HK 17: Structure and Dynamics of Nuclei III

Time: Monday 16:00–17:45 Location: HK-H6

Group Report HK 17.1 Mon 16:00 HK-H6

Absolute electromagnetic transition rates in the semi-magic 211At nucleus and their implications for the nuclear structure above 208Pb. — •Jan Jolie[1], Vasil Karayonchev[1], Andrey Blazhev[1], Arwin Esmaylzadeh[1], Christoph Fransen[1], Lukas Knafla[1], Claus Mueller-Gatermann[1], Jean-Marc Regis[1], and Pieter Van Isacker[2] — [1]IKP, Universitaet zu Koeln, Zuelpicher Str. 77, D-50937 Koeln, Germany — [2]GANIL, CEA/DRF-CNRS/IN2P3, Bvd Henri Becquerel, F-14076 Caen, France

Motivated by the abnormal yrast B(E2) values in 210Po[1], lifetimes of excited states in 211At were measured using the electronic gamma - gamma fast timing technique and the Recoil Doppler Shift Method (RDSM) at the Cologne FN Tandem accelerator. For the fast timing experiment the 208Pb(6Li,3n) fusion-evaporation reaction and the HORUS detector array equipped with eight HPGe detectors and nine LaBr3(Ce) scintillators were used[2]. For the RDSM experiment the 209Bi(16O,14C) two-proton transfer reaction was performed and 14C was detected with solar cells mounted in the Cologne plunger setup. Several lifetimes were determined for the first time. The results are compared to shell model calculation using two approaches: analytical calculations using a semiempirical interaction for three particles in a single j = 9/2 shell and untruncated numerical full shell model calculations with the modified Kuo-Herling interaction. Very good agreement is obtained, especially with the analytical single-j calculation. [1] D. Kocheva, et al., Eur. Phys. J. A 53 (2017) 175;[2] V. Karayonchev, et al., Phys. Rev. C 99 (2019) 024326.

HK 17.2 Mon 16:30 HK-H6

Investigation of collectivity in ^{142}Xe by Coulomb excitation — •Corinna Henrich for the IS548-MINIBALL-Collaboration — TU Darmstadt, Darmstadt, Germany

The isotope ^{142}Xe lies in the neutron-rich area north-east of the doubly-magic ^{132}Sn, in a region through which the astrophysical r-process is expected to pass. This nucleus is of particular interest as it allows to follow the onset of octupole collectivity, which is expected to peak for the nearby ^{144}Ba, and the evolution of quadrupole collectivity.

A perfect tool to investigate the low-lying structure and collectivity of ^{142}Xe is “safe” Coulomb excitation as it gives access to reduced transition strengths as well as spectroscopic quadrupole moments.

The experimental campaign was carried out at HIE-ISOLDE (CERN). After the excitation on a lead target, the deexcitation gamma rays are detected using the MINIBALL spectrometer in coincidence with the corresponding particles. The latter are detected utilizing the silicon detector array C-REX.

Final experimental results are presented and compared to SCCM and LSSM calculations.

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HK 17.3 Mon 16:45 HK-H6

Lifetime measurements to investigate γ-softness and shape coexistence in ^{102}Mo — •Arwin Esmaylzadeh[1], Vasil Karayonchev[1], Jan Jolie[1], Kosuke Nomura[2], Marcel Beckers[1], Andrey Blazhev[1], Christoph Fransen[1], and Lukas Knafla[1] — [1]Institut für Kernphysik, Universität zu Köln — [2]Department of Physics, University of Zagreb

Lifetimes of low-spin excited states in ^{102}Mo populated in a ^{100}Mo(^{18}O, ^{16}O)^{102}Mo two-neutron transfer reaction were measured using the recoil-distance Doppler-shift technique at the Cologne FN Tandem accelerator. Lifetimes of the 2^+_1, 4^+_1, 6^+_1, 0^+_2, 2^+_γ, 3^+_γ states and one upper limit for the lifetime of the 4^+_γ state were obtained. The energy levels and deduced electromagnetic transition probabilities are compared with the ones obtained within the mapped interacting boson model framework with microscopic input from Gogny mean field calculations. With the newly obtained signatures a more detailed insight in the γ-softness and shape coexistence in ^{102}Mo is possible and discussed in the context of the $Z \approx 40$ and $N \approx 60$ region. The nucleus of ^{102}Mo follows the γ-soft trend of the Mo isotopes. The properties of the 0^+_2 state indicate, in contrast to the microscopic predictions, shape coexistence which also occurs in other $N = 60$ isotones [1].

