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Impact of Z' Boson on Pure Annihilation Decays

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We study the $B_s \rightarrow \pi^+ \pi^-$ and $B_d \rightarrow K^+ K^-$ decays in the standard model and the family non-universal Z' model. Since none of the quarks in final states is the same as the initial quark, these decay modes can occur only via power-suppressed annihilation diagrams. Despite the consistence of the standard model prediction with the available data, there is a surviving room for a light Z' boson. Taking into account the Z' contribution, we find theoretical results for branching fractions can better accommodate the data. With the relevant data, we also derive a constraint on the parameter space for the Z' . Moreover, for the $B_d \rightarrow K^+ K^-$, both the direct and the mixing-induced CP asymmetry are sensitive to the couplings between Z' and fermions in the parameter spaces constrained by data. The measurements at future experimental facilities, including the LHC-b, Belle-II and the proposed high energy e^+e^- collider, will provide us useful hints for direct searching for the light Z' boson.

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