HK 6: Structure and Dynamics of Nuclei II

Time: Monday 16:45–18:15 Location: HBR 19: C 5b

Group Report HK 6.1 Mon 16:45 HBR 19: C 5b

Nuclear charge radius measurements in ^{32}Si at FRIB — •Kristian König for the BECOLA-Collaboration — TU Darmstadt, Germany — Michigan State University, USA

The nuclear charge radius of ^{32}Si was determined from isotope shift measurements performed at the collinear laser spectroscopy setup BECOLA at the Facility for Rare Isotope Beams (FRIB, Michigan State University). The extracted charge radius was compared to ab initio nuclear lattice effective field theory, valence-space in-medium similarity renormalization group and mean field calculations. Furthermore, the charge radius of ^{32}Si completes the radii of the mirror pair ^{32}Ar - ^{32}Si, whose difference was correlated to the slope L of the symmetry energy in the nuclear equation of state [1]. In this talk the BECOLA facility will be presented, the ^{32}Si results will be discussed and an outlook for future experiments at FRIB will be given.

This work was supported in part by the National Science Foundation, Grants No. PHY-21-11185 and the DFG, Project-Id 279384907-SFB 1245.

[1] arXiv:2309.02037 [nucl-ex]

HK 6.2 Mon 17:15 HBR 19: C 5b

Two-Neutron Halo Nuclei With Weak Neutron-Core Interaction — •Daniel Kromm[1], Matthias Göbel[2], and Hans-Werner Hammer[1] — [1]Technische Universität Darmstadt, Institut für Kernphysik — [2]Istituto Nazionale di Fisica Nucleare, Sezione di Pisa

We investigate the renormalization properties of an EFT for two-neutron halo nuclei with weak neutron-core interaction proposed by Hongo and Son. In this theory, there is a universal prediction for the ratio of the mean-square matter radius and charge radius. We investigate the possibility to predict the radii separately without using additional input. We argue that one further renormalization input is required to predict both radii separately. Using one of the radii as this input, we quantify the restriction on the UV cutoff from the Landau pole. We apply our results to the case of ^{22}C and discuss the hierarchy of scales implicit in the power counting.

This work is supported by the Deutsche Forschungsgemeinschaft (DFG, German Research Foundation) - Project-ID 279384907 - SFB 1245.

HK 6.3 Mon 17:30 HBR 19: C 5b

Nuclear Moments and Charge Radii of Neutron-Rich Palladium Isotopes — •Laura Renth for the ATLANTIS-Collaboration — Institut für Kernphysik, Technische Universität Darmstadt, Darmstadt, Germany

We present the first experimental results taken at the new collinear laser spectrosocpy setup ATLANTIS (**A**rgonne **T**andem hall **LA**ser beamli**N**e for a**T**om and **I**on **S**pectroscopy) at the Argonne National Laboratory. Short-lived exotic isotopes are generated from the CARIBU source, which collects ^{252}Cf fission fragments in a gas catcher. After mass speparation, the isotopes of interest are transported at a beam energy of 27keV to the laser spectroscopy setup.

The hyperfine spectra of neutron rich palladium iostopes $^{112-116,118}$Pd will be presented as well as the differential mean-square nuclear charge radii, nuclear moments and nuclear spins. These properties add insights in the physics of nuclear shell strucuture evolution, which are discussed in this talk.

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HK 6.4 Mon 17:45 HBR 19: C 5b

Uncertainty quantification for nuclear structure calculations using low-resolution potentials — •Tom Plies[1,2], Matthias Heinz[1,2,3], and Achim Schwenk[1,2,3] — [1]Technische Universität Darmstadt, Department of Physics — [2]ExtreMe Matter Institute EMMI, GSI Helmholtzzentrum für Schwerionenforschung GmbH — [3]Max-Planck-Institut für Kernphysik, Heidelberg

Uncertainty quantification is a key aspect in modern nuclear theory. Nuclear Hamiltonians are uncertain, with the uncertainty residing in the low-energy constants (LECs) parametrizing the interactions. As these parameter-dependent interactions are used as input for nuclear structure calculations, distributions of many-body observables can be inferred from distributions of LECs. We deploy the singular value decomposition (SVD) to recover a linear operator basis for our interactions. We use Bayesian methods to infer distributions for the LECs from the theoretical uncertainties in nucleon-nucleon phase shifts. We then sample from the LEC posteriors to obtain distributions for the ground-state energies of ^{3}H and ^{16}O.

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HK 6.5 Mon 18:00 HBR 19: C 5b

Investigation of the proton radius of the neutron-rich Borromean halo nucleus ^{19}B — •Divyang Prajapati for the RIBF132-Collaboration — Saint Mary's University, Halifax, Canada

The structural properties of neutron-rich nuclei are an ideal presentation for understanding the underlying nuclear forces. The evolution of the nuclear charge or matter-density distribution along the isotopic chain reflects the complex nature of strong force. For instance, the drip line nucleus ^{19}B has garnered the attention of theory and experiments due to its Borromean structure. However, the proton distribution of this nucleus is still unknown, and theoretical predictions vary widely.

The measurement of the charge-changing cross-section (σ_{cc}) has emerged as a new method for probing the point proton radius of exotic nuclei. Therefore, the σ_{cc} of the ^{19}B nucleus was measured at RIBF, RIKEN using the BigRIPS and ZDS. The secondary beam of ^{19}B was produced via projectile fragmentation of a ^{48}Ca primary beam at ∼345A MeV on a ^{9}Be production target. The σ_{cc} was measured with a carbon target, placed at the achromatic focus F11. The measurement of Time Of Flight (TOF) using plastic scintillators, magnetic rigidity (Bρ) using PPAC, and energy loss (ΔE) information from MUSIC detectors identifies the A, Q, and Z of the particle.

The presentation will describe the experimental details. Preliminary observations from the data analysis will be discussed. The radius that will be extracted from the measured cross-sections via Glauber model analysis will aid in understanding the evolution of neutron skin in ^{19}B and its Borromean structure.