HK 68: Heavy-Ion Collisions and QCD Phases XV

Time: Thursday 15:45–17:15 Location: HBR 62: EG 03

Group Report HK 68.1 Thu 15:45 HBR 62: EG 03

QCD Phase Diagram from Strong Coupling Lattice QCD — •Wolfgag Unger[1], Pratitee Pattanaik[1], and Jangho Kim[2] — [1]Fakultät für Physik, Universität Bielefeld — [2]Institute for Advanced Simulation (IAS-4), Forschungszentrum Jülich

We review recent results based on the strong coupling expansion for lattice QCD with staggered fermions at finite temperature and density. The representation of the lattice partition function is in terms of so-called dual variables that allow to circumvent the finite density sign problem. It can be efficiently sampled via Monte Carlo, and is also suitable for Quantum Computing.

We summarize results of the phase diagram at finite baryon density and also address the extension of the strong coupling phase diagram to finite isopin density.

HK 68.2 Thu 16:15 HBR 62: EG 03

A Stability Analysis of Inhomogeneous Phases in QCD. — •Theo Motta[1,2], Julian Bernhardt[1], Michael Buballa[2], and Christian Fischer[1] — [1]JLU Gießen — [2]TU Darmstadt

Understanding the phase structure of Quantum Chromodynamics (QCD) is of paramount importance for nuclear and particle physics. At large densities and low temperatures, many complex phases are expected to appear. This is where the lattice sign problem is unavoidable and extrapolation methods such as Taylor expansions are out-of-bounds. Alongside colour-superconductivity, quarkyonic matter, and so on, the possibility of a crystalline phase has been studied for over twenty years. In simplified models of QCD such as NJL or quark-meson models, these phases are present. However, no unambiguous determination exists that they appear in QCD. In this talk, I will discuss our efforts to develop a method of stability analysis that is compatible with full QCD via Dyson-Schwinger Equations.

HK 68.3 Thu 16:30 HBR 62: EG 03

Quark diffusion coefficients in the phase structure of QCD — •Jonas Wessely[1], Jan M Pawlowski[1,2], and Nicolas Wink[3] — [1]Institut für Theoretische Physik, Universität Heidelberg, Philosophenweg 16, 69120 Heidelberg, Germany — [2]ExtreMe Matter Institute EMMI, GSI, Planckstr. 1, 64291 Darmstadt, Germany — [3]Institut für Kernphysik, Technisch Universität Darmstadt, Schloessgartenstraße 2, 64289 Darmstadt, Germany

I present result on the quark diffusion coefficient for different (light) flavours at finite temperature and density. The diffusion coefficients are obtained via the Kubo relation from non-perturbative realtime diagrams which depend on single particle spectral functions of quarks and gluons. The latter are computed with a combination of spectral reconstructions and recently developed spectral functional techniques for the quark propagator spectral functions at finite T and μ_B.

HK 68.4 Thu 16:45 HBR 62: EG 03

Searching for inhomogeneous phases in the quark-meson model beyond mean field — •Lennart Kurth — TU Darmstadt, Germany

Mean field studies of effective models for QCD have revealed the possibility of the preferred condensate being spatially modulated in certain regions of the phase diagram, i.e., inhomogeneous phases. We extend these studies beyond mean field using the functional renormalization group to include pion fluctuations in a simple truncation of the quark-meson model. In this context, we perform a systematic scan of all UV parameters and investigate their effect on the phase diagram, including inhomogeneous phases. The presence of these is determined via stability analysis. As a result, we find that there is a region in parameter space in which an inhomogeneous phase exists, as is the case in mean field.

HK 68.5 Thu 17:00 HBR 62: EG 03

QCD Anderson transition with overlap valence quarks on a twisted-mass sea — •Robin Kehr[1], Dominik Smith[1,2], and Lorenz von Smekal[1,3] — [1]Institut für Theoretische Physik, Justus-Liebig-Universität, Heinrich-Buff-Ring 16, 35392 Giessen, Germany — [2]Facility for Antiproton and Ion Research in Europe GmbH (FAIR GmbH), 64291 Darmstadt, Germany — [3]Helmholtz Forschungsakademie Hessen für FAIR (HFHF), GSI Helmholtzzentrum für Schwerionenforschung, Campus Gießen

In this work we probe the QCD Anderson transition by studying spectral distributions of the massless overlap operator on gauge configurations created by the *twisted mass at finite temperature collaboration* (tmfT) with 2+1+1 flavors of dynamical quarks and the Iwasaki gauge action. We assess finite-size and discretization effects by considering two different lattice spacings and several physical volumes, and mimic the approach to the continuum limit through stereographic projection. Fitting the inflection points of the participation ratios of the overlap Dirac eigenmodes, we obtain estimates of the temperature dependence of the mobility edge, below which quark modes are localized. We observe that it is well-described by a quadratic polynomial and systematically vanishes at temperatures below the pseudo-critical one of the chiral transition. In fact, our best estimates within errors overlap with that of the chiral phase transition temperature of QCD in the chiral limit.