HK 31: Struktur und Dynamik von Kernen

Zeit: Mittwoch 16:30–19:00 Raum: HZ 4

Gruppenbericht HK 31.1 Mi 16:30 HZ 4

Multi-Strangeness dynamics at $\overline{\mathrm{P}}$ANDA — •Theodoros Gaitanos, Horst Lenske und Ulrich Mosel — Institut für Theoretische Physik, Universität Gießen

Multi-strange bound hadron systems are excellent candidates for studying in-medium hyperon-hyperon (YY) interactions. A better understanding of the strangeness sector of the hadronic equation of state is crucial for our understanding of astrophysical objects like neutron stars. Furthermore, these studies are being motivated by actual and planed experimental activities on hypernuclear physics (HypHI and $\overline{\mathrm{P}}$ANDA Collaborations). In fact, HypHI has already studied single-strange hypernuclei in heavy-ion collisions, whereas studies on double- and multi-strange nuclear systems are being planed by $\overline{\mathrm{P}}$ANDA. We have reported in the past first studies on single- and double-Λ hypernuclei production in reactions induced by heavy-ions and antiprotons, respectively. The YY-interaction is still little known and many controversial theoretical predictions exist in the literature. We therefore extend our previous works by investigating the influence of various hyperon-hyperon interactions on the production dynamics of multi-Λ hypernuclei in reactions relevant for FAIR. Particular attention is paid to the heavy Ω-baryon ($S = -3$) and its role to the formation of multi-Λ hypernuclei in reactions induced by antiprotons.

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Gruppenbericht HK 31.2 Mi 17:00 HZ 4

Isospin properties of low-lying electric dipole excitations — •Vera Derya[1], Janis Endres[1], Muhsin N. Harakeh[2,3], Deniz Savran[4,5], Mark Spieker[1], Heinrich J. Wörtche[2], and Andreas Zilges[1] — [1]Institute for Nuclear Physics, University of Cologne — [2]KVI, University of Groningen, The Netherlands — [3]GANIL, CEA/DSM-CNRS/IN2P3, Caen, France — [4]ExtreMe Matter Institute EMMI and Research Division, GSI, Darmstadt — [5]Frankfurt Institute for Advanced Studies FIAS, Frankfurt

An accumulation of low-lying electric dipole excitations, the electric Pygmy Dipole Resonance (PDR), was observed below and around the neutron threshold in neutron-rich atomic nuclei [1]. In a systematic study, complementary to real-photon scattering experiments, the isoscalar probe of α particles at 136 MeV was used in α-γ coincidence experiments at the Big-Bite Spectrometer at KVI to study the isospin character of low-lying $E1$ excitations. The combined results permit a separation of the isovector from the isoscalar dipole response. Whereas a splitting into a lower-energy isospin-mixed part and a higher-energy isovector part was observed in heavier nuclei, a state-to-state change in isospin character was found in ^{48}Ca. Recently, protons at 80 MeV were used as an additional probe in a p-γ coincidence experiment. The most recent results and an overview of the systematics will be presented.

Supported by the DFG (ZI 510/4-2), EURONS, and the Alliance Program of the Helmholtz Association (HA216/EMMI).

[1] D. Savran, T. Aumann, and A. Zilges, Prog. Part. Nucl. Phys. 70 (2013) 210.

HK 31.3 Mi 17:30 HZ 4

Ab initio description of p-shell hypernuclei — •Roland Wirth, Angelo Calci, Joachim Langhammer, and Robert Roth — Institut für Kernphysik, Technische Universität Darmstadt

Tremendous progress is being made on the experimental study of hypernuclei, especially on the spectroscopy of p-shell hypernuclei. Their theoretical description, however, is limited to phenomenological models or to very light (i.e. s-shell) systems. We present *ab initio* calculations of p-shell hypernuclei using chiral Hamiltonians including leading-order (LO) hyperon–nucleon as well as two- and three-nucleon interactions at N^{3}LO and N^{2}LO, respectively. To improve convergence with respect to model space size, the Hamiltonians are evolved using a Similarity Renormalization Group (SRG) transformation. The many-body calculations are carried out in the framework of the importance-truncated no-core shell model.

