T 19: Flavourphysik (Theorie)

Convenor: M. Blanke, M. Jung

Zeit: Montag 16:45–19:00 Raum: VSH 06

T 19.1 Mo 16:45 VSH 06

Leptoquark Flavor Patterns and B Decay Anomalies — Gudrun Hiller[2], Dennis Loose[2], and •Kay Schönwald[1] — [1]DESY — [2]TU Dortmund

By embedding leptoquarks into flavor symmetries that explain masses and mixings in the SM it is possible to construct patterns for the leptoquarks' couplings to the SM fermions. These patterns are used to address current B decay anomalies, namely $R_{D^{(*)}}$ and R_K.

We find that effects in $R_{D^{(*)}}$ are generally too small to account for the experimental data, while a natural explanation of R_K is possible.

T 19.2 Mo 17:00 VSH 06

Flavour signatures in Pati-Salam — •Marta Moscati and Monika Blanke — Karlsruher Institut für Technologie, Karlsruhe, Germany

We analyse the Pati-Salam model, based on the gauge group $SU(4) \otimes SU(2)_L \otimes SU(2)_R$. The interest in this model is motivated by the possibility of embedding it into a larger, unified gauge group (GUT) and, from a phenomenological point of view, by the presence of vector and scalar Lepto-Quarks. In particular, we focus on the possible signatures of these particles in the flavour sector.

T 19.3 Mo 17:15 VSH 06

Precision calculation of $B \to X_c \tau \bar{\nu}$ and the $R(D^{(*)})$ puzzle — •Farnoush Shahriaran, Thomas Mannel, and Aleksey V. Rusov — University of Siegen

We calculate the decay width of inclusive $B \to X_c \tau \nu_\tau$ process including power corrections up to Λ_{QCD}/m_b^3 order and radiative corrections to the partonic level. We show that our result is in a tension with the sum of the rates of the exclusive $B \to D\tau\nu$, $B \to D^*\tau\nu$ and $B \to D^{**}\tau\nu$ decays.

For solving this puzzle, we include contributions from two possible new physics four-Fermi operators, (NP vector right-handed and left-handed scalar operators), with arbitrary couplings that can accommodate the measured central value of the ratio $R(D)$ and $R(D^*)$. We performed the calculation of the decay with of the process $B \to X_c \tau \nu_\tau$ in the presence of thees operators at tree level at leading order in $1/m_b$ expansion. The updated prediction is consistent with the sum of the branching fractions of exclusive modes.

T 19.4 Mo 17:30 VSH 06

The Axiflavon — •Robert Ziegler — KIT, Karlsruhe, Germany

I will discuss how solving the flavor problem of the Standard Model with a simple U(1) flavor symmetry naturally leads to an axion that solves the strong CP problem and constitutes a viable Dark Matter candidate. In this framework, the ratio of the axion mass and its coupling to photons is related to the SM fermion masses and predicted within a small range, as a direct result of the observed hierarchies in quark and charged lepton masses. The same hierarchies determine the axion couplings to fermions, making the framework very predictive and experimentally testable by future axion and precision flavor experiments.

T 19.5 Mo 17:45 VSH 06

Exclusive $B_{(s)} \to \pi(K)\ell^+\ell^-$ decays at large recoil and CKM matrix elements — Alexander Khodjamirian and •Aleksey Rusov — Universität Siegen

We propose a way to determine the Wolfenstein parameters A, ρ, η of the CKM matrix from the observables in semileptonic exclusive FCNC decays, combining the branching fractions and direct CP-asymmetry of $B \to \pi\ell^+\ell^-$ decays with the branching fraction of $B \to K\ell^+\ell^-$ processes. To this end, we calculate the required hadronic input involved in the binned observables in the large recoil region, taking into account, in addition to the form factors, the nonlocal hadronic matrix elements. The latter are obtained combining QCD factorization and light-cone sum rules (LCSR) with hadronic dispersion relations. For form factors we use revisited LCSR results taking also the recent estimate of the higher twist effects into account. Moreover, we calculate the hadronic input for a yet unexplored channel $B_s \to K^0\ell^+\ell^-$.

