HK 42: Schwerionenkollisionen und QCD Phasen

Zeit: Donnerstag 14:00–16:00 Raum: HZ 7

Gruppenbericht HK 42.1 Do 14:00 HZ 7

Modification of hadron properties in compressed nuclear matter: Recent results from the FOPI collaboration. — •Victoria Zinyuk for the FOPI-Collaboration — Universität Heidelberg, Heidelberg, Germany

In compressed baryonic matter the properties of hadrons are believed to alter as a result of various non-trivial in -medium effects such as the partial restoration of the spontaneously broken chiral symmetry, the modified baryon-meson couplings and the nuclear potential. Possible modification of properties like mass, width and dispersion relation can be experimentally observed for strange particles produced sub- or close-to-production threshold energies. The FOPI detector at SIS18 provides a possibility to investigate the production and propagation of charged and neutral strange particles in a wide range of phase space. This presentation gives an overview of FOPI's recent results on collective behavior and modification of phase space distribution for strange mesons at densities up to 2-3 ρ_0, investigated in heavy-ion collisions, and at normal nuclear matter density as observed in pion-induced reactions.

HK 42.2 Do 14:30 HZ 7

Strange meson spectral functions and cross sections at GSI-FAIR conditions — •Daniel Cabrera[1], Laura Tolós[2], Jörg Aichelin[3], and Elena Bratkovskaya[1] — [1]Institute for Theoretical Physics and Frankfurt Institute for Advanced Studies, Frankfurt University, 60438 Frankfurt am Main, Germany — [2]Institut de Ciències de l'Espai (IEEE/CSIC), Campus Universitat Autònoma de Barcelona, Facultat de Ciències, Torre C-5, E-08193 Bellaterra, Spain — [3]Subatech, UMR 6457, IN2P3/CNRS, Université de Nantes, École des Mines de Nantes, Nantes, France

We discuss recent progress on the properties of strange mesons in nuclear matter at finite temperature from a chiral unitary approach in coupled channels, which incorporates the s- and p-waves of the kaon nucleon interaction. As a novelty, the in-medium scattering amplitudes and cross sections in several channels (such as $\bar{K}N \to \pi\Sigma$) are obtained in addition to the (off-shell) K and $\bar{K}$ spectral functions and quasi-particle properties, which is of particular interest for microscopic transport evaluations of strangeness production and propagation in heavy-ion collisions. We overview previous results from the Parton-Hadron-String Dynamics transport approach (PHSD), relying on a G-matrix calculation of strange meson spectral functions within a meson-exchange model. Our understanding of strange meson interactions in nuclear matter within transport simulations is discussed in view of the in-medium cross sections obtained within the chiral unitary approach.

HK 42.3 Do 14:45 HZ 7

In-medium properties of strange vector mesons in dense and hot nuclear matter — •Andrej Ilner[1], Daniel Cabrera[1,2], Pornrad Srisawad[3], and Elena Bratkovskaya[1,2] — [1]Institut für theoretische Physik, Johann Wolfgang-Goethe Universität, Frankfurt am Main, Deutschland — [2]FIAS, Frankfurt am Main, Deutschland — [3]Faculty of Science, Naresuan University, Phitsanulok, Thailand

We investigate the in-medium properties of strange vector mesons (K^* and $\bar{K}^*$) in dense and hot nuclear matter based on chirally motivated models of the meson self-energies. We parameterise medium effects as density or temperature dependent effective masses and widths, obtain the vector meson spectral functions within a Breit-Wigner prescription (which is often used in transport simulations), and study whether such an approach can retain the essential features of full microscopic calculations. For $\mu_B \neq 0$ the medium corrections arise from $\bar{K}^*(K^*)N$ scattering and the $\bar{K}^*(K^*) \to \bar{K}(K)\pi$ decay mode (accounting for in-medium $\bar{K}(K)$ dynamics). We calculate the scattering contribution to the K^* self-energy based on the hidden local symmetry formalism for vector meson nucleon interactions, whereas for the $\bar{K}^*$ self-energy we implement recent results from a self-consistent coupled-channel determination within the same approach. For $\mu_B \simeq 0$ and finite temperature we rely on a phenomenological approach for the kaon self-energy in a hot pionic medium consistent with chiral symmetry, and evaluate the $\bar{K}^*(K^*) \to \bar{K}(K)\pi$ decay width. The emergence of a mass shift at finite temperature is studied with a dispersion relation over the imaginary part of the vector meson self-energy.

