HK 70: Structure and Dynamics of Nuclei XV

Time: Thursday 15:45–17:15 Location: SCH/A215

Group Report HK 70.1 Thu 15:45 SCH/A215

Evolution of low-lying M1 modes in germanium isotopes — Stefan Frauendorf[1] and •Ronald Schwengner[2] — [1]University of Notre Dame, Indiana 46556, USA — [2]Helmholtz-Zentrum Dresden-Rossendorf, Germany

Magnetic dipole strength functions are determined for the series of germanium isotopes from $N = Z = 32$ to $N = 48$ on the basis of a large number of transition strengths calculated within the shell model. The evolution of the strength with increasing neutron number in the $1g_{9/2}$ orbital is analyzed. A bimodal structure comprising an enhancement toward low transition energy and a resonance in the region of the scissors mode is identified. The low-energy enhancement is strongest near closed shells, in particular at the almost completely filled $1g_{9/2}$ orbital, while the scissorslike resonance is most pronounced in the middle of the open shell, which correlates with the magnitude of the also deduced electric quadrupole transition strengths. The results are consistent with previous findings for the shorter series of iron isotopes [1] and prove the occurrence and correlation of the two low-lying magnetic dipole modes as a global structural feature [2].

[1] R. Schwengner, S. Frauendorf, B.A. Brown, Phys. Rev. Lett. **118**, 092502 (2017).

[2] S. Frauendorf, R. Schwengner, Phys. Rev. C **105**, 034335 (2022).

HK 70.2 Thu 16:15 SCH/A215

Coulomb excitation and lifetime measurements in $^{84-86}$Ge with relativistic radioactive ion beams — •U. Ahmed[1,2], V. Werner[1,2], F. Browne[3], M. L. Cortés[4], N. Pietralla[1], and K. Wimmer[5] for the HiCARI-Collaboration — [1]IKP, TU Darmstadt, Germany — [2]HFHF, GSI Darmstadt, Germany — [3]CERN, Geneva, Switzerland — [4]RIKEN, Wako, Japan — [5]GSI, Darmstadt, Germany

Coulomb excitation cross sections of $^{84-86}$Ge nuclei and level lifetimes were investigated through reactions of Ge and As beams on heavy and light targets. The cross sections of these reactions will be determined from the ratio of incoming and outgoing particles and de-excitation γ-ray peak areas as measured by the High-resolution Cluster Array (HiCARI) at RIKEN-RIBF in Japan. The ongoing gamma-ray analysis aims at the measurement of the $E2$ transition probabilities of the lowest excited 2^+ states to chart the evolution of collectivity in the Ge chain above the $N = 50$ neutron shell closure. First steps of the analysis will be presented, namely the particle identification for the incoming particles from the BigRIPS fragment separator and the outgoing particles in the ZeroDegree spectrometer. Additionally, Doppler-corrected gamma-ray spectra based on the reconstructed velocity of incoming ions will be presented.

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HK 70.3 Thu 16:30 SCH/A215

The isovector spin-$M1$ response of ^{90}Zr and ^{92}Mo — •A. Gupta[1], V. Werner[1], K.E. Ide[1], A.D. Ayangeakaa[2,3], M. Beuschlein[1], S.W. Finch[3,4], U. Friman-Gayer[3,4,5], D. Gribble[2,3], J. Hauf[1], J. Isaak[1], X. James[2,3], R.V.F. Janssens[2,3], S.R. Johnson[2,3], J. Kleemann[1], P. Koseoglou[1], T. Kowalewski[2,3], B. Löher[6], O. Papst[1], N. Pietralla[1], A. Saracino[2,3], and D. Savran[6] — [1]IKP, TU Darmstadt — [2]UNC, Chapel Hill, NC, USA — [3]TUNL, Durham, NC, USA — [4]Duke U., Durham, NC, USA — [5]ESS, Lund, SE — [6]GSI, Darmstadt

