HK 30: Structure and Dynamics of Nuclei VII

Time: Tuesday 17:30–19:15 Location: HBR 19: C 5b

Group Report HK 30.1 Tue 17:30 HBR 19: C 5b

Absolute electromagnetic transition rates in semi-magic N = 50 isotones as a test for $(\pi g_{9/2})^n$ single particle calculations. — Mario Ley[1], •Jan Jolie[1], Arwin Esmaylzadeh[1], Andreas Harter[1], Lukas Knafla[1], Aaron Pfeil[1], Andrey Blazhev[1], Christoph Fransen[1], Jean-Marc Regis[1], and Piet Van Isacker[2] — [1]Institut fuer Kernphysik, Universitaet zu Koeln, Zuelpicher Str. 77, D-50937 Koeln, Germany — [2]GANIL, Bvd. Henri Becquerel, F-14076 Caen, France

Single-j calculations for $(j)^n$ configurations with n = 3,..,2j+1 can be performed using a semi-empirical approach, provided that the energies and absolute electromagnetic transition rates are known for the two-particle (hole) nucleus. This approach was already successfully applied in the case of protons in the $(\pi h_{9/2})^3$ nucleus ^{211}At [1]. At the Cologne Tandem Accelerator of the Institute for Nuclear Physics we have tested these relations by measuring lifetimes of excited states in the $(\pi g_{9/2})^n$ isotones with N = 50. We started the studies in the two-proton nucleus ^{92}Mo where the previously unknown B(E2:$4_1^+ \rightarrow 2_1^+$) value, was measured with high precision using the electronic $\gamma - \gamma$ fast timing technique [2]. Subsequently we applied the same technique in ^{93}Tc and ^{94}Ru [3]. Work supported by DFG Grant JO391/18-1.

[1] V. Karayonchev, *et al.*, Phys. Rev. C 106, 044321 (2022). [2] M. Ley, L. Knafla, J. Jolie, A. Esmaylzadeh, A. Harter, A. Blazhev, C. Fransen, A. Pfeil, J.-M. Regis, P. Van Isacker, accepted for publication in Phys. Rev. C (2023). [3] M. Ley, *et al.*, to be submitted to Phys. Rev. C.

HK 30.2 Tue 18:00 HBR 19: C 5b

Coulomb excitation of ^{124}Te: persisting seniority structure in the 6_1^+ level — •Martha Reece[1,2], Ben Coombes[2], AJ Mitchell[2], Andrew Stuchbery[2], Greg Lane[2], Angela Gargano[3], Nathan Spinks[2], and Jack Woodside[2] — [1]GSI, Darmstadt, Germany — [2]ANU, Canberra, Australia — [3]INFN, Napoli, Italy

A new research program at the Australian Heavy Ion Accelerator Facility is examining the nature of near-spherical nuclei using Coulomb-excitation measurements. To facilitate these measurements, a new silicon photodiode particle detector system has been developed and integrated into the CAESAR array of Compton-suppressed γ-ray detectors. The first experiments studied ^{124}Te, a nucleus that lies in a transitional region between single-particle and collective behaviour just beyond the Z = 50 proton shell. The value $B(E2; 6_1^+ \rightarrow 4_1^+) = 25(7)$ W.u. was measured for the first time in this nucleus; this is significantly below the collective limits of the previously proposed spherical-vibrator and triaxial-rotor models. The experimental results are compared to shell-model calculations for $^{120-128}$Te, which show remarkable agreement for the known $B(E2; 6_1^+ \rightarrow 4_1^+)$ values. It appears that, despite approaching mid-shell, ^{124}Te retains single-particle structure in the 6_1^+ level. This is in contrast to other $B(E2)$ values in ^{124}Te, and neighboring ^{120,122}Te, in which collectivity becomes enhanced as more neutrons are removed.

