HK 28: Structure and Dynamics of Nuclei VII

Zeit: Dienstag 16:30–18:15 Raum: S1/01 A04

Gruppenbericht HK 28.1 Di 16:30 S1/01 A04

The low-lying collective multipole response of atomic nuclei — •Mark Spieker[1], Vera Derya[1], Andreas Hennig[1], Pavel Petkov[1,2,3], Simon G. Pickstone[1], Sarah Prill[1], Vera Vielmetter[1], Michael Weinert[1], Julius Wilhelmy[1], and Andreas Zilges[1] — [1]Institute for Nuclear Physics, University of Cologne, Cologne (Germany) — [2]INRNE, Bulgarian Academy of Sciences, Sofia (Bulgaria) — [3]National Institute for Physics and Nuclear Engineering, Bucharest (Romania)

We present experimental results on the low-lying multipole response, which were obtained with the recently established DSA-method in Cologne [1]. Nuclear level lifetimes in the sub-ps regime are extracted by means of centroid-shifts utilizing the $(p, p'\gamma)$ reaction at the 10 MV FN-Tandem accelerator in Cologne [1,2]. The scattered protons are coincidently detected with the deexciting γ rays using the SONIC@HORUS detector array, which allows for a precise determination of the reaction kinematics. In addition to the pioneering results on octupole and hexadecapole mixed-symmetry states of ^{96}Ru [2], this contribution will feature new results on low-lying quadrupole-octupole coupled states and on the low-lying $E2$ strength of ^{112,114}Sn, which was recently discussed to be generated due to a quadrupole-type oscillation of the neutron skin against the isospin-saturated core [3]. Supported by the DFG (ZI-510/7-1). M.S., S.G.P., S.P., and J.W. are supported by the Bonn-Cologne Graduate School of Physics and Astronomy. [1] A. Hennig et al., NIM A **758**, 171 (2015), [2] A. Hennig et al., PRC **90**, 051302(R) (2014), [3] M. Spieker et al., PLB **752**, 102 (2016)

HK 28.2 Di 17:00 S1/01 A04

Pygmy quadrupole resonance as a manifestation of the nuclear skin — •Nadia Tsoneva[1,2] and Horst Lenske[2] — [1]Frankfurt Institute for Advanced Studies (FIAS), 60438 Frankfurt am Main, Germany — [2]Institut für Theoretische Physik, Universität Gießen, Heinrich-Buff-Ring 16, D-35392 Gießen, Germany

Recently, a new mode of nuclear excitation called pygmy quadrupole resonance (PQR) was theoretically predicted in the framework of energy-density functional (EDF) theory plus three-phonon quasiparticle-phonon model (QPM) in Sn isotopic chain. It is closely connected with higher order multipole vibrations of nuclear skin induced by the action of the electromagnetic and hadronic external fields. The predictions initiated new experiments using $(^{17}O,^{17}O'\gamma)$, $(\alpha, \alpha'\gamma)$ and (γ, γ') reactions which were carried out in ^{124}Sn nucleus. The aim was to probe for the first time experimentally, the possibility of existence of PQR. The detailed analysis of the obtained experimental results in comparison with the EDF+QPM theory indicates clearly the presence of a multitude of discrete low-energy 2^+ excitations of neutron type which can be addressed to PQR mode. The independent measurements of B(E2) values with different probes and the theory allow to identify the dominant isoscalar character of these states. Furthermore, newly determined γ-decay branching ratios exclude a statistical origin of the PQR strength. The latter are important to discriminate between PQR and multiphonon excitations.
The work is supported by the HIC for FAIR within the framework of the LOEWE program.

