HK 58: Nuclear Structure and Dynamics I

Time: Wednesday 16:30–19:00 Location: H-ZO 40

Invited Group Report HK 58.1 We 16:30 H-ZO 40

Aspects of gamma spectroscopy in reactions induced by light ions — •Nicolae Marius Marginean — IFIN-HH, Bucharest-Magurele, Romania

The reactions induced by light ions give access to nuclear states not accessible from reactions involving heavy-ion collisions. Light and heavy-ion induced reactions provide complementary experimental information and constitute mandatory steps toward complete gamma spectroscopy of a given nucleus. Several gamma spectroscopy techniques used in reactions induced by light ions as alpha particles or 7Li will be discussed and illustrated with recent experimental results in the Sn-Te region obtained from experiments performed at the Tandem accelerator in Bucharest.

HK 58.2 We 17:00 H-ZO 40

One-phonon excitations of ^{92}Zr from electron scattering * — •A. Scheikh Obeid, C. Walz, O. Burda, M. Chernykh, A. Krugmann, I. Poltoratska, and N. Pietralla — Institut für Kernphysik, Technische Universität Darmstadt, Germany

Low-lying collective vibrational excitations in ^{94}Mo have previously been investigated with electron scattering experiments [1] at the 130 MeV superconducting electron accelerator S-DALINAC. The evaluation of the measured form factors as a function of momentum transfer had supported the one-phonon interpretation of symmetric and mixed-symmetric states (MSSs) which have been defined in the framework of IBM-2. In the neighbouring even-even isotone ^{92}Zr formed by N=52 neutrons with two valence neutrons and Z=40 with no protons occupying the $\pi(g_{9/2})$ sub-shell a stronger configurational isospin polarization of the one-phonon states than in ^{94}Mo is expected [2]. In order to verify this expectation, a new electron scattering experiment at the S-DALINAC has been performed. Our data and a comparison to the momentum-transfer dependence of the form factor of the 2^+ states will be presented. The E2 transition strength of the one-quadrupole phonon states and the E3 transition strength of the one-octupole phonon state have been extracted and will be compared to previously derived spectroscopic data on MSSs of ^{92}Zr [3].

[1] O. Burda *et al*, Phys. Rev. Lett. **99**, 092503 (2007).
[2] J. D. Holt *et al*, Phys. Rev. C **76**, 034325 (2007).
[3] C. Fransen *et al*, Phys. Rev. C **71**, 054304 (2005).
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HK 58.3 We 17:15 H-ZO 40

Yrast structure of 97Zr . — •Magdalena Matejska-Minda[1], Bogdan Fornal[1], Rafał Broda[1], M.P. Carpenter[2], R.V.F. Janssens[2], W. Królas[1], K. Mazurek[1], T. Pawłat[1], J. Wrzesinski[1], and S. Zhu[2] — [1]Institute of Nuclear Physics, Polish Academy of Sciences, Kraków — [2]Physics Division, Argonne National Laboratory, Argonne, IL, USA

The experiment performed at the ANL, USA, in which gamma rays emitted during reactions induced by a 48Ca beam on 208Pb and 238U targets were measured, showed that the process of fission of target-like nuclei populate relatively high-spin states in nuclei near 96Zr. One of the intense products was 97Zr for which information on higher lying yrast states was largely missing. We analyzed the spectra of gamma rays that were coincident with the beam pulse, and associated with subsequent detection of transitions deexciting the 7/2+ isomer. In this nucleus a series of gamma rays was displayed as candidates for higher lying transitions. Using those gamma rays as starting points, we identified lines preceding the isomer. These lines were used to extended the yrast states in 97Zr up to the excitation energy of 7294 keV and spin of approximately 33/2. In addition, the identification of high-spin excitations in 97Zr allowed to establish the states fed in the beta-decay branch of the 27/2- high-spin isomer in 97Y. The structure located in the present work will be discussed from the perspective of the shell model.

