HK 26 Theorie

Zeit: Dienstag 14:00–16:00 Raum: TU MA004

Gruppenbericht HK 26.1 Di 14:00 TU MA004

The Phase Diagram of the Quark-Meson Model — •Bernd-Jochen Schaefer[1] and Jochen Wambach[1,2] — [1]Institut für Kernphysik, TU Darmstadt — [2]GSI, Darmstadt

A renormalization group (RG) analysis of the chiral phase diagram of a two-flavor quark-meson model is presented. Using the proper-time RG approach in the chiral limit two transition lines in the phase diagram at finite chemical potential and small temperatures are observed. The sensitivity and cutoff dependence of this novel result on the approximation used are discussed and compared with an so-called Exact RG approach. The influence of a finite (realistic) pion mass on the phase diagram is discussed.

Gruppenbericht HK 26.2 Di 14:30 TU MA004

Phenomenology of Hot QCD at Finite Quark Chemical Potential — •Michael Thaler, Claudia Ratti, and Wolfram Weise — Physik Department, Technische Universität München, 85747 Garching, GERMANY

We investigate two- and three-color QCD thermodynamics at finite quark chemical potential by means of an extended Nambu-Jona-Lasinio model including the scalar diquark channel. A background temporal gauge field couples the chiral and diquark condensates to the Polyakov loop. The model includes the features of deconfinement and chiral symmetry restoration. The parameters of the Polyakov loop potential are fixed in the pure gauge sector by comparison with lattice results. The chiral and diquark condensates and the Polyakov loop expectation value as functions of temperature and quark chemical potential are obtained by minimizing the thermodynamic potential. As an application, the phase diagram, the pion and the scalar diquark masses, the scaled pressure difference $\Delta p(T,\mu)/T^4 = (p(T,\mu) - p(T,0))/T^4$ and the scaled quark number density $n_q(T,\mu)/T^3$ are calculated for two and three colors. Comparison to recent lattice results is discussed.

Work supported in part by INFN and BMBF.

HK 26.3 Di 15:00 TU MA004

The QCD equation of state at finite temperature and baryon density within a quasi-particle model — •Marcus Bluhm[1,2], Burkhard Kämpfer[1], and Gerhard Soff[2] — [1]Forschungszentrum Rossendorf, Dresden, Germany — [2]Institut für Theoretische Physik, TU Dresden, Dresden, Germany

We present a quasi-particle model for the equation of state of QCD matter. The model is compared in detail with lattice QCD calculations at finite temperature and baryo-chemical potential which became accessible only recently. Special focus is put onto the expansion coefficients of the corresponding Taylor series of the thermodynamic potential from which all thermodynamic quantities, like susceptibilities, follow in a thermodynamicly self-consistent way.

Within the Φ functional approach the chain of approximations is outlined which is needed in order to derive our phenomenological model from QCD.

HK 26.4 Di 15:15 TU MA004

Dilepton production from hot hadronic matter in nonequilibrium — •Bjoern Schenke and Carsten Greiner — Institut fuer Theoretische Physik, Johann Wolfgang Goethe Universitaet, Robert-Mayer-Str. 10, 60054 Frankfurt am Main

We investigate medium modifications of low mass vector mesons in heavy ion collisions within a nonequilibrium quantum field theoretical description. In particular the emphasis lies on studying the fundamental question whether an adiabatic, i.e. instantaneous adaption of the dynamic and spectral information to the changing medium, as assumed in schematic model calculations and microscopic transport simulations, is a valid assumption. A significant retardation of the meson's spectral function and the resulting dilepton rate is found, increasing with smaller vacuum widths. This results in remarkable effects on the total dilepton yield, especially within the range where the CERES experiment measured an increased production. Our findings show that an exact treatment of medium modifications requires the consideration of memory effects, and hence is more complicated than commonly assumed.

HK 26.5 Di 15:30 TU MA004

Relativistic Mean Field Model with Momentum Dependent Self Energies — •Stefan Typel — GSI Darmstadt

The relativistic mean field (RMF) model with minimal density dependent meson-nucleon couplings is extended to include couplings of mesons to derivatives of the nucleon field. The basic Lagrangian is presented and the consequences for the nucleon and meson field equations are discussed. In this approach, the nucleon self energies become differential operators with a non-trivial dependence on the medium density. Correspondingly, a momentum dependence of the effective interaction is generated that is absent from conventional RMF models. The effective (Landau) mass of the nucleons (related to the density of states near the Fermi surface) can be freely adjusted in the extended model. Additionally, the Schrödinger equivalent optical potential as extracted from elastic proton-nucleus scattering in Dirac phenomenology can be well described. Parameters of the coupling functions are determined by a fit to properties of finite nuclei. Results for nuclear matter and finite nuclei are compared to conventional models with density dependent couplings or with nonlinear meson self interactions.

HK 26.6 Di 15:45 TU MA004

Correlations in quark matter — •Frank Frömel, Stefan Leupold, and Ulrich Mosel — Institut für Theoretische Physik, Universität Giessen, Germany

The spectral functions of light quarks and mesons in quark matter can be investigated in a fully self consistent approach. Using the pointlike interaction of the Nambu-Jona-Lasinio model, relations between quark self energies and spectral functions are the basis for an iterative calculation beyond the usual mean-field and RPA approximations. We consider a full series of RPA type diagrams with dressed quarks for the quark collision rate. These diagrams can be interpreted as dynamically generated mesons (σ, π) coupled to the quarks. To obtain a self consistent scheme, the results are fed back into the quark self energies. This method allows, in particular, to investigate the role of short-range correlations in quark matter. Calculations have been performed for vanishing temperature and finite chemical potential. The results clearly show effects of collisional broadening in the spectral functions of quarks and mesons. Also, other deviations from mean field calculations will be discussed.