T 13: Theorie: QFT / Gittereichtheorie

Zeit: Montag 16:00–17:30 Raum: Z6 - SR 1.013

T 13.1 Mo 16:00 Z6 - SR 1.013

$\mathcal{N} = 1$ supersymmetric Yang-Mills theory and the gluino condensate from the gradient flow — Sajid Ali[1], Georg Bergner[2], Henning Gerber[1], Pietro Giudice[1], •Camilo Lopez[2], Istvan Montvay[4], Gernot Münster[1], Stefano Piemonte[3], and Philipp Scior[1] — [1]University of Münster — [2]University of Jena — [3]University of Regensburg — [4]Deutsches Elektronen-Synchrotron (DESY)

This talk summarises results from lattice simulations of $\mathcal{N} = 1$ supersymmetric Yang-Mills theory for the gauge groups SU(2) and SU(3). It is expected that this theory has a phase with broken chiral symmetry and non-vanishing gluino condensate. I will discuss the first exploratory studies of the gluino condensate with the gradient flow. If composite operators of bare fields are evolved along a trajectory on field space by means of the flow equations, they become renormalised up to a multiplicative renormalisation constant for the fermionic fields. This allows to calculate the topological charge, chiral condensate and energy density in terms of bare flowed fields on the lattice. We begin exploring this technique by measuring the finite temperature behaviour of the gluino condensate.

T 13.2 Mo 16:15 Z6 - SR 1.013

$\mathcal{N}$=1 supersymmetric SU(3) Yang-Mills theory on the lattice — •Marc Steinhauser, André Sternbeck, Björn Wellegehausen, and Andreas Wipf — Theoretisch-Physikalisches Institut, Friedrich-Schiller-Universität Jena, Germany

Supersymmetric gauge theories are an important building block for extensions of the standard model. As a first step towards Super-QCD we investigate the pure gauge sector, in particular the bound states: meson-like gluinoballs, gluino-glueballs and pure glueballs. The talk will focus on different strategies to improve discretization artifacts, in which the chiral symmetry and the supersymmetry provide important guidelines. The supersymmetric continuum limit and particle masses are discussed and compared to predictions from effective field theory.

T 13.3 Mo 16:30 Z6 - SR 1.013

Elements of non-perturbative quark mass renormalization in three-flavour lattice QCD — Jochen Heitger[1], •Fabian Joswig[1], Simon Kuberski[1], and Anastassios Vladikas[2] — [1]Westfälische Wilhelms-Universität Münster, Institut für Theoretische Physik, Wilhelm-Klemm-Straße 9, 48149 Münster, Germany — [2]INFN, Sezione di Tor Vergata, c/o Dipartimento di Fisica, Università di Roma Tor Vergata, Via della Ricerca Scientifica 1, 00133 Rome, Italy

We report on advances in the determination of the ratio Z_S/Z_P of the scalar to the pseudoscalar renormalization constants in three-flavour lattice QCD with Wilson-clover quarks and tree-level Symanzik improved gluons. The computations are based on the Ward identity approach, using Schrödinger functional boundary conditions. Our results for Z_S/Z_P cover a range of couplings along a line of constant physics with lattice spacings of about 0.09 fm and below, relevant for phenomenological applications such as the non-perturbative renormalization of quark masses. We also outline a strategy to determine the charm quark's mass from $N_f = 2 + 1$ lattice QCD.

T 13.4 Mo 16:45 Z6 - SR 1.013

Non-perturbative improvement of quark mass renormalization in the small lattice spacing region of three-flavor lattice QCD — Patrick Fritzsch[1], Jochen Heitger[2], and •Simon Kuberski[2] — [1]Theoretical Physics Department, CERN, 1211 Geneva 23, Switzerland — [2]Institut für Theoretische Physik, Westfälische Wilhelms-Universität Münster, Wilhelm-Klemm-Straße 9, D-48149 Münster, Germany

The use of Heavy Quark Effective Theory (HQET) on the lattice as an approach to B-physics phenomenology is based on a non-perturbative matching of HQET to QCD in finite volume. As a first step to apply the underlying strategy in the three-flavor ($N_f = 2 + 1$) theory, we determine the renormalization constant and improvement coefficients relating the renormalized current and subtracted quark mass of (quenched) valence quarks in $\mathcal{O}(a)$ improved $N_f = 3$ lattice QCD. We present first results of our calculation for the relevant parameter region towards weak couplings along a line of constant physics, which corresponds to lattice resolutions $a \lesssim 0.02\,\text{fm}$ and fixes the physical extent of the matching volume to $L \approx 0.5\,\text{fm}$.

T 13.5 Mo 17:00 Z6 - SR 1.013

Asymptotic freedom in Higgs-top-QCD model — •Alessandro Ugolotti, Holger Gies, Luca Zambelli, and René Sondenheimer — TPI, FSU Jena

We investigate the existence of asymptotically free trajectories for Higgs-top-QCD models by exploiting generalized boundary conditions. We construct quasi-fixed points for the scalar Higgs potential within different approximation schemes. We substantiate our findings first in standard perturbation theory for renormalizable couplings, then refine these results within an effective-field-theory approach, and obtain a comprehensive picture using the functional renormalization group. We infer the existence of scaling solutions also by means of a weak-Yukawa-coupling expansion in the far ultraviolet. In the same regime we discuss the stability of the quasi-fixed point solutions for large field. We provide further evidence for such asymptotically free theories by numerical studies using pseudo-spectral and shooting methods.

T 13.6 Mo 17:15 Z6 - SR 1.013

Trans-cutoff scattering in theory of a Goldstone boson — •Lukas Eisemann — LMU, Muenchen, Deutschland

In a model of a Nambu-Goldstone-type scalar, we consider $2 \to n$ scattering processes with the CM-energy E distributed equally over the n final quanta. We work out the scaling with n of the tree-level cross sections for these processes. At trans-cutoff energies, perturbative unitarity is violated for $2 \to \textit{few}$, while for n sufficiently large, the theory behaves perturbatively. The turning point n_t, which sets the boundary between in- and decreasing behaviour of the cross section with n, can be found in terms of the CM-energy E.

We then investigate whether the existence of the turning point n_t may indicate that, in trans-cutoff scattering, non-perturbative states, which correspond to certain classical solutions, play a role. We do so by checking whether the spatial extension of those classical solutions $R(E)$ scales in the same way with E as does the wavelength $\lambda(E) = n_t(E)/E$ of the final quanta in the scattering processes $2 \to n_t$.