HK 5: Structure and Dynamics of Nuclei I

Zeit: Montag 14:00–16:00 Raum: HS 14

Gruppenbericht HK 5.1 Mo 14:00 HS 14

The FRS Ion Catcher: Status, Results and Outlook — •Daler Amanbayev for the The FRS Ion Catcher-Collaboration — II. Physikalisches Institut, Justus-Liebig-Universität Gießen, Gießen, Germany

In the Fragment Separator (FRS) at GSI, exotic nuclei are produced by projectile fragmentation and fission at relativistic energies, separated in-flight and range-bunched. In the FRS Ion Catcher experiment (FRS-IC), nuclides are thermalized and stopped in a Cryogenic Stopping Cell (CSC), transported via versatile RFQ beamline to a Multiple-Reflection Time-of-Flight Mass Spectrometer (MR-TOF-MS) for high precision mass measurements or isobar and isomer separation.

Masses of more than 30 short-lived isotopes were measured with accuracies down to $6{\times}10^{-8}$, as well as 6 isomers with excitation energies down to 300 keV were observed.

A novel technique for measuring half-lives and decay branching ratios was developed. Feasibility measurements were carried out with ^{216}Po alpha decay and ^{119n}Sb isomer-to-ground transition. These results, recent technical upgrades and approved experiments for FAIR Phase-0 will be presented.

The FRS-IC also serves as a prototype for the future Ion Catcher at the Low-Energy-Branch (LEB) of the Super-FRS at FAIR. Latest results of the next-generation CSC for the LEB with higher rate capability (10^7 ions per second), shorter extraction time (5 ms) and higher areal density (30 mg/cm^2) will be discussed.

HK 5.2 Mo 14:30 HS 14

Statue report of PUMA project — •Noritsugu Nakatsuka[1], Alexandre Obertelli[1], Jaume Carbonell[4,7], Anna Corsi[7], Freddy Flavigny[4], Herbert De Gersem[1], Guillaume Hupin[4], Yuki Kubota[1], Rimantas Lazauskas[3], Stephan Malbrunot[2], Nicolas Marsic[1], Wolfgang Müller[1], Sarah Naimi[5], Nancy Paul[5], Patrice Pérez[2,7], Emmanuel Pollacco[7], Marco Rosenbusch[5], Ryoichi Seki[6], Tomohiro Uesaka[5], Frank Wienholtz[2], Jonas Fischer[1], and Alexander Schmidt[1] — [1]Technische Universität Darmstadt, Germany — [2]CERN, Geneva, Switzerland — [3]Institut Hubert Curien, CNRS, France — [4]Institut de Physique Nucléaire, Orsay, CNRS, France — [5]RIKEN Nishina Center, Wakoshi, Japan — [6]RCNP, Osaka, Japan — [7]CEA, IRFU, Université Paris-Saclay, France

PUMA: antiProton Unstable Matter Annihilation is a starting project aimed at measuring annihilation of antiprotons with short-lived nuclei. The objective of PUMA is to determine the surface neutron/proton density profile of short-lived nuclei using the annihilation with antiprotons. The experiments will be carried out at CERN. We are developing a transportable device that can store, transport, and annihilate antiprotons with the short-lived nuclei, so that we can bring antiprotons from ELENA to short-lived nuclei produced at ISOLDE. The PUMA will consists of superconducting solenoid, ion traps for the storage and annihilation, and a detection system for the annihilation products. The development status of the PUMA ion trap will be presented.

HK 5.3 Mo 14:45 HS 14

Invariant-Mass Spectroscopy at the low-Z Shore of the Island of Inversion — •Julian Kahlbow[1], Thomas Aumann[1,2], Yosuke Kondo[3], and Heiko Scheit[1] for the NeuLAND-SAMURAI-Collaboration — [1]Institut für Kernphysik, Technische Universität Darmstadt, Germany — [2]GSI Helmholtzzentrum für Schwerionenforschung, Darmstadt, Germany — [3]Department of Physics, Tokyo Institute of Technology, Japan

The so-called "island of inversion" is a region in the nuclear landscape where shell-structure changes are observed and in particular the magic neutron number at $N = 20$ vanishes. For those nuclei at $Z = 10 - 12$ and around $N = 20$, the shell gap at $N = 20$ quenches and pf-shell intruder configurations become important. We address the question how strong such configurations are for very neutron-rich but $Z = 9$ fluorine isotopes. Such exotic nuclei are produced at the radioactive-ion beam factory (Japan) at beam energies around 250 MeV/u. ^{29}F* & ^{30}F are studied in inverse kinematics at the SAMURAI experimental setup by $(p, 2p)$ reactions on neon isotopes. The two and one neutron-unbound states, respectively, are investigated in terms of invariant-mass spectroscopy where the decay neutrons are measured explicitly. The resulting excitation-energy spectra are compared to different shell-model based calculations. Moreover, ^{29}F* shows a strong two-neutron sequential decay that is also analyzed by means of Jacobi coordinates.