HK 58.4 We 17:30 H-ZO 40

Low-spin excitations in ^{98}Ru — •Désirée Radeck, Michael Albers, Christian Bernards, Christoph Fransen, Jan Jolie, and Dennis Mücher — Institut für Kernphysik, Universität zu Köln

In the context of collectivity in the A=100 mass region N=52 isotones were investigated in detail and phonon excitations - especially the mixed-symmetry (MS) states - were identified. In order to investigate how states with this MS character evolve with increasing valence neutron number N=54 isotones were studied. While in ^{96}Mo the one-phonon MS state $2^+_{1,\mathrm{ms}}$ was identified [1], ^{98}Ru shows a breakdown of vibrational structure above the two-phonon triplet and no candidate for the $2^+_{1,\mathrm{ms}}$ state was assigned [2]. The recently investigated N=54 isotone ^{100}Pd was explained well with an $U_{\pi\nu}(5)$ fit within the IBM-2. Furthermore, a candidate for the one-phonon MS $2^+_{1,\mathrm{ms}}$ state was determined [3]. To do further investigations on the N=54 isotone ^{98}Ru - in particular regarding the breakdown of vibrational symmetry and the one-phonon MS excitation - an experiment was performed at the Cologne Tandem Accelerator using the HORUS spectrometer. The nuclei were populated by the reaction ^{97}Mo(^{3}He,2n)^{98}Ru. By analysing the coincidence and $\gamma\gamma$ angular correlation data the level scheme was extended and clarified by determining spins, multipole mixing ratios and branching ratios. The low-energy excitations of positive parity will be discussed and compared to theoretical expectations. The results will be compared with those for other N=54 isotones. [1] S.R. Lesher et al., Phys. Rev. C 75, 2007. [2] R.B. Cakirli et al., Phys. Rev. C 70, 2004. [3] D. Radeck et al., submitted. Supported by DFG, grant Jo 391/3-2.

HK 58.5 We 17:45 H-ZO 40

Lifetime Measurements for non-yrast states in ^{118}Te — •C. Mihai[1], I. Cata-Danil[1], A.A. Pasternak[2], A.D. Efimov[2], L. Stroe[1], D. Filipescu[1], M. Ivascu[1], T. Glodariu[1], D. Bucurescu[1], G. Cata-Danil[3], N. Marginean[1], and N.V. Zamfir[1] — [1]National Institute for Physics and Nuclear Engineering "Horia Hulubei", Bucharest-Magurele, Romania — [2]Cyclotron Laboratory, A.F. Ioffe Physical Technical Institute,194021, St. Peterburg, Russia — [3]Physics Department, University "Politehnica", Bucharest, Romania

Lifetimes of excited states in ^{118}Te populated in the ^{115}Sn(α,n)^{118}Te reaction have been measured using the Doppler Shift Attenuation method (DSAM). A 15 pnA, 15 MeV ^{4}He2^+ beam delivered by the Bucharest FN-TANDEM impinged on a 3.72 mg/cm2 tin target, 56% enriched in ^{115}Sn. The non-selective character of the reaction allowed us to measure lifetimes of non-yrast states with spin up to 8^+, by line-shape analysis of the γ-ray spectra. The γ-rays emitted following the reaction were detected in 7 large volume HPGe detectors, 5 placed in a 37 degrees ring in the backward direction, one at 90 degree and one at various angles in the forward direction. Additionally, a NE213 liquid scintillator detector was used for the detection of neutrons emitted in the reaction in coincidence with γ-rays.

Lifetimes of the yrast states in ^{118}Te were previously measured in heavy ions reactions, both by DSAM and RDM methods. The new results obtained in this work for the non-yrast states together with the existing information on lifetimes in the ground state band of 118Te are discussed in the framework of the Interacting Bosons Model (IBM).

HK 58.6 We 18:00 H-ZO 40

New Nuclear Stability Islands of Octahedral and Tetrahedral Shapes — •Katarzyna Mazurek[1], Jerzy Dudek[2], Andrzej Gozdz[3], Dominique Curien[2], Maria Kmiecik[1], and Adam Maj[1] — [1]The Niewodniczański Institute of Nuclear Physics - PAN, ul. Radzikowskiego 152, PL-31-342 Kraków, Poland — [2]Institut de Recherches Subatomiques and Université Louis Pasteur, F-67037 Strasbourg Cedex 2, France — [3]Zakład Fizyki Matematycznej - Uniwersytet Marii Curie-Skłodowskiej, pl. Marii Curie-Skłodowskiej 1, PL-20031 Lublin, Poland

Large scale calculations based on the microscopic-macroscopic method with Woods- Saxon single particle potential guided by the use of the discrete point group symmetries allow us to find the new islands of nuclear stability. These new stability regions are the consequence of particularly strong shell effects which are obtained in the calculations when the nuclear mean field is allowed to deform by respecting some special the so called high-rank symmetry-point groups. The underlying mechanism is illustrated together with the full chain of the symmetry-associated magic numbers.

