T 23: Quantenfeldtheorie 1

Convenor: Dominik Stöckinger / Oliver Bär

Zeit: Dienstag 16:45–18:55 Raum: WIL-C129

Gruppenbericht T 23.1 Di 16:45 WIL-C129

N=1 supersymmetric Yang-Mills theory on the lattice — Georg Bergner[3], Istvan Montvay[2], •Gernot Münster[1], Umut D. Özugurel[1], Stefano Piemonte[1], and Dirk Sandbrink[1] — [1]Universität Münster — [2]DESY Hamburg — [3]Universität Frankfurt

N=1 supersymmetric Yang-Mills theory describes interacting gauge fields and their superpartners, the spin 1/2 gluinos. A gluino mass term breaks supersymmetry softly. In the supersymmetric limit, the physical particles are expected to form supermultiplets. Past numerical simulations on the lattice were afflicted by significant systematic errors and did not show a clear picture of degenerate multiplets. We report about progress in the study of systematic effects and about the present status of the results.

Gruppenbericht T 23.2 Di 17:05 WIL-C129

Towards Higgs sector spectroscopy — •Axel Maas — Theoretisch-Physikalisches Institut, Universität Jena, Max-Wien-Platz 1, 07743 Jena

Just like the weakly-interacting QED the weak and Higgs interaction can sustain bound states. Field-theoretical considerations suggest that these are deeply-bound, relativistic bound states, at least for a sufficiently light Higgs. Thus, they cannot be described using quantum mechanics. In the here presented lattice results these considerations are confirmed, and the low-lying spectrum of bound states is determined. It is shown how these relate to the observed Higgs and W/Z signals, being in agreement with present experimental results. Furthermore, first estimates are provided for how additional bound states could be observed experimentally.

T 23.3 Di 17:25 WIL-C129

Higgs boson mass bounds in a Higgs-Yukawa model — •Attila Nagy[1,2], John Bulava[3], and Karl Jansen[2] — [1]Humboldt Universität zu Berlin — [2]NIC, Desy Zeuthen — [3]CERN, Theory Devision

We investigate a chirally invaraiant Higgs-Yukawa model using a lattice regularisation by means of Monte Carlo simulations. The model consists of a complex scalar doublet and a doublet of fermions. We use dynamical overlap fermions to maintain an exact chiral symmetry while still not being affected by doubler modes.

In this model calculate Higgs boson mass bounds in the presence of a hypothetical fourth heavy fermion generation. With the propable discovery of the Higgs boson of a mass around 125 GeV, we give strong constrains on the mass of a forth quark generation to be maximally around 300 GeV. Comparison of our findings to lattice perturbation theory show that the model is qualitatively described by perturbation theory up to rather large Yukawa couplings. Using perturbation theory we additionally address the influence on the lower bound of higher dimensional operators (like a ϕ^6-term) in the scalar field potential.

T 23.4 Di 17:40 WIL-C129

Higgs mass bounds from the functional RG — •René Sondenheimer and Holger Gies — Theoretisch-Physikalisches Institut, FSU Jena, Germany

We investigate a Top-Yukawa toy model to study Higgs mass bounds in the framework of the functional renormalization group (RG). Starting the calculations with a quartic ultraviolet (UV) potential we get a finite range of values for the Higgs mass in the infrared for a given cutoff. The bounds appear in a natural way as a consequence of the RG flow. The lower mass bound is approached for a vanishing UV quartic coupling. Furthermore, we study the influence of higher-dimensional operators on the lower Higgs mass bound. We find that even seemingly RG irrelevant interactions can take a substantial influence on the lower bound for the Higgs mass.

