T 84: Gittereichtheorie

Convenor: C. Bogner, P. Maierhöfer

Zeit: Mittwoch 16:45–19:00 Raum: VSH 11

T 84.1 Mi 16:45 VSH 11

Non-perturbative improvement and renormalization of quark bilinears in lattice QCD with three flavours — •Fabian Joswig[1], Jochen Heitger[1], Anastassios Vladikas[2], and Christian Wittemeier[1] — [1]Institut für Theoretische Physik, Universität Münster, Wilhelm-Klemm-Str. 9, 48149 Münster, Germany — [2]INFN, Sezione di Tor Vergata, c/o Dipartimento di Fisica, Universitá di Roma Tor Vergata, Via della Ricerca Scientifica 1, I-00133 Rome, Italy

We report on calculations in lattice QCD with 3 flavours of Wilson-clover fermions and the tree-level Symanzik-improved gauge action, in order to non-perturbatively determine the improvement coefficient and the renormalization factor of the vector current. The improvement and renormalization conditions are derived from massive Ward identities, using Schrödinger functional boundary conditions, which also offer a method to extract the ratio of the scalar to pseudoscalar renormalization constants. Our computations are done along a line of constant physics with couplings corresponding to lattice spacings of about 0.09 fm and below, relevant for phenomenological applications.

T 84.2 Mi 17:00 VSH 11

Applying the generalized eigenvalue method to extract masses and decay constants in the D_s-meson system — Benoit Blossier[1], Jochen Heitger[2], and •Matthias Post[2] — [1]Laboratoire de Physique Théorique, Bâtiment 210, Université Paris XI, F-91405 Orsay Cedex, France — [2]Institut für Theoretische Physik, Universität Münster, Wilhelm-Klemm-Str. 9, 48149 Münster, Germany

We discuss the application of the generalized eigenvalue problem to lattice QCD determinations of energies and matrix elements in the pseudoscalar and vector meson channel of the charm-strange meson system. The computations employ CLS $N_f = 2$ ensembles with the Wilson gauge action, O(a) improved Wilson-clover fermions and lattice spacings of about 0.065 and 0.05 fm. To extract the ground state masses and decay constants and to investigate effects from excited states, our analysis involves enlarged bases of interpolating fields, e.g., matrices of cross correlators defined via different iterations of Gaussian smearing or including terms with covariant derivatives. These techniques are also expected to be useful for studies of the phenomenologically interesting charmonium system.

T 84.3 Mi 17:15 VSH 11

Lattice Simulations of QCD-like Theories at Finite Density — •Philipp Scior[1], Lorenz von Smekal[2], and Björn Wellegehausen[2] — [1]Institut für Theoretische Physik, Westfälische Wilhelms-Universität Münster — [2]Institut für Theoretische Physik, Justus-Liebig-Universität Gießen

We study QCD-like theories at finite density. In particular we investigate the cold and dense regime of the phase diagram where we expect to find the Silverblaze property realized as Bose-Einstein-condensation of diquarks or a first order liquid-gas transition depending on the gauge group of the theory. Part of our results are derived in the limit of heavy quark masses by using a three-dimensional Polyakov loop theory. This theory can be derived from the full QCD-like theory by a combined strong coupling and hopping expansion.

T 84.4 Mi 17:30 VSH 11

Light Bound States in $\mathcal{N}$=1 SU(2) SUSY Yang-Mills Theory — Sajid Ali[1], Georg Bergner[2], •Henning Gerber[1], Pietro Giudice[1], Simon Kuberski[1], Istvan Montvay[3], Gernot Münster[1], Philipp Scior[1], and Stefano Piemonte[4] — [1]Universität Münster — [2]Universität Jena — [3]DESY Hamburg — [4]Universität Regensburg

Supersymmetry has been investigated for more than forty years. However, the non-perturbative nature of supersymmetric field theories is still largely unknown.

We study non-perturbative properties of $\mathcal{N}$=1 supersymmetric Yang-Mills theory (SYM) within the lattice field theory approach using Monte Carlo simulations. Similar to QCD, SYM is confining and contains strongly bound states.

Applying the variational method together with different smearing techniques we extract masses of the lightest bound states such as gluino-glue, glueball and mesonic states. As these states should form supermultiplets, this study allows to check whether SYM remains supersymmetric also on the quantum level.

