HK 6: Structure and Dynamics of Nuclei I

Time: Monday 16:30–18:00 Location: J-HS E

Group Report HK 6.1 Mon 16:30 J-HS E

Constraints on the symmetry energy from dipole excitations and neutron-removal cross-sections — •Andrea Horvat[1,2], Thomas Aumann[1,2], Konstanze Boretzky[2], Ashton Falduto[1,2], Dominic Rossi[1,2], Heiko Scheit[1], Dmytro Symochko[1], Patrick van Beek[1], and Lorenzo Zanetti[1,2] — [1]Technische Universität Darmstadt — [2]GSI Helmholtzzentrum, Darmstadt

The understanding of the equation of state (EOS) of isospin-asymmetric nuclear matter around saturation density is of crucial importance for the description of exotic nuclei and astrophysical processes. The symmetry energy, describing the isospin-dependence of the EOS, is parametrized by its value at saturation (J) and the slope (L), with the latter quantity still poorly constrained. For this purpose, we aim to experimentally determine the values of selected observables exhibiting sensitivity to varying L in calculations within the scope of energy density functional theory. The newly upgraded R^3B setup with the R3B-GLAD spectrometer and the NeuLAND neutron detector at GSI provide a unique opportunity to determine the Coulomb excitation and neutron-removal cross sections of heavy neutron-rich nuclei at energies between 400 and 1000 MeV/nucleon. The dipole response of stable nuclei will be investigated using monoenergetic (GACKO, NewSUBARU) and energy-tagged photons (NEPTUN, S-DALINAC) , complementing the approach with rare isotope beams.

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HK 6.2 Mon 17:00 J-HS E

Phase-0 Experiments using the R3B CALIFA Calorimeter — •Lukas Ponnath for the R3B-Collaboration — Technische Universität München

According to recent observations neutron-star mergers providing a suitable system for the rapid neutron capture process (r-process) nucleosynthesis and thus for the origin of the heaviest elements in the universe. This process is dominated by nuclei with an extreme proton-to-neutron asymmetry which are guiding the the r-process-path through the nuclear chart far from stability.

The upcoming R3B (Reactions with Relativistic Radioactive Ion Beams) experiment at the research facility FAIR, currently under construction in Darmstadt, will enable kinematic complete measurements to gain a deep insight and understanding of the structure of these exotic nuclei.

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

We will present first results of the Phase-0 experiment of R3B where we operated the CALIFA demonstrator combined with R3B detectors and the GLAD magnet for the first time.

HK 6.3 Mon 17:15 J-HS E

Lifetime Measurement of the ^{26}O g.s. at SAMURAI — •Sonja Storck[1,3], Thomas Aumann[1,2], Christoph Caesar[2,3], Julian Kahlbow[1,2], and Dominic Rossi[1] for the NeuLAND-SAMURAI-Collaboration — [1]Institut für Kernphysik, TU Darmstadt — [2]GSI Helmholtzzentrum für Schwerionenforschung, Darmstadt — [3]RIKEN Nishina Center, Tokyo

The ground state of the neutron unbound nucleus ^{26}O is speculated to have a lifetime in the pico-second regime. In order to determine the decay lifetime of the ^{26}O ground state with high sensitivity and precision, a new method has been applied. The experiment was performed in December 2016 at the Superconducting Analyzer for MUlti-particle from RadioIsotope Beams (SAMURAI) at the Radioactive Isotope Beam Factory (RIBF) at RIKEN. A ^{27}F beam was produced in the fragment separator BigRIPS and impinged on a W/Pt target stack where ^{26}O was produced. According to the lifetime, the decay of ^{26}O happens either in or outside the target. Thus, the velocity difference between the decay neutrons and the fragment ^{24}O delivers a characteristic spectrum from which the lifetime can be extracted. In the report, the experimental setup and method are introduced and the current analysis status is presented.

This work is supported by the DFG through grant no. SFB 1245, the BMBF under contract number 05P15RDFN1 and the GSI-TU Darmstadt cooperation agreement.

HK 6.4 Mon 17:30 J-HS E

Towards Laser Spectroscopy of Boron-8 — •Bernhard Maass[1], Jason Clark[3], Phillip Imgram[1], Kristian König[2], Jörg Krämer[1], Tim Lellinger[1], Peter Müller[3], Tim Ratajczyk[1], Rodolfo Sánchez[4], Guy Savard[3], Felix Sommer[1], and Wilfried Nörtershäuser[1] — [1]IKP, TU Darmstadt, DE — [2]NSCL, East Lansing, MI, USA — [3]ANL, Lemont, IL, USA — [4]GSI, Darmstadt, DE

We report on our progress towards confirming the exotic structure of the proton-halo candidate ^{8}B. So far, only model-dependent experimental evidence exists which suggests a strong increase in nuclear charge radius. This observable can be accessed model-independently by a laser-spectroscopic investigation, benchmarking not only the results of almost three decades of research, but also of nuclear theory approaches to model this exotic nucleus.

A precursor resonance laser ionization mass spectrometry experiment was performed on stable boron isotopes at TU Darmstadt, delivering the difference in mean-squared nuclear charge radius between ^{10}B and ^{11}B. It also proved the disposability of the atomic theory calculations which are necessary to interpret the results. Apart from the results of this experiment, updates from the ongoing effort to extend it to ^{8}B at Argonne National Laboratory will be presented.

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HK 6.5 Mon 17:45 J-HS E

Collinear and anti-collinear laser spectroscopy measurements on He-like ^{11}B and ^{10}B — •A. Buss[1], Z. Andelkovic[2], V. M. Hannen[1], P. Imgram[3], K. Mohr[3], R. Sánchez[2], W. Nörtershäuser[3], C. Weinheimer[1], B. Maass[3], K. König[4], J. Krämer[3], and S. Rausch[3] — [1]IKP, WWU Münster — [2]GSI, Darmstadt — [3]IKP, TU Darmstadt — [4]NSCL, MSU

We present preliminary results of hyperfine spectroscopy measurements on He-like boron atoms. In particular, experimental results for ^{11}B and previously unobserved HFS transitions in ^{10}B are presented.

The measurements have been performed at the HITRAP facility, using a local ion source and a beam line leading to the SPECTRAP experiment. A downscaled version of the CRYRING fluorescence detector was installed on top of the SPECTRAP magnet. The detector was built as a general purpose detector for collinear and anti-collinear laser spectroscopy experiments and is able to detect fluorescence photons in a wavelength range from 250 nm to 900 nm. Together with a frequency doubled continous wave laser system, the setup enables high precision measurements of the hyperfine transitions $1s2s\,^3S_1 \rightarrow 1s2p\,^3P_{0,1,2}$. The metastable $^3S_1$ state in ^{11}B and ^{10}B is populated in an up to now unknown fraction of the ions produced in the local electron beam ion source (EBIS). Uncertainties in the ions' acceleration voltage can be eliminated by combining collinear and anti-collinear measurements of the same transition and therefore allow a precise determination of the transition wavelengths. This work is supported by BMBF under contract numbers 05P19PMFA1 and 05P19RDFAA.