HK 42.4 Do 15:00 HZ 7

Charged Kaon Production in Au+Au-Collisions at 1.23 AGeV with HADES — •Heidi Schuldes for the HADES-Collaboration — Goethe-Universität Frankfurt

In the energy regime of 1-2 AGeV, strangeness is produced below its elementary production threshold, this results in a steep excitation function. Due to their quark content, positive and negative kaons have different elementary production thresholds. Furthermore, K^+ are supposed to feel a repulsive kaon nucleon potential, while K^- can be resonantly absorbed by nucleons.

HADES, installed at the Helmholtzzentrum für Schwerionenforschung (GSI) in Darmstadt, Germany, provides excellent capability to measure rare kaon signals. In April and May 2012, 7.3 billion Au(1.23 GeV per nucleon)+Au collisions have been recorded by the HADES detector. In this contribution preliminary particle spectra of charged kaons measured in Au+Au reactions will be presented. The results will be discussed with respect to the production mechanism.

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HK 42.5 Do 15:15 HZ 7

Spectral Functions for the Quark-Meson Model Phase Diagram from the Functional Renormalization Group — •Ralf-Arno Tripolt[1], Nils Strodthoff[2], Lorenz von Smekal[1,3], and Jochen Wambach[1,4] — [1]Theoriezentrum, Institut für Kernphysik, Technische Universität Darmstadt, 64289 Darmstadt, Germany — [2]Institut für Theoretische Physik, Ruprecht-Karls-Universität Heidelberg, 69120 Heidelberg, Germany — [3]Institut für Theoretische Physik, Justus-Liebig-Universität Giessen, 35392 Giessen, Germany — [4]GSI Helmholtzzentrum für Schwerionenforschung GmbH, 64291 Darmstadt, Germany

We present a method to obtain spectral functions at finite temperature and density from the Functional Renormalization Group. Our method is based on a thermodynamically consistent truncation of the flow equations for 2-point functions with analytically continued frequency components in the originally Euclidean external momenta. For the uniqueness of this continuation at finite temperature we furthermore implement the physical Baym-Mermin boundary conditions. We demonstrate the feasibility of the method by calculating the mesonic spectral functions in the quark-meson model along the temperature axis of the phase diagram, and at finite quark chemical potential along the fixed-temperature line that crosses the critical endpoint of the model.

HK 42.6 Do 15:30 HZ 7

Chiral restoration and deconfinement in two-color QCD with two flavors of staggered quarks — •David Scheffler[1], Christian Schmidt[2], Philipp Scior[1], Dominik Smith[1], and Lorenz von Smekal[1,3] — [1]Institut für Kernphysik, Technische Universität Darmstadt, Darmstadt, Germany — [2]Fakultät für Physik, Universität Bielefeld, Bielefeld, Germany — [3]Institut für Theoretische Physik, Justus-Liebig-Universität, Gießen, Germany

In preparation of lattice studies of the two-color QCD phase diagram we study chiral restoration and deconfinement at finite temperature with two flavors of staggered quarks using an RHMC algorithm on GPUs. We first study unquenching effects in local Polyakov loop distributions, and the Polyakov loop potential obtained via Legendre transformation, in a fixed-scale approach for heavier quarks. We also present the chiral condensate and the corresponding susceptibility over the lattice coupling across the chiral transition for lighter quarks. Using Ferrenberg-Swendsen reweighting we extract the maxima of the chiral susceptibility in order to determine pseudo-critical couplings on various lattices suitable for chiral extrapolations. These are then used to fix the relation between coupling and temperature in the chiral limit.

HK 42.7 Do 15:45 HZ 7

Lattice simulations of the interacting tight-binding model of graphene — •Dominik Smith[1] and Lorenz von Smekal[1,2] — [1]Technische Universität Darmstadt — [2]Justus-Liebig-Universität Giessen

We present results of lattice simulations of the tight-binding model of graphene (carbon atoms arranged on a two-dimensional hexagonal lat-

tice) using a realistic two-body interaction potential for the electronic quasi-particles in which screening of electromagnetic interactions is taken into account. We discuss the spontaneous breaking of the symmetry under exchange of the two triangular sub-lattices, which corresponds to a transition from a conducting to an insulating phase and which occurs when the effective fine structure constant of the theory crosses above a certain threshold. This transition posesses strong similarities to chiral symmetry breaking in relativistic field theory, due to the structure of the low-energy effective theory of graphene, which is a theory of strongly coupled massless Dirac particles. We present a prediction for the exact location of the transition and discuss the possibility of studying other phase transitions of the sytem, such as the topological Lifshitz transition which occurs at finite density in the pure tight-binding theory.