HK 41: Struktur und Dynamik von Kernen VI

Time: Wednesday 16:30–18:45 Location: O-1

Group Report HK 41.1 Wed 16:30 O-1

Production of hypernuclei at FAIR — •Theodoros Gaitanos, Alexei Larionov, and Ulrich Mosel — Institut für Theoretische Physik, Universität Giessen, Germany

The strangeness sector of the strong interaction is important for our knowledge on, e.g., nuclear astrophysics. It is still a widely debated topic of current research. Hypernuclear production in heavy-ion collisions and $\bar{p}$-nucleus collisions offers the opportunity to investigate the hyperon-nucleon and hyperon-hyperon interaction inside a hadronic environment in terrestrial laboratories. We study the formation of fragments with and without strangeness contents in the framework of a dynamical transport model (Giessen Boltzmann-Uehling- Uhlenbeck, GiBUU) [1] and a statistical approach (Statistical Multifragmentation Model, SMM) of fragment formation [2]. We use a coalescence picture for the production of single-Λ and double-Λ hypernuclei, and provide theoretical estimates on their spectra and inclusive cross sections in heavy-ion collisions and $\bar{p}$ induced reactions, relevant for HypHI and PANDA experiments at FAIR.

[1] *http : //gibuu.physik.uni − giessen.de/GiBUU*.
[2] A.S. Botvina *et al.*, Nucl. Phys. **A475** (1987) 663;
J.P. Bondorf *et al.*, Phys. Rep. **257** (1995) 133.

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HK 41.2 Wed 17:00 O-1

Antiproton Interactions with Neutron-rich Nuclei — •Stefanie Lourenco and Horst Lenske — Institut für Theoretische Physik, Universität Giessen

One of the most exciting topics of modern physics is to study antimatter. In connection to the upcoming FAIR facility antiproton-nucleus interactions are of special interest.

We describe the elastic p̄A-interactions by a microscopic optical potential derived from realistic HFB-ground state densities and the Paris p̄N T-matrix. The emission of mesons produced in the in-medium p̄N annihilation processes are studied perturbatively. Final state meson-nucleus interactions are taken into account by an eikonal approach. Results for p̄A-scattering and meson reactions are presented for Ni-isotopes.

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HK 41.3 Wed 17:15 O-1

Strange particles production in antiproton-nucleus collisions — •Alexei Larionov[1,2], Theodoros Gaitanos[1], and Ulrich Mosel[1] — [1]Institut für Theoretische Physik, Universität Giessen, Germany — [2]Russian Research Center Kurchatov Institute, 123182 Moscow, Russia

The $\bar{p}N$ annihilation is a powerful source of strangeness production. Even for stopped antiprotons, about 5% of $\bar{p}p$ annihilation events contain a $K\bar{K}$ pair. Thus, $\bar{p}$ annihilation on a nucleus is well suited for the studies of the interactions of kaons and antikaons with nuclear medium. In particular, hyperon production in $\bar{p}A$ interactions is very sensitive to the properties of the antikaon-nucleon interaction in nuclear medium. Within the Giessen Boltzmann-Uehling-Uhlenbeck transport model [1], we analyse the experimental data on Λ and K_S production in $\bar{p}A$ collisions at $p_{\rm lab} = 0.2 - 4$ GeV/c taken at BNL, LEAR, and KEK. A satisfactory overall agreement on Λ production is reached. However, our calculations tend to overestimate K_S production, especially at low beam momenta, which has been also observed in earlier transport studies of $\bar{p}A$ interactions [2]. We also study the Ξ^- hyperon production focusing on the efficiencies of the $\bar{\Xi}^+$ and $2K^+$ triggers in view of the forthcoming $\overline{\rm P}$ANDA experiment.

This work was supported by BMBF.

