HK 55: Structure and Dynamics of Nuclei 11

Time: Thursday 14:30–16:15 Location: T/SR19

Group Report HK 55.1 Thu 14:30 T/SR19

Location of the maximum of collectivity in $N > 40$ Fe and Cr isotopes* — •V. Werner[1,2], C. Louchart-Henning[1], C. Santamaria[3], A. Obertelli[3], P. Doornenbal[4], and F. Nowacki[5] for the SEASTAR-Collaboration — [1]TU Darmstadt — [2]Yale University — [3]CEA Saclay — [4]RIKEN — [5]IPHC, CNRS/IN2P3 and Université Louis Pasteur

The liquid-hydrogen target and TPC system MINOS has been combined with the DALI2 detector device for the first time at RIKEN-RIBF within the SEASTAR project. In the first experiment campaign, excited-state energies in neutron-rich Fe and Cr isotopes, as well as ^{78}Ni have been measured. The RIKEN-RIBF cyclotrons delivered a 345 MeV/u ^{238}U beam with an intensity of about 13 pnA, impinging on a Be target. Fission fragments were separated and identified using the BigRIPS spectrograph, and reaction products were analyzed using the ZeroDegree spectrograph behind the secondary target. First results on 2_1^+ and 4_1^+ energies give an indication for the location of the maximum of collectivity in the Fe and Cr isotopic chains. The new MINOS/DALI2 setup, experiment details, and first results on the Fe and Cr isotopes will be presented.

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HK 55.2 Thu 15:00 T/SR19

Reactions of neutron-rich Sn isotopes investigated at relativistic energies at R^{3}B — •Fabia Schindler[1], Thomas Aumann[1], Konstanze Boretzky[2], Jacob Johansen[1], and Philipp Schrock[1] for the R3B-Collaboration — [1]IKP, TU Darmstadt — [2]GSI Helmholtzzentrum

Reactions of neutron-rich tin isotopes in a mass range of A=124 to A=134 have been measured at the R^{3}B setup at GSI in inverse kinematics. Due to the neutron excess, which results in a weaker binding of the valence neutrons such isotopes are expected to form a neutron skin. The investigation of this phenomenon is an important goal in nuclear-structure physics.

Reactions of the tin isotopes with different targets have been performed kinematically complete. The taken data set therefore allows for the extraction of the neutron-skin thickness from two independent reaction channels. These are dipole excitations on the one hand and nuclear-induced reactions on the other hand. This contribution focuses on the latter mechanism. The analysis techniques which are used to extract the total charge-changing as well as the total neutron-removal cross section are presented using the example of ^{124}Sn. The total neutron-removal cross section is of particular interest because of its high sensitivity to the neutron-skin thickness.

This work is supported by HIC for FAIR, GSI-TU Darmstadt cooperation, NAVI and the BMBF project 05P12RDFN8.

HK 55.3 Thu 15:15 T/SR19

Entwicklung der Scherenmode in Gd Isotopen* — •Jacob Beller, Tobias Beck, Udo Gayer, Laura Mertes, Haridas Pai, Norbert Pietralla, Philipp Ries, Christopher Romig, Volker Werner und Markus Zweidinger — Institut für Kernphysik TU Darmstadt, Darmstadt, Deutschland

Kürzlich wurde in ^{154}Gd eine Kopplung der $J^\pi = 1^+$ Scherenmode zu anderen intrinsischen Anregungsmoden beobachtet [1]. Zum Studium der Scherenmode und ihrer Zerfallskanäle entlang des Gestaltphasenübergangs von sphärischen zu deformierten Kernen wurden die Nachbarisotope ^{152,156}Gd untersucht. Dazu wurden Experimente mit der Methode der Kernresonanzfluoreszenz am DHIPS Setup der TU Darmstadt und am HIGS Setup der Triangle Universities Nuclear Laboratory, NC, USA, durchgeführt. Messmethoden und Ergebnisse werden vorgestellt sowie ihre Sensitivität hinsichtlich des Phasenübergangs diskutiert.

[1] J. Beller *et al.*, PRL **111**, 172501 (2013).