We present the first *ab initio* results for the spectroscopy of ${}^{7}_{\Lambda}$Li, ${}^{9}_{\Lambda}$Be and ${}^{13}_{\Lambda}$C obtained using chiral and phenomenological hyperon–nucleon interactions. We also discuss the role of SRG-induced hyperon–nucleon–nucleon (YNN) terms which hint at the impact of chiral YNN interactions.

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HK 31.4 Mi 17:45 HZ 4

Constraining the electric dipole photon strength function in ^{130}Te — •J. Isaak[1,2], M.W. Ahmed[3], J. Beller[4], J. Glorius[5], J.H. Kelley[3], M. Krtička[6], B. Löher[1,2], N. Pietralla[4], C. Romig[4], G. Rusev[7], D. Savran[1,2], M. Scheck[8], J. Silva[1,2], K. Sonnabend[5], A.P. Tonchev[9], W. Tornow[3], H.R. Weller[3], and M. Zweidinger[4] — [1]ExtreMe Matter Institute EMMI and Research Division, Darmstadt — [2]FIAS, Frankfurt — [3]Department of Physics, Duke University, TUNL, USA — [4]Institut für Kernphysik, TU Darmstadt — [5]Institut für Angewandte Physik, Goethe-Universität Frankfurt — [6]Faculty of Mathematics and Physics, Charles University, Prague — [7]Chemistry Division, LANL, USA — [8]School of Engineering, University of the West of Scotland, UK — [9]Physics Division, LLNL, USA

The decay properties of photo-excited states in ^{130}Te have been investigated by means of Nuclear Resonance Fluorescence experiments at the Darmstadt High Intensity Photon Setup (DHIPS) and the High Intensity γ-ray Source (HIγS). The combination of continuous-energy bremsstrahlung on the one hand and the quasi-monoenergetic and linearly polarized photon beam on the other enables a detailed insight into the photoabsorption cross section and the decay behavior of spin-1 states. Comparing these results to simulations within the statistical model allow for constraining the electric dipole photon strength function ($E1$-PSF) [1]. Results are presented and discussed.

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[1] J. Isaak *et al.*, PLB 727 (2013) 361-365.

HK 31.5 Mi 18:00 HZ 4

Studying the potential of antihyperons in nuclei with antiprotons — •Alicia Sanchez Lorente[1], Sebastian Bleser[1], Josef Pochodzalla[2], and Marcell Steinen[1] for the PANDA-Collaboration — [1]Helmholtz-Institut Mainz — [2]Institute for nuclear physics, JGU Mainz

The interaction between an antibaryon and a nucleus may shed light on the short range antibaryon-baryon force in a unique way. However, because of the deep imaginary part of the nuclear potential of antibaryons, the physics of antihyperons in nuclei is hitherto an uncharted territory. Recently it was proposed to use transverse momentum correlations of exclusively produced antihyperon-hyperon pairs in antiproton-nucleus collisions to obtain information on the antihyperon potentials relative to that of the corresponding hyperon[1]. In the present study we use the Giessen Boltzmann-Uehling- Uhlenbeck Transportmodell (GiBUU) to explore the production of exclusive hyperon-antihyperon pairs close to threshold. Unlike the schematic calculation of ref.[1], these GiBBU simulations take e.g. important rescattering effects into account. In case of $\bar{p}$+^{20}Ne→ $\bar{\Lambda}\Lambda$+X we confirm a significant sensitivity of transverse momentum correlations to the nuclear potential of Λ's. We also explore the feasibility of such measurements at the $\bar{P}$ANDA experiment of the international facility FAIR.

