

# A combined explanation of the $B$ -decay anomalies with a single vector leptoquark

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In order to simultaneously account for both  $R_{D^{(*)}}$  and  $R_{K^{(*)}}$  anomalies in  $B$ -decays, we consider an extension of the Standard Model by a single vector leptoquark field, and study how one can achieve the required lepton flavour non-universality, starting from a priori universal gauge couplings. While the unitary quark-lepton mixing induced by  $SU(2)_L$  breaking is insufficient, we find that effectively nonunitary mixings hold the key to simultaneously address the  $R_{K^{(*)}}$  and  $R_{D^{(*)}}$  anomalies. As an intermediate step towards various UV-complete models, we show that the mixings of charged leptons with additional vector-like heavy leptons successfully provide a nonunitary framework to explain  $R_{K^{(*)}}$  and  $R_{D^{(*)}}$ . These realisations have a strong impact for electroweak precision observables and for flavour violating ones: isosinglet heavy lepton realisations are already excluded due to excessive contributions to lepton flavour violating  $Z$ -decays. Furthermore, in the near future, the expected progress in the sensitivity of charged lepton flavour violation experiments should allow to fully probe this class of vector leptoquark models.

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