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Investigating new physics in $\tau - \mu$ sector via LFU ratios $R_K^{\tau\mu}$ and $R_{K^*}^{\tau\mu}$

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We explore the potential of the ratios $R^{\tau\mu}$ in the decays $B \rightarrow K\ell\ell$ and $B \rightarrow K^*\ell\ell$ ($\ell = \mu, \tau$) as a means to probe new physics effects within the $\tau - \mu$ sector. We find that these ratios deviate from their SM predictions even for universal couplings. This indicates that the observed deviation of these ratios from their SM predictions alone is insufficient to definitively establish the underlying nature of new physics. For this, we need to compare the allowed range of $R^{\tau\mu}$ for a class of solutions with only universal couplings to leptons and solutions having both universal and non-universal components. By comparing the predictions of $R_K^{\tau\mu}$ and $R_{K^*}^{\tau\mu}$ for the two classes of solutions using the current data, we find that the distinction becomes feasible if the measured value of $R_{K^*}^{\tau\mu}$ exceeds the SM prediction.

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