T 129: Flavor X

Time: Thursday 17:30–19:00 Location: HSZ/0304

T 129.1 Thu 17:30 HSZ/0304
New physics in $b \to c\tau\nu$ — Marco Fedele[1], Monika Blanke[1,2], Andreas Crivellin[3,4], Syuhei Iguro[1,2], Teppei Kitahara[5,6,7], •Ulrich Nierste[1], and Ryoutaro Watanabe[8] — [1]Institut für Theoretische Teilchenphysik (TTP), Karlsruhe Institute of Technology (KIT) — [2]Institut für Astroteilchenphysik (IAP), Karlsruhe Institute of Technology (KIT) — [3]Paul Scherrer Institut — [4]Physik-Institut, Universität Zürich — [5]Institute for Advanced Research & Kobayashi-Maskawa Institute for the Origin of Particles and the Universe, Nagoya University — [6]KEK Theory Center, IPNS, Tsukuba — [7]CAS Key Laboratory of Theoretical Physics, Institute of Theoretical Physics, Chinese Academy of Sciences, Beijing — [8]INFN, Sezione di Pisa

The branching fractions of the decays $B \to D\tau\nu$ and $B \to D^*\tau\nu$ have been measured by BaBar, Belle, and LHCb. The combination of these measurements indicates an enhancement of the $b \to c\tau\nu$ amplitude w.r.t. the Standard-Model prediction by 3.2σ. This finding is in in tension with the measurement of $B(\Lambda_b \to \Lambda_c\tau\nu)$, which is related to the former two branching ratios by a sum rule. I discuss the implications of this sum rule for future measurements and assess popular scenarios of new physics postulating either a charged Higgs boson or leptoquarks.

T 129.2 Thu 17:45 HSZ/0304
Measurement of $R(D^*)$ **with inclusive** B **meson tagging at Belle II** — •Stephanie Steinmetz, Thomas Lück, and Thomas Kuhr — Ludwig-Maximilians-Universität München

The measured ratio $R(D^*) = \mathcal{B}(B \to D^*\tau\nu)/\mathcal{B}(B \to D^*\ell\nu)$ of branching fractions, where $\ell = e, \mu$, has consistently shown an excess of $B \to D^*\tau\nu$ events. The deviation between Standard Model predictions and the current world average lies at 2.8σ, made even more interesting by the fact that many systematic uncertainties cancel in the ratio. In combination with the analogous $R(D)$, the discrepancy exceeds 3σ and has therefore attracted much attention as a possible hint towards new physics phenomena such as leptoquarks or a charged Higgs.

In this analysis at Belle II, we investigate the decay chains $B \to D^*\tau(\ell\nu\nu)\nu$ as the signal channel, and $B \to D^*\ell\nu$ as normalisation. As both provide the same final state (up to neutrinos), a D^* and a lepton are reconstructed in both cases. The other B meson ("tag B") in the $\Upsilon(4S) \to BB$ event is reconstructed ("tagged") inclusively, i.e. by assuming all particles not assigned to the signal B belong to the tag B without reconstructing intermediate particles. The resulting higher event yields are especially useful when only limited data is available, but come at the cost of higher background levels compared to previous approaches where specific tag B decay trees are reconstructed. The goal of this analysis is to determine the feasibility of applying the inclusive tagging approach to early Belle II data in order to gain competitive results w.r.t. other approaches. The current status of the analysis will be presented in this talk.

T 129.3 Thu 18:00 HSZ/0304
Measuring R(D*) **in hadronic one-prong** τ **decays at Belle II.** — Florian Bernlochner, Jochen Dingfelder, Peter Lewis, and •Ilias Tsaklidis for the Belle II-Collaboration — Physikalisches Institut der Rheinischen Friedrich-Wilhelms-Universität Bonn, Nußallee 12, 53115 Bonn, Germany

Over the last years many experiments have hinted at the existence of lepton universality violating processes. In this work we probe these processes by measuring the R(D*) ratio with hadronically decaying τ leptons. The Belle II experiment produces BB̄ pairs and it greatly benefits from the clean experimental environment of $e^+ e^-$ collisions. In this study we tag one of the two B mesons using the Full Event Interpretation algorithm in fully hadronic modes, in order to kinematically constrain the second B meson. We further reconstruct B → D*$\tau\nu$ decays with a single charged hadron originating from the τ decay and two missing neutrinos in the event. This gives us a unique access to

other quantities sensitive to New Physics, such as the polarization of the τ lepton in B-meson decays. In this talk the current status of the analysis and the expected sensitivity using 364 fb^{-1} of Belle II data will be presented.

