HK 40: Structure and Dynamics of Nuclei VIII

Zeit: Mittwoch 16:30–18:15 Raum: HZO 70

Gruppenbericht HK 40.1 Mi 16:30 HZO 70

Investigation of the dipole response in atomic nuclei in different mass regions in photon scattering experiments — •Julius Wilhelmy[1], Johann Isaak[2], Bastian Löher[3], Miriam Müscher[1], Simon G. Pickstone[1], Norbert Pietralla[4], Deniz Savran[3], Philipp Scholz[1], Mark Spieker[1,5], Werner Tornow[6], Volker Werner[4], and Andreas Zilges[1] — [1]Institute for Nuclear Physics, University of Cologne — [2]RCNP, Osaka — [3]GSI, Darmstadt — [4]Institute for Nuclear Physics, TU Darmstadt — [5]NSCL, Michigan State University — [6]Department of Physics, Duke University

The understanding of different generating mechanisms of electric (E1) and magnetic (M1) dipole excitations in atomic nuclei are of fundamental importance for the description of nuclear matter. Level lifetimes, γ-decay branching ratios and parity quantum numbers of excited $J = 1$ states are extracted from high resolution photon scattering experiments in a model-independent way. Experimental results of complementary measurements with continuous photon flux distributions (at the bremsstrahlung facilities DHIPS [1] and γELBE [2]) and quasi-monoenergetic beams (at HIγS [3]) for nuclei in the A≈50 and A≈140 mass regions will be presented and discussed. First results of the dipole response of ^{87}Rb will be shown.

Supported by the BMBF (05P15PKEN9), JW is supported by the Bonn-Cologne Graduate School of Physics and Astronomy.

[1] K. Sonnabend, D. Savran *et al.*, NIM A 640 (2011) 6-12
[2] R. Schwengner *et al.*, NIM A 555 (2005) 211
[3] B. Löher *et al.*, NIM A 723 (2013) 136

HK 40.2 Mi 17:00 HZO 70

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 40.3 Mi 17:15 HZO 70

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], Dmytro Symochko[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

The investigation of the nuclear equation of state (EOS), especially its isovector character, is at present one of the most active fields of pursuit in nuclear physics. It is already well established by various theoretical frameworks that observables related to the electric dipole response of heavy nuclei, such as the dipole polarizability, can be used to put constraints on isovector properties of the EOS.

In order to study the systematics of the E1 response on the neutron-rich side of the tin isotope chain ($^{124-132}$Sn) via the invariant mass method, a Coulomb excitation experiment has been carried out at the R3B/LAND setup at GSI (Helmholtzzentrum für Schwerionenforschung). The tin isotopes present an interesting case due to the doubly magic ^{132}Sn and the opportunity to compare the results to complementary methods utilizing normal kinematics for the stable isotope ^{124}Sn. The experimental setup, analysis method and current status of the analysis will be presented.

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HK 40.4 Mi 17:30 HZO 70

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 constant, α_D.

The S412 experiment at the GSI was a Coulomb excitation experiment investigating 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 full energy spectrum for the gamma deexictation is available. We are currently analysing the lower energy (below the neutron separation threshold) part of the gamma spectrum in order to complete the picture.

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HK 40.5 Mi 17:45 HZO 70

Study of the dipole response in ^{142}Ce — •Miriam Müscher[1], Anna Bohn[1], Michelle Färber[1], Johann Isaak[2], Simon G. Pickstone[1], Sarah Prill[1], Deniz Savran[3], Philipp Scholz[1], Mark Spieker[1,4], Vera Vielmetter[1], Michael Weinert[1], Julius Wilhelmy[1], and Andreas Zilges[1] — [1]Institute for Nuclear Physics, University of Cologne — [2]RCNP, Osaka, Japan — [3]GSI, Darmstadt — [4]NSCL, Michigan State University, MI 48824, USA

The $N = 84$ nucleus ^{142}Ce has been investigated in real photon scattering experiments to analyze the dipole response's evolution near the $N = 82$ shell closure. Two (γ,γ) experiments that selectively excite $J = 1$ states were performed. Firstly, ^{142}Ce was measured at the Darmstadt High Intensity Photon Setup (DHIPS) [1] using bremsstrahlung with an endpoint energy of 7.35 MeV. Secondly, an experiment was performed with a linearly polarized, quasi mono-energetic γ beam in the entrance channel at ten different beam energies at the High Intensity Gamma-Ray Source (HIγS) [2] facility of Duke University, Durham, USA. The photons of the subsequent decay provide information on ground state widths and parity quantum numbers of excited states. Within this contribution the experimental setups will be presented and first results will be discussed.

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[1] K. Sonnabend *et al.*, Nucl. Instr. and Meth. A 640 (2011) 6-12
[2] B. Löher *et al.*, Nucl. Instr. and Meth. A 723 (2013) 136

HK 40.6 Mi 18:00 HZO 70

Study of the Pygmy Dipole Resonance in ^{64}Ni via particle $-\gamma$ coincidence measurements — •Johann Isaak for the CAGRA-Collaboration — Research Center for Nuclear Physics, Osaka Univ., Japan

The low-energy part of the electric dipole response in the region of the Pygmy Dipole Resonance (PDR) [1] is studied in the rare nickel isotope ^{64}Ni via inelastic proton and α-scattering with subsequent γ spectroscopy of the decay channel. The aim is to determine the full dipole strength distribution to fill the gap between existing data on the stable isotopes ^{58,60}Ni [2,3] and the unstable ^{68}Ni [4] for the systematic investigation of the PDR as a function of the neutron-to-proton ratio. The energy loss of inelastically scattered protons and α particles were measured using the high-resolution magnetic Grand Raiden spectrometer at RCNP [5]. In coincidence, γ rays emitted from the target nuclei were detected by the γ-ray detector array CAGRA, which consisted of 12 Clover detectors and 4 $LaBr_3$ scintillators. The recent status of the data analysis and preliminary results will be presented.

[1] D. Savran, T. Aumann and A. Zilges, PPNP 70 (2013) 210.

[2] M. Scheck et al., PRC 87 (2013) 051304(R).
[3] M. Scheck et al., PRC 88 (2013) 044304.
[4] D. Rossi et al., PRL 111 (2013) 242503.
[5] M. Fujiwara et al., NIM A 422 (1999) 484.