HK 20: Schwerionenkollisionen und QCD Phasen

Zeit: Dienstag 14:00–16:00 Raum: HZ 7

HK 20.1 Di 14:00 HZ 7

Thermalization through Hagedorn-States — •Maxim Beitel — Institut für Theoretische Physik, Goethe-Universität Frankfurt, Max-von-Laue-Straße 1, D-60438 Frankfurt, Germany

Our goal is to examine the evolution of a heavy ion collision starting from non-equilibrium to an equilibrium state by looking at the corresponding thermalization times. Therefore we use the hadronic transport model "UrQMD" as microscopic model for high-energetic heavy ion collisions. Unfortunately these times are too long at present because detailed balance is not realized for all collisions which may occur. In our approach to get rid of this drawback we deploy Hagedorn-States proposed by the "Statistical Bootstrap Model". Creation of these states in binary collisions and their decay into two particles only will lower the thermalization times in UrQMD. Supported by HGS-HIRe.

HK 20.2 Di 14:15 HZ 7

The role of fluctuations in the QCD phase diagram — •Naseemuddin Khan[1], Jan Martin Pawlowski[1], Kenji Fukushima[2], and Nils Strodthoff[1] — [1]Institute of Theoretical Physics Heidelberg — [2]Departement of Physics, Tokio University

We construct an effective quark meson diquark model to simulate QCD at low energies. We employ the framework of the functional renormalization group, within which fluctuations of fermions and bosons can be included. We study the behavior of the chiral condensate at various temperatures and chemical potentials as well as the diquark condensate, which arises at higher chemical potentials.

HK 20.3 Di 14:30 HZ 7

Dynamical simulation of a linear sigma model near the critical point — •Christian Wesp[1], Alex Meistrenko[1], Hendrik van Hees[2], and Carsten Greiner[1] — [1]Institut für Theoretische Physik, Goethe-Universität Frankfurt, Max-von-Laue-Straße 1, D-60438 Frankfurt, Germany — [2]Frankfurt Institute for Advanced Studies, Ruth-Moufang-Straße 1, D-60438 Frankfurt, Germany

The intention of this study is the search for signatures of the chiral phase transition. To investigate the impact of flucutations, e.g. of the baryon number, on the transition or a critical point, the linear sigma model is treated in a dynamical 3+1D numerical simulation. Chiral fields are approximated as classical fields, quarks are described by quasi particles in a Vlasov equation. Additional dynamic is implemented by quark-quark and quark-sigma-field interaction. For a consistent description of field-particle interactions, a new Monte-Carlo-Langevin-like formalism has been developed and is discussed.
Supported by HGS-HIRe.

HK 20.4 Di 14:45 HZ 7

Inhomogeneous phases of isospin-asymmetric matter in the Nambu–Jona-Lasinio model — •Daniel Nowakowski[1,2], Michael Buballa[1], Stefano Carignano[3], and Jochen Wambach[1] — [1]Institut für Kernphysik, Technische Universität Darmstadt — [2]ExtreMe Matter Institute EMMI, GSI Helmholtzzentrum für Schwerionenforschung — [3]Department of Physics, University of Texas at El Paso

We investigate the phase structure of strong-interaction matter within a two-flavor Nambu–Jona-Lasinio model. Earlier it has been shown for degenerate quark flavors that chiral symmetry-breaking phases with spatially modulated order-parameters can occur. We analyze the emergence of these inhomogeneous phases in isospin-asymmetric matter by extending the model through an additional isospin chemical potential, however restricting the order-parameter to be spatially modulated in only one dimension. It is found that for a non-vanishing isospin chemical potential the formation of inhomogeneous chiral symmetry-breaking phases is disfavored, when enforcing equal periodicities for the up and down quarks and neglecting charged pion condensation. If the periodicities of the quarks are not limited to be of the same magnitude, inhomogeneous chiral symmetry-breaking phases are found to be less sensitive to the additional pairing stress and can occur in a larger domain of the phase diagram. As an outlook we discuss possible extensions, like the addition of inhomogeneous charged pion condensation or color superconductivity.