T 129.4 Thu 18:15 HSZ/0304
Measurement of $R(D^{(*)})$ **using** $B \to D^{(*)}\tau\nu$ **events with semileptonic tagging and leptonic** τ **decays** — Florian Bernlochner, Jochen Dingfelder, Peter Lewis, and •Alina Manthei for the Belle II-Collaboration — Physikalisches Institut der Rheinischen Friedrich-Wilhelms-Universität Bonn

The Belle II experiment at the SuperKEKB asymmetric-energy collider, where electrons and positrons are collided at the $\Upsilon(4S)$ resonance, collects a large number of events with $B\bar{B}$ pairs. The analysis of semitauonic decays of these B mesons allows for tests of lepton flavour universality. Existing experimental results on the ratios of the branching fractions $\mathcal{R}(D) = \mathcal{B}(\overline{B} \to D\tau^-\overline{\nu})/\mathcal{B}(\overline{B} \to D\ell^-\overline{\nu})$ and $\mathcal{R}(D^*) = \mathcal{B}(\overline{B} \to D^*\tau^-\overline{\nu})/\mathcal{B}(B^* \to D\ell^-\nu^-)$, where ℓ denotes an electron or muon, are in tension with the Standard Model (SM) predictions, which might hint at physics beyond the SM, such as the presence of charged Higgs bosons or leptoquarks. A combined analysis of $\mathcal{R}(D)$ and $\mathcal{R}(D^*)$ with measurements from Belle, BaBar and LHCb yields a divergence from the SM prediction of $> 3\sigma$. Thus, further investigations of these decays with the recently collected Belle II data are necessary. In order to exploit kinematic constraints in the $B\bar{B}$ decay, the second B meson in the event is reconstructed in semileptonic decay modes, a technique denoted as semileptonic tagging. In this talk, a signal extraction strategy for such a measurement will be presented and the current status and plans for the analysis will be outlined.

T 129.5 Thu 18:30 HSZ/0304
Probing lepton universality in inclusive semileptonic B-**meson decays at Belle II** — Florian Bernlochner, Jochen Dingfelder, •Henrik Junkerkalefeld, and Peter Lewis for the Belle II-Collaboration — Physikalisches Institut der Rheinischen Friedrich-Wilhelms-Universität Bonn

Excesses in the ratios $R(D^{(*)}) = \mathcal{B}(B \to D^{(*)}\tau\nu)/\mathcal{B}(B \to D^{(*)}\ell\nu)$ measured by BaBar, Belle and LHCb have created large interest in recent years. Together with other measurements in the flavor sector they may hint at non-universality of lepton couplings. The Belle II experiment in Japan enables a complementary test of these measurements. Due to the precise knowledge of the initial state of the collision and the controlled production of $B\bar{B}$ pairs, an inclusive measurement of $R(X_{\tau/\ell}) = \mathcal{B}(B \to X\tau\nu)/\mathcal{B}(B \to X\ell\nu)$ as well as the light-lepton ratio $R(X_{e/\mu}) = \mathcal{B}(B \to Xe\nu)/\mathcal{B}(B \to X\mu\nu)$ becomes possible. Here, the hadronic system X is not constrained to specific final states, i.e., all possible B-meson decay modes contribute. In this talk, the results of the $R(X_{e/\mu})$ measurement based on a Belle II dataset of 189 fb^{-1} are presented and the current status of the $R(X_{\tau/\ell})$ measurement is discussed.

T 129.6 Thu 18:45 HSZ/0304
Flavour of the dark photon — •Jordi Folch Eguren[1], Emmanuel Stamou[1], Mustafa Tabet[1], and Robert Ziegler[2] — [1]Fakultät für Physik, TU Dortmund, D-44221 Dortmund, Germany — [2]Physikhochhaus (Gebäude 30.23, 9. Stock) Wolfgang-Gaede-Str. 1 D-76131 Karlsruhe

In this work we analyse a BSM model in which an additional U(1) symmetry is added to the SM. We study how FCNCs might arise in this setup due to the new gauge field, the Dark Photon. We constrain the model by considering 2-body meson and baryon decays with different quark transitions, in which form factors play a crucial role.

Jordi Folch Eguren (TU Dortmund), Emmanuel Stamou (TU Dortmund), Mustafa Tabet (TU Dortmund) and Robert Ziegler (KIT).