T 49: Flavour physics 2

Time: Tuesday 16:00–18:15 Location: Geb. 30.41: HS 4

T 49.1 Tue 16:00 Geb. 30.41: HS 4

First search for the decays $\Xi_b^0 \to \Xi^0 J/\psi$ and $\Xi_b^0 \to \Xi^0 \psi(2S)$ at the LHCb experiment — Johannes Albrecht[1], Vitalii Lisovskyi[3], •Leandra Moeser[1], and Janina Nicolini[1,2] — [1]TU Dortmund University, Dortmund, Germany — [2]IJCLab, Orsay, France — [3]EPFL, Lausanne, Switzerland

Weak decays of heavy-quark baryons offer an attractive laboratory to search for effects beyond the Standard Model, complementary to searches in meson decays. Due to the high masses of b-baryons, most of them can only be studied at hadron colliders. The LHCb experiment is investigating such weakly decaying b-baryons, the most comprehensively studied of which is the Λ_b baryon, where tensions towards theoretical predictions have been observed. Further analyses of b-baryon decays would thus be beneficial.

The current status of the first search for the tree-level decays $\Xi_b^0 \to \Xi^0 J/\psi$ and $\Xi_b^0 \to \Xi^0 \psi(2S)$ and computation of the ratio of their respective branching fractions $\mathcal{B}(\Xi_b^0 \to \Xi^0 \psi(2S))/\mathcal{B}(\Xi_b^0 \to \Xi^0 J/\psi)$ is presented.
The used data was collected at the LHCb experiment from 2016 to 2018, corresponding to an integrated luminosity of $5.4\,\text{fb}^{-1}$.

T 49.2 Tue 16:15 Geb. 30.41: HS 4

Search for exotic states with $c\bar{c}s\bar{c}$ content at Belle — •Dmytro Meleshko, Elisabetta Prencipe, and Soeren Lange — Justus-Liebig-Universität, Gießen.

We present results for an analysis of $e^+e^- \to D_s^+ D_{sJ}^- A$ + c.c. processes in the continuum (A = anything else) using the whole Belle dataset (980.1 fb^{-1}). The goal of the analysis is the study of $D_s^+ D_{s0}^*(2317)^-$ and $D_s^+ D_{s1}(2460)^-$ invariant mass systems to search for possible exotic, resonant states with $c\bar{c}s\bar{c}$ quark content. As the D_{s0} and D_{s1} are often considered themselves as 4-quark candidates, the combined states may contain admixtures of a 6-quark state in the wave function. In addition, precise mass resolution and mass splitting measurements are presented as a test of the chiral perturbation theory.
This research is supported by BMBF (05H21RGKB1) and Horizon2020 European Union Marie Slodowska Curie Action in the RISE program (n.822070).

T 49.3 Tue 16:30 Geb. 30.41: HS 4

Dalitz analysis of $B^- \to D^+\pi^-\pi^-$ — •Bhavesh Narayan Sirvi, Florian Bernlochner, Jochen Dingfelder, and Markus Prim — Physikalisches Institut der Rheinischen Friedrich-Wilhelms-Universität Bonn

Fully hadronic B meson decays provide a unique tool to study hadronic properties of excited D meson states beyond the 1S ground state. These charm states are not very well explored. In this talk we present the current status of studies of the decay of $B^- \to D^+\pi^-\pi^-$ to study orbitally excited 1P charm states, with the goal to determine widths, masses, spin and other properties. For this we carry out a Dalitz analysis, reconstructing the $B^- \to D^+\pi^-\pi^-$ via $D^+ \to K^-\pi^+\pi^+$ decays. We analyze simulated Belle II data and show the sensitivity to physical parameters assuming the Run 1 integrated luminosity. More precise knowledge of these states will facilitate a better understanding of semileptonic processes, such as $B^+ \to D^*\tau^+\nu_\tau$, for which semileptonic contributions with higher charm states represent an important background, and will help reducing uncertainties in future determinations of matrix elements of the Cabibbo-Kobayashi-Maskawa matrix.

T 49.4 Tue 16:45 Geb. 30.41: HS 4

Amplitude Analysis of $\longrightarrow K^+\pi^-\pi^0$ Decays — •Ceren Ay[1,2], Markus Reif[1], Stefan Wallner[1], Thomas Kuhr[2], and Hans-Günther Moser[1] — [1]Max-Planck-Institüte für Physik — [2]Ludwig-Maximilians-Universität München

The measurement of branching ratios and CP asymmetries of B meson decays are essential tools for understanding the underlying physics. These measurements are particularly challenging for the decays of B mesons to multi-body hadronic final states, since elaborate amplitude analyses are required to separate and measure the contributions of the interfering resonances in these final states. We perform a Dalitz plot analysis of data recorded by the Belle II experiment to extract these parameters for $B^0\bar{B}^0 \longrightarrow K^+\pi^-\pi^0$ decays. As part of this, we investigate the model dependence by studying different parameterizations of amplitude models. We also check the dependence on the initial values of the fit and investigate fit biases. Recent results from these studies will be presented.

T 49.5 Tue 17:00 Geb. 30.41: HS 4

Dalitz analysis on $B^+ \to K_S^0\pi^+\pi^0$ — •Oskar Tittel — Max-Planck-Institut für Physik, München

The Belle II experiment in Tsukuba, Japan, is working at the high-intensity frontier of the search for physics beyond the Standard Model (SM). A direct test of the SM is the verification of the so-called "isospin sum-rule" in the $B \to K^*\pi$ system, which depends on the branching fractions (BF's) and the direct CP asymmetries of all $B \to K^*\pi$ decay modes. These quantities can be extracted from Dalitz analyses on the decay channels $B^0 \to K^+\pi^-\pi^0$ and $B^+ \to K_S^0\pi^+\pi^0$.

