T 22: Gittereichtheorie

Convenor: Oliver Bär

Zeit: Montag 16:45–18:45 Raum: WIL-C129

T 22.1 Mo 16:45 WIL-C129

Leading-order hadronic contributions to a_μ and $\alpha_{\rm QED}$ from $N_f = 2+1+1$ twisted mass fermions — Xu Feng[1], •Grit Hotzel[2], Karl Jansen[3], Marcus Petschlies[4], and Dru Renner[5] — [1]High Energy Accelerator Research Organization (KEK), Tsukuba, Japan — [2]Humboldt-Universität zu Berlin, Institut für Physik, Berlin, Germany — [3]NIC, DESY, Zeuthen, Germany — [4]The Cyprus Institute, Nicosia, Cyprus — [5]Jefferson Lab, Newport News, USA

We present the first four-flavour lattice calculation of the leading-order hadronic vacuum-polarisation contribution to the anomalous magnetic moment of the muon, $a_\mu^{\rm hvp}$, and the hadronic running of the QED coupling constant, $\Delta\alpha_{\rm QED}^{\rm hvp}(Q^2)$.

In the heavy sector a mixed-action setup is employed. The bare quark masses are determined from matching the K- and D-meson masses to their physical values. Several light quark masses are used in order to yield a controlled extrapolation to the physical pion mass by utilising a recently proposed improved method. We demonstrate that this method also works in the four-flavour case.

T 22.2 Mo 17:00 WIL-C129

Kaon semileptonic form factor from 2+1 flavor Lattice-QCD — •Alessio Burello and Enno Scholz — Universität Regensburg

We compute the scalar form factor at zero momentum transfer $f_0(0)$ for the kaon to pion semileptonic decay ($k\ell_3$) on the lattice. Such a quantity is of interest because it is a major source of uncertainty in the determination of the V_{us} entry of the electroweak mixing (CKM) matrix. Ultimately, one is interested in checking whether the determined values are compatible with the unitarity of the CKM matrix. The form factor can be determined building suitable ratios of two and three point functions. To reach zero momentum transfer the use of the recently developed technique of the partially twisted boundary conditions is applied. We are using the $N_f = 2+1$ SLinC fermion action with pion masses in the range 210-400 MeV and lattice spacing $a \approx 0.08fm$. In this talk we will describe the methodology and present some preliminary results.

T 22.3 Mo 17:15 WIL-C129

First results for pseudoscalar decay constants of D-mesons from Nf = 2 + 1 + 1 twisted mass Lattice-QCD — •Andreas Nube — DESY in Zeuthen, Platanenallee 6, 15738 Zeuthen

The aim of this project is to calculate a theoretical estimate of the D_s-meson decay constant fDs in the framework of lattice-QCD with a chirally rotated mass term and four dynamic quark flavours (up, down, strange and charm). A comprehensive set of gauge configurations has been produced with high input on super-computers across Europe. Data from three different lattice spacings is available with four to eight different light quark masses each. HMXPT is used to extrapolate the estimates of fDs to the physical point. First determinations indicate a good agreement with both, former lattice determinations and experimental measurements.

T 22.4 Mo 17:30 WIL-C129

Towards a non-perturbative matching between heavy-light currents in HQET and QCD — •Michele Della Morte[3], Jochen Heitger[1], Hubert Simma[2], and Christian Wittemeier[1] — [1]Institut für Theoretische Physik, WWU Münster, Wilhelm-Klemm-Straße 9, 48149 Münster, Germany — [2]DESY, Platanenallee 6, 15738 Zeuthen, Germany — [3]IFIC, Catedrático José Beltrán 2, E-46980 Paterna, Spain

We outline our strategy to non-perturbatively match all components of the heavy-light axial and vector currents in Heavy Quark Effective Theory (HQET) at O($1/m_{\rm h}$) to finite-volume lattice QCD. Based on a tree-level study, we propose a set of matching conditions between suitable observables defined in QCD and HQET to fix the parameters of the effective theory, which are required to absorb the power divergences of lattice HQET. These conditions can be evaluated through numerical simulations, and we report on the status of our implementation in two-flavour QCD. The results of this finite-volume matching strategy will enter a HQET computation of the form factors of semi-leptonic $B \to \pi$ decays as a first application.

