

HK 46: Structure and Dynamics of Nuclei 10

Time: Wednesday 14:30–16:15

Location: T/SR14

HK 46.1 Wed 14:30 T/SR14

Isotope Shifts and Charge Radii in Zn around N=50 — ●LAURA GROB for the COLLAPS IS519-Collaboration — CERN, Geneva, Switzerland — Institut für Kernphysik, TU Darmstadt

For neutron-rich isotopes far from stability shell closures have been observed at neutron numbers that differ from the well-established magic ones. The weakening or disappearance of the magic number N=50 has been predicted for isotopes around the Z=28 shell closure and might be caused by tensor interactions. Laser spectroscopic studies of Cu (Z=29) and Ga (Z=31) around the N=50 shell closure have already provided information on level migration due to tensor effects. In both isotopic chains an inversion of the proton level occurs, detected by spin changes. To study the Z-dependence of this level migration and its link to the tensor interaction, collinear laser spectroscopy measurements on neutron-rich Zn were performed at COLLAPS/ISOLDE. The optical spectra comprise important information on the ground state properties of the measured isotopes such as spins, charge radii, magnetic and quadrupole moments. For Zn there are four stable isotopes for which charge radii are known from electron scattering experiments. This will allow us to calibrate the charge radius information in this region. This talk will briefly explain the experimental technique and setup, and will present the first results of isotope shifts and charge radii for the even Zn isotopes up to N=50.

HK 46.2 Wed 14:45 T/SR14

Coulombanregung von ^{48}K — ●BURKHARD SIEBECK für die IS482 - 2012-Kollaboration — IKP, Universität zu Köln

Isotope in der direkten Nachbarschaft von doppelt-magischen Kernen sind besonders geeignet zur Untersuchung von Einteilchenzuständen und effektiven Zweikörperwechselwirkungen. Im Falle von ^{48}K koppelt ein Neutron in der $p_{3/2}$ -Schale mit einem Protonloch in der $s_{1/2}$ - oder $d_{3/2}$ -Schale. Der niederenergetische Teil des Termschemas von ^{48}K , sowie Lebensdauern wurden mit einer tief inelastischen Transferreaktion bestimmt [1]. Komplementär wurden nun reduzierte Übergangswahrscheinlichkeiten gemessen. Hierzu wurde ein Coulombanregungs-experiment mit einem radioaktiven ^{48}K -Strahl vom REX-ISOLDE Beschleuniger bei einer Energie von 2,82 MeV/u und dem MINIBALL-Spektrometer durchgeführt. Die Abregung der ersten beiden angeregten Zustände von ^{48}K bei 143 keV und 279 keV sowie des ersten angeregten Zustandes des ^{104}Pd Targets wurden beobachtet. Mithilfe von GOSIA2 werden hieraus die Übergangsmatrixelemente bestimmt und mit theoretischen Werten aus Schalenmodellrechnungen verglichen.

Unterstützt durch BMBF (05P09PKCI5 und 05P12PKFNE)

[1] W. Krolas et al.; Phys. Rev. C 84, 064301 (2011)

HK 46.3 Wed 15:00 T/SR14

Low-lying structure of ^{30}Na and the sd - pf shell gap — ●MARINA PETRI — Institut für Kernphysik, Technische Universität Darmstadt, Darmstadt, Germany

Light neutron-rich nuclei around N=20 show properties that are not in line with their expected magicity but rather imply a deformed shape. These nuclei lie in the so-called “Island of Inversion” where the deformation is due to neutron cross-shell excitations, namely $\nu(sd)^{-2}(fp)^2$ configurations, dominating their ground and low-lying states. Recently, there has been much interest in studying the transition towards this region to determine the evolution of the N=20 shell gap and to provide a stringent test for nuclear models.

In this work the odd-odd nucleus ^{30}Na is studied via $1p$, $1p1n$ and $1n$ knockout reactions at the NSCL using ^{31}Mg , ^{32}Mg and ^{31}Na radioactive beams, respectively. Combining high-resolution γ -ray spectroscopy with the selectivity of the various reaction mechanisms we are able to distinguish multiple configurations. Negative parity states in ^{30}Na are identified for the first time, providing an important measure of the excitation of the $1p1h$ configuration. Gamma rays de-exciting both K=1 and K=2 $2p2h$ structures have been observed, while the rotational band built on the ground state has been established. These new results provide a stringent test for the state-of-the-art effective interactions used in this region and constrain the sd - pf shell gap.

