

B anomaly hunting at the LHC: tau b + missing search for leptoquarks

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One of the long-standing B anomalies is the $b \rightarrow c\tau\nu$ anomaly, which remains at ~ 4 sigma level. This anomaly will be confirmed or disappeared by the ongoing Belle II and LHCb experiments. In this talk, we will discuss the possibility that another crosscheck could be possible by the LHC search. In our work arXiv:2111.04748, we study non-resonant searched for new physics at the LHC by considering final states with an energetic and hadronically decaying τ lepton, a b -jet and large missing transverse momentum ($pp \rightarrow \tau b + E_T^{miss}$). This channel is related to the $b \rightarrow c\tau\nu$ process by the crossing symmetry of the amplitudes. We analyze them not only within the dimension-six EFT but also in explicit leptoquark models. Although the leptoquark models provide a weaker sensitivity than the EFT, it is found that the non-resonant search of $pp \rightarrow \tau b + E_T^{miss}$ can improve the sensitivity by $\sim 40\%$ versus a conventional $pp \rightarrow \tau + E_T^{miss}$ search in the whole leptoquark mass region. Consequently, it is expected that most of the parameter regions suggested by the B anomaly can be probed at the HL-LHC. Also, it is shown that SU(2) doublet leptoquark scenario is accessible entirely once the LHC Run 2 data are analyzed. In addition, we discuss the angular correlations among b, τ and the missing transverse momentum to discriminate the LQ scenarios.

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