T 31: Flavour physics II

Time: Tuesday 16:00–18:30 Location: Tf

T 31.1 Tue 16:00 Tf

Search for lepton-flavour violating decays in the charm system at the LHCb experiment — •Daniel Unverzagt — Physikalisches Institut Heidelberg, Heidelberg, Germany

Decays of hadrons that violate the conservation of the lepton flavour number are forbidden within the standard model, but might be generated in many theories that go beyond. This talk summarises recent results on lepton-flavour violating decays in the charm system at the LHCb experiment. The focus will be on existing searches for two- and three-body decay topologies of neutral and charged charm mesons. Furthermore, plans and prospects to extend the program to four-body decays in the near future are presented.

T 31.2 Tue 16:15 Tf

Extrapolation of flavour tagging calibrations to high transverse momenta — Arnulf Quadt, Elizaveta Shabalina, and •Sreelakshmi Sindhu — II. Physikalisches Institut, Georg-August-Universität Göttingen

Identifying jets containing heavy-flavour hadrons can be very beneficial for a variety of analyses and this can be done using flavour tagging algorithms. Currently, these algorithms are calibrated by matching their performance on data to simulation. However, for jets with transverse momenta greater than a few hundred GeV, these calibrations do not exist due to statistical limitations. Flavour-tagging information for jets with high transverse momenta can be quite useful for analyses such as searches for heavy resonances. Hence, a Monte Carlo based extrapolation is done on the data based flavour tagging calibrations to extend these up to 3 TeV. The extrapolation uncertainties are calculated by propagating the relevant modelling, tracking and jet uncertainties through the tagging algorithm. In this talk, the extrapolation procedure will be explained. The results for extrapolation of b, c and light jets will be presented for the b-tagging algorithm that was used for the analysis of the Run 2 data by the ATLAS Collaboration.

T 31.3 Tue 16:30 Tf

Extending the Full Event Interpretation to the Y(5S) system at Belle — •Moritz Bauer and Pablo Goldenzweig — Karlsruhe Institute of Technology, Karlsruhe, Germany

The Belle experiment has, in addition to the data collected at the $\Upsilon(4S)$ resonance, also collected 121 fb^{-1} of data at the $\Upsilon(5S)$ resonance. The decay products of this resonance include B_s mesons which present interesting channels to test the standard model. Until now, it has not been possible to apply Belle II's new B meson tagging algorithm, the Full Event Interpretation (FEI), to the $\Upsilon(5S)$ dataset. This exclusive tagging algorithm uses O(10k) decay channels to recombine final-state particles to B mesons.

This talk presents the development and validation of the FEI at the $\Upsilon(5S)$ resonance.

T 31.4 Tue 16:45 Tf

Test of isospin symmetry by measuring $\Upsilon(4S) \to B^0\overline{B^0}$ — •Pascal Schmolz and Thomas Kuhr — Ludwig-Maximilians-Universität München

In contrast to hadron colliders, B-factories allow for the determination of absolute branching fractions. The *Belle* experiment as well as its successor, *Belle II*, examine decays of the $\Upsilon(4S)$ to pairs of either neutral or charged B mesons. The calculation of the production rate for B mesons is often based on the assumption of strong isospin symmetry, i.e. charged and neutral pairs would be produced with the same probability. Quark masses and electromagnetic interaction, however, are responsible for slightly breaking isospin symmetry. In most of the previous measurements of $f_{00} = Br(\Upsilon(4S) \to B^0\overline{B^0})$ isospin is assumed. We present an analysis that bypasses this bias with a sophisticated method, first applied by the *BABAR* collaboration for such a measurement, that avoids any assumption on isospin.

T 31.5 Tue 17:00 Tf

Theory status of the lifetime ratio $\tau(B_s)/\tau(B_d)$ — Daniel King[1], Alexander Lenz[2], Maria Laura Piscopo[2], Thomas Rauh[3], and •Aleksey Rusov[2] — [1]IPPP, University of Durham, UK — [2]Universität Siegen, Germany — [3]University of Bern, Switzerland

The precise determination of the lifetime ratios of heavy hadrons plays a crucial role both for the accurate test of the Heavy Quark Expansion in the Standard Model and for the search of New Physics which may be hidden in the invisible decays of heavy hadrons. In this talk, I plan to overview the current theoretical status of the lifetime ratio $\tau(B_s)/\tau(B_d)$ in the light of recent determination of important Darwin operator contribution to non-leptonic decays of heavy hadrons and of s-quark mass corrections to the corresponding dimension-6 Bag parameters obtained in the framework of HQET Sum Rules.

