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B-anomalies in a twin Pati-Salam theory of flavour

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The vector leptoquark $U_1(3, 1, 2/3)$ is the only single mediator which can simultaneously address the anomalies in B-physics. Remarkably, such explanation of the B-anomalies requires a hierarchy in the U_1 couplings which may be connected with the well-known hierarchies in the masses of the SM fermions. In this direction, a twin Pati-Salam model was recently proposed, in which the U_1 couplings and the SM Yukawa couplings find a common origin via mixing of chiral quarks and leptons with vector-like fermions, providing a direct link between the B-anomalies and the fermion masses and mixing. I will present a simplified version of the model with three vector-like fermion families, in the massless first family approximation, and show that the second and third family charged fermion masses and mixings and the B-anomalies can be simultaneously explained and related. I will show that the model recovers the phenomenology of 4321 models at low-energies, being compatible with all known low-energy data, and I will highlight predictions in promising observables such as $\tau \to 3\mu$, $\tau \to \mu\gamma$ and $B \to K^{(*)}\nu\bar{\nu}$ at Belle II and LHCb. Finally, I will discuss high-p_T signals of the rich spectrum of new particles at the TeV scale, comprising the vector leptoquark U_1, a coloron g' and Z', as well as vector-like quarks and leptons with masses also around the TeV scale.

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