HK 12: Structure and Dynamics of Nuclei III

Zeit: Montag 16:30–18:15 Raum: S1/01 A03

Gruppenbericht HK 12.1 Mo 16:30 S1/01 A03

Spectroscopy of light and heavy transfer products following multinucleon transfer reactions — •Andreas Vogt[1], Benedikt Birkenbach[1], Peter Reiter[1], Lorenzo Corradi[2], Daniele Montanari[3], and Suzana Szilner[4] for the LNL 11.22-Collaboration — [1]IKP, Universität zu Köln — [2]INFN - LNL, Italy — [3]INFN Padova, Italy — [4]RBI Zagreb, Croatia

Multinucleon transfer reactions (MNT) are a competitive tool to populate exotic neutron-rich nuclei. Excited reaction products have been measured in ^{136}Xe + ^{238}U at 1 GeV with the high-resolution γ-ray tracking array AGATA coupled to the mass spectrometer PRISMA at LNL (INFN, Italy). Fission and transfer events are discriminated by exploiting kinematic coincidences between the binary reaction products. Mass yields have been extracted and compared with calculations based on the GRAZING model for MNT reactions. Population yields for nuclei in the actinide region were obtained and compared to x-ray yields measured by AGATA. Nuclear structure information of neutron-rich actinide nuclei are a benchmark for theoretical models providing predictions for the heaviest nuclei. An extension of the ground-state rotational band in ^{240}U was achieved and evidence for an extended first negative-parity band in ^{240}U is found. The results are compared to recent mean-field and DFT calculations. Based on relative cross-section distributions for various reaction channels, perspectives and limitations for the production of the hard-to-reach neutron-rich isotopes with this experimental method will be presented. Supported by the German BMBF (05P12PKFNE TP4), ENSAR-TNA03, BCGS.

HK 12.2 Mo 17:00 S1/01 A03

Reduced transition probabilities in ^{80,82,84,86}Se — •Julia Litzinger for the Cologne-LNL-Collaboration — Institut für Kernphysik, Universität zu Köln, 50937 Köln, Germany

The systematic investigation of exotic nuclei around the N=50 shell-closure is of high interest for nuclear structure research, as single particle-, particle-hole- and collective excitations coexist in this region of nuclei. Transition probabilities from lifetimes of excited states give insight to nuclear structure and allow to probe nuclear models, i.e. the nuclear shell model. We performed a recoil-distance-Doppler-shift experiment at the INFN, Legnaro, using the Cologne Plunger for the RDDS technique, the PRISMA magnetic spectrometer for the event-by-event particle identification and the AGATA spectrometer in its demonstrator configuration for the γ-ray detection and tracking. Using a ^{82}Se beam and a ^{238}U target ^{80,84,86}Se nuclei were produced in excited states via multi-neutron transfer reactions. ^{82}Se nuclei were excited via multiple-step Coulomb excitation. Because of low statistics $\gamma\gamma$-coincidences could not be used for the lifetime analysis. Therefore special care has to be taken to consider all relevant feeding. In order to better estimate effects caused by unobserved side feeding different gates on the total kinetic energy loss of the recoils were investigated. Experimental results on transition probabilities in ^{80,82,84,86}Se isotopes will be presented and discussed in terms of large-scale shell-model calculations we performed.

HK 12.3 Mo 17:15 S1/01 A03

Coulomb excitation of ^{48}K — •Burkhard Siebeck[1], Christopher Bauer[2], Andrey Blazhev[1], Hilde De Witte[3], Kerstin Geibel[1], Herbert Hess[1], Malin Klintefjord[4], Janne Pakarinen[5], Elisa Rapisarda[3,6], Peter Reiter[1], Michael Seidlitz[1], Marcus Scheck[7], David Schneiders[1], Tim Steinbach[1], Didier Voulot[6], Nigel Warr[1] und Frederik Wenander[6] — [1]IKP, Universität zu Köln — [2]IKP, TU Darmstadt — [3]KU Leuven — [4]University of Oslo — [5]University of Jyväskylä — [6]CERN, Genf — [7]University of the West of Scotland, Paisley

Potassium isotopes in the direct vicinity of doubly-magic nuclei are of great interest and subject of recent shell model calculations. These show that the ground states of most K isotopes are dominated by a π0p0h configuration, while ^{47}K and ^{49}K have a major π2p2h contribution. However, the situation is not clear for the odd-odd isotope ^{48}K, which shows a mixture between 0p0h and 2p2h. In order to study the coupling between the $\nu p_{3/2}$-shell and the $\pi s_{1/2}$-, $\pi d_{3/2}$-shells, transition matrix elements are deduced from a Coulomb excitation experiment performed with MINIBALL at REX-ISOLDE. A ^{104}Pd target was irradiated by a radioactive ^{48}K beam. γ rays of both target and projectile deexcitation have been observed. Those yields, together with available spectroscopic data, allow the detemination of transition matrix elements with GOSIA2. The new findings are compared to shell model calculations.

