HK 42: Structure and Dynamics of Nuclei VIII

Zeit: Mittwoch 16:30–18:30 Raum: HS 14

Gruppenbericht HK 42.1 Mi 16:30 HS 14

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, TU Darmstadt, Darmstadt, Germany — [2]RCNP, Osaka, Japan

The electric dipole is an important property of heavy nuclei. Precise knowledge of 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 even-even $^{112-124}$Sn isotopes 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 will be discussed.

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HK 42.2 Mi 17:00 HS 14

Electric Dipole Response of Neutron Rich Tin Isotopes — Andrea Horvat[1], Thomas Aumann[1,2], •Philipp Schrock[3], Konstanze Boretzky[2], Igor Gasparic[4], Dominic Rossi[1], Fabia Schindler[1], and Lorenzo Zanetti[1] for the R3B-Collaboration — [1]TU Darmstadt, Germany — [2]GSI Helmholtzzentrum, Darmstadt, Germany — [3]CNS, The University of Tokyo — [4]Ruder Boskovic Institute, Zagreb, Croatia

One of the most active pursuits in nuclear physics nowadays is to arrive at a better understanding of forces which bind the nucleus and govern the behavior of objects such as neutron stars, involving a great deal of theoretical and experimental effort. Accurate measurements of observables sensitive to isovector properties are needed in order to provide better constraints on nuclear interaction models in the isovector channel. For this purpose an experimental campaign investigating the electric dipole response via Coulomb excitation 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). Coulomb excitation cross sections have been extracted in the 1, 2 and 3 neutron decay channels.

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HK 42.3 Mi 17:15 HS 14

Investigation of the low-lying dipole response in ^{120}Sn — •M. Müscher[1], M. Färber[1], D. Savran[2], P. Scholz[1], R. Schwengner[3], M. Spieker[4], J. Wilhelmy[1], and A. Zilges[1] — [1]University of Cologne, Institute for Nuclear Physics, Germany — [2]GSI, Darmstadt, Germany — [3]HZDR, Dresden-Rossendorf, Germany — [4]NSCL, Michigan State University, MI 48824, USA

The low-lying dipole strength of the proton-magic nucleus ^{120}Sn was investigated in a real-photon scattering experiment. The measurement was performed at the γELBE facility at the Helmholtz-Zentrum Dresden-Rossendorf [1] where bremsstrahlung was used as photon source with an endpoint energy of 9.5 MeV.
The nucleus ^{120}Sn is a well-suited candidate for a systematic study of the Pygmy Dipole Resonance (PDR) because the tin isotopic chain covers a large range of N/Z ratios. Furthermore, the results of a previous bremsstrahlung experiment on ^{120}Sn neither confirmed the expectation of an increase of the electric dipole strength with an increasing N/Z ratio [2] nor fit to the results of a (p,p') measurement [3]. To investigate these discrepancies this additional (γ, γ') experiment was performed. Experimental details and preliminary results will be presented.

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[1] R. Schwengner *et al.*, Nucl. Instr. and Meth. A **555** (2005) 211.
[2] B. Özel-Tashenov *et al.*, Phys. Rev. C **90** (2014) 024304.
[3] A.M. Krumbholz *et al.*, Phys. Lett. B **744** (2015) 7.

HK 42.4 Mi 17:30 HS 14

Electric dipole excitation of neutron-rich nuclei in a relativistic energy density functional approach — •Stefan Typel — Institut für Kernphysik, Technische Universität Darmstadt — GSI Helmholtzzentrum für Schwerionenforschung, Darmstadt

Neutron-rich nuclei are expected to exhibit a low-lying pygmy resonance in the strength distribution of electric dipole excitations that is correlated with the neutron skin thickness and the slope of the nuclear symmetry energy. This feature can be studied theoretically with the help of relativistic energy density functionals employing a systematic variation of the isovector part in the effective interaction. In contrast to conventional RPA-type calculations, a shell-model inspired approach is explored in the present contribution with particular interest in the evolution of the dipole strength distribution across neutron shell closures.

