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Resolution of the B -> pi pi, pi K puzzles

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We show that there exist uncanceled soft divergences in the k_T factorization for nonfactorizable amplitudes of two-body nonleptonic B meson decays, similar to those identified in hadron-hadron collisions. Viewing the special role of the pion as a q-qbar bound state and as a pseudo Nambu-Goldstone boson, we associate a soft factor with it in the perturbative QCD formalism. This soft factor enhances the nonfactorizable color-suppressed tree amplitudes, such that the branching ratios B(B->piˆ0 piˆ0) and B(B->piˆ0 rhoˆ0) are increased under the constraint of the B(B->rhoˆ0 rhoˆ0) data, the difference between the direct CP asymmetries A_{CP}(B->piˆ\mp Kˆ\pm) and A_{CP}(B->piˆ0 Kˆ\pm) is enlarged, and the mixing-induced CP asymmetry S_{piˆ0 K_S} is reduced. That is, the known B->pi pi and B->pi K puzzles can be resolved simultaneously.

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