T 23: Gittereichtheorie

Convenor: Carsten Urbach

Zeit: Donnerstag 16:45–18:15 Raum: VG 3.101

T 23.1 Do 16:45 VG 3.101

Correlation functions of atomic nuclei in Lattice QCD — Zoltán Fodor[1,2,3], •Jana Günther[1], Balint Toth[1], and Lukas Varnhorst[1] — [1]Department of Physics, Bergische Universität Wuppertal, D-42119 Wuppertal, Germany — [2]Institute for Theoretical Physics, Eötvös University, H-1117 Budapest, Hungary — [3]Jülich Supercomputing Centre, Forschungszentrum Jülich, D-52425 Jülich, Germany

To determine the mass of the atomic nuclei in lattice QCD one has to calculate the correlation function of suitable combinations of quark field operators. However the calculation of this correlation functions requires to evaluate a large number of Wick contractions which scales as the factorial of the number of nucleons in the system. We explore the possibilities to reduce the computational effort for such evaluations by exploiting certain symmetries of the systems. We discuss a recursive approach which respects these symmetries and may allow the determination of the correlation function in significantly less computer time.

T 23.2 Do 17:00 VG 3.101

QCD phase transition at finite temperature? — Szabolcs Borsányi[1], Zoltán Fodor[1,2,3], Jana Günther[1], Christian Hölbling[1], Sándor D. Katz[1,2], Thorsten Kurth[1], Kalman Szabo[1], and •Lukas Varnhorst[1] — [1]Department of Physics, Bergische Universität Wuppertal, D-42119 Wuppertal, Germany — [2]Institute for Theoretical Physics, Eötvös University, H-1117 Budapest, Hungary — [3]Jülich Supercomputing Centre, Forschungszentrum Jülich, D-52425 Jülich, Germany

We investigate the finite temperature phase transition at $\mu = 0$ in 6-flavour QCD. It is believed that in QCD a transition between the deconfined phase at high temperature and the hadronic phase at low temperature exits. The type of the transition between these two states of matter depends on the quark masses. For physical quark masses it has been shown that the transition is an analytic crossover and not a true phase transition. However at lower quark masses it was suggested that a region exists where a first order phase transition occurs. These region should be separated from the crossover region by a line of second order phase transition.

As a first approach for finding this line of second order phase transition we present lattice calculations with six degenerate staggered quark fields and strong stout smearing. We observe evidence which might suggest a phase transition at low quark masses in this scenario.

T 23.3 Do 17:15 VG 3.101

Confining dyon gas with finite-volume effects under control — •Benjamin Maier[1], Falk Bruckmann[2], Simon Dinter[1,3], Ernst-Michael Ilgenfritz[1,4], Michael Müller-Preussker[1], and Marc Wagner[1,5] — [1]Humboldt-Universität zu Berlin, Institut für Physik, Newtonstr. 15, D-12489 Berlin, Germany — [2]Universität Regensburg, Institut für Theoretische Physik, D-93040 Regensburg, Germany — [3]NIC, DESY Zeuthen, Platanenallee 6, D-15738 Zeuthen, Germany — [4]Joint Institute for Nuclear Research, VBLHEP, 141980 Dubna, Russia — [5]Goethe-Universität Frankfurt am Main, Institut für Theoretische Physik, Max-von-Laue-Straße 1, D-60438 Frankfurt am Main, Germany

As an approach to describe the long-range properties of non-Abelian gauge theories at non-zero temperature $T < T_c$, we consider a non-interacting ensemble of dyons (magnetic monopoles) with non-trivial holonomy. We show analytically, that the quark-antiquark free energy from the Polyakov loop correlator grows linearly with the distance, and how the string tension scales with the dyon density. In numerical treatments, the long-range tails of the dyon fields cause severe finite-volume effects. Therefore, we demonstrate the application of Ewald's summation method to this system. Finite-volume effects are shown to be under control, which is a crucial requirement for numerical studies of interacting dyon ensembles.

T 23.4 Do 17:30 VG 3.101

Recent results in a chirally invariant Higgs-Yukawa model — •Attila Nagy[1,2], John Bulava[2,3], Philipp Gerhold[1,2], Karl Jansen[2], and Jim Kallarackal[1,2] — [1]Humboldt-Universät zu Berlin — [2]NIC, DESY Zeuthen — [3]CERN, Geneva

We study a chirally invariant Higgs-Yukawa model on a four dimensional space-time lattice by means of a polynonial Hybrid Monte Carlo algorithm. We show results concerning Higgs boson mass bounds in the presence of a hypothetical fourth quark generation for various quark masses. Furthermore we determine the critical temperature of the model, where a phase transition in the vacuum expectation value of the scalar field takes place.

T 23.5 Do 17:45 VG 3.101

η,η' mesons in 2+1+1 twisted mass lattice QCD — Konstantin Ottnad[1,2], Carsten Urbach[1,2], and •Falk Zimmermann[1,2] — [1]Helmholtz-Institut für Strahlen- und Kernphysik, Universität Bonn — [2]European Twisted Mass Collaboration

The twisted mass formulation of lattice QCD is a framework for simulations with an even number of dynamical quarks which benefits from automatic $O(a)$ improvement.

Analysing suitable correlation functions, we focus on the mass splitting between the η and η' meson and related quantities in a setup with $2+1+1$ dynamical quarks. In addition to the unitary setup, a different regularization of valence and sea quarks (Osterwalder-Seiler approach) is employed to study the strange quark mass dependence.

T 23.6 Do 18:00 VG 3.101

MCRG Flow for the Nonlinear Sigma Model — •Daniel Körner — Theoretisch-Physikalisches Institut, Friedrich-Schiller-Universität Jena, Max-Wien-Platz 1, 07743 Jena, Deutschland

A study of the renormalization group flow in the three-dimensional nonlinear O(N) sigma model using Monte Carlo Renormalization Group (MCRG) techniques is presented. To achieve this, blockspin transformations are combined with canonical demon methods to determine the flow diagram for a number of different truncations. Systematic errors of the approach are highlighted. Results are discussed with hindsight on the fixed point structure of the model and the corresponding critical exponents. Special emphasis is drawn on the existence of a nontrivial ultra violet fixed point which is a desired property for theories modeling the asymptotic safety scenario of quantum gravity.