T 71: Theorie: Flavorphysik

Zeit: Mittwoch 16:00–18:30 Raum: H11

T 71.1 Mi 16:00 H11

$B \to \pi, K, \bar{D}$ and $B \to \rho, K^*, \bar{D}^*$ Form Factors from B-Meson Light-Cone Sum Rules — •Nico Gubernari, Danny Van Dyk, and Ahmet Kokulu — Technische Universität München, München, Germany

Our understanding of semileptonic B decays depends on accurate estimates of hadronic matrix elements. The latter are usually expressed in terms of form factors, which are functions of the momentum transfer. We calculate the $B \to \pi, K, \bar{D}$ and $B \to \rho, K^*, \bar{D}^*$ form factors in the framework of QCD Light-Cone Sum Rules (LCSRs) with B-meson distribution amplitudes. Our calculation improves upon previous studies by including higher twist contributions and the full set of the three-particle distribution amplitudes. Our LCSR results are complementary to present and future Lattice QCD studies. Finally, we discuss selected phenomenological implications of our results, giving predictions for the Lepon-Flavour Universality ratios $R(D)$ and $R(D^*)$.

T 71.2 Mi 16:15 H11

Angular analysis of $B^+ \to K^{+*}\mu\mu$ decays at LHCb — •Renata Kopečná, David Gerick, Martino Borsato, and Stephanie Hansmann-Menzemer — Physikalisches Institut, Heidelberg, Germany

Flavor-changing neutral current $b \to s$ quark transitions are in the Standard Model forbidden at tree level and occur at the lowest order as so-called box or penguin processes. Angular observables of such transitions probe the underlying Lorentz structure of the Standard Model. These observables are of particular interest and suitable for theory comparison since the predictions are only little affected by form-factor uncertainties.

LHCb reported on several $b \to s$ quark flavor-changing neutral current transitions including $B^0 \to K^{0*}\mu\mu$ decays with various $K^*(\to K\pi)$ decay modes. These studies revealed tensions with the Standard Model predictions of an angular observable (P_5'), hinting to a potential contribution from physics beyond the Standard Model.

We present the first angular analysis of $B^+ \to K^{+*}\mu\mu$ decays at LHCb. This channel is experimentally challenging due to neutral particles present in the final state. The analysis is however an important complement to the $B^0 \to K^{0*}\mu\mu$ measurements and will significantly contribute to understanding of the observed tensions.

T 71.3 Mi 16:30 H11

D-Wave Contributions in B_{l4} Decays — •Stephan Kürten[1] and Bastian Kubis[2] — [1]Physik Department, Technische Universität München, James-Franck-Straße 1, D-85748 Garching, Germany — [2]HISKP, Universität Bonn, Nussallee 14-16, D-53115 Bonn, Germany

Semileptonic $b \to u$ transitions are used to further refine the Cabbibo-Kobayashi-Maskawa matrix element $|V_{ub}|$. Previously, extractions of $|V_{ub}|$ from $B \to \rho(\to \pi\pi)l\nu$ only assumed P-wave dominance of the decay distribution. For precision determinations, we need to understand the composition of the $\pi\pi$ partial waves at a precision level, which includes S-wave and D-wave contributions. This talk focuses on the methods and the actual comparison between the $\rho(770)$ and $f_2(1270)$ as first resonances in their respective partial waves.

T 71.4 Mi 16:45 H11

V_{cb} from inclusive $b \to c\ell\nu$ decays: an alternative method — •Matteo Fael, Thomas Mannel, and Keri Vos — Universität Siegen, Siegen, Germany

The standard method to extract V_{cb} from inclusive semileptonic B decays relies on the precise calculation of the inclusive rate as well as of spectral moments (i.e. moments of the charged lepton energy and the hadronic mass spectra) performed in the Heavy Quark Expansion (HQE). The HQE allows us to predict physical observables as a series in $\Lambda_{\rm QCD}/m_b$ and to write them in terms of HQE parameters, the non-perturbative inputs that can be determined on the lattice or fitted from data.

Their extraction from data is possible only up to $1/m_b^3$; up to this order there are only four independent parameters. However starting at order $1/m_b^4$, their proliferation prevents their extraction from data.

In this talk I will discuss how reparametrization invariance, a symmetry within the HQE reflecting Lorentz invariance of the underlying QCD, reduces the number of independent HQE parameters. Specific observables, in particular the total rates and the q^2 moments (the moments of the leptonic invariant mass spectrum), indeed depend on a smaller set of non-perturbative inputs. I will propose an alternative extraction of V_{cb} based on the q^2-moment measurement that could push the V_{cb} determination up to order $1/m_b^4$ without making use of models for the HQE parameters, i.e. to have a fully data-driven analysis up to this order