For the $N = 50$ isotones ^{90}Zr and ^{92}Mo, additional isovector spin-flip M1 (IVSM1) strength is expected for ^{92}Mo in comparison to ^{90}Zr because of the two additional protons in the proton $g_{9/2}$ orbital above the closed pf shell. In addition, the IVSM1 resonance is closely related to Gamow-Teller strengths and can serve to constrain the calculation of electron-capture rates in core-collapse supernova scenarios[1]. Using the newly available hybrid array of HPGe Clover and $LaBr_3$ detectors at the High Intensity γ-ray source (HIγS), we probed the dipole response of both isotopes in an integral-spectroscopy approach below neutron separation thresholds.The $E1$ and $M1$ strengths will be determined up to about 9 MeV by measuring the asymmetries resulting from the excitation of the target nuclei by the fully-polarized γ-ray beam. The experimental method and first results will be discussed.

Supported by DFG Project No.279384907-SFB 1245 and the U.S. DOE Grant No. DE-FG02-97ER41041 and No. DE-FG02-97ER41033.

[1] K. Langanke et al., Rep. Prog. Phys. **84**, 066301 (2021)

HK 70.4 Thu 16:45 SCH/A215

Lifetime measurement of low-lying states in ^{92}Mo via γ-γ fast-timing spectroscopy — •Mario Ley[1], Lukas Knafla[1], Andreas Harter[1], Arwin Esmaylzadeh[1], Jan Jolie[1], and Piet Van Isacker[2] — [1]Institut für Kernphysik, Universität zu Köln — [2]Grand Accélérateur National d'Ions Lourds, Caen

Lifetimes of the first excited states in ^{92}Mo were measured using the digital γ-γ fast-timing technique with a detector array consisting of $LaBr_3$(Ce) and HPGe detectors. States were populated in a ^{90}Zr(α,2nγ)^{92}Mo reaction using the FN-Tandem accelerator of the institute for nuclear physics at the university of Cologne. The symmetrised centroid shift method [1], which is suitable for the determination of lifetimes in the pico- to nanosecond regime, was used to determine the lifetimes. The experimental results are used in a semiempirical approach which uses a single shell ($1g_{9/2}$) orbit to predict the B(E2) values in the N = 50 isotones from ^{93}Tc up to ^{98}Cd.

Work supported by DFG grant JO391/18.1

[1] J.-M. Régis et al., Nucl. Instrum. Methods Phys. Res. A 897 (2018)

HK 70.5 Thu 17:00 SCH/A215

Electron-Gamma Coincidence Measurements at S-DALINAC — •Gerhart Steinhilber, Jonny Birkhan, Isabelle Brandherm, Juliane Buschinger, Bastian Hesbacher, Johann Isaak, Igor Jurosevic, Peter von Neumann Cosel, Norbert Pietralla, Maxim Singer, and Maximilian Spall — IKP, Technische Universität Darmstadt

Inclusive (e,e') electron scattering is an established tool in nuclear physics that provides insights in nuclear structure with high accuracy because of its pure electromagnetic nature. (e,e'γ) coincidence experiments preserve this strength of inclusive electron scattering while additional information, for example, γ-decay branchings of PDR/GDR and the interference of longitudinal and transversal components of low-lying electric dipole excitations are accessible. The existing (e,e') setup at S-DALINAC was extended by a detector array consisting of 6 $LaBr_3$:Ce detectors. In 2021 a successful (e,e'γ) measurement was conducted on a mid-heavy nucleus, ^{96}Ru, for the first time. The main goal of this measurement was to study the B(M1,$2^+_{ms}\rightarrow 2^+_1$) and B(E2,$2^+_{ms}\rightarrow 0^+_1$) decay transition strengths of the 2^+_{ms} state of ^{96}Ru. Data were taken at excitation energies below and above the neutron separation threshold allowing a variety of physics cases to be studied. This talk will present the (e,e'γ) coincidence setup and preliminary results of the ^{96}Ru measurement.

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