T 19.6 Mo 18:00 VSH 06

QCD Factorization for $B \to \pi\pi\ell\nu$ Decays at Large Dipion Masses — •Philipp Böer[1], Danny van Dyk[2], and Thorsten Feldmann[1] — [1]Universität Siegen — [2]Universität Zürich

$B \to \pi\pi$ form factors are an essential non-perturbative ingredient for $B \to \pi\pi\ell\nu$ decays as well as three-body $B \to \pi\pi\pi$ decays. We introduce a factorization formula for these form factors in the limit of large pion energies and large dipion invariant mass. We explicitly check this formula by calculating the leading contributions in a combined expansion in the strong coupling and powers of $\Lambda_{\rm QCD}/m_b$. Our results provide useful theoretical constraints for phenomenological models that aim to analyze the complete $B \to \pi\pi\ell\bar{\nu}$ phase space.

T 19.7 Mo 18:15 VSH 06

CP violation in non-leptonic three-body B decays — Keri Vos[1], •Rebecca Klein[1], Javier Virto[2], and Thomas Mannel[1] — [1]Universität Siegen — [2]Universität Bern

Three-body decays, which form a large part of the B meson branching fraction, contain much more information than two-body decays, because of their non-trivial kinematic structure. Recently, progress was made to study three-body decays using a QCD factorization framework. We use this framework to study CP violation in three-body decays. Experimental data shows a rich CP structure with large local CP asymmetries. We study if these measured CP patterns can be explained using our factorization framework.

T 19.8 Mo 18:30 VSH 06

Pseudo-scalar D-meson decay constants from three- flavour lattice QCD — Sara Collins[2], •Kevin Eckert[1], Jochen Heitger[1], Stefan Hofmann[2], and Wolfgang Söldner[2] — [1]Institut für Theoretische Physik, Universität Münster — [2]Institut für Theoretische Physik, Universität Regensburg

We report on the status of an ongoing effort by the RQCD and ALPHA Collaborations, aimed at determining masses and leptonic decay constants of charmed mesons. Our analysis is based on large-volume ensembles generated within the CLS effort, employing $N_f = 2 + 1$ non-perturbatively $\mathcal{O}(a)$ improved Wilson quarks, tree-level Symanzik-improved gauge action and open boundary conditions. The ensembles cover lattice spacings from $a \approx 0.09$ fm to $a \approx 0.05$ fm, with pion masses varied from 420 to 200 MeV. Furthermore we report on our implementation of distance preconditioning for the calculation of heavy quark propagators and resulting accuracy improvements for the extraction of charmed meson masses and decay constants. To extrapolate to the physical masses, we follow both the $(2m_l + m_s) = const.$ and the $m_s = const.$ line in parameter space.

T 19.9 Mo 18:45 VSH 06

Rare radiative D-decays in QCD factorization — Thorsten Feldmann, •Bastian Müller, and Dirk Seidel — Uni Siegen

The idea of the QCD factorization approach (QCDF) is to disentangle short- and long-distance dynamics in exclusive heavy-quark decays. The short-distance processes can be calculated in perturbation theory, the long-distance effects are contained in universal hadronic matrix elements that can be addressed by means of non-perturbative methods. QCDF involves a simultaneous expansion in the strong coupling constant α_s and in the ratio $\Lambda_{\rm QCD}/M_h$, where $\Lambda_{\rm QCD}$ is the typical QCD scale and M_h the mass of a heavy hadron. In the past, QCDF has been successfully applied to charmless B-meson decays, including rare radiative decays into a light vector or pseudoscalar mesons at large recoil energy, like $B \to K^{(*)}\ell^+\ell^-$ or $B \to K^*\gamma$. However, it has been queried whether QCDF would result in a reasonable description of the analogous D-meson decays, since the expansion might not converge and non-factorizable long-distance effects might be dominant. In order to shed more light on this issue, the project presented in this talk addresses rare radiative D-meson decays, $D \to \rho\gamma$ and $D \to \rho(\pi)\ell^+\ell^-$ in the framework of QCDF in order to carefully assess the hadronic uncertainties related to spectator-scattering and annihilation topologies.