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Rare $B \to K^{(*)}\mu^+\mu^-$ Decays as Probes of New Physics: Z' Mediation in a $U(1)_{B-L} \times S_3$ Framework

Rare semileptonic B-meson decays provide an important framework for testing the Standard Model and searching for new physics. In this work, we study a flavor non-universal $U(1)'$ extension of a $B - L$ model with an S_3 flavor symmetry and three Higgs doublets. The additional $U(1)'$ symmetry introduces a new neutral gauge boson, Z', with family-dependent couplings to fermions. After rotating to the quark mass basis, these interactions can generate a flavor-changing b–s–Z' coupling at tree level. We investigate its contribution to the effective Hamiltonian for $b \to s\mu^+\mu^-$, particularly through modifications of the Wilson coefficients C_9^μ and C_{10}^μ, and its possible implications for observables such as R_K, R_{K^*}, and P_5'.

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