HK 43 Theorie

Zeit: Donnerstag 14:00–15:30 Raum: G

Gruppenbericht HK 43.1 Do 14:00 G

Phases of QCD — •Claudia Ratti[1,2], Simon Rössner[1], Michael Thaler[1], and Wolfram Weise[1] — [1]Physik Department, T39, Technische Universität München — [2]ECT*, Trento, Italy

We investigate QCD-based thermodynamics at finite quark chemical potential. Lattice QCD results are compared with a generalized Nambu Jona-Lasinio model in which quarks couple simultaneously to the chiral condensate and to a background temporal gauge field representing Polyakov loop dynamics. This so-called PNJL model thus includes features of both deconfinement and chiral symmetry restoration. The equation of state of a system of two [1] and two-plus-one [2] quark flavours is evaluated, and the results are compared to the corresponding lattice data, at zero and finite quark chemical potential. The phase diagram of the model, in the temperature-chemical potential plane, is obtained [3], and its quark-mass dependence is investigated. Predictions are made for the phase diagram at values of the physical quark masses, still inaccessible by the present lattice calculations. The position of the tricritical point, separating first-order phase transition from crossover, is studied as a function of the bare quark masses. Regions of high chemical potential are explored in the two-flavour case, and the possibility of diquark condensation and colour superconductivity is taken into account.

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[1] C. Ratti, M. A. Thaler and W. Weise, hep-ph/0506234.
[2] C. Ratti, M. A. Thaler and W. Weise, in preparation.
[3] C. Ratti, S. Rößner and W. Weise, in preparation.

Gruppenbericht HK 43.2 Do 14:30 G

Aspects of the confinement mechanism in Coulomb-gauge QCD — •Reinhard Alkofer, Markus Kloker, Andreas Krassnigg, Klaus Lichtenegger, and Robert F. Wagenbrunn — Institut für Physik, University of Graz, A-8010 Graz, Austria

Phenomenological consequences of the infrared singular, instantaneous part of the gluon propagator in Coulomb gauge are investigated [1]. The corresponding quark Dyson-Schwinger equation is solved, neglecting retardation and transverse gluons and regulating the resulting infrared singularities. While the quark propagator vanishes as the infrared regulator goes to zero, the frequency integral over the quark propagator stays finite and well-defined. Solutions of the homogeneous Bethe-Salpeter equation for the pseudoscalar and vector mesons as well as for scalar and axialvector diquarks are obtained. In the limit of a vanishing infrared regulator the diquark masses diverge, while meson properties and diquark radii remain finite and well-defined. These features are interpreted with respect to the resulting aspects of confinement for colored quark-quark correlations. The qualitative features are stable when including transverse gluons. Corresponding preliminary results are presented.

[1] R. Alkofer, M. Kloker, A. Krassnigg, R.F. Wagenbrunn, Phys. Rev. Lett., in print [arXiv:hep-ph/0510028].

Gruppenbericht HK 43.3 Do 15:00 G

The Critical Region of the QCD Phase Transition — •Bernd-Jochen Schaefer[1,2] and Jochen Wambach[2,3] — [1]Institut f\"ur Physik, Karl-Franzens-Universit\"at, A-8010 Graz, Austria — [2]Institut f\"ur Kernphysik, TU Darmstadt, D-64289 Darmstadt, Germany — [3]Gesellschaft f\"ur Schwerionenforschung GSI, D-64291 Darmstadt, Germany

The QCD (tri)critical point is a genuine second-order phase transition and implies the existence of a massless scalar mode. In this talk we focus on the finite region around the critical point and estimate its size. We use the proper-time renormalization group method in order to calculate the scalar and quark-number susceptibilities and compare the results with a mean-field approximation where fluctuations are neglected.