T 84.5 Mi 17:45 VSH 11

Ward identities in $\mathcal{N}$ = 1 supersymmetric SU(3) Yang-Mills theory on the lattice — •Sajid Ali[1], Gernot Münster[1], Istavn Montvay[2], Georg Bergner[4], Pietro Giudice[1], Henning Gerber[1], and Stefano Piemonte[3] — [1]Institut für Theoretische Physik, Westfälische Wilhelms-Universität, Wilhelm-Klemm-Str. 9 D-48149 Münster. — [2]Deutsches Elektronen-Synchrotron DESY, Notkestr. 85, D-22603 Hamburg. — [3]Universität Regensburg, Institute for Theoretical Physics, D-93040 Regensburg. — [4]Theoretisch-Physikalisches Institut Friedrich-Schiller-Universität Jena Max-Wien-Platz 1

The introduction of space-time lattice as a regulator of path integral breaks symmetries associated with continuous space-time i.e. Poincare invariance and supersymmetry. Due to non-zero bare gluino mass in the supersymmetric Yang-Mills theory the chiral symmetry is also broken. Provided that there are no SUSY-anomalies the lattice form of Ward identities can be used, by imposing that their continuum form should be recovered when removing the lattice regulator, to obtain chiral limit where the theory is characterized by massless gluinos.

T 84.6 Mi 18:00 VSH 11

Lattice studies of the charmonium spectrum — •Stefano Piemonte — University of Regensburg

Many experiments have found evidence of charmonium-like states that do not fit into conventional models of quark-antiquark mesons. Non-perturbative insight provided by lattice simulations is required to fully understand the properties of those states. The computation of single and multiparticle correlators is the main challenge of the numerical investigation of unstable states on the lattice. The phase shift and the properties of the resonance are then extracted from the finite volume energy levels. We present our analysis based on the distillation method and preliminary results for the charmonium states near the threshold.

T 84.7 Mi 18:15 VSH 11

Near threshold charmed-strange meson states — •Antonio Cox — Universitätsstraße 31 93053 Regensburg Deutschland

Early theoretical studies and lattice simulations predicted the scalar and axial-vector D_s charmed-strange mesons to be broad states lying above the thresholds, DK and D^*K respectively. Experiments found narrow states $D^*_{s0}(2317)$ and $D_{s1}(2460)$ below threshold. We present lattice results of a high statistics $N_f = 2$ study with a lattice spacing of approximately 0.071 fm, taking explicitly into account the thresholds by including four quark operators. We find a lowering of the meson's masses relative to the two quark operator results. Two pion masses of 290 and 150 MeV with multiple volumes up to 4.5 fm were employed. The volume dependence of the resulting spectrum is investigated according to Luescher's formula.

T 84.8 Mi 18:30 VSH 11

η and η' masses and decay constants from lattice QCD — •Jakob Simeth, Gunnar Bali, and Sara Collins — Universität Regensburg, D-93040 Regensburg

We present preliminary results for the masses and decay constants of the η and η' mesons from ab initio lattice QCD simulations.

The analysis is performed using the CLS $N_f = 2 + 1$ ensembles, which cover a wide range of quark masses, lattice spacings and volumes and approach the physical point along two trajectories, one keeping the trace of the quark masses fixed and the other at constant strange quark mass.

One of the major challenges in these calculations are the large statistical fluctuations due to disconnected quark loops. We tackle these by employing a combination of noise reduction techniques which are tuned to achieve the optimal noise reduction per cost.

T 84.9 Mi 18:45 VSH 11

Faster process integration and event generation with WHIZARD — •Wolfgang Kilian[1], Thorsten Ohl[2], Jürgen Reuter[3], and Simon Brass[1] — [1]Department Physik, University of

Siegen, D-57068 Siegen, Germany — [2]Institut für Theoretische Physik und Astrophysik, University of Würzburg, D-97074 Würzburg, Germany — [3]Theory Group, DESY Hamburg, D-22603 Hamburg, Germany

Monte Carlo generators are committed to keep up with the rising complexity of collider experiments. Collider energies rising to new levels make the simulation of processes with an increasing number of final state particles more and more time-consuming.

We describe a parallelisation ansatz using first-principle strategies provided by OpenMP and MPI for the Monte Carlo generator `WHIZARD` and show the gained speed up of `WHIZARD` for $2 \to 6$ benchmarking processes.