T 71.5 Mi 17:00 H11

Combining theory inputs for $\bar{B} \to D^{(*)}\ell\bar{n}u$ and extracting $|V_{cb}|$ — Marzia Bordone[1,2], Martin Jung[3], and •Danny van Dyk[4] — [1]Physik-Institut, Universität Zürich, Winterthurer Strasse 190, 8057 Zürich, Switzerland — [2]Theoretische Physik 1, Universität Siegen, Walter-Flex-Straße 3, D-57068 Siegen, Germany — [3]Excellence Cluster Universe, Technische Universität München, Boltzmannstr. 2, D-85748 Garching, Germany — [4]Physik Department, TU München, James-Franck-Straße 1, D-85748 Garching, Germany

Recent theory results for the full set of hadronic matrix elements arising in $\bar{B} \to D^{(*)}\ell\bar{\nu}$ decays have triggered our interest. We investigate if and how various pieces of theory information on these hadronic matrix elements fit together. As a consequence, we obtain precise theory predictions for the full angular distribution of these decays in the SM and beyond. Finally, we challenge the experimental data available from the BaBar and Belle collaborations. We discuss the compatibility between our results for $|V_{cb}|$ and the inclusive determination.

T 71.6 Mi 17:15 H11

Clustering of B Decay Kinematic Distributions — •Kilian Lieret[1,3], Thomas Kuhr[1,3], and Jason Aebischer[2,3] — [1]Ludwig-Maximilians-Universität München — [2]Technische Universität München — [3]Excellence Cluster Universe

The phenomenology of New Physics models typically depends on a number of free parameters, sometimes strongly influencing the shape of kinematic distributions. Besides being an obvious challenge when presenting exclusion limits on such models, this also is an issue for analyses that need to make assumptions on kinematic distributions in order to extract features of interest, but still want to publish their results in a very general way.

By clustering the New Physics parameter space based on a metric that quantifies the similarity of the resulting kinematic distributions, a small number of New Physics benchmark points can be chosen in such a way that they can together represent the whole parameter space. Experiments can then report exclusion limits and measurements for these benchmark points without sacrificing generality.

In this talk, such a clustering procedure is carried out with kinematic distributions relevant to semileptonic B decays, in particular in light of the recent flavor anomalies.

T 71.7 Mi 17:30 H11

New new physics probes with $\Lambda_b \to \Lambda_c(\to \pi\Lambda)\ell\bar{\nu}$ — •Ahmet Kokulu, Danny van Dyk, and Philipp Böer — Technische Universität München, James-Franck-Straße 1, D-85748 Garching, Germany

We calculate the four-differential decay rate for the cascade $\Lambda_b \to \Lambda_c(\to \Lambda\pi)\ell\nu$ for the full set of $b \to c\ell\nu$ operators up to dimension six. Our work extends earlier studies in this respect. We find the cascade to provide complimentary constraints compared to those arising in $B \to D(*)$, $B_c \to \ell\nu$.

T 71.8 Mi 17:45 H11

Testing the standard model with the photon polarization in radiative charm decays — •Nico Adolph, Gudrun Hiller, and Andrey Tayduganov — TU Dortmund, Deutschland

We study the photon polarization in radiative charm decays with an up-down asymmetry in the decays $D^+_{(s)} \to K_1^+(\to K\pi\pi)\gamma$. Angular distributions of the three body decay are used to determine the polarization of the K_1^+ which is correlated to the photon polarization. While the D^+ decay is SM like, the D_s decay is sensitive to BSM physics in the $c \to u\gamma$ coupling, which induces differences in the up-down asymmetries between these two decays, as a signature of new physics.

T 71.9 Mi 18:00 H11

Flavor physics meets Asymptotic Safety — •Marcel Golz and Gudrun Hiller — TU Dortmund, Theoretische Physik IV

Most common explanations of the recent B-anomalies involve additional massive gauge bosons. In order to assess those models from the theoretical point of view, consistency checks such as anomaly cancellation conditions and perturbativity checks are available but less widely applied.

Asymptotic safety is a concept that was originally developed for quantum gravity in the 1970s and recently put forward for gauge-Yukawa theories, and in the context of the Standard Model and extensions thereof. In such a scenario the energy dependent couplings of a model are running into a non-vanishing fixed point, so that an ultraviolet complete model is achieved.

We consider a fully-fledged model (Alonso et al., **1704.08158**) involving a gauged $SU(3)_{\rm H} \otimes U(1)_{\rm B\text{-}L}$ flavor symmetry, which adresses the current B-anomalies. We point out UV-inconsistencies due to Landau poles below the GUT-scale and show how this can be fixed within asymptotic safety.

We confront this extended model to B-anomaly data.

T 71.10 Mi 18:15 H11

A Realistic $U(2)$ Model of Flavor — •Matthias Linster[1] and Robert Ziegler[2] — [1]Institut für Theoretische Teilchenphysik, Karlsruher Institut für Technologie — [2]Theoretical Physics Department, CERN

We propose a simple model based on a $U(2)$ flavor symmetry which is able to describe all mixings in quarks, charged leptons and neutrinos by powers of two small parameters. Comparing with experimental data we obtain predictions for the yet unknown neutrino mass scale. Moreover, we discuss a variant of this model based on a $D_6 \times U(1)$ flavor symmetry that leads to large mixings in the lepton sector due to the small mixings in the quark sector.