Contribution ID: **42** Type: **not specified**

New physics in inclusive $\bar{B} \to X_c \tau^- \bar{\nu}_\tau$ decay including $\mathcal{O}(\Lambda^2_{QCD}/m_b^2)$ and $\mathcal{O}(\alpha_s)$ corrections

Motivated by the $R(D^{(*)})$ anomalies observed in exclusive $\bar{B} \to D^{(*)}\tau^-\bar{\nu}_\tau decays, which might hint at the violation of lepton flavoru$ $physics signals that couple non-universally to the three generations of leptons, we perform a detailed study of the new-$ $physics effects in the inclusive$ \bar{B}\to X_c\tau^-\bar{\nu}\tau$decay, including both$ \mathcal{O}(\Lambda{QCD}^2/m_b^2) and \math $independent effective field theory framework and in the popular leptoquark models, focusing on the behaviors of the lepton energ$ $side forward-backward asymmetry$ A_{FB}, the \tau $polarization$ P_\tau, $as well as the$ q^2 $-dependent ratio of the differential dec$ X_c \tau^- \bar{\nu}\tau)/dq^2}{d\Gamma(\bar{B}\to X_c \ell^- \bar{\nu}$\ell)/dq^2}, under different assumptions about the new-physics contributions. It is found that, under the combined constraints from the ratios $R(D^{(*)})$ and other relevant observables, the new-physics operators with different Dirac structures are insensitive to both the perturbative and non-perturbative corrections, in either the 1S or the kinetic scheme. Some observables in inclusive $\bar{B} \to X_c\tau^-\bar{\nu}_\tau$ decay are also found to be helpful for discriminating the different new-physics scenarios proposed to account for the $R(D^{(*)})$ anomalies.

Presentation type

Oral

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