[1] http://gibuu.physik.uni-giessen.de/GiBUU
[2] J. Cugnon, P. Deneye, and J. Vandermeulen, Phys. Rev. C **41, 1701 (1990).**

HK 41.4 Wed 17:30 O-1

HypHI Phase 0 experiment — •Olga Borodina[1,2], Sebastien Bianchin[1], Vakkas Bozkurt[1,3], Daisuke Nakajima[1,4], Banu Özel-Tashenov[1], Christophe Rappold[1], Takehiko Saito[1,2], Dmitry Khaneft[1,2], Yue Ma[1,5], and Frank Maas[1,2,5] — [1]GSI Helmholtzzentrum für Schwerionenforschung GmbH, Darmstadt, Germany — [2]Johannes Gutenberg Universität Mainz, Mainz, Germany — [3]Nigde University, Nigde, Turkey — [4]The University of Tokyo, Tokyo, Japan — [5]Helmholtz-Institut Mainz, Mainz, Germany

The international HypHI collaboration proposes to performer hypernuclear spectroscopy with stable heavy ion beams and rare isotope beams at GSI and FAIR in order to study neutron/proton rich hypenuclei and to measure hypenuclear magnetic moment for the first time. The first experiment (Phase 0) has been performed in October 2009 with ^6Li beam on a carbon target at 2 A GeV in order to show the feasibility of the method by producing and identifying light hypernuclei such as ${}^{3}_{\Lambda}$H, ${}^{4}_{\Lambda}$H, ${}^{5}_{\Lambda}$He. The preliminary results of data analysis will be discussed.

HK 41.5 Wed 17:45 O-1

Similarity Renormalization Group for chiral two- plus three-body Hamiltonians — •Joachim Langhammer, Angelo Calci, Sven Binder, and Robert Roth — Institut für Kernphysik - Theoriezentrum, TU Darmstadt

At present, chiral effective field theory provides the most systematic QCD-based interaction for nuclear structure calculations. We present a consistent Similarity Renormalization Group (SRG) transformation of the three-body (3N) interaction at N2LO together with the two-body (NN) interaction at N3LO. We study the properties and convergence behavior of the transformed Hamiltonian in Hartree-Fock and many-body perturbation theory calculations of ground-state energies and charge radii of closed-shell nuclei across the whole nuclear chart from ^{4}He up to ^{208}Pb. In particular, we analyze the contributions of the NN, the induced 3N and the genuine 3N interaction. The systematics of binding energies and radii and their dependence on the SRG flow parameter after successive inclusion of these three contributions reveal a characteristic pattern hinting of significant contributions from induced higher-order many-body interactions. To reduce the influence of these contributions we discuss alternative SRG generators.

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HK 41.6 Wed 18:00 O-1

Operator representation for realistic effective interactions — •Dennis Weber, Hans Feldmeier, and Thomas Neff — GSI Helmholtzzentrum für Schwerionenforschung GmbH, Darmstadt, Germany

We present a method to derive an operator representation for realistic effective interactions obtained in the 'Unitary Correlation Operator Method' (UCOM) and 'Similarity Renormalization Group' (SRG) approach starting from partial wave matrix-elements. This method allows to use interactions formulated in a partial wave basis in models which require an operator representation of the interaction. Furthermore it is possible to use this technique to derive interactions using a reduced set of operators for potentials with a known operator representation. To show that two-nucleon properties (scattering phase-shifts and Deuteron) and binding energies of light nuclei are the same for the initial partial wave matrix-elements and the derived operator representation, we compare the results of two-nucleon and 'No Core Shell Model' calculations using the initial interaction matrix-elements and calculations with the obtained operator representation.

HK 41.7 Wed 18:15 O-1

Relativistic RPA Functions with Density Dependent NN Interactions — •Andreas Fedoseew and Horst Lenske — Institut für Theoretische Physik, Universität Giessen

We derive longitudinal and transverse response functions taking into account relativistic RPA correlations. For our calculations we use an effective Lagrangian characterized by density-dependent meson-nucleon vertex functionals. The explicit density dependence of the meson-nucleon couplings is obtained from ab-initio Dirac-Brueckner calculations, which lead to additional rearrangement terms in the residual two-body interaction. We present results for symmetric and antisymmetric nuclear matter and closed shell nuclei using local density approximation.

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HK 41.8 Wed 18:30 O-1

The pairing interaction in asymmetric nuclear matter —

•Urnaa Badarch and Horst Lenske — Institut für Theoretische Physik, Universität Giessen

The pairing interaction and the density dependence of the nuclear matter symmetry energy are very important for understanding many phenomena in both nuclear physics and especially for the impact on exotic nuclei and astrophysics. We study the effects of the pairing on the symmetry energy and incompressibility using the relativistic density dependent hadron field theory (DDRH). Contributions from polarization self-energies are discussed. The results of our calculation for the isospin dependence of: (i) the effective pairing interaction (ii) nuclear symmetry energy (iii) incompressibility which are calculated within the mean field approximation in the range from symmetric nuclear matter to pure neutron matter will be presented.