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Exploring Lepton Flavour with b-hadron Decays at LHCb: Universality Tests and Searches for Violation

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Lepton flavour plays a crucial role in tests of the Standard Model and searches for New Physics. Within the Standard Model, the electroweak bosons couple universally to the three lepton families, differing only by mass effects (Lepton Flavour Universality, LFU) — charged Lepton Flavour Violation (cLFV) is highly suppressed. However, several beyond-the-Standard-Model scenarios predict deviations from LFU or enhanced rates for cLFV decays, making their observation a clear indication of New Physics. Current measurements of ratios of branching fractions for b-hadrons decaying into final states with different lepton flavours show deviations from the Standard Model predictions at the order of 3σ. The LHCb experiment, optimized for studying heavy-flavour hadrons with excellent tracking and particle identification, provides an ideal environment for probing these rare phenomena. This talk will present recent results from LHCb on tests of lepton flavour universality, specifically in $b \to c\ell\nu$ decays using hadronic or muonic τ decays, as well as results from searches for charged lepton flavour violation in b-hadron decays. These results contribute significantly to our understanding of potential new interactions beyond the Standard Model, offering stringent constraints on Standard Model extensions.

Secondary track

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