T 23.5 Di 17:55 WIL-C129

All-order perturbation theory in non-Abelian gauge theories — •Leila Ali Cavasonza[1] and Giovanni Ridolfi[2] — [1]Institute for Theoretical Particle Physics and Cosmology, RWTH Aachen, Sommerfeldstr. 16, 52074 Aachen — [2]Dipartimento di Fisica, Universita' di Genova and INFN, Via Dodecaneso 33 I16146, Genova Italy

All-order resummation is often crucial to improve fixed-order calculations in perturbative quantum field theories like QCD. Typically one introduces some integral transform, and usually difficulties in computing quantities in the physical space arise, due to non-perturbative effects in the infrared region (the Landau Pole). It is therefore necessary to introduce prescriptions to obtain finite results and, obviously, such prescriptions involve a certain degree of arbitrariness, which leads to uncertainties in the predictions that must be taken under control.

In this project we study some of these prescription and provide physical motivations for their application. More specifically, after an analysis of the so-called traditional resummation procedures (Minimal Prescription and Borel Prescription), we focus on a different approach, which provides resummed quantities free of the problems related to the existence of the Landau Pole. This is done in the analytic infrared coupling hypothesis, using the concept of dispersive integral, and the contribution of the so-called renormalonic diagrams is taken into account. In the perspective of a comparison of this new approach with traditional methods, our analysis focuses on the prescription used to go around the Landau Pole and on the physical justifications for this procedure.

T 23.6 Di 18:10 WIL-C129

Corrections to the strong coupling limit of staggered lattice QCD — •Wolfgang Unger[1], Philippe de Forcrand[2], Michael Fromm[1], Jens Langelage[2], Kotaroh Miura[3], and Owe Philipsen[1] — [1]ITP, Goethe Universität Frankfurt, Deutschland — [2]ITP, ETH Zürich, Schweiz — [3]INFN Laboratori Nazionali di Frascati, Italy

The strong coupling limit of staggered lattice QCD has been studied since decades, both via Monte Carlo and Mean field theory. In this model, the finite density sign problem is mild and the full phase diagram can be studied, even in the chiral limit. It is however desirable to understand the effect of a finite lattice coupling β on the phase diagram in the μ_B-T plane in order to see how it might be related to the phase diagram of continuum QCD. Here we discuss how to construct an effective theory for non-zero lattice coupling, valid to $O(\beta)$, and present Monte Carlo results incorporating these corrections.

T 23.7 Di 18:25 WIL-C129

Lattice computation of the transport coefficient κ in pure Yang-Mills theory — •Christian Schäfer and Owe Philipsen — Goethe-Universität, Frankfurt am Main, Germany

From heavy-ion collision experiments we know that the quark-gluon plasma behaves almost like an ideal fluid and can be described by hydrodynamics. The dynamic properties of the quark-gluon plasma are determined by transport coefficients.

The second order transport coefficient κ is related to a momentum expansion of the euclidean energy-momentum tensor correlator at vanishing Matsubara frequency. The computation of the Fourier-transformed correlator in lattice gauge theory allows the determination of kappa from first principles. We present the results obtained by pure Yang-Mills lattice simulations in comparison to a computation in quasi-free lattice perturbation theory as well as the temperature dependency of the transport coefficient kappa.

T 23.8 Di 18:40 WIL-C129

Yang Mills theory at finite temperature in Coulomb gauge — •Jan Heffner, Hugo Reinhardt, and Davide Campagnari — Institut fuer Theoretische Physik, Uni Tuebingen, Deutschland

The deconfinement phase transition of SU(2) Yang–Mills theory is investigated in the Hamiltonian approach in Coulomb gauge:

Within the variational approach a decent description of the infrared sector of vacuum Yang–Mills theory was obtained. Recently, this approach was extended to finite temperatures by considering the grand canonical ensemble making a suitable quasi-particle ansatz for the density operator and minimizing the free energy. Solving Dyson-Schwinger equations a critical temperature of the deconfinement phase transition is extracted.

Also the effective potential of the order parameter for confinement is calculated within the Hamiltonian approach by compactifying one spatial dimension and using a background gauge fixing. From the full non-perturbative potential calculated within a variational approach a critical temperature of the deconfinement phase transition of 269 MeV is found.