HK 30.3 Tue 18:15 HBR 19: C 5b

Shell-Model calculations for masses and β-decay half-lives near $N = 50$ — •Zafar Iftikhar[1,2,3], Gabriel Martínez-Pinedo[1,2,4], Thomas Neff[1], Riccardo Mancino[2,1], and Frédéric Nowacki[5] — [1]GSI Helmholtzzentrum für Schwerionenforschung, D-64291 Darmstadt, Germany — [2]Institut für Kernphysik (Theoriezentrum), Department of Physics, Technische Universität Darmstadt, D-64298 Darmstadt, Germany — [3]FATA University, FR Kohat 26100, Khyber Pakhtunkhwa, Pakistan — [4]Helmholtz Forschungsakademie Hessen für FAIR, GSI Helmholtzzentrum für Schwerionenforschung, D-64291 Darmstadt, Germany — [5]Institut Pluridisciplinaire Hubert CURIEN (IPHC), Strasbourg 67200, France

The doubly magic ^{78}Ni was recently investigated at RIBF, revealing competing spherical and deformed configurations. Due to limited experimental data in this neutron-rich region, one has to rely on theoretical calculations for masses and β-decay half-lives. We perform shell-model calculations for β-decay half-lives with $pf - sdg$ model space for protons and neutrons (required by the unnatural parity states and Gamow-Teller transitions). We use an effective interaction adjusted to reproduce the experimental data around ^{78}Ni and the measured half-lives. We also report the calculated S_{2n} for the isotopic chains of Z=22−30 with $N = 40 - 52$.

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HK 30.4 Tue 18:30 HBR 19: C 5b

Lifetime measurements of excited states in the doubly magic nucleus ^{40}Ca using the Doppler-Shift-Attenuation-Method — •Timon Sültenfuss, Maximilian Droste, Peter Reiter, Anna Bohn, Ramona Burggraf, Hannah Kleis, and Sarah Prill — Institute for Nuclear Physics, University of Cologne

Lifetimes of excited states in the doubly magic nucleus ^{40}Ca were measured at the FN tandem accelerator of the University of Cologne. Excited states were populated using a ^{40}Ca(p, p' γ) reaction at a beam energy of 15 MeV. The detector array SONIC@HORUS, consisting of 12 silicon and 14 HPGe detectors, was used to detect scattered protons and emitted γ-rays in coincidence. Lifetimes of yrast states in ^{40}Ca have been determined using the Doppler-Shift-Attenuation Method. To perform a lineshape analysis the APCAD code [1] was employed. The resulting new lifetimes reduce the experimental uncertainty significantly with respect to the evaluated lifetimes. Comparison of the new lifetime values with shell-model calculations will be discussed.

[1] C. Stahl et al., Comput. Phys. Commun. 214 (2017) 174-198

HK 30.5 Tue 18:45 HBR 19: C 5b

Lifetime measurement in ^{214}Rn applying the Fast-Timing method — •Martin von Tresckow for the IFIN-HH-214Rn-Collaboration — Institut für Kernphysik, TU Darmstadt

^{214}Rn is in the vicinity of the ^{208}Pb closed core and different theoretical calculations are recently published in this region, based on the independent particle model or taking into account short-range nucleon-nucleon correlations, such as α-clustering. α-clustering may have an important role in the description of the structure of ^{214}Rn due to our results in the isotope with two protons less, ^{212}Po, [Ma. von Tresckow et al., PLB 821, 136624 (2021)] and the large α-decay width of the ground state of ^{214}Rn. However the experimental transition strengths of the low lying yrast-states aren't well known and a comparison to theory predictions is not conclusive. Therefore, we performed in June 2023 a fusion-evaporation experiment to investigate excited states of ^{214}Rn and determine the lifetimes applying the Fast-Timing method. The experiment was performed at the ROSPHERE γ-ray detector array at IFIN-HH in Magurele, Romania.
I will present the current state of the lifetime analysis.

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HK 30.6 Tue 19:00 HBR 19: C 5b

Gamma-ray spectroscopy of the neutron-rich ^{55,57,59}Sc isotopes — •R. Zidarova[1], M. L. Cortés[2], V. Werner[1], P. Koseoglou[1], N. Pietralla[1], P. Doornenbal[2], A. Obertelli[1], T. Otsuka[3], Y. Tsunoda[3], and Y. Utsuno[3,4] for the SEASTAR3-Collaboration — [1]IKP, TU Darmstadt, Darmstadt, Germany — [2]RIKEN Nishina Center, Wako, Saitama, Japan — [3]Center for Nuclear Study, University of Tokyo,Tokyo, Japan — [4]Advanced Science Research Center, Japan Atomic Energy Agency, Ibaraki , 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 γ-ray spectroscopy and mass measurements in Ar, Ca and Ti isotopes. 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 γ-rays from ^{57,59}Sc were identified for the first time. γ-ray spectra together with proposal for level schemes will be presented and compared to calculations in the framework of the SPDF-MU shell model.

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