HK 49: Structure and Dynamics of Nuclei IX

Time: Wednesday 17:30–19:00 Location: SCH/A118

HK 49.1 Wed 17:30 SCH/A118

Measurements of the reaction cross sections of neutron-rich Sn isotopes at R^{3}B setup. — •Eleonora Kudaibergenova[1], Thomas Aumann[1,2,4], Martina Feijoo Fontan[5], Andrea Horvat[1,3], Ivana Lihtar[3], Valerii Panin[2], and Dominic Rossi[1,2] for the R3B-Collaboration — [1]Institut für Kernphysik, TU Darmstadt, Germany — [2]GSI Helmholtzzentrum für Schwerionenforschung, Darmstadt, Germany — [3]Rudjer Boskovic Institute, Zagreb, Croatia — [4]Helmholtz Forschungsakademie HFHF — [5]IGFAE, Universidad de Santiago de Compostela, Spain

The equation of state (EoS) is fundamental for understanding the structure of nuclear matter.The study of asymmetric nuclear matter via properties of neutron-rich nuclei became a current focus of investigation.The asymmetry term of the nuclear EoS is expressed by the symmetry energy at saturation J and its slope L, which has not yet been constrained well experimentally. It has been identified that a precise determination of the neutron removal cross section of neutron-rich nuclei, which is directly related to the neutron skin, would provide a much better constraint on L. To this end, an experiment was performed with the neutron-rich tin isotopes in the mass range A=124-134 on ^{12}C targets at the R^{3}B setup at the GSI/FAIR facility in inverse kinematics with very large acceptance. In this report, the current detector calibration, analysis status is presented.

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HK 49.2 Wed 17:45 SCH/A118

Investigation of γ-softness: Lifetime measurements in ^{104,106}Ru — •Arwin Esmaylzadeh[1], Andrey Blazhev[1], Kosuke Nomura[2], Jan Jolie[1], Marcel Beckers[1], Christoph Fransen[1], Rosa-Belle Gerst[1], Andreas Harter[1], Vasil Karayonchev[1,3], Lukas Knafla[1], Mario Ley[1], and Franziskus von Spee[1] — [1]Insitute for Nuclear Physics, University of Cologne — [2]Department of Physics, University of Zagreb — [3]TRIUMF, Canada

Lifetimes of the 2^+_1, 4^+_1, 6^+_1, 2^+_γ and 3^+_γ states in ^{104,106}Ru were measured using the recoil distance Doppler shift technique and the Cologne Plunger device. Low-lying excited states in both nuclei were populated in a ^{104}Ru(^{18}O, ^{18}O)^{104}Ru* inelastic scattering and in a ^{104}Ru(^{18}O, ^{16}O)^{106}Ru two-neutron transfer reaction using the Cologne FN Tandem accelerator. The experimental energy levels and deduced electromagnetic transition probabilities are compared in the context of γ-softness and the mapped interacting boson model with input from the microscopic self-consistent mean-field calculation using a Gogny interaction [1]. The newly obtained results for the γ band, give a more detailed insight about the triaxial behavior of ^{104,106}Ru. The results will be discussed in the context of γ soft and rigid triaxial behavior which is present in the neutron-rich Ru isotopes [2]. This work supported by BMBF erbundprojekt 05P2021 (ErUM-FSP T07) grant 05P21PKFN1.

[1] K. Nomura et al., Phys. Rev. C 94, 044314 (2016)
[2] A. Esmaylzadeh et al., Phys. Rev. C (accepted in PRC) (2022)

HK 49.3 Wed 18:00 SCH/A118

Lifetime measurement of neutron rich Xe isotopes applying Fast-Timing method — •Andi Messingschlager[1], Martin von Tresckow[1], Thorsten Kröll[1], Matthias Rudigier[1], Andrey Blazhev[2], Julia Fischer[2], Sorin Pascu[3], and Jonathan N. Wilson[4] for the nu-Ball2 N-SI-120-Collaboration — [1]TU Darmstadt — [2]U Cologne — [3]U Surrey — [4]IJCLab Orsay

^{142}Xe is a neutron rich even-even isotope which lies between the double shell closure N = 82 and Z = 50 and a region in which an increased quadrupole and octupole collectivity is expected [1,2]. The lifetimes of excited states of ^{142}Xe are located in the range of some picoseconds. In this time range the Fast-Timing method is suited to determine the lifetime of exited states. Since there are different results for the lifetimes of excited states of the Xe-isotopes in experiments using the Fast-Timing method [1] and Coulomb exitation [2]. Therefore, we are going to analyse the data taken following the fission of ^{238}U induced by a pulsed neutron beam of 1.7 MeV energy from the LICORNE neutron source. The nu-Ball2 multidetector array consisted of 24 HPGe Clover detectors and 20 LaBr$_3$(Ce) detectors which promise excellent energy and time resolution, respectively. The campaign was performed at IJCLab in Orsay, France. Preliminary results will be presented. Supported by BMBF under Verbundprojekt 05P2021 (ErUM-FSP T07) grant 05P21RDFN1 and ARIEL