I will present the Belle II experiment, introduce the isospin sum rule and show the current state of the analysis on $B^+ \to K_S^0\pi^+\pi^0$.

T 49.6 Tue 17:15 Geb. 30.41: HS 4

Direct measurement of $R^{\pm 0}$ at Belle II — Florian Bernlochner, Jochen Dingfelder, •Anna-Maria Heyn, and Markus Prim — Physikalisches Institut der Rheinischen Friedrich-Wilhelms-Universität Bonn

The ratio of the $\Upsilon(4S) \to B^+B^-$ and $\Upsilon(4S) \to B^0\bar{B}^0$ decay rates, $R^{\pm 0}$, represents a crucial input quantity to convert measured yields into branching fractions at e^+e^- B-factory experiments. The most precise present day determinations rely on isospin assumptions. We present the status of a novel approach to determine the $B^\pm$ and B^0 production fraction using an inclusive approach. It relies on analyzing the reconstructed number of charged tracks in a collision event. On average the decay of two B mesons results in about 10 charged final state particles and if perfectly reconstructed, the number of charged tracks from $B^\pm$ and B^0 differ by two. In this talk, we explore the experimental feasibility to determine $R^{\pm 0}$ from a careful analysis of the number of charged tracks in a collision event. Contributions from continuum processes are suppressed using multivariate methods and the template shapes on the number of charged tracks are determined using fully hadronic control channels of self-tagging decays.

T 49.7 Tue 17:30 Geb. 30.41: HS 4

Search for Baryon Number Violation by two units in the $B^+ \to p\Lambda\pi^+\pi^-$ decay channel — •Melanie Hess, Thomas Lück, and Thomas Kuhr — Ludwig-Maximilians-Universität München

Baryon Number Violation is an important topic in the search for an explanation of the matter antimatter asymmetry observed in the universe. This analysis focuses on the violation by two units, which is experimentally less constrained than a violation by one unit. An ideal laboratory to study this are B mesons due to their large variety of hadronic decays. Data recorded by the Belle II experiment at the asymmetric energy e^+e^- collider SuperKEKB in Japan is analyzed. The collider is operated at a center of mass energy corresponding to the mass of the $\Upsilon(4S)$ meson, which predominantly decays into a pair of B mesons.

For this analysis, the decay channel $B^+ \to p\Lambda\pi^+\pi^-$ was chosen taking the already established Standard Model channel $B^+ \to p\overline{\Lambda}\pi^+\pi^-$ as reference. The Λ is reconstructed via the $\Lambda \to p\pi^-$ decay. Simulated data is used to optimize the sensitivity of the search.

This talk summarizes the current status of the analysis and gives an outlook on the next steps.

T 49.8 Tue 17:45 Geb. 30.41: HS 4

Higher twist corrections to B-meson decays into a proton and dark antibaryon from QCD light-cone sum rules [1] — •Anastasia Boushmelev and Marcel Wald — Theoretische Teilchenphysik, Center for Particle Physics Siegen, Universität Siegen

The B-Mesogenesis framework anticipates decays of B mesons into a dark antibaryon Ψ and various Standard Model baryons. Here, we focus on the exclusive decay process $B \to p\Psi$ observed as a proton and missing energy in the final state and determine the decay width by employing the QCD light-cone sum rule framework. We include all contributions up to twist six to the nucleon distribution amplitudes in order to parameterize the non-perturbative effects in the operator

product expansion. We obtain the decay width and branching fraction with respect to the mass m_Ψ of the dark antibaryon Ψ, normalized to the model-dependent effective four-fermion coupling.

[1] A. Boushmelev and M. Wald, [arXiv:2311.13482 [hep-ph]]

T 49.9 Tue 18:00 Geb. 30.41: HS 4

Using Gradient Flow to Renormalise Matrix Elements for Meson Mixing and Lifetimes — •Matthew Black[1], Robert Harlander[2], Fabian Lange[3,4,5,6], Antonio Rago[7], Andrea Shindler[2], and Oliver Witzel[1] — [1]Theoretische Teilchenphysik, Center for Particle Physics Siegen, Universitaet Siegen, Germany — [2]Institute for Theoretical Particle Physics and Cosmology, RWTH Aachen University, Germany — [3]Physik-Institut, Universitaet Zuerich, Switzerland — [4]Paul Scherrer Institut, Villigen PSI, Switzerland — [5]Institut fuer Theoretische Teilchenphysik, Karlsruhe Institute of Technology, Germany — [6]Institut fuer Astroteilchenphysik, Karlsruhe Institute of Technology, Germany — [7]IMADA and Qauntum Theory Center, University of Southern Denmark, Odense, Denmark

Neutral meson mixing and meson lifetimes are theory-side parametrised in terms four-quark operators which can be determined by calculating weak decay matrix elements using lattice QCD. While calculations of meson mixing matrix elements are standard, determinations of lifetimes typically suffer from complications in renormalisation procedures because dimension-6 four-quark operators can mix with operators of lower mass dimension and, moreover, quark-line disconnected diagrams contribute.

We present work detailing the idea to use fermionic gradient flow to non-perturbatively renormalise matrix elements describing meson mixing or lifetimes, which later is to be combined with a perturbative calculation to match to the MS-bar scheme.