T 31.6 Tue 17:15 Tf

Measurement of the time-integrated mixing parameter χ_d with dilepton tagging using semileptonic B decays at the Belle II experiment — Florian Bernlochner, Jochen Dingfelder, •Stephan Duell, and Peter Lewis for the Belle II-Collaboration — Rheinische Friedrich-Wilhelms-Universität Bonn

We present the current status of an analysis of inclusive semileptonic B decays with electrons in the final state and an early dataset of about 36.4fb^{-1} of integrated luminosity, which was recorded by the Belle II experiment in 2019 and 2020. The analysis aims to measure the time-integrated mixing parameter of the neutral B meson, χ_d, by exploiting the charge-flavour correlation between the B meson and the electron in inclusive semileptonic $B \to Xe\nu_e$ decays. A double tag strategy is employed where two electron candidates are reconstructed and the prompt semileptonic contribution is determined by a fit to the lepton momentum spectrum. The resulting yields can be separated into same-sign and opposite-sign events, which allows the direct determination of χ_d. The current status of the analysis will be presented in this talk.

T 31.7 Tue 17:30 Tf

NNLO QCD corrections to B_s mixing — •Marvin Gerlach, Ulrich Nierste, Vladyslav Shtabovenko, and Matthias Steinhauser — Institut für Theoretische Teilchenphysik, Karlsruhe Institute of Technology (KIT), Wolfgang-Gaede Straße 1, 76128 Karlsruhe, Germany

Since late 1980s, when the mixing of neutral B-mesons was first observed at DESY, B-$\bar{B}$ systems are an ever growing field of interest. The experimental as well as the theoretical progress in the recent 20 years enables precise determination of key parameters, such as the width difference $\Delta\Gamma_s$ between B_s and $\bar{B}_s$. The experimental uncertainty of this quantity only amounts to a few percent. The precision of the theoretical prediction, on the other hand, is currently limited by perturbative uncertainties. In this talk we give a short overview of the perturbative corrections to $\Delta\Gamma_s$, including QCD corrections to contributions with effective current-current and penguin operators in the framework of Heavy Quark Expansion (HQE).

T 31.8 Tue 17:45 Tf

CP Violation in Three-body B Decays: A Model Ansatz — •Kevin Olschewsky[1], Thomas Mannel[1], and Keri Vos[2] — [1]Center for Particle Physics Siegen, Theoretische Physik 1, Universität Siegen — [2]Faculty of Science and Engineering, Maastricht University

The mechanism of CP violation remains one of the puzzles in particle physics. Key to understanding this phenomenon are nonleptonic B decays, especially multibody decays which exhibit large CP asymmetries in various regions of phase space. A full QCD-based theoretical description of these decays is still missing, requiring the use of models to fit the data.

We suggest a model ansatz which reflects the underlying physics and the known mechanism of CP violation via the CKM matrix. In addition, since CP violation is driven by the interference between amplitudes with and without valence charm quarks, we argue that the opening of the open-charm threshold may play an important role in generating CP violation in the high invariant mass region. We present a natural extension of the isobar model to incorporate these effects and suggest using it to analyse nonleptonic three-body B decay data.

T 31.9 Tue 18:00 Tf

QCD Sum Rules for Parameters of the B-meson Distribution Amplitudes — •Muslem Rahimi and Marcel Wald — Theoretische Physik 1, Naturwissenschaftlich-Technische Fakultät, Universität Siegen, Germany

We obtain new estimates for the parameters λ_E^2, λ_H^2 and their ratio

$\mathcal{R} = \lambda_E^2/\lambda_H^2$, which appear in the second moments of the B-meson light-cone distribution amplitudes defined in the heavy-quark effective field theory.

The computation is based on two-point QCD sum rules for the diagonal correlation function and includes all contributions up to mass dimension seven in the operator-product expansion. For the ratio we get $\mathcal{R} = (0.1 \pm 0.1)$ with $\lambda_E^2 = (0.01 \pm 0.01)\,\mathrm{GeV}^2$ and $\lambda_H^2 = (0.11 \pm 0.02)\,\mathrm{GeV}^2$.

T 31.10 Tue 18:15 Tf

QED effects and factorization in charmless B decays — Martin Beneke[1], Philipp Böer[1], •Jan-Niklas Toelstede[1], and Keri Vos[2] — [1]Technical University of Munich — [2]Maastricht University

In the heavy-quark limit, hadronic matrix elements of B-meson decays into two light charmless final-state mesons factorize to all orders in the strong coupling into universal hadronic quantities (form factors and light-cone distribution amplitudes) as well as process-dependent hard-scattering kernels. Within the framework of Soft-Collinear Effective Theory, we generalize the QCD factorization to include QED corrections and show that it retains its QCD form. However, the presence of electrically charged final state mesons requires to introduce modified hadronic functions that become process-dependent to a certain extent as soft photons do not decouple completely. It further leads to interesting and qualitatively new features, in particular regarding the renormalization group of these objects, that will be discussed in this presentation, as well as the size of QED corrections on selected observables for πK final states.