HK 4: Structure and Dynamics of Nuclei I

Zeit: Montag 16:45–18:30 Raum: F 2

Gruppenbericht HK 4.1 Mo 16:45 F 2

Measurements of total reaction cross sections in neutron-rich Sn isotopes at R^{3}B - A method to constrain the EOS — •Fabia Schindler[1,2], Thomas Aumann[1,2], Konstanze Boretzky[2], Andrea Horvat[1,2], Philipp Schrock[3], 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 (EOS) of neutron-rich matter. Due to the short-range nature of the nuclear interaction, nuclear-induced reactions are a good tool to probe nuclear sizes. 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.
Total reaction, charge changing, and neutron-removal cross sections of neutron-rich tin isotopes in the mass range from A=124 to A=134 have been measured on carbon targets at the R3B setup at GSI in inverse kinematics and, for the first time, with very large acceptance and in a kinematically complete manner. The measurements are compared to calculations based on different energy-density functionals and the impact on the neutron-skin thickness and key parameters of the EOS will be discussed.
This work is supported by HIC for FAIR, NAVI, the GSI-TU Darmstadt cooperation, and the BMBF project 05P15RDFN1.

HK 4.2 Mo 17:15 F 2

Systematics of the Electric Dipole Response in Stable Tin Isotopes* — •Sergej Bassauer[1], Peter von Neumann-Cosel[1], and Atsushi Tamii[2] for the E422-Collaboration — [1]Institut für Kernphysik, Technische Universität Darmstadt, D-64289 Darmstadt, Germany — [2]Research Center for Nuclear Physics, Osaka 567-0047, Japan

The electric dipole is an important property of heavy nuclei. Precise information on the electric dipole response provides information on the electric dipole polarisability which in turn allows to extract important constraints on neutron-skin thickness in heavy nuclei and parameters of the symmetry energy. The tin isotope chain is particularly suited for a systematic study of the dependence of the electric dipole response on neutron excess as it provides a wide mass range of accessible isotopes with little change of the underlying structure. Recently an inelastic proton scattering experiment under forward angles including 0° on ^{112,116,124}Sn was performed at the Research Centre for Nuclear Physics (RCNP), Japan with a focus on the low energy strength and polarisability. In this talk first results and further analysis plans will be discussed.

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HK 4.3 Mo 17:30 F 2

Dipole polarizability of neutron rich tin isotopes — •Andrea Horvat[1,2], Thomas Aumann[1,2], Konstanze Boretzky[2], Dominic Rossi[1,2], Fabia Schindler[1,2], Philipp Schrock[3], and Dmytro Symochko[1] for the R3B-Collaboration — [1]TU Darmstadt, Germany — [2]GSI Helmholtzzentrum, Darmstadt, Germany — [3]CNS, University of Tokyo, Japan

Collective excitation modes in neutron rich nuclei contain valuable information about the isospin dependence of the nuclear equation of state (EOS). A key observable in this regard is the dipole polarizability, a quantity shown be strongly related to the EOS slope parameter L.

To this purpose an experimental campaign aimed at measuring the dipole response of the neutron rich side of the tin isotopic chain ($^{124-132}$Sn) has been conducted at GSI Helmholtzzentrum für Schwerionenforschung. The method used was relativistic Coulomb scattering in inverse kinematics. The present status of the analysis will be presented.

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HK 4.4 Mo 17:45 F 2

Observation of single-particle nature of the low-lying E1 strength in ^{120}Sn — •Michael Weinert, Michelle Färber, Miriam Müscher, Simon G. Pickstone, Mark Spieker, Julius Wilhelmy, Sarah Prill, and Andreas Zilges — Institute for Nuclear Physics, University of Cologne.

A ^{119}Sn(d,pγ) experiment was performed using the combined setup SONIC@HORUS at the 10 MV FN Tandem accelerator in Cologne. The excitation of states in the region of the Pygmy Dipole Resonance (PDR) via this neutron-transfer reaction was investigated in detail. The setup consisted of 14 HPGe and 6 ΔE-E silicon telescope detectors, allowing an offline selection of excitation and deexcitation channels due to the coincident detection of γ-rays and charged particles. Data show a clear excitation of states in the PDR region and several states in this region were identified as J=1 states by comparison to data from a Nuclear Resonance Fluorescence (NRF) experiment. Individual branching ratios could be determined, shedding more light on the internal structure of the PDR. By normalizing the relative excitation in the (d,pγ) reaction to the B(E1) values extracted from NRF, a splitting into two groups of states seems evident, which might hint at a different single-particle character of these groups. This contribution will present the (d,pγ) experiment and all observables determined. Furthermore, results will be put into context by comparison to data from other experiments, i.e., NRF and (p,p') experiments.

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HK 4.5 Mo 18:00 F 2

Soft-dipol excitation in neutron-rich Sn-isotopes — •Joachim Tscheuschner and Thomas Aumann for the DALI-LaBr-RIBF-Collaboration — TU Darmstadt

To investigate the pygmy-dipole resonance (PDR) in the unstable Sn-128 and Sn-132 isotopes, an alpha-scattering experiment was performed at RIKEN, Japan. The photons of the excited states are measured with a high efficiency detector-array consisting of NaI crystals (DALI2) and in forward-directions large volume LaBr crystals (HECTOR). With alpha-scattering mainly the isoscalar modes are excited, through comparison with Coulomb-excitation it is possible to disentangle the isovector and the isoscalar part of the PDR. The aim of the experiments is to study the the development of the PDR as a function of the neutron-excess. In this contribution the experiments and results of the ingoing analysis are presented. This project is supported by by DFG (SFB1245).

HK 4.6 Mo 18:15 F 2

Measurement of the E1 Strength in ^{112}Sn with NEPTUN — •Diego Semmler[1], Thomas Aumann[1,2], Martin Baumann[1], Michael Beckstein[1], Yevhen Kozymka[1], Philipp Kuchenbrod[1], Norbert Pietralla[1], Heiko Scheit[1], Saket Suman[1], Dmytro Symochko[1], and Sebastian Vaupel[1] — [1]TU Darmstadt, Darmstadt, Germany — [2]GSI, Darmstadt, Germany

The low energy photon tagger NEPTUN at the S-DALINAC delivers a quasi-monoenergetic photon beam between about 1 MeV and 20 MeV with a resolution of approximately 25 keV. In this talk results from (γ,γ')-reactions in the commissioning with ^{32}S and the first measurement with ^{112}Sn targets will be presented. An excitation energy range from 7.6 MeV to 9.6 MeV has been covered.

This measurement helps to understand the discrepancy observed in the data on E1 strength distribution obtained in recent NRF [1] and (p, p') scattering [2] experiments. It shows that experiments with (quasi-)monochromatic γ-beams are required in this energy regime.

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[1] B. Özel-Tashenov et al. "Low-energy dipole strength in ^{112,120}Sn". In: Physical Review C 90 (2014)

[2] A. M. Krumbholz et al. "Low-energy electric dipole response in ^{120}Sn". In: Physics Letters B 744 (2015), pp. 7 – 12