HK 58.7 We 18:15 H-ZO 40

Low-lying collective states in the O(6)-like nucleus ^{126}Xe — •Laurent Coquard[1], Norbert Pietralla[1], Georgi Rainovski[2],

Tan Ahn[3], Robert Janssens[4], and Michael Carpenter[4] — [1]Institut für Kernphysik, Technische Universität Darmstadt, 64289 Darmstadt, Germany — [2]Faculty of Physics, St. Kliment Ohridski University of Sofia, 1164 Sofia, Bulgaria — [3]WNSL, Yale University, New Haven, CT 06520, USA — [4]Argonne National Laboratory, 700 South Cass Avenue, Argonne, Illinois 60439, USA

Low-lying collective excited states in ^{126}Xe have been investigated via the ^{12}C(^{126}Xe,^{126}Xe*) Coulomb excitation reaction @ 85% of the Coulomb barrier (399MeV) at the Gammasphere Ge-detector array at the Argonne National Laboratory. Absolute E2 transitions strengths have been obtained from the COULEX cross sections that were deduced from the relative γ-ray yields as in [1]. These experimental values are then compared with the theoretical values calculated within the Interacting Boson Model [2,3] near the O(6) limit. The agreement between the measured B(E2) values and the ones predicted by the IBM, on an absolute scale, enables us to understand the decay of the low-lying collective states in terms of σ and τ selection rules for the O(6)-like nucleus ^{126}Xe.

[1] G. Rainovski *et al*, Phys. Rev. Lett. 96, 122501 (2006).
[2] A. Arima and F. Iachello, Phys. Rev. Lett. **40**, 385 (1978).
[3] F. Iachello and A. Arima, The Interacting Boson Model (Cambridge University Press, Cambridge, 1987).

HK 58.8 We 18:30 H-ZO 40

Monte Carlo optimization of the High Resolution Gamma Spectroscopy Germanium Array for DESPEC — •Maria Doncel[1], Begoña Quintana[1], Alejandro Algora[2], Felipe Lorenzo[1], and Pavel Detistov[1] — [1]Departamento de Física Fundamental. Universidad de Salamanca, 37008 Spain — [2]Instituto de Física Corpuscular. Universidad de Valencia, 46071 Spain

In this work, we present the results obtained by Monte Carlo simulations with Geant4 aimed to search the best response of the high resolution gamma spectroscopy germanium array for DESPEC (Decay Spectroscopy) that is going to be built at FAIR (GSI). This array will be based on the new concepts of the pulse shape analysis, γ-ray tracking and imaging. The technical proposal is based on planar germanium detectors due to for the new capabilities we want to develop, high position and energy resolution is needed, and in this terms planar detectors are better than coaxial detectors. In our study, we have optimized the value of the principal parameters that can affect the quality of the system and the best geometry for the experiments proposed for this array. Thinking in the capabilities of tracking and imaging, we have also considered different configurations of planar detectors with the objective of knowing which of them has the best specifications in terms of ϵ and P/T in a wide range of energies (from 100 keV to 8 MeV). In the simulations we take into account an extended source in the implantation plane therefore we obtain a map of the efficiency and P/T for all the possible emitting points.

HK 58.9 We 18:45 H-ZO 40

Simulations and first feasibility experiment for EXL — •Hossein Moeini[1] and Nasser Kalantar-Nayestanaki[2] — [1]KVI, Groningen, The Natherlands — [2]KVI, Groningen, The Natherlands

The EXL objective is mainly to focus on light-ion reactions in inverse kinematics using a universal detector system providing high resolution and large solid angle coverage in kinematically complete measurements. Hence one of the main parts of the project is the EXL Silicon Particle Array (ESPA) and EXL Gamma and Particle Array (EGPA). The analysis of the recoil detector data taken during the test run in 2005 has shown that having a comprehensive simulation package for the EXL setup is highly essential in order to fully understand the data. While there has been already some simulation activities going on for the EXL, we started with a Geant4 code to integrate all the necessary parts of the detection system in the simulations. These include ESPA, EGPA, forward detectors for high-energy particles, and the magnetic lattice of the ring leading to the heavy-ion detection systems. In this presentation, an overview of the simulations along with some results will be shown.