Supported by BMBF (05P09PKCI5 und 05P12PKFNE)

HK 12.4 Mo 17:30 S1/01 A03

First dedicated in-beam X-ray measurement in heavy-ion fusion reactions — •C. Berner[1,3], W. Henning[2,3], D. Mücher[1], R. Gernhäuser[1], K. Morita[3], K. Morimoto[3], D. Kaji[3], S. Hellgartner[1], R. Lutter[4], L. Maier[1], Y. Wakabayashi[3], and H. Baba[3] — [1]Technische Universität München, Lehrstuhl E12 — [2]Argonne National Laboratory, Physics Division — [3]RIKEN, Research Group for Superheavy Elements — [4]Ludwig-Maximilians-Universität, München

We report on an experiment aiming at in-beam X- ray spectroscopy of heavy and superheavy elements (SHE). The goal is to establish K-X-ray spectroscopy as a sensitive tool to identify SHE produced in fusion reactions. SHE, formed after cold or hot fusion, are usually identified via the alpha-decay products, which have to be connected to well-known elements. However, various theories predict spontaneous fission as the dominant decay mode for the daughter nuclides. Additionally, half-lives of these elements are expected to increase to values impeding the identification of SHE solely by their decay. The in-beam identification of the characteristic X-rays would precisely allow to identify the charge number of the produced SHE. Experiments were performed at the RIKEN Nishina Centre for Accelerator based Science by using the gas-filled magnet separator GARIS for superheavy element detection. A high-purity, low-energy planar germanium LEGe-detector was adapted to the GARIS system at the target place for the first time in order to measure the element-characteristic, prompt X-ray emission. Supported by DFG Cluster: "Origin and structure of the Universe"

HK 12.5 Mo 17:45 S1/01 A03

Decay Spectroscopy at SHIP with a new Focal Plane Detector System — •Andrew. K. Mistry for the SHIP Decay Spectroscopy-Collaboration — Helmholtz Institute Mainz

Decay spectroscopy of the heaviest elements remains a crucial tool in nuclear structure physics in testing a variety of theoretical models predicting the next proton and neutron shell stabilization region beyond 208Pb [1]. Experimental measurements of alpha-decay energies and half-lives, ordering and configurations of ground state and excited levels, and the determination of high-K isomers provide necessary information in constraining these models. To this end, a new focal plane detection system for decay spectroscopy has been designed and developed at GSI for the SHIP separator [2]. It consists of a double sided silicon strip implantation detector surrounded by 4 single sided silicon strip detectors on each side in a box formation with a compact design, allowing for good germanium solid angle coverage for gamma ray detection. The data acquisition is based on FEBEX flash ADC modules, developed at GSI [3], for digital signal processing enables an almost deadtime free system. Recently, a commissioning run was successfully performed using the device. In my talk I will present recent highlights of decay spectroscopy at SHIP, and demonstrate results from measurements assessing the performance of the new setup.

[1] R-D. Herzberg & P.T. Greenlees Progress in Particle and Nuclear Physics 61, 674 (2008)

[2] D. Ackermann et.al., GSI Annual report (2015)

[3] N. Kurz, J. Hoffmann et al., GSI Scientific Report 2011, p. 252-3;

HK 12.6 Mo 18:00 S1/01 A03

Laser spectroscopy of nobelium isotopes — •Premaditya Chhetri for the RADRIS-Collaboration — TU Darmstadt, Darmstadt

Laser spectroscopy of the heaviest elements with Z>100 allows studying the influence of relativistic and QED effects on the atomic shell structure. Furthermore, nuclear ground state properties can be extracted from isotopic shifts and the hyperfine structure of the atomic transitions. The low production rates of a few atoms per second and the so far unknown atomic structure make such studies quite challenging. Applying the Radiation Detected Resonance Ionization Spectroscopy (RADRIS) technique [1] at the SHIP velocity filter at GSI, offered us the possibility to observe the first laser spectroscopic signal on nobelium (Z=102). In this talk the RADRIS setup and the results on laser spectroscopy of the isotopes $^{252-254}$No will be discussed.

[1]. H. Backe et. al. Eur. Phys. J. D 45, 99 (2007)