HK 42.5 Mi 17:45 HS 14

Study of dipole excitations in ^{124}Sn via inelastic proton scattering @ 15 MeV — •M. Färber[1], A. Bohn[1], V. Everwyn[1], M. Müscher[1], S.G. Pickstone[1], S. Prill[1], P. Scholz[1], M. Spieker[2], M. Weinert[1], J. Wilhelmy[1], and A. Zilges[1] — [1]University of Cologne, Institute for Nuclear Physics, Germany — [2]NSCL, Michigan State University, MI 48824, USA

The E1 strength distribution of a nucleus can be investigated via different excitation mechanisms. The tin isotopic chain is perfect for systematic studies, favoured by their magic proton number. Experiments on ^{124}Sn using $(\alpha,\alpha'\gamma)$ [1], (γ,γ') [2] as well as $(^{17}O,^{17}O'\gamma)$ [3] were already performed. The different excitation pattern observed in experiments with hadronic probes compared to electromagnetic probes might indicate a more isospin-mixed character of the Pygmy Dipole Resonance in contrast to the isovector character of the Giant Dipole Resonance [4]. To further investigate this phenomenon, a (p,p'γ) experiment at E_p=15 MeV was performed at the Cologne Tandem accelerator. The combined setup SONIC@HORUS was used, enabling a coincident measurement of the scattered protons and γ-rays. Apart from the excitation response, preliminary results on branching ratios will be presented. Supported by DFG(ZI 510/7-1). A.B. is supported by the Bonn-Cologne Graduate School of Physics and Astronomy.

[1] J. Endres *et al.*, Phys. Rev. C **85**, 064331 (2012).
[2] K. Govaert *et al.*, Phys. Rev. C **57**, 2229 (1998).
[3] L. Pellegri *et al.*, Phys. Lett. B **738**, 519 (2014).
[4] D. Savran *et al.*, Prog. Part. Nucl. Phys. **70**, 210 (2013).

HK 42.6 Mi 18:00 HS 14

Looking below the threshold: low energy spectrum for neutron-rich Tin isotopes — •Lorenzo Zanetti[1], Thomas Aumann[1,2], Philipp Schrock[3], Kostanze Boretzky[2], Igor Gasparic[4], Dominic Rossi[1], Dmytro Symochko[1], Andrea Horvat[1], and Fabia Schindler[1] for the R3B-Collaboration — [1]TU Darmstadt — [2]GSI Helmholtzzentrum — [3]CNS, The University of Tokyo — [4]Ruder Boskovic Institute, Zagreb, Croatia

Research on the nuclear equation of state (EOS) is very active: many theoretical frameworks provide a way to put constraint on the EOS's isovector properties, using observables relating to the electric dipole response of neutron-rich nuclei. One of such observables is the dipole polarizability, α_D.

A Coulomb excitation experiment was performed at GSI to investigate the E1 response of neutron-rich isotopes of Tin with the R3B/LAND setup. The data collected during the campaign, especially for ^{132}Sn, can be used to estimate α_D, provided a good enough understanding of the gamma deexcitation of the nucleus is reached. We are currently analysing the lower energy (below the neutron separation threshold) part of the gamma spectrum in order to reach such understanding.

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HK 42.7 Mi 18:15 HS 14

Low-energy dipole response of the halo nuclei ^{6,8}He — •Christopher Lehr[1] and Thomas Aumann[1,2] for the NeuLAND-SAMURAI-Collaboration — [1]TU Darmstadt — [2]GSI Helmholtzzentrum

The heaviest bound helium isotopes ^{6}He and ^{8}He are 2- and 4-neutron

halo nuclei with a clear alpha plus 2n and 4n structure.

The multi-neutron decay of ^{6}He and ^{8}He after heavy-ion induced electromagnetic excitation reactions has been measured kinematically complete to study the dipole response of these nuclei.

An experiment was performed at the RIBF facility at the RIKEN Nishina Center in Japan. The combination of the neutron detectors NEBULA and NeuLAND at the SAMURAI setup and the high beam intensities available at RIBF made this measurement possible for the first time. The experimental method is based on the measurement of the differential cross section via the invariant-mass method, which allows to extract the dipole strength distribution dB(E1)/dE and the photo-absorption cross section. To induce electromagnetic excitation reactions of ^{6}He and ^{8}He and to treat the contribution of nuclear reactions, a series of targets with increasing Z was used.

During the talk the experimental setup and the method are explained. An update on the analysis is presented, focusing on the fragment identification and neutron reconstruction.

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