T 105: Flavor IX

Time: Thursday 15:50–17:20 Location: HSZ/0401

T 105.1 Thu 15:50 HSZ/0401

Search for the lepton flavour violating decay $B^0 \to \tau^\pm \ell^\mp$ — •Nathalie Eberlein, Thomas Kuhr, and Thomas Lück — Ludwig-Maximilians-Universität, München

Lepton flavour is conserved in the Standard Model, but violated in many new physics models. An observation of the $B^0 \to \tau^\pm \ell^\mp$ decay, where $\ell = e/\mu$, would be a clear sign for new physics. While an upper limit on the expected branching ratio would help constrain new physics models.

At B factories one can determine the kinematics of the signal B meson by fully reconstructing the accompanying B meson in $e^+e^- \to \Upsilon(4S) \to B\overline{B}$ events. In the rest frame of the signal B meson the mono-energetic lepton provides a clean signature to identify the signal decay. This talk presents the current status of the search for $B^0 \to \tau^\pm \ell^\mp$ decays with the full Belle data set using the Full Event Interpretation algorithm for the reconstruction of the accompanying B meson in hadronic decay modes.

T 105.2 Thu 16:05 HSZ/0401

Search for the lepton flavour violating decay $\tau^+ \to \mu^+\mu^-\mu^+$ with the LHCb experiment — •Giulia Frau[1], Flavio Archilli[2], and Rowina Caspary[1] — [1]Physikalisches Institut, Heidelberg University,Germany — [2]Università di Roma Tor Vergata, Rome, Italy

As lepton flavour violating, the $\tau^+ \to \mu^+\mu^-\mu^+$ decay is forbidden in the Standard Model (SM) at the tree level. The combination of the SM with neutrino oscillations predicts for this decay a branching ratio (BR) of the order of 10^{-55}, well below our current and foreseen experimental sensitivity. Improving the existing limit on the BR of this decay would allow to constrain theories of Physics beyond the SM. Especially lepto-quark models which are often discussed in the context of the recently observed flavor anomalies predict $\tau \to \mu\mu\mu$ BR which are testable with the current available data set. In this talk, I will show the different steps of the analysis performed to evaluate the limit on the BR using data collected by LHCb during Run 2, by focusing on the improvements introduced with respect to the previous LHCb analysis, which was conducted by analyzing Run 1 data. With the increasing luminosity and cross section of Run 2 and a more sophisticated analysis, we expect the LHCb limit to improve by at least a factor of two, making our results competitive with the current best experimental limit.

T 105.3 Thu 16:20 HSZ/0401

Restrictions on scalar leptoquark couplings from charged lepton flavor violation processes — •Uladzimir Khasianevich, Dominik Stöckinger, Hyejung Stöckinger-Kim, and Johannes Wünsche — Institut für Kern- und Teilchenphysik, TU Dresden, Zellescher Weg 19, 01069 Dresden, Germany

We derived the most conservative limits on the S_1 leptoquark model that comes from charged lepton flavour violation observables and magnetic moment of the muon, as they involve a similar diagrammatic structure. We apply the case study, where top-induced, charm-induced or mixed scenarios lead to an explanation of the $(g-2)_\mu$ and then further apply additional two- and three- body decay observables to restrict relevant couplings and their products. The $\mu - e$ conversion process in Au and Al is used to restrict the first row of couplings. As there are known restrictions from K- and D-meson decays, we incorporate them to further improve the bounds on the relevant coupling entries. The FlexibleSUSY program was used in this work to perform scans over various leptoquark coupling scenarios. We designed appropriate model files incorporating the parameterization of the couplings in the up-type mass diagonal basis. The expressions for the leptonic observables were generated with the help of the NPointFunctions extension of the FlexibleSUSY program.

T 105.4 Thu 16:35 HSZ/0401

Probing light New Physics in invisible rare charm decays — •Dominik Suelmann and Gudrun Hiller — TU Dortmund University, Department of Physics, Otto-Hahn-Str.4, D-44221 Dortmund, Germany

We analyze rare $|\Delta c| = |\Delta u| = 1$ charm decays with missing energy in the final state and study their potential to probe different scenarios of light New Physics (NP). We study three-body and two-body decays of baryons and mesons and probe the sensitivities of different observables for the various light NP models. We find that the $\Lambda_c \to p\,\nu\bar{\nu}$ missing energy distribution can distinguish between the scenario of only left-handed neutrinos and the scenario with additional light right-handed neutrinos. We also work out constrains from available experimental data for the two body decays $\Lambda_c \to p + nothing$ and $D \to \pi + nothing$ and point out the benefits of baryonic modes in rare decays.

T 105.5 Thu 16:50 HSZ/0401

Estimate of material effects on neutral charm mixing at the LHCb experiment — •Lennart Uecker[1], Adam Davis[2], Evelina Mihova Gersabeck[2], and Marco Gersabeck[2] — [1]Physikalisches Institut, Universität Heidelberg, Germany — [2]Department of Physics and Astronomy, The University of Manchester, United Kingdom

The LHCb experiment at the LHC is leading the precision measurements in the charm sector. The large charm production cross section and the unique vertex detector, with first detector compoments as close as 6mm to the interaction point, enable the LHCb experiment to measure a larger number of D^0 mesons passing through material

In this talk, we present a data-driven approach to estimate material effects on the mixing of neutral charm mesons using $D^0 \to K\pi$ decays recorded during Run 2 of the LHC, corresponding to an integrated luminosity of 5.6 fb^{-1}. Further, we explore the sensitivity of the upgraded LHCb detector for Run 3+4 to material effects on the charm mixing.

T 105.6 Thu 17:05 HSZ/0401

Constraining flavorful SMEFT operators with missing energy plus jet — Gudrun Hiller and •Daniel Wendler — TU Dortmund University, Department of Physics, Otto-Hahn-Str.4, D-44221 Dortmund, Germany

We consider the Drell-Yan process with final state neutrinos, where the experimental signature is given by "missing energy + jet", as a probe for new physics. The process $pp \to \nu\bar{\nu} + \text{jet}$ is analyzed, to constrain flavorful semileptonic four-fermion operators based on present LHC data ($\mathcal{L}_{int} = 139\,\text{fb}^{-1}$). Projections are derived for the High Luminosity Large Hadron Collider (HL-LHC). New physics scales probed are $\Lambda_{NP} \sim 3.5\,\text{TeV}, 3.0\,\text{TeV}, 2.6\,\text{TeV}$ and $1.6\,\text{TeV}$ for uc, ds, db and sb, respectively for four-fermion operators. The limits are complementary and competitive or better to those from Drell-Yan involving taus, and with low energy observables, such as from rare decays of kaons, charm and beauty hadrons.