[1] A. Esmaylzadeh et al., Phys. Rev. C (accepted in PRC) (2022)

HK 17.4 Mon 17:00 HK-H6

Configuration Interaction Monte Carlo with Chiral Three-Body Forces — •Pierre Arthuis[1,2,3], Carlo Barbieri[3,4,5], Francesco Pederiva[6,7], and Alessandro Roggero[6,7,8] — [1]Technische Universität Darmstadt, Department of Physics — [2]ExtreMe Matter Institute EMMI, GSI — [3]Department of Physics, University of Surrey — [4]Dipartimento di Fisica, Università degli Studi di Milano — [5]INFN, Sezione di Milano — [6]Physics Department, University of Trento — [7]INFN-TIFPA Trento Institute of Fundamental Physics and Applications — [8]InQubator for Quantum Simulation (IQuS), Department of Physics, University of Washington

Neutron matter from saturation to low densities is a particluarly interesting system, its equation of state (EoS) directly affecting the structure of the inner core of neutron stars and the skin of heavy neutron-rich nuclei. High-accuracy methods are thus of remarkable importance.

Configuration Interaction Monte Carlo (CIMC) combines the natural language needed to deal with momentum-dependent interactions to the efficiency of Quantum Monte Carlo techniques while satisfying the variational ansatz. The method demonstrated very efficient for two-body Hamiltonians, but was never extended to tackle three-body interactions.

Here we present the first CIMC results obtained for cold neutron matter at densities below and around nuclear saturation density with a chiral potential including three-body forces. Besides the EoS of neutron matter, we will display also results for the momentum distribution and the static structure factor.

HK 17.5 Mon 17:15 HK-H6

Investigation of the B(E2; $0^+_{gs} \to 2^+_1$) value of ^{116}Sn — •M. Beuschlein[1], O. Papst[1], J. Kleemann[1], V. Werner[1], N. Pietralla[1], T. Beck[1,3], M. Berger[1], I. Brandherm[1], A. D'Alessio[1], U. Friman-Gayer[1,2], M. Hilcker[1], K. E. Ide[1], J. Isaak[1], R. Kern[1], F. Niederschuh[1], P. C. Ries[1], G. Steinhilber[1], J. Wiederhold[1], and R. Zidarova[1] — [1]IKP, TU Darmstadt — [2]Duke University and TUNL, Durham, NC, USA — [3]FRIB, East Lansing, MI, USA

The tin isotopes, being proton-magic with a long chain of experimentally accessible nuclei, are an important testing ground for nuclear structure models. Present data show systematic deviations between measured electric quadrupole (E2) ground-state excitation strengths depending on the used techniques. Also, various nuclear structure models come to different predictions on the systematics of B(E2) strengths, particulary around ^{116}Sn. We performed a measurement of ^{116}Sn relative to ^{112}Sn using the nuclear resonance fluorescence method at S-DALINAC at TU Darmstadt. A beam of continuous bremsstrahlung up to an endpoint energy of 2.2 MeV was used to populate the first excited 2^+ states of ^{112}Sn and ^{116}Sn. Photons of the subsequent de-excitation were measured by three high-purity germanium detectors. With our relative measurement we aim to provide a test for a predicted dip of E2 strengths around ^{116}Sn [1], and obtain the absolute B(E2) strength from a previous measurement of ^{112}Sn. Supported by the DFG through the research grant SFB 1245.

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

HK 17.6 Mon 17:30 HK-H6

Transition strengths of the intruder band of ^{96}Zr — •T. Stetz[1], T. Beck[1], N. Pietralla[1], V. Werner[1], M. Boromiza[2], I. Gheorge[2], A. Ionescu[2], R. Kern[1], R. Lica[2], N. Mărginean[2], R. Mărginean[2], C. Mihai[2], R.-E. Mihai[2], C.R. Nita[2], O. Pabst[1], S. Pascu[2], C. Sotty[2], L. Stan[2], A. Turturica[2], J. Wiederhold[1], and W. Witt[1] — [1]TU Darmstadt, Germany — [2]IFIN-HH, Romania

The zirconium (Zr) isotopes have recently been discussed in terms of type-II shell evolution [1,2], with ^{98}Zr closest to the critical point of a quantum phase transition from spherical to deformed ground-state shapes [3,4]. Spherical and deformed structures were found to coexist, weakly mixing, already in ^{96}Zr [2], but key data to classify the observed structures is missing [4]. Therefore, ^{96}Zr has been studied in an experiment, populating excited states of the intruder band in the 2n transfer reaction ^{94}Zr(^{18}O,^{16}O)^{96}Zr at 49 MeV at the 9 MV tandem accelerator in IFIN-HH. The HPGe ROSPHERE array in a combination with the SORCERER particle detector was used to obtain the data. With the Doppler shift attenuation method, the lifetime of the first excited 4^+ state was determined. From this, transition strengths to lower lying states have been obtained and compared with theoretical approaches in order to study the shape of the intruder band.

[1] T. Togashi *et al.*, Phys. Rev. Lett. **117** 172502 (2016)
[2] C. Kremer *et al.*, Phys. Rev. Lett. **117** 172503 (2016)
[3] W. Witt *et al.*, Phys. Rev. C **98** 041302 (2018)
[4] W. Witt *et al.*, Eur. Phys. J. A **55** 79 (2019)

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