T 22.5 Mo 17:45 WIL-C129

Moment of pion parton distribution function from lattice — •Narjes Javadi-Motaghi, Gunnar Bali, Sara Collins, and Andre Sternbeck — Institute for Theoretische Physik,Universitaet Regensburg, Regensburg, Germany

We are studying the second moment of the pion quark distribution function in lattice QCD. Our simulations are based on dynamical Nf = 2 in Wilson -Clover fermions with pion mass down to 160 MeV . We compare our preliminary data to previous results using the quenched approximation.

T 22.6 Mo 18:00 WIL-C129

A BChPT approach to analyzing fanplot data — •Ludwig Greil, Peter C. Bruns, and Andreas Schäfer — Universität Regensburg, Germany

We apply the framework of covariant $SU(3)_f$ baryon chiral perturbation theory (BChPT) to calculate the quark mass dependence of the baryon octet (to $\mathcal{O}(p^4)$) and the quark mass dependence of the vector meson octet (to $\mathcal{O}(p^3)$). These formulae we use to extrapolate QCDSF lattice data down to the physical point while determining the low energy constants (LECs) appearing in our calculation. We then use these LECs to make predictions for quantities that, from a ChPT viewpoint can be related (by chiral symmetry and unitarity), like the πN sigma term or the isospin $I = 1$, $l = 1$ scattering phaseshift for $\pi\pi$-scattering.

References:

P. C. Bruns, L. Greil, A. Schäfer, arXiv:1209.0980 (2012)

T 22.7 Mo 18:15 WIL-C129

$\overline{\rm MS}$ and RI-MOM renormalization of three-quark operators — •Michael Gruber — Institut für Theoretische Physik, Universität Regensburg

The most widely used renormalization condition in continuum QCD is the modified minimal subtraction ($\overline{\rm MS}$) scheme, which requires the use of dimensional regularization. Because dimensional regularization is not possible on a 4-dimensional lattice, regularization invariant (RI) renormalization conditions such as the RI-MOM schemes are used instead.

Since such a scheme is also viable in the continuum we aim to employ perturbative QCD calculations to provide conversion between RI-MOM and $\overline{\rm MS}$ renormalization factors for three-quark operators.

These conversion factors can then be applied to renormalized lattice results for e.g. nucleon distribution amplitudes or coupling constants in order to facilitate better comparability to values obtained from continuum methods such as QCD sum rules.

T 22.8 Mo 18:30 WIL-C129

Mass–reweighting: Problems und Prospects — •Jacob Finkenrath, Francesco Knechtli, and Björn Leder — Bergische Universität Wuppertal, Germany

Today's simulations in lattice quantum chromodynamic get closer and closer to the physical point by simultaneously minimizing the statistical errors. Systematic effects like isospin symmetry–breaking start becoming significant. An effective method which can incorporate these effects is the correction of the Boltzmann factor of the ensemble.

This correction enters as the reweighting factor which is the ratio of the new over the old Boltzmann factor. In the case of a mass shift Δm the resulting determinant ratio can be estimated stochastically. Thereby the effectiveness of reweighting is regulated by the fluctuations in the range Δm (ensemble fluc.) and by the computational cost (stochastic fluc.).

We want to discuss some problems of mass–reweighting, arising from the estimation but also from the reweighting range Δm, and some prospects like reduction of costs by employing domain decomposition and by using correlations between parts of the action. Our result are obtained on ensembles with lattice spacing $a = 0.66$ fm by reweighting from 440 MeV to 310 MeV pions.