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HK 5.4 Mo 15:00 HS 14

Enhanced quadrupole and octupole strength in doubly-magic ^{132}Sn — D. Rosiak, •M. Seidlitz, and P. Reiter for the IS551 Miniball and HIE-ISOLDE-Collaboration — Institut für Kernphysik, Universität zu Köln

The first 2^+ and 3^- states of the doubly-magic nucleus ^{132}Sn were populated via safe Coulomb excitation at HIE-ISOLDE, CERN, employing the highly-efficient MINIBALL array. ^{132}Sn ions with a beam energy of 5.49 MeV/nucleon were impinged on a ^{206}Pb target. Deexciting γ rays from the low-lying excited states of the target and the projectile were recorded in coincidence with scattered particles. Reduced $E1$, $E2$, and $E3$ transition strengths were determined. A locally enhanced $B(E2; 0^+_{\mathrm{g.s.}} \rightarrow 2^+_1)$ strength at doubly-magic ^{132}Sn is found and confronted with the microscopic description of the structure of the respective states within different theoretical approaches. The results provide crucial information on cross-shell configurations which were determined for the first time within state-of-the-art shell-model (LSSM, MCSM) and mean-field calculations (RPA). The presented results of experiment and theory can be considered to be the first direct verification of the sphericity and double-magicity of ^{132}Sn.

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HK 5.5 Mo 15:15 HS 14

Coulex of ^{142}Xe — •Corinna Henrich for the IS548-MINIBALL-Collaboration — TU Darmstadt, Darmstadt, Germany

Coulomb excitation is a perfect tool to investigate the structure of ^{142}Xe as it gives access to quadrupole as well as octupole collectivity. The isotope is of particular interest as it is located in a region through which the r-process is expected to pass and also as it is in the proximity of ^{144}Ba, which shows the largest octupole collectivity in the region. The experimental campaign was carried out at HIE-ISOLDE (CERN) in 2016. After undergoing "safe" Coulomb excitation, beam and target nuclei were detected with C-REX, an array of segmented Si detectors, which covers forward and backward angles. The MINIBALL spectrometer was used to detect the emitted gamma rays in coincidence.

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HK 5.6 Mo 15:30 HS 14

Phase-0 Experiments using the R3B CALIFA Demonstrator — •Lukas Ponnath for the R3B-Collaboration — TU München, Deutschland

Studies on the rapid neutron capture process (r-process) nucleosynthesis try to clarify the origin of the heaviest elements in the universe, which was once titled as "one of the 11 greatest unanswered questions of mondern physics". A deep insight and understanding of the structure of exotic (neutron rich) nuclei is mandatory in order to model the r-process under different astrophysical conditions.

The upcoming R3B (Reactions with Relativistic Radioactive Ion Beams) experiment at the research facility FAIR, currently under construction in Darmstadt, will enable a kinematic complete measurements to gain a deep insight to the nuclear structure far from stability.

One of the key instruments of the R3B experimental setup will be the highly segmented CALIFA calorimeter surrounding the R3B reaction target. For in flight detection of gamma-rays and light charged particles this will provide unique resolution for relativistic beam energies.

We will present first results of the Phase-0 experiments of R3B scheduled for February 2019 with the CALIFA demonstrator combined R3B detectors and the GLAD magnet for the first time.

HK 5.7 Mo 15:45 HS 14

Fission cross section measurements of ^{235}U and ^{242}Pu — •Hans Hoffmann[1,2], Toni Kögler[1,2], Roland Beyer[1], Arnd R. Junghans[1], and Ralf Nolte[3] — [1]Helmholtz-Zentrum Dresden-Rossendorf, 01328 Dresden, Germany — [2]Technische Universität Dresden, 01062 Dresden, Germany — [3]Physikalisch-Technische Bundesanstalt, 38116 Braunschweig, Germany

At Physikalisch-Technische Bundesanstalt the neutron-induced fission cross sections of ^{235}U and ^{242}Pu have been measured using parallel plate fission ionization chambers with novel, large area actinide deposits made in the Institute of Nuclear Chemistry, Mainz (A. Vascon *et al.*, Appl. Radiat. Isotopes **95** (2015) 36). The fission cross section of ^{242}Pu has been measured at 15 MeV using quasimonoenergetic neutrons from the DT reaction, which is above the threshold for second chance fission. These data extend the measurement done at HZDR's neutron time of flight facility nELBE to higher neutron energy (T. Kögler et al., Phys. Rev. C (2019) in press)). A status report of the experiment and data analysis will be given. This work has been supported by the German Federal Ministry of Education and Research (PTKA-WTE 02NUK13A).