[1] J. Pochodzalla, Phys. Lett. B **669**, 306-310 (2008)

HK 31.6 Mi 18:15 HZ 4

Gamma Strength Function of ^{96}Mo: A Test of the Axel-Brink Hypothesis ⋆ — •Dirk Martin[1], Andreas Krugmann[1], Anna Maria Krumbholz[1], Peter von Neumann-Cosel[1], Norbert Pietralla[1], Iryna Poltoratska[1], Vladimir Ponomarev[1], and Atsushi Tamii[2] for the E376-Collaboration — [1]Institut für Kernphysik, TU Darmstadt — [2]Research Center for Nuclear Physics, Osaka, Japan

The gamma strength function of ^{96}Mo, derived from a variety of experiments, shows quite severe disagreement, in particular near the neutron threshold. A new experimental method is discussed, viz. relativistic proton scattering under extreme forward angles at RCNP Osaka, Japan [1], which allows a consistent analysis of data below and above the particle threshold. Here, intermediate-energy proton beams are used in combination with a high energy resolution of the order $\Delta E/E \approx 8 \cdot 10^{-5}$. E1 and M1 cross sections can be determined by a multipole decomposition of angular distributions utilizing DWBA calculations [2, 3]. The additional measurement of polarization transfer observables provides an independent check of the method. Results for the gamma strength function of ^{96}Mo derived from the E1 cross sec-

tions are presented and compared to findings with other experimental techniques.

[1] A. Tamii et al., Nucl. Inst. Meth. A 605 (2009) 326.
[2] A. Tamii et al., Phys. Rev. Lett. 107 (2011) 062502.
[3] I. Poltoratska et al., Phys. Rev. C 85 (2012) 041304(R).

⋆ Supported by DFG through SFB 634 and NE 679/3-1.

HK 31.7 Mi 18:30 HZ 4

To which densities is spin-polarized neutron matter a weakly interacting Fermi gas?⋆ — •Thomas Krüger[1,2], Kai Hebeler[1,2], and Achim Schwenk[2,1] — [1]Institut für Kernphysik, Technische Universität Darmstadt — [2]ExtreMe Matter Institute EMMI, GSI Helmholtzzentrum für Schwerionenforschung

We study spin-polarized neutron matter based on chiral NN, 3N and 4N interactions to next-to-next-to-next-to-leading order (N^3LO) and provide theoretical uncertainties. Our results show that spin-polarized neutron matter at nuclear and subnuclear densities is remarkably close to a noninteracting Fermi gas. Implications of our findings for energy-density functionals and other applications are discussed.

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HK 31.8 Mi 18:45 HZ 4

First results of a ^{92}Mo(p,p'γ) experiment performed with SONIC&HORUS — •Simon G. Pickstone, Vera Derya, Andreas Hennig, Mark Spieker, Julius Wilhelmy, and Andreas Zilges — Institute for Nuclear Physics, University of Cologne

To gain additional information on nuclear structure from particle-induced reactions, the new silicon-detector array SONIC with 8 ΔE-E-telescopes was installed inside the existing γ array HORUS consisting of 14 HPGe detectors. The main purpose of the combined setup will be the study of inelastic scattering experiments using p, d and α beams delivered by the Cologne 10 MV Tandem accelerator.

Since the excitation of the target nucleus is uniquely determined by the energy loss of the projectile, gates on the excitation of specific levels or on a certain final level can be set. Due to the angular granularity of SONIC&HORUS, angular correlations between the ejectile and the emitted γ ray can be measured, which gives access to the spin of the level. Using the particle identification capabilities, light ejectiles (p to α) can be easily distinguished, allowing the study of weaker reaction channels, e.g. inelastic scattering, even if the cross section is dominated by others, e.g. transfer reactions.

As a first physics test case, the reaction ^{92}Mo(p,p'γ) was measured. Preliminary results of this experiment will be shown, concentrating on states and decay properties of the Pygmy Dipole Resonance.

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