HK 34: Heavy Ion Collision and QCD Phases VIII

Zeit: Mittwoch 14:00–16:00 Raum: S1/01 A01

Gruppenbericht HK 34.1 Mi 14:00 S1/01 A01

QCD inspired determination of NJL-parameters — •Paul Springer[1], Jens Braun[2,3], Stefan Rechenberger[2], and Fabian Rennecke[3,4] — [1]Physik Department, Technische Universität München, 85747 Garching, Germany — [2]Institut für Kernphysik (Theoriezentrum), Technische Universität Darmstadt, 64289 Darmstadt, Germany — [3]ExtreMe Matter Institute EMMI, GSI, 64291 Darmstadt, Germany — [4]Institut für Theoretische Physik, Universität Heidelberg, 69120 Heidelberg, Germany

Studies of the QCD phase diagram at finite temperature and quark chemical potential are currently one of the most discussed topics in theoretical physics and are of great importance to better our understanding of heavy-ion collision experiments. However, there is considerable uncertainty about the detailed structure of the QCD phase diagram at high baryon densities. Models provide some insight into the phase structure but usually rely on various parameters and therefore require validation from the point of view of the fundamental theory. We propose to apply nonperturbative functional Renormalization Group methods (FRG) to QCD in order to determine constraints on the parameters used in low-energy QCD models. In particular, this includes a determination of the dependence of these parameters on temperature and quark chemical potential. We present first results and argue that our findings can be used to improve the predictive power of model calculations.

HK 34.2 Mi 14:30 S1/01 A01

Stochastic Quantization with Colored Noise — •Felix Ziegler, Jan Martin Pawlowski, and Ion-Olimpiu Stamatescu — Institute for Theoretical Physics, Heidelberg University

Studying the topological properties of the QCD vacuum, observables obtained from lattice simulations are suffering from short-distance fluctuations. To solve this problem, smoothening methods such as cooling and the Wilson flow have been developed.

We present a method based on stochastic quantization with UV-regulated noise enabling a direct control of the quantum fluctuations at all lattice momentum scales. Smoothened configurations are generated from the beginning.

The method is tested on a scalar field theory in two and four dimensions as well as pure SU(2) gauge theory. Effects of colored noise on observables are analyzed. Moreover, we investigate the existence of a scale above which physical quantities become independent of UV fluctuations at larger scales.

We present and discuss our recent results.

HK 34.3 Mi 14:45 S1/01 A01

Yang-Mills correlation functions from functional methods — •Anton Konrad Cyrol[1], Leonard Fister[2], Mario Mitter[1], Jan Martin Pawlowski[1,3], and Nils Strodthoff[1] — [1]Institute for Theoretical Physics, Heidelberg University, Philosophenweg 16, 69120 Heidelberg, Germany — [2]Institut de Physique Theorique, CEA Saclay, F-91191 Gif-sur-Yvette, France — [3]ExtreMe Matter Institute EMMI, GSI, Planckstr. 1, D-64291 Darmstadt, Germany

We investigate SU(3)-Yang-Mills theory in a systematic vertex expansion scheme for the effective action. Particular focus is put on the dynamical creation of the gluon mass gap at non-perturbative momenta, and the consistent treatment of quadratic divergences. The gluon and ghost propagators as well as the momentum-dependent ghost-gluon, three-gluon and four-gluon vertices are calculated self-consistently. Furthermore, we calculate the two-ghost-two-gluon and the four-ghost vertices and back-couple them into the propagator equations. Apparent convergence of the expansion scheme is shown. The result for the gluon propagators is in quantitative agreement with the corresponding lattice results.

HK 34.4 Mi 15:00 S1/01 A01

Shear viscosity and entropy of a pion gas — •Jean-Bernard Rose, Dmytro Oliinychenko, Anna Schäfer, and Hannah Petersen — FIAS, Goethe University, Frankfurt, Germany

A model of microscopic non-equilibrium dynamics for classical point particles is used to calculate the transport coefficients of dense hadronic matter. Specifically, the shear viscosity to entropy density ratio is investigated, and the temperature dependence between 100 MeV and 300 MeV is explored. Calculations are made at corresponding particle densities going from 0.01 to 0.34 in a pion box simulating infinite matter. The results for the entropy and shear viscosity are then compared to analytic estimates. In addition, massless particles as well as ρ-meson resonance excitations are included. This will be the starting point for the calculation of more transport coefficients as functions of T and μ_B; expanding systems could also be considered.

HK 34.5 Mi 15:15 S1/01 A01

Non-perturbative dynamics in gauge and scalar systems - a challenge to kinetic theory — Jürgen Berges[1], •Kirill Boguslavski[1], Sören Schlichting[2], and Raju Venugopalan[1,2] — [1]Institut für Theoretische Physik, Universität Heidelberg, Heidelberg, Germany — [2]Brookhaven National Laboratory, Physics Department, Upton, NY, USA

We report of a universality class for longitudinally expanding systems, encompassing strongly correlated non-Abelian plasmas and scalar field theories in an intermediate range of momenta. This poses further challenges to our understanding of the thermalization process in the high-energy limit of heavy-ion collisions, like a puzzling evolution of the longitudinal to transverse pressure ratio in non-Abelian plasmas. In scalar theory, we show that the same behavior can be understood from non-trivial infrared dynamics related to a nonthermal fixed point.

HK 34.6 Mi 15:30 S1/01 A01

Inverse Monte Carlo Methoden für effektive SU(2)-Polyakovmodelle — •Bardiya Bahrampour — Institut für Theoretische Physik, JLU Gießen, Deutschland

Wir benutzen geometrische Ward-Identitäten der Eichgruppen einer effektiven Quantenfeldtheorie, um die Kopplungskonstanten mittels sogenannter inverser Monte Carlo Methoden an eine volle Theorie zu fitten. Dazu betrachten wir die Ward-Identitäten als Erwartungswerte einer Oberservablen in der vollen Theorie und bestimmen die Kopplungskonstanten numerisch, so dass die erhaltenen Gleichungen erfüllt sind. Mit dieser Methode untersuchen wir verschiedener effektive Theorien (resummierte und nicht-lokale Polyakov-Modelle) und das verhalten ihrer Kopplungskonstanten.

HK 34.7 Mi 15:45 S1/01 A01

Mesonic Spectral Functions from the Functional Renormalization Group — •Christopher Jung[1,2] and Lorenz von Smekal[1,2] — [1]JLU Giessen — [2]TU Darmstadt

We present a non-perturbative method to obtain spectral functions at finite temperature and density from the Functional Renormalization Group (FRG). This method is based on an analytic continuation on the level of the flow equations. In particular, we will use an effective QCD model, the Polyakov-quark-meson model, to calculate mesonic spectral functions along the phase diagram of the model.