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Test of new physics effects in $\bar{B} \to D^{(*)}\ell^-\bar{\nu}_\ell$ decays with heavy and light leptons

We have reconsidered the possible new physics (NP) scenarios in the $\bar{B} \to D(D^*)\ell^-\bar{\nu}_\ell$ decays in light of the recent LHCb result on $R_{D^*} = \frac{\Gamma(\bar{B}\to D^*\tau^-\bar{\nu}_\tau)}{\Gamma(\bar{B}\to D^*\ell^-\bar{\nu}_\ell)}$ ($l \in e, \mu$). The contribution from NP could be of minimal flavor violating (MFV) type which leads to similar effects in decays to τ and light lepton modes. Also, it could be a non-MFV scenario where the contributions are flavor dependent leading to different contributions
in the light and heavy lepton final states. We have divided our analyses based on whether there are similar or different types of NP in the decays with τ and μ or e in the final state. For different types of NP in the heavy and light lepton modes, none of the one-operator scenarios can accommodate the Heavy Flavor Averaging Group (HFLAV)
average on $R_{D^{(*)}}$ and the Belle measurement on $F_L^{D^*}$ simultaneously. Only the two-operator scenario $[\mathcal{O}^\tau_{S_1}, \mathcal{O}^\tau_{S_2}]$ can explain all the measured values, also simultaneously satisfying the conservative limit of $\mathcal{B}(B_c \to \tau\nu_\tau) < 60\ \%$. We have also given bounds on the couplings of the relevant Standard Model effective field theory (SMEFT) operators and the probable NP scale and noticed that for a given value of the NP scale, the coupling in the τ channel is almost 10 times the coupling in the μ channel which is as per the expectation.

Mini Symposia (Invited Talks Only)

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