B meson anomalies and large $B^+ \to K^+ \nu \bar{\nu}$ in non-universal $U(1)'$ models

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In view of both the latest LHCb measurement of $R_{K^{(*)}}$ and the new 2.8σ deviation reported by Belle II on $B^+ \to K^+ \nu \bar{\nu}$ decays, we present a fit to the B meson anomalies for various one and two dimensional hypothesis including complex Wilson coefficients. We show in a model-independent way that the generic non-universal $U(1)'$ extensions of the SM, without flavour violation, fail to simultaneously fit those observables and corroborate that they can modify $\mathrm{BR}(B^+ \to K^+ \nu \bar{\nu})$ up to only a 10%. In view of this deficit, we propose a new way in which those models can accommodate the data at tree level by introducing lepton flavour violating couplings and non-diagonal elements of the charged lepton mixing matrix, with implications in future charged lepton flavour violation searches.

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