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Non-leptonic weak decay of doubly charmed baryon

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The doubly charmed baryon, Ξ_{cc}^{++}, was first observed by
LHCb through the non-leptonic decay modes of $\Xi_{cc}^{++} \to \Lambda_c^+ K^- \pi^+ \pi^+$
and $\Xi_c^+ \pi^+$. Following this discovery, researchers shifted
their focus to identifying other doubly charmed baryons, specifically
Ξ_{cc}^+ and Ω_{cc}^+. In this study, we examine
the non-leptonic weak decays of doubly charmed baryons, denoted as
$calB_{cc} \to calB_c P$, where $calB_{cc}$ represents
the doubly charmed baryons, specifically $(\Xi_{cc}^{++}, \Xi_{cc}^+, \Omega_{cc}^+)$.
The notation $calB_c$ denotes the singly charmed baryons, specifically
$(calB_{\bar{3}}, calB_6)$, while P signifies the light
pseudoscalar. These terms are pertinent to the non-leptonic decay
modes under discussion. While the short-distance contributions can
be precisely estimated through theoretical calculations, addressing
the long-distance contributions for final-state-interaction effects
presents a significant challenge. In order to address this issue, we utilize the rescattering mechanism of final state interaction effects to compute the long-distance contributions. We initially derive the entire hadronic loop contributions for these two-body nonleptonic decays of doubly charmed baryons. In subsequent analyses, we are able to calculate relative strong phases. As a result, we can provide predictions for their decay asymmetry parameters and CP violations.
Furthermore, we employ experimental data from the LHCb collaboration, specifically the ratio $Br(\Xi_{cc}^{++} \to \Xi_c^{\prime +} \pi^+)/Br(\Xi_{cc}^{++} \to \Xi_c^+ \pi^+) = (1.41 \pm 0.17 \pm 0.10)$, to ascertain the model parameters $\eta = 0.9 \pm 0.2$. Consequently, we present the predictions of branching ratios and decay asymmetry parameters for 67 distinct decay processes and CP violations for the singly Cabibbo suppressed channels.
This not only strengthens the validity of our theoretical predictions, but also provides a more comprehensive theoretical framework for the future identification of other doubly charmed baryons.

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