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Phenomenological Constraints on Effective Amplitudes in Rare Two-body Baryonic Decays of $B^0_{(s)}$ Mesons

Rare two-body baryonic B-meson decays probe weak interactions in the presence of nonperturbative hadronic dynamics. We study $B^0 \to p\bar{p}$ and $B^0_s \to p\bar{p}$ decays using the general Lorentz-covariant amplitude $\mathcal{M}_q = \bar{u}(p_1)(A_q + B_q\gamma_5)v(p_2)$, with $q = d, s$. We find that the decay width receives two contributions: a scalar (S-wave) contribution and a pseudoscalar (P-wave) contribution. For CP-averaged branching fractions, we define the kinematically weighted amplitude combination $H_q^2 = \beta_q^2 a_q^2 + b_q^2$, where $\beta_q \equiv \frac{p_q}{E_q}$. From the combined LHCb measurement of $B^0 \to p\bar{p}$, we obtain $H_d = (1.6784^{+0.0916}_{-0.0969}) \times 10^{-10}$, where the error follows from a transformed, approximately Gaussian 68.27% range. The upper limit on $B^0_s \to p\bar{p}$ gives $H_s^{\text{ref}} < 9.7751 \times 10^{-11}$ (90% confidence level). We construct the associated elliptical uncertainty band and upper-limit region and examine three amplitude scenarios, and verify the B^0 error propagation with one million Monte Carlo events.

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