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An Imperative study of the angular observables in $\Lambda_b^0 \to \Lambda_c^+(\to \Lambda\pi^+)\tau\bar{\nu_\tau}$ decay and probing the footprint of new physics

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We have conducted an investigation and prediction of the angular observables in the complete 4-body angular distribution for the decay of $\Lambda_b^0 \to \Lambda_c^+(\to \Lambda\pi^+)\tau\bar{\nu_\tau}$. This analysis takes into account all New Physics (NP) operators in a model-independent manner while analyzing the NP sensitivity of each angular observable with the associated NP operators. We have also provided the shape of the form factor for BGL parametrization, and have updated the SM prediction for angular observables with the LFUV ratio $R(\backslash Lambda\_\{c\})$ which we find consistent with the Lattice. We have constructed for the first time, the CP-violating observable for this decay mode and analyzed it for various NP operators along with other angular observables. Recently, LHCb has measured the Branching Ratio of this for τ mode and provided $R(\backslash Lambda\_\{c\})$ Using these results along with the current HFLAV average of $R(D)$, $R(D*)$, and also LHCb measured value for $F_L(D^*)$, we have performed a χ^2 analysis with one and/or two parameters, one at a time. We found that a scenario $\mathcal{R}][C_{V_2}]$, can explain \text{$R(D^*)$} and \text{$R(\Lambda_c)$} but can't explain \text{$R(D)$} marginally. However, all one-operator scenarios can explain all the observable within 2σ. On the other hand, in a two-parameter scenario, the situation has improved significantly, and \text{$C_{S_1} - C_T$} turns out as a best-fit scenario that can explain all the observable within 1σ. We extensively studied correlations between observables for this charge current decay process in the presence of both one and/or two-operator new physics scenarios.

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