[1] S. Ilieva et al., PRC 94, 034302 (2016).
[2] C. Henrich, Dissertation TU Darmstadt (2020)

HK 49.4 Wed 18:15 SCH/A118

Gamma-ray spectroscopy of neutron-rich ^{55,57,59}Sc isotopes — •Radostina Zidarova[1], Martha Liliana Cortés[2], Volker Werner[1], Pavlos Koseoglou[1], Norbert Pietralla[1], Pieter Doornenbal[2], and Alexandre Obertelli[1] — [1]TU Darmstadt, Germany — [2]RIKEN-RIBF, Japan

Experimental data have shown that far from the valley of stability new magic numbers can emerge and the traditional ones can disappear. In particular, two new magic numbers at N=32 and N=34 have been suggested in the vicinity of Z=20 based on gamma-ray spectroscopy and mass measurements. In order to assess the impact of a single valence proton outside of the Z=20 shell on the shell-evolution mechanism in this region, it is necessary to study the neutron-rich Sc isotopes around, and even beyond, neutron number N=34. Investigation of exotic nuclei in this region was the goal of the third SEASTAR campaign at RIKEN-RIBF. Neutron-rich isotopes in the vicinity of ^{53}K were produced by fragmentation of a primary ^{70}Zn beam on a ^{9}Be target. Known and new γ-ray transitions of the isotope ^{55}Sc were observed and new γ-rays from ^{57,59}Sc identified for the first time. Observed γ spectra from ^{55,57,59}Sc will be presented together with preliminary level schemes. They will be discussed in the framework of the tensor-driven shell evolution.

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HK 49.5 Wed 18:30 SCH/A118

Lifetime measurements of excited states in ^{57}Mn — •Hannah Kleis, Peter Reiter, Konrad Arnswald, Maximilian Droste, Andrey Blazhev, Ramona Burggraf, and Cristoph Fransen — Institut für Kernphysik, Universität zu Köln

Previously, the $N = 32$ subshell closure was observed in the even-even Ca-, Ti-, and Cr-isotopes [1]. Adding more valence protons to the $\pi(f_{7/2})$ orbital reduces the shell gap at $N = 32$ which vanishes completely at $^{58}_{26}$Fe. Lifetime measurements in the odd-even ^{57}Mn nucleus were performed in order to close the gap between $Z = 24$ and $Z = 26$. Excited states of ^{57}Mn were populated via ^{55}Mn(^{18}O, ^{16}O)^{57}Mn two-neutron transfer reactions at a beam energy of 38 MeV employing the FN tandem accelerator at the University of Cologne. The Doppler-shift attenuation method is utilized to determine new lifetimes for the $11/2^-_1$ and $9/2^-_1$ states. The experimentally determined transition probabilities are confronted with results from the GXPF1A shell-model interaction along the Mn-isotopes. The experimental findings in ^{57}Mn are well reproduced by this interaction. The comparison of excitation energies and $B(E2)$ strengths is extended to all odd-even nuclei between Ca and Ni with neutron numbers $N = 26$ and $N = 36$ in order to discuss the nature of the $N = 32$ subshell closure.

[1] D. Steppenbeck *et al.*, Nature 502, 7470 (2013)

HK 49.6 Wed 18:45 SCH/A118

Lifetime measurements of neutron-rich Kr isotopes within the nu-Ball2 fission campaign — •J. Fischer[1], A. Blazhev[1], C. Hiver[2], J. Jolie[1], A. Messingschlager[3], S. Pascu[4], M. von Tresckow[3], N. Warr[1], and J. N. Wilson[2] for the nu-Ball2 N-SI-120-Collaboration — [1]U Cologne — [2]IJCLab Orsay — [3]TU Darmstadt — [4]U Surrey

Nuclei beyond the band of stability are crucial to our understanding of the atomic nucleus and nuclear forces. In recent years, neutron-rich krypton isotopes have been studied as part of various campaigns. New gamma-transitions and levels were discovered in the first nu-Ball and SEASTAR-2015 campaigns [1,2] which compared to theory indicated oblate-prolate shape coexistence already in ^{96}Kr [2]. However, the limited information on transition strengths did not allow for firm conclusions. Therefore lifetime measurements were performed at the IJCLab Orsay as part of the nu-Ball2 fission campaign. The nuclei of interest were produced with a fast-neutron-induced fission reaction $^{238}U(n,f)$. The improved multidetector-array (nu-Ball2), a novel hybrid γ-spectrometer consisting of HPGe and LaBr3(Ce) detectors provided excellent energy and timing information, respectively. The fast-timing method allows for lifetime determination down to about 10 ps and thus a possibility to determine transition strengths in the nuclei of interest. Preliminary results will be presented. *Supported by BMBF under Verbundprojekt 05P2021 (ErUM-FSP T07) grant 05P21PKFN1. / [1] R.-B. Gerst et al., PRC 102, 064323 (2020). ; [2] R.-B. Gerst et al., PRC 105, 024302 (2022).