T 77: Flavor VI

Time: Wednesday 17:20–18:50 Location: HSZ/0401

T 77.1 Wed 17:20 HSZ/0401

Studies of lepton universality with $\Lambda_b \to pKl^+l^-$ decays at LHCb — Johannes Albrecht, Vitalii Lisovskyi, and •Jannis Speer — TU Dortmund University, Dortmund, Germany

In recent measurements of b-hadron decays, a pattern of consistent tensions with the Standard Model predictions is observed. This includes rare decays with $b \to s\ell^+\ell^-$ transitions, which play an important role in lepton flavor universality tests. Complementary to b-meson decays, lepton flavor universality can also be tested in b-baryon decays, which come with partly orthogonal experimental uncertainties. The first measurement of the ratio of branching fractions of the decays $\Lambda_b \to pKe^+e^-$ and $\Lambda_b \to pK\mu^+\mu^-$, R^{-1}_{pK}, was published by the LHCb Collaboration using proton-proton collision data corresponding to an integrated luminosity of $4.7\,\mathrm{fb}^{-1}$. The ratio was measured to be $R^{-1}_{pK} = 1.17^{+0.18}_{-0.16} \pm 0.07$ in the dilepton mass-squared range $0.1 < q^2 < 6.0\,\mathrm{GeV}^2/\mathrm{c}^4$ and the pK mass range $m(pK) < 2600\,\mathrm{MeV/c}^2$. The legacy measurement of R^{-1}_{pK} aims to reduce the uncertainties by analyzing the full $9\,\mathrm{fb}^{-1}$ dataset of LHCb experiment and implementing new selection techniques. In this talk, the recent developments of the ongoing measurement are presented.

T 77.2 Wed 17:35 HSZ/0401

Updated Search for Rare Electroweak Decay $B \to K^{(*)}\nu\overline{\nu}$ to Constrain New Physics Models — •Caspar Schmitt, Sviatoslav Bilokin, and Thomas Kuhr — LMU München, Am Coulombwall 1, 85748 Garching, Germany

Precision measurements of rare decays serve as indirect searches for new physics up to scales well beyond the collider energy, since Standard Model contributions are strongly suppressed. Multiple anomalies are seen in rare decays of B mesons, in particular of the type $B \to K^{(*)}l^+l^-$. We search hints for new physics in the neutral lepton channel $B \to K^{(*)}\nu\overline{\nu}$, which is closely related assuming an unbroken SU(2) Standard Model symmetry. This channel allows particularly precise theoretical predictions and can help reducing hadronic uncertainties in the charged lepton channel.

Experimentally the decay has not yet been detected and is challenging due to the two neutrinos in its final state. Belle II currently is the only experiment in operation that can infer the decay from missing energy and momentum searches. Current experimental limits are model-dependent and a factor 3 to 5 above the Standard Model expectations.

In subsets of new physics models, Wilson coefficients map onto observables and make clear experimental signatures for different new physics scenarios accessible. We explore possibilities for model-independent q^2-binned searches for new physics contributions in $B \to K^{(*)}\nu\overline{\nu}$ by employing novel untagged methods using machine learning.

T 77.3 Wed 17:50 HSZ/0401

Enhancing data exploitation with public likelihoods — •Lorenz Gaertner[1], Thomas Kuhr[1], Danny van Dyk[2], Lukas Heinrich[3], Méril Reboud[2], and Slavomira Stefkova[4] — [1]Ludwig-Maximilians-Universität, München, DE — [2]IPPP, Durham University, Durham, UK — [3]Technical University Munich, München, DE — [4]Karlsruhe Institute of Technology, Karlsruhe, DE

The results published using data from high-energy experiments have large scientific potential beyond initial publication. To maximize the scientific impact of the data and the corresponding likelihood of the results, facilitating reuse for combination, reinterpretation, and the generation of pseudo data should be made standard practice.

A channel with a potentially high benefit from reinterpretation in terms of new physics models is the rare $B^+ \to K^+\nu\bar{\nu}$ decay, for which a search is conducted by the Belle II collaboration. The observables arising from such decays are very sensitive to many new physics models. Due to the experimental challenge arising from two final state neutrinos, the analysis of this decay requires assumptions on the kinematic distribution. Consequently, the results feature a model dependency arising from both (beyond) standard model assumptions and from the description of the pertinent hadronic matrix element. This dependency makes reinterpretation complicated without reanalysing the underlying data. By exploring methods to perform result-level reweighting of published likelihoods according to new theoretical models, we want to study the effect on the likelihoods and interpret the physical significance.

T 77.4 Wed 18:05 HSZ/0401

Studies of angular and CP asymmetries in $D^+_{(s)} \to h^+l^-l^+$ decays at LHCb — Serena Maccolini, Dominik Mitzel, and •Luca Toscano — TU Dortmund University, Dortmund, Germany

LHCb has recorded the world's largest sample of charm hadron decays and takes a leading role in measurements of rare decays and searches for CP violation.

Rare semi-leptonic charm decays such as $D^+ \to \pi^+l^-l^+$ and $D^+_s \to K^+l^-l^+$ are sensitive to beyond-standard-model effects in flavour-changing neutral current $c \to u\ell^+\ell^-$ transitions, where $\ell^+\ell^-$ is a pair of oppositely charged electrons or muons. Null test observables can be defined to test the Standard Model in angular or CP asymmetries, where new physics signals can be enhanced in the vicinity of intermediate hadronic resonances.

In this talk, an overview of the tentative analysis strategy to perform a first study of angular distributions and CP asymmetries in $D^+_{(s)} \to h^+l^-l^+$ decays is presented. The analysis uses data collected by the LHCb detector from 2016 to 2018 at a centre-of-mass energy of 13 TeV, corresponding to an integrated luminosity of $6\mathrm{fb}^{-1}$.

T 77.5 Wed 18:20 HSZ/0401

Measurement of the branching fraction of the rare decay $D^0 \to K^-\pi^+e^-e^+$ with the LHCb experiment — Daniel Unverzagt and •Stefan Blenkle — Physikalisches Institut, Heidelberg, Germany

The LHCb experiment at the Large Hadron Collider (LHC) is particularly suitable for studying decays of charm hadrons. This talk presents the branching fraction measurement of the four-body decay $D^0 \to K^-\pi^+e^-e^+$ using LHCb data collected in 2017 and 2018, corresponding to an integrated luminosity of $3.8fb^{-1}$. The analysis aims to measure the most precise value for the decay branching fraction using the world's largest data sample of charm decays.

T 77.6 Wed 18:35 HSZ/0401

New Physics at the $K \to \pi\nu\nu$ kinematic distributions — •Kai Sieja[1], Emmanuel Stamou[1], Mustafa Tabet[1], and Martin Gorbahn[2] — [1]TU Dortmund, Germany — [2]University of Liverpool, United Kingdom

The rare decays $K^+ \to \pi^+\nu\nu$ and $K_L \to \pi^0\nu\nu$ are among the strongest probes of Beyond-the-Standard-Model dynamics with new sources of quark-flavour violation. These decays are thus the main target for the dedicated experiments NA62 and KOTO. Working within the LEFT framework, we analyze the impact of dimension-six operators including lepton-number violating ones on the experimentally accessible distributions. Concrete New Physics models can induce operators with different chirality, i.e., vector-, scalar, tensor-type operators, and different neutrino flavour structure. Using published data from NA62, we assess the impact of a combined binned likelihood in constraining the New Physics parameter space and how this varies for different operator types.