

Consequences of $b \rightarrow s \mu^+ \mu^-$ anomalies on $B \rightarrow K^{(*)} \nu \bar{\nu}$, $B_s \rightarrow (\eta, \eta') \nu \bar{\nu}$ and $B_s \rightarrow \phi \nu \bar{\nu}$ decay observables

The long persistent discrepancies in $b \rightarrow s \ell \ell$ quark level transitions continue to be the ideal platform for an indirect search of new physics that lies beyond the standard model. The recent updated measurements of R_K , $\mathcal{B}(B_s \rightarrow \phi \mu^+ \mu^-)$ and $\mathcal{B}(B_s \rightarrow \mu^+ \mu^-)$ from LHCb persistently deviate from the standard model expectations at the level of 3.1σ in R_K and 3.6σ in $\mathcal{B}(B_s \rightarrow \phi \mu^+ \mu^-)$. Similarly, the measurements of R_{K^*} and P'_5 in $B \rightarrow K^* \ell \ell$ decays still continue to disagree with the standard model at $\sim 2.4\sigma$ and $\sim 3.3\sigma$ respectively. Similarly the new tests of lepton flavor universality performed using the isospin partners such as $B^0 \rightarrow K_S^0 \ell \ell$ and $B^+ \rightarrow K^{*+} \ell \ell$ exhibit the same pattern of deviation with the previous results. The new ratios $R_{K_S^0}$ and $R_{K^{*+}}$ stand respectively at 1.4σ and 1.5σ away and the combination of both stand at 2σ away from the standard model expectations. Motivated by these anomalies we search for the patterns of new physics in the family of flavor changing neutral decays with neutral leptons in the final state undergoing $b \rightarrow s \nu \bar{\nu}$ quark level transitions. There are close relations in the analysis of $b \rightarrow s \ell \ell$ and $b \rightarrow s \nu \bar{\nu}$ transitions not only in standard model but also in various beyond the standard model scenarios. For beyond the standard model physics under the $SU_L(2)$ gauge symmetry one can relate the left handed charged leptons to the neutrinos. Moreover, there are several advantages of studying $b \rightarrow s \nu \bar{\nu}$ transitions over $b \rightarrow s \ell \ell$ as they are free from various hadronic uncertainties beyond the form factors such as the non-factorizable corrections and photonic penguin contributions. Hence, we explore the consequences of $b \rightarrow s \mu^+ \mu^-$ anomalies on $B \rightarrow K^{(*)} \nu \bar{\nu}$, $B_s \rightarrow (\eta, \eta') \nu \bar{\nu}$ and $B_s \rightarrow \phi \nu \bar{\nu}$ decay observables in SMEFT platform within various 1D and 2D new physics scenarios.

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