HK 46.4 Wed 15:15 T/SR14

Single-particle structure of exotic beryllium isotopes studied in quasi-free (p,pn)-reactions — ●JULIAN KAHLBOW¹, THOMAS

AUMANN¹, CHRISTOPH CAESAR², and HEIKO SCHEIT¹ for the R3B-Collaboration — ¹IKP, TU Darmstadt, Germany — ²GSI, Darmstadt, Germany

The neutron-rich beryllium isotopes have been studied in inverse kinematics at the R³B-LAND setup at GSI. The high neutron-proton asymmetry leads to the breakdown of the $N = 8$ shell-closure in ^{12}Be . The ^{12}Be ground-state configuration is composed of s-,p- and d-wave for the valence-neutron pair.

Proton-induced quasi-free neutron-knockout reactions at relativistic energies are used to investigate these single-particle properties in a kinematically complete measurement. The ^{11}Be -halo fragment is either populated in the ground-state, in a low-lying excited or an unbound state that is identified. Finally, partial cross sections are extracted.

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

HK 46.5 Wed 15:30 T/SR14

Isomer measurements with the MR-TOF-MS at the FRS Ion Catcher — ●CHRISTINE HORNING for the FRS Ion Catcher-Collaboration — II. Physikalisches Institut, Justus-Liebig-Universität Giessen, Giessen, Germany

At the future Low-Energy Branch (LEB) of the Super-FRS at FAIR, the precision experiments MATS and LaSpec will be performed. The FRS Ion Catcher at GSI is the test facility for the future LEB, consisting of the following three key components. With the FRS projectile and fission fragments are produced at relativistic energies, separated in-flight and range-focused. Further they are slowed-down and thermalized in a cryogenic stopping cell (CSC) to kinetic energies of a few eV. A multiple-reflection time-of-flight mass spectrometer (MR-TOF-MS) is used to clean the beam from isobaric contaminants. Due to its ultra-high mass resolving power excited and ground state can be spatially separated and pure isomeric beams can be provided.

In the experiment in October 2014, mass measurements of the isomeric and ground states of projectile and fission fragments were performed with the MR-TOF-MS. The capability of the MR-TOF-MS of a simultaneous mass measurement of the ground and isomeric state is used to confirm excitation energies and yield ratios of isomers and it will open new possibilities for mass and isomer resolved decay spectroscopy. This will lead to a better understanding of the production mechanisms and yield rates of in-flight facilities.

HK 46.6 Wed 15:45 T/SR14

Radiale Dichteverteilung der Kernmaterie in ^{56}Ni — ●MIRKO VON SCHMID für die EXL E105-Kollaboration — Institut für Kernphysik, TU Darmstadt

Im Rahmen des laufenden EXL-Experimentierprogramms („EXotic nuclei studied in Light-ion induced reactions“) wurde am ESR („Experimental Storage Ring“, GSI) mit der Reaktion $^{56}\text{Ni}(p,p)^{56}\text{Ni}$ zum ersten Mal erfolgreich eine Kernreaktion mit gespeicherten, exotischen Schwerionen untersucht.

Das Kernziel des Experiments war dabei die Bestimmung der radialen Dichteverteilung des doppelt magischen $N = Z$ Kerns ^{56}Ni mittels elastischer Protonenstreuung. Um die Dichteverteilung der Kernmaterie zu bestimmen, wird eine phänomenologische Parametrisierung der Dichteverteilung durch Variation ihrer freien Parameter so angepasst, dass der daraus mittels Glauber-Modellrechnungen errechnete Wirkungsquerschnitt den experimentell gemessenen Wirkungsquerschnitt nachbildet. Für die Parametrisierung der Dichteverteilung wurde hierbei ein modellunabhängiger Sum-Of-Gaussians (SOG) Ansatz gewählt. Der Vortrag wird die Ergebnisse dieser Analyse diskutieren.

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HK 46.7 Wed 16:00 T/SR14

Investigation of isoscalar giant resonances in a stored beam experiment with EXL — ●J.C. ZAMORA for the EXL E105-Collaboration — Institut für Kernphysik, TU Darmstadt

The objective of the EXL project is the investigation of nuclear reactions of stored exotic nuclei with internal targets at FAIR. In this project a universal detector system will provide high resolution and large solid

angle coverage for kinematically complete measurements. In the first campaign of EXL at the present Experimental Storage Ring (ESR) at GSI, the collaboration performed commissioning and a first physics programme by using dedicated UHV compatible DSSDs for in-ring particle detection. With this setup, an experiment was done with a stored ion beam of ^{58}Ni and an internal helium gas-jet target aiming for the investigation of isoscalar giant resonances in inverse kinematics.

Preliminary results show evidence for the excitation of the ISoscalar Giant Monopole Resonance (ISGMR) and the ISoscalar Giant Dipole Resonance (ISGDR) in the ^{58}Ni nucleus. In this talk, results and the current status of the data analysis will be discussed. This work is supported by BMBF (06DA9040I and 05P12RDFN8), HIC for FAIR, TU Darmstadt-GSI cooperation contract and GSI-KVI/RUG cooperation contract.