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HK 55.4 Thu 15:30 T/SR19

Investigation of reduced transition-strengths in neutron-rich chromium isotopes — •Thomas Braunroth[1], Alfred Dewald[1], Christoph Fransen[1], Hironori Iwasaki[2], Antoine Lemasson[3], Silvia Lenzi[4], and Julia Litzinger[1] — [1]Institut für Kernphysik, Universität zu Köln, Germany — [2]National Superconducting Cyclotron Laboratory, MSU, USA — [3]GANIL, Laboratoire Commun DSM/CEA, France — [4]Department of Physics and Astronomy, University of Padova and INFN Sezione di Padova, Italy

Neutron-rich nuclei close to $N = 40$ are known for their rapid changes in nuclear structure. While ^{68}Ni exhibits signatures of a shell closure, experimental data - e.g. excitation energies of the 2_1^+-state and B(E2;$2_1^+ \rightarrow 0_1^+$)-values - along the isotopic chains in even more exotic Fe and Cr-isotopes suggest a sudden rise in collective behaviour for $N \rightarrow 40$. Lifetimes of low-lying yrast states in ^{58,60,62}Cr were measured with the Recoil Distance Doppler-shift (RDDS) technique at NSCL, MSU (USA) to deduce model independent B(E2)-values. After fragmentation of a primary ^{82}Se beam (E=140 AMeV) on a ^{9}Be target and subsequent filtering with the A1900 fragment separator, high purity ^{59,61,63}Mn-beams ($E \sim 95$ AMeV) impinged on the ^{9}Be plunger target, where excited states in the above mentioned Cr-isotopes were then populated in one proton knockout reactions. The S800 spectrograph allowed a clear recoil identification, which then lead to clean γ-spectra as measured by the Segmented Germanium Array (SeGA). Final results of this experiment will be shown and discussed in the context of state-of-the-art shell-model calculations.

HK 55.5 Thu 15:45 T/SR19

Neutronskin studies in heavy nuclei with coherent π^0 photoproduction — •Maria Isabel Ferretti Bondy for the A2-Collaboration — Institut für Kernphysik - Johannes Gutenberg Universität Mainz

The charge distribution of nuclei is known with very high accuracy, i.e. in electron scattering experiments, conversely, the mass distribution is experimentally less accessible and therefore less precisely known. An accurate determination of the neutron density distribution is of particular interest. Especially in nuclei with N » Z, a strong neutron skin is expected, since the excess neutrons are pushed outwards against surface tension by the coulomb forces. With the precise experimental determination of the neutron skin thickness essential constraints for the nuclear equation of state (EOS) can be provided and thus allowing to draw conclusions on the size of neutron stars.

The method of coherent π^0 photoproduction, $A(\gamma, \pi^0)A$, provides a powerful tool to determine the mass distribution of various nuclei. In a novel experimental campaign carried out in 2012 within the A2 collaboration at the Mainz Microtron (MAMI), five nuclei have been measured: ^{58}Ni, $^{116,120,124}Sn$, ^{208}Pb. The tin targets are of special interest because most of the systematic errors due to pion-nucleon interaction can be neglected, and they allow a precise investigation along an isotopic chain.

First results of these studies will be presented in this talk.

HK 55.6 Thu 16:00 T/SR19

Quasi-free one nucleon knockout reactions on neutron-rich Oxygen Isotopes — •Leyla Atar[1,2], Thomas Aumann[1,2], Carlos Bertulani[3], Stefanos Paschalis[1], and Chiara Nociforo[2] for the R3B-Collaboration — [1]TU Darmstadt, Darmstadt, Germany — [2]GSI, Darmstadt, Germany — [3]Texas A&M University-Commerce, Commerse, USA

Recent experiments have shown a reduction of spectroscopic strengths to about 60-70% for stable nuclei. When going to driplines this tendency is changing, loosely bound nucleons have spectroscopic strengths close unity while deeply bound nucleons have a large reduction of the strength. We aim to make a systematic study of spectroscopic factors (SF) of the Oxygen isotopes using quasi-free (p,2p) and (p,pn) knockout reactions in inverse kinematics. Quasi-free knockout reactions are a direct tool to study the occupancy and the location of valance and deeply bound single particle states. The Oxygen isotopes offer a large variation of separation energies which will allow us to obtain a qualitative and quantitative understanding of SF in a large variation of isospin asymmetry. For this we performed an experiment at the R3B-LAND setup at the GSI with secondary beams containing $^{14-24}$O. The $^{16-18}$O and $^{21-23}$O isotopes have been analyzed and the preliminary results will be presented. The results include the partial cross sections, gamma ray spectra of the residual fragments in coincidence, and the SF obtained via comparison with theory. This work is supported by HIC for FAIR, GSI-TU Darmstadt cooperation, and the BMBF project 05P12RDFN8.