik, Technische Universität Darmstadt, Germany — [2]Technische Universität München, Germany

CALIFA (the CALorimeter for In Flight detection of γ-rays and light charged pArticles) is one of the key detectors of the R^{3}B experiment at the GSI/FAIR facility. CALIFA is highly segmented and currently consists of 1528 scintillation CsI(Tl) crystals surrounding the reaction target area to facilitate measurement of the emission angle and energy of reaction products. CALIFA covers a large dynamic range to allow a simultaneous measurement of γ-rays down to 100 keV and scattered protons up to 300 MeV. A special feature of CALIFA is the digital Quick Particle Identification (QPID) enabling γ-rays and charged particle identification through Pulse Shape Analysis (PSA) of the scintillation light output.

I will shortly introduce the CALIFA calorimeter and its auxiliary detector systems and give an overview of the performance of CALIFA in the frame of FAIR-Phase-0 experiments performed at the R^{3}B/FAIR setup. First results from specific reaction channels will be presented.

This work is supported by BMBF contracts (05P19RDFN1) and (05P21RDFN2).

HK 59.4 Thu 15:00 SCH/A118

Lifetime measurements of excited states of ^{132}Te after 2n transfer — •H. Mayr[1], T. Stetz[1], V. Werner[1], T. Beck[5], M. Beckers[2], A. Blazhev[2], R. Borcea[4], S. Calinescu[4], C. Costache[4], I. Dinescu[4], A. Esmaylzadeh[2], B. Falk[2], J. Fischer[2], R.-B. Gerst[2], K. Gladnishki[3], A. Ionescu[4], V. Karayonchev[6], E. Kleis[2], H. Kleis[2], L. Klöckner[2], P. Koch[2], D. Kocheva[3], P. Koseoglou[1], R. Mayer[1], R.-E. Mihai[4], C. M. Nickel[1], C.-R. Nita[4], A. Pfeil[2], N. Pietralla[1], G. Rainovski[3], F. Spee[2], L. Stan[4], M. Stoyanova[3], S. Toma[7], and R. Zidarova[1] — [1]TU Darmstadt — [2]U Cologne — [3]U Sofia — [4]IFIN-HH Bucharest — [5]MSU — [6]TRIUMF Canada — [7]UP Bucharest

The proton-neutron symmetry of low-lying nuclear states is characterized by the mixing of respective configurations to their wave functions, dominated by few two-nucleon configurations near shell closures. Located closely to the doubly-magic ^{132}Sn, ^{132}Te is therefore well suited to study mixed-symmetric configurations and their fragmentation. By applying the Doppler Shift Attenuation Method, following a two-neutron transfer reaction to ^{132}Te, the location and fragmentation of mixed-symmetric states has been studied through the measurement of excited-state lifetimes. Results for the 2^+ mixed-symmetric states will be presented. A complementary experiment has been performed using the Recoil Distance Doppler Shift method, in order to access lifetimes of longer-lived states. With the resulting lifetimes, transition strengths to lower lying states have been determined and compared to theoretical approaches. *Supported by the BMBF 05P21RDCI2-TP1.

HK 59.5 Thu 15:15 SCH/A118

Development of a new γ-γ angular correlation analysis method using asymmetric ring of clover detectors — •Lukas Knafla[1], Arwin Esmaylzadeh[1], Andreas Harter[1], Jan Jolie[1], Ulli Köster[2], Mario Ley[1], Caterina Michelagnoli[2], and Jean-Marc Régis[1] — [1]Institut für Kernphysik, Universität zu Köln — [2]Institut Laue-Langevin, Grenoble, Frankreich

A new method for γ-γ angular correlation analysis using a symmetric ring of HPGe clover detectors is presented. Pairwise combinations of individual crystals are grouped based on the geometric properties of the spectrometer, constrained by a single variable parameterization. The corresponding effective interaction angles between crystal pairs, as well as the attenuation coefficients are extracted directly from the measured experimental data. Angular correlation coefficients, parameter uncertainties and parameter co-variances are derived using a Monte-Carlo approach, considering all sources of statistical uncertainty. The general applicability of this approach is demonstrated by reproducing known multipole mixing ratios in ^{177}Hf, ^{152}Gd and ^{116}Sn, populated by either β-decay or (n, γ)-reactions, measured at the Institut Laue-Langevin, using the EXILL&FATIMA spectrometer and different configurations of the FIPPS instrument. The derived mixing ratios are in excellent agreement with adopted literature values with comparable or better precision [1].

[1] L. Knafla et al., Nucl. Instrum. Methods Phys. Res. A 1042 (2022)