HK 20.5 Di 15:00 HZ 7

Effective SU(2) Polyakov Loop Models for the Deconfinement Transition — •Philipp Scior[1], Lukas Holicki[1], David Scheffer[1], Dominik Smith[1], Lorenz von Smekal[1,2], and Björn Wellegehausen[2] — [1]TU Darmstadt — [2]Justus-Liebig-Universität Gießen

We compare different SU(2) Polyakov loop actions with full two-color QCD simmulations around and above the critical Temperature. The actions are motivated by combined strong coupling and hopping expansion and respect Z_{2} center symmetry. We extract the effective couplings of our models by matching the Polyakov loop distributions and correlators in the effective models with those from full two-color QCD simmulations.

HK 20.6 Di 15:15 HZ 7

Dynamical quark mass generation in a strong external magnetic field — •Niklas Mueller[1,2], Christian S. Fischer[1], and Jacqueline A. Bonnet[1] — [1]Justus-Liebig-Universität Giessen — [2]Universität Heidelberg

We investigate the effect of a strong magnetic field on dynamical chiral symmetry breaking in quenched and unquenched QCD. To this end we apply the Ritus formalism to the coupled set of (truncated) Dyson-Schwinger equations for the quark and gluon propagator under the presence of an external constant Abelian magnetic field. We discuss the effect of the magnetic field onto the quark condensate and extract the chiral suszeptibility.

HK 20.7 Di 15:30 HZ 7

On three-point correlations in pure Landau gauge QCD — Adrian Blum[1], •Markus Huber[1], Mario Mitter[2,3], and Lorenz von Smekal[1,4] — [1]Theoriezentrum, Institut für Kernphysik, Technische Universität Darmstadt, Schlossgartenstrasse 2, 64289 Darmstadt — [2]Institut für Theoretische Physik, Universität Heidelberg, Philosophenweg 16, 69120 Heidelberg — [3]Institut für Theoretische Physik, Goethe-Universität Frankfurt, Max-von-Laue-Straße 1, 60438 Frankfurt/Main — [4]Institut für Theoretische Physik, Justus-Liebig-Universität, 35392 Gießen

In the investigation of quantum chromodynamics Green functions are a useful means to bridge the gap between elementary fields and the emergent physics. Important for the progress in recent years was a good understanding of Green functions in the vacuum. Here we use functional methods for the calculation of correlation functions and investigate how large the errors induced by modern truncation schemes are. For this we calculate three-point functions and include them for the first time also dynamically into the system of truncated Dyson-Schwinger equations, thus reducing the dependence on models.

HK 20.8 Di 15:45 HZ 7

The Binder cumulant in O(N)-models — •Paul Springer and Bertram Klein — Physik Department, Technische Universität München, 85747 Garching

The phase structure of QCD is a much discussed topic in particle physics. In the context of this discussion we need precise knowledge about the nature of the chiral phase transition. A powerful tool to investigate it are lattice simulations. They are, however, still restricted to relatively large quark masses, far from the chiral limit, and to small volumes, which could affect the critical behavior. These two facts complicate the scaling analysis of lattice QCD results.

In the chiral limit, a continuous phase transition is expected in two-flavor QCD. Since continuous phase transitions are controlled by the long range fluctuations, only the dimensionality and symmetries dictate the universal behavior near the critical point. Therefore, more simple systems from the same universality class can be investigated in order to describe scaling behavior which is expected in lattice QCD.

Because the long range fluctuations play a prominent role at continuous phase transitions, it is self-evident that it is useful to investigate the behavior of higher-order critical fluctuations at the transition point. For this purpose the Binder cumulants seem to be very well suited.

We analyze the fourth-order Binder cumulant in 3-dimensional O(2)- and O(4)-models in finite volumes using non-perturbative Renormalization Group methods. This approach allows us to gain explicit insight into the behavior of the critical fluctuations and provides a tool which assists in analysis of lattice QCD data.