HK 75: Invited Talks IV

Time: Friday 11:00–12:30 Location: HBR 14: HS 1

Invited Talk HK 75.1 Fri 11:00 HBR 14: HS 1

Precision theory for charge radii of light nuclei —
•Arseniy Filin[1], Vadim Baru[1], Evgeny Epelbaum[1], Christopher Körber[1], Hermann Krebs[1], Daniel Möller[1], Andreas Nogga[2], and Patrick Reinert[1] — [1]Institut für Theoretische Physik II, Ruhr-Universität Bochum, Bochum, Germany — [2]IAS-4, IKP-3, JHCP, and CASA Forschungszentrum Jülich, Juilich, Germany

Charge radii of light nuclei characterize the distribution of electric charge inside the corresponding nuclei and are a perfect tool to test modern high-precision nuclear forces. Experimentally, these radii can be extracted from electron scattering and the laser spectroscopy of normal and muonic atoms with the sub-percent level of accuracy. Theoretical description with a similar accuracy level requires a very good understanding of two- and three-body forces, two-body electromagnetic currents, and various relativistic effects. We present a high-accuracy calculation of the nuclear structure for A=2,3,4 nuclei using the latest two- and three-nucleon forces and charge density operators derived up through the fifth order in the chiral effective field theory. We predict the structure radii of the deuteron, the alpha-particle and the isoscalar combination of ^{3}H and ^{3}He and perform a comprehensive analysis of various sources of uncertainties. Using the predicted values of the ^{2}H and ^{4}He structure radii combined with the spectroscopic measurements of the deuteron-proton charge radius difference and ^{4}He charge radius we extract the neutron and proton charge radii.

Invited Talk HK 75.2 Fri 11:30 HBR 14: HS 1

Investigating dense nuclear matter - recent results from HADES —
•Behruz Kardan for the HADES-Collaboration — Goethe-Universität, Frankfurt am Main

The study of strongly interacting matter under extreme conditions is one of the most important topics in the exploration of Quantum Chromodynamics (QCD).

In this talk, we highlight new measurements by HADES, the *High-Acceptance Dielectron Spectrometer* located at the SIS18 at GSI in Darmstadt, which is currently the only experimental setup with the unique ability to measure rare and penetrating probes at the high-μ_B frontier of the QCD phase diagram. The possibility of performing measurements with the same apparatus in a variety of reaction systems, such as elementary exclusive channels, in cold nuclear matter, and in its dense and excited state, provides a broad and complementary way of exploring the properties of strongly interacting matter. The main objective of the physics program is to investigate the *emissivity of resonance matter*, the role of *baryonic resonances* in these reactions, and the mechanism of *strangeness* and *light nuclei production*.

We discuss recent high statistics results on spectra, collective flow phenomena and correlations of hadrons, light nuclei, and dileptons. The data provide essential constraints for theoretical transport models utilised in the determination of the properties of dense baryonic matter, such as its *emissivity* and *equation-of-state* (EOS).

Supported by the Helmholtz Forschungsakademie HFHF and the BMBF grant 05P21RFFC3.

Invited Talk HK 75.3 Fri 12:00 HBR 14: HS 1

High-precision mass measurements of light ion species —
•Sangeetha Sasidharan[1,2], Olesia Bezrodnova[1], Wolfgang Quint[2], Sven Sturm[1], and Klaus Blaum[1] — [1]Max-Planck-Institut für Kernphysik, Heidelberg, Germany — [2]GSI Helmholtzzentrum, Darmstadt, Germany

The properties of simple atomic nuclei, like the proton, deuteron, helion, and alpha particle, along with the electron, are cornerstones in understanding fundamental physics. These light ion systems allow precise atomic structure calculations, thus enabling tests of fundamental theories such as QED. Accurate calculation of the predictions requires precise values of fundamental physical constants, which are often connected to the masses of light ions. For example, in hydrogen spectroscopy, the proton's mass impacts the value of the Rydberg constant. The electron's atomic mass could be improved by accurately measuring the bound electron g-factor in ^{4}He$^+$. The highly precise atomic mass of ^{4}He$^+$ is instrumental in achieving this objective. Furthermore, a mass difference measurement of ^{3}He and T will provide a crosscheck of the systematics in the electron anti-neutrino mass determination with the KATRIN experiment. Many world-leading experiments have measured these masses, but inconsistencies are observed among their results, known as the "Light Ion mass puzzle". Improved measurements of the light ion masses will help clarify this puzzle. In this talk, I will present the recent highlights and results of LIONTRAP (Light ION TRAP), a Penning trap setup dedicated to mass measurements of light ions with a relative precision of 10 parts-per-trillion and better.