HK 28.3 Di 17:15 S1/01 A04

Niveaudichte und Gammastärkefunktion von ^{208}Pb* — •Sergej Bassauer und Peter von Neumann-Cosel — Institut für Kernphysik, Technische Universität Darmstadt, Darmstadt, Germany

Die totale Niveaudichte sowie die Gammastärkefunktion inklusive der E1-, E2- und M1-Beiträge für den Kern ^{208}Pb wurden bestimmt. Diese basieren auf Daten aus polarisierter inelastischer Protonenstreuung, die in einem Anregungsenergiebereich zwischen 5 und 20 MeV am Research Center for Nuclear Physics (RCNP), Osaka, Japan aufgenommen wurden, sowie anderen Experimenten [1,2,3]. Die Ergebnisse werden mit experimentellen Daten anderer Gruppen [4] sowie mit theoretischen Modellen verglichen [5,6,7].
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HK 28.4 Di 17:30 S1/01 A04

Wavelet and fluctuation analysis of ^{120}Sn and ^{90}Zr(p,p') reaction data — •Andreas Ebert[1], Anna Maria Krumbholz[1], Chihiro Iwamoto[2], Peter von Neumann-Cosel[1], and Atsushi Tamii[2] — [1]Institut für Kernphysik, TU Darmstadt — [2]Research Center for Nuclear Physics, Osaka

In the recent years the wavelet analysis has been established as a tool in nuclear structure physics. For an analysis of the fine structure in the energy region of giant resonances the Discrete [1] and Continous Wavelet Transform [2] allows the determination of a phenomenological background and the extraction of characteristic scales, respectively, from scattering data. Furthermore a fluctuation analysis [3] provides spin- and parity-resolved level densities. Data on the Giant Dipole Resonance from ^{120}Sn and ^{90}Zr(p,p') reactions performed with a 295 MeV beam scattered under zero degrees at the Research Center for Nuclear Physics (RCNP) in Osaka/Japan [4,5,6] are analyzed. The extracted scales and level densities are compared with various theoretical predictions and decay mechanisms are identified.
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HK 28.5 Di 17:45 S1/01 A04

The electric dipole response of neutron rich tin isotopes — •Andrea Horvat[1], Thomas Aumann[1], Konstanze Boretzky[2], Jacob Johansen[3], Dominic Rossi[1], Fabia Schindler[1], and Philipp Schrock[4] for the R3B-Collaboration — [1]Institut für Kernphysik, TU Darmstadt, Germany — [2]GSI Helmholzzentrum für Schwerionenforschung, Darmstadt, Germany — [3]Aarhus University, Denmark — [4]The University of Tokyo, Japan

Studies of the dipole response in medium heavy and heavy neutron rich nuclei reveal valuable information about the isospin dependence of the nuclear equation of state. Therefore an experimental campaign investigating both the electric dipole response via Coulomb excitation and neutron removal along the tin isotope chain ($^{124-134}$Sn) has been carried out at the R3B (Reactions with Relativistic Radioactive Beams) setup at GSI (Helmholtzzentrum für Schwerionenforschung) for which the analysis is ongoing.

The E1 response was induced via relativistic Coulomb scattering by a lead target in inverse kinematics, and calls for a kinematically complete determination of all reaction products in order to reconstruct the excitation energy by means of the invariant mass method. The goal is to obtain the Coulomb excitation cross section up to the adiabatic cut-off energy, covering the giant dipole resonance (GDR) range.

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HK 28.6 Di 18:00 S1/01 A04

Nuclear reactions of neutron-rich Sn isotopes investigated at relativistic energies at R^{3}B — •Fabia Schindler[1], Thomas Aumann[1], Konstanze Boretzky[2], Philipp Schrock[3], Andrea Horvat[1], and Jacob Johansen[4] for the R3B-Collaboration — [1]TU Darmstadt — [2]GSI Helmholtzzentrum — [3]CNS, University of Tokyo — [4]Aarhus University

Nuclei with a large neutron excess are expected to form a neutron-rich surface layer which is often referred to as the neutron skin. The investigation of this phenomenon is of great interest in nuclear-structure physics and offers a possibility to constrain the equation-of-state of neutron-rich matter.
Assuming a geometrical description of reaction processes as in the eikonal approximation, nuclear-induced reactions are a good tool to probe the neutron skin. Measured reaction cross sections can be used to constrain the density distributions of protons and neutrons in the

nucleus and therefore the neutron-skin thickness.
For this purpose, reactions of neutron-rich tin isotopes in the A=124-134 mass range have been measured on a carbon target at the R^3B-setup at GSI in inverse kinematics in a kinematically complete manner. Preliminary results for the reaction cross sections of ^{124}Sn will be presented.
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