T 9: Flavour Physics I

Time: Monday 16:45–18:15 Location: VG 1.104

T 9.1 Mon 16:45 VG 1.104

Search for $B^+ \to K^{*+}\tau\ell$ with hadronic tagging at the Belle II experiment — •Lara Fuchs, Torben Ferber, Pablo Goldenzweig, and Raynette van Tonder — Institute of Experimental Particle, Karlsruhe Institute of Technology, Karlsruhe, Germany

Current measurements of semileptonic B meson decays are in tension with Standard Model predictions, giving rise to a plethora of proposed New Physics models to explain the observed results. These models not only incorporate lepton flavor violation, but also predict significantly enhanced rates for lepton flavor violating decays involving second- and third-generation leptons. Among these processes, flavor-changing neutral current transitions such as $b \to s\tau\ell$ are further suppressed, and thus especially sensitive to New Physics contributions.

In this talk, we present the status of the first search for $B^+ \to K^{*+}\tau\ell$, conducted at the Belle II experiment, located at the SuperKEKB asymmetric e^+e^- collider. We employ a hadronic tagging approach where the accompanying B meson in $e^+e^- \to \Upsilon(4S) \to B^+B^-$ events is fully reconstructed via hadronic decay chains. The complete knowledge of the tag-side particle's four-momentum combined with the well-known event energy allow for a direct determination of the invariant mass of the system recoiling against the $B_{\text{tag}}K^{*+}\ell$ system. This provides a reliable method for signal extraction despite the presence of missing energy in the decay, making Belle II an excellent experiment for conducting this search.

T 9.2 Mon 17:00 VG 1.104

CP violation in $\tau \to K^0 h(\geq 0\pi^0)\nu_\tau$ decays at Belle * — •Katarina Dugic[1,2], Daniel Greenwald[1], and Stephan Paul[1] — [1]Technical University Munich — [2]Max Planck Institute for Physics

In 2012, Babar measured a CP-violating decay-rate asymmetry in $\tau \to K_S\pi(\geq 0\pi^0)\nu_\tau$ that deviates from the standard-model prediction by 2.8σ. We present studies for measuring this asymmetry in $\tau \to K^0 h(\geq 0\pi^0)\nu_\tau$ using data from the Belle experiment.

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T 9.3 Mon 17:15 VG 1.104

Study of $B \to D(^*)\pi\ell\nu$ decays — Florian Bernlochner, Markus Prim, Valerio Bertacchi, and •Nada Gharbi — Physikalisches Institut der Rheinischen Friedrich-Wilhelms-Universität Bonn

The excited states of charmed D mesons beyond the 1S ground state are not well explored and entails a lot of puzzles. One such puzzle arises from the observation that the masses of the $D_0^*(2300)$ and $D_{s0}^*(2317)$ mesons, as reported by the Particle Data Group, are nearly equal: $M_{D_0^*(2300)} \simeq M_{D_{s0}^*(2317)}$. This mass similarity contradicts expectations from SU(3) flavor symmetry breaking, which should account for the strangeness of the $D_{s0}^*(2317)$. Beyond the quark model, these excited charmed mesons can be interpreted as hadronic molecules. Using unitarized chiral perturbation theory (UChPT), it has been theoretically shown that the true SU(3) flavour partner of the $D_{s0}^*(2317)$ is the $D_0^*(2100)$, resolving this mass discrepancy and providing a compelling explanation for the observed phenomena and other puzzles. To investigate this theory, we analyse Belle II data focusing on the invariant mass spectrum of the $D^{(*)}\pi$ system from the decay $B \to D^{(*)}\pi\ell\nu$. By extracting the S-wave contribution in this spectrum, one can make a comparison between the Belle II data and the UChPT predictions. A deeper understanding of the $B \to D^{**}\ell\nu$ decays could significantly reduce the systematic uncertainties in the measurement of R(D$^{()}$), a key observable that points to possible deviations from the Standard Model.

T 9.4 Mon 17:30 VG 1.104

Partial-Wave Analysis for $B \to J/\psi K\pi$ at Belle and Belle II — •Martin Bartl, Stefan Wallner, and Hans-Günther Moser — Max-Planck-Institut für Physik, München

We will present initial input-output studies based on simulated data for a partial-wave analysis (PWA) of $B^0 \to J/\psi K^+\pi^-$ at Belle and Belle II. The PWA disentangles contributions from numerous intermediate resonances, e.g. K^* mesons in the $K\pi$ subsystem. We will discuss the search for exotic, i.e. non $q\bar{q}$, states, which may appear in the $J/\psi K$ and $J/\psi\pi$ subsystems, complementing recent observations by LHCb.

In addition, we will present plans to study isospin related channels, e.g. $B^+ \to J/\psi K^+\pi^0$ and $B^+ \to J/\psi K_S^0\pi^+$.

T 9.5 Mon 17:45 VG 1.104

Dalitz analysis of $B^- \to D^+\pi^-\pi^-$ and $\overline{B}^0 \to D^+\pi^-\pi^0$ — Florian Bernlochner, Markus Prim, Valerio Bertacchi, Agrim Aggarwal, and •Melisa Akdag — Physikalisches Institut der Rheinischen Friedrich-Wilhelms-Universität Bonn, Germany

Recent studies have provided strong evidence that the D_0^* meson is better described by an amplitude modeled using unitarized chiral perturbation theory rather than a traditional Breit-Wigner distribution. This finding underscores the importance of a more nuanced approach to modeling these states. The $D^+\pi^-\pi^-$ decay is dominated by a loop diagram that includes the ρ meson, resulting in significant theoretical uncertainties. To mitigate these uncertainties, we directly access the ρ meson in the analysis by incorporating the isospin conjugated modes which include the π^0 via the decay chain $\overline{B}^0 \to D^+\rho^-$ into our considerations. To achieve these goals, it is crucial to analyze not only the $B^- \to D^+\pi^-\pi^-$ final state, which the LHCb experiment can measure with high precision, but also decays involving neutral pions, emerging from $\overline{B}^0 \to D^+\pi^-\pi^0$, where the Belle II experiment can uniquely contribute. This allows us to study the orbitally excited charmed mesons, the D_0^* and the D_2^* in the $D\pi\pi$ final state, and the D_1, D_1' and D_2^* in the $D^*\pi\pi$ final state. By studying both processes we can test heavy quark spin symmetry in these final states.

T 9.6 Mon 18:00 VG 1.104

Group summary: Plans for hadron spectroscopy analyses at LHCb using Run 3 data — Mikhail Mikhasenko and •Marian Stahl — Ruhr University Bochum, Bochum, Germany

The LHCb experiment has undergone a major upgrade to be able to collect data at a five-fold increased instantaneous luminosity during Runs 3 and 4 of the LHC. With the removal of the hardware trigger, the detectors are readout at the LHC collision rate of 30 MHz and the data is processed in real-time by a heterogeneous two-stage software trigger. This leads to improved efficiencies in the event reconstruction, in particular that of fully hadronic decay channels. For spectroscopy, this opens up possibilities to search for particles with low production rates, or to measure properties of known states with improved precision or in new decay modes. I will give a comprehensive overview of LHCb's potential for spectroscopy measurements in Run 3 and highlight topics of the immediate effort within the German spectroscopy community.