SU(3) $_{\text{flavor}}$ analysis of two-body weak decays of charmed baryons

K. K. Sharma and R. C. Verma*
Centre for Advanced Study in Physics, Department of Physics, Panjab University, Chandigarh-160014, India

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We study two-body weak decays of charmed baryons Λ_c^+, Ξ_c^+, and Ξ_c^0 into an octet or decuplet baryon and a pseudoscalar meson employing the SU(3) flavor symmetry. Using certain measured Cabibbo-favored modes, we fix the reduced amplitudes and predict the branching ratios of various decays of charmed baryons in the Cabibbo-enhanced, -suppressed, and -doubly-suppressed modes. [S0556-2821(97)01211-3]

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I. INTRODUCTION

As more new data [1–4] on charmed baryons have become available in recent years, the theoretical study of nonleptonic weak decays of charmed baryons has acquired significance. Earlier, it was hoped that like meson decays the spectator quark process would dominate for charm baryon decays also. However, this scheme does not seem to be supported by experiment, as the observed branching ratio for decays such as $\Lambda_c^+\to\Sigma^+\pi^0/\Xi^0K^+$, forbidden in the spectator quark model, are significantly large thereby indicating the need of nonspectator contributions. Generally, these contributions are treated through the current algebra approach and soft pion techniques [5]. Unfortunately, the calculations of both pole terms and factorizable contributions have their own uncertainties associated with many parameters and even by adjusting all the parameters, agreement with the experimental observations is far from satisfactory [6].

An alternative to the above approach is to employ the flavor symmetry approach [7–9]. Though this approach involves a number of unknown reduced amplitudes, it has the advantage that it lumps all the dynamical processes together. In contrast with the badly broken SU(4) charm scheme, SU(3) flavor symmetry is expected to be more reliable for the study of charm baryons. Recently, one of us (R.C.V.) and Khanna [10] studied the Cabibbo-favored (CF) decays of charmed baryons in the SU(3) flavor symmetry generated by u, d, and s quarks. In this work, we extend this approach to study Cabibbo-suppressed (CS) and -doubly-suppressed (CDS) $B_c\to BP/DP$ decays (where B_c represents the charmed baryon and B/D the octet or decuplet baryon and P a pseudoscalar meson, respectively). Using the data available on $\Lambda_c^+\to\Lambda\pi^+/\Sigma^+\pi^0/\Xi^0K^+$ decays, we determine the reduced amplitudes, which are then used to predict branching ratios and asymmetry of various CF, CS, and CDS decays. Similarly, we also study $B_c\to DP$ decays, where we use $B(\Lambda_c^+\to\Delta^{++}K^-/\Xi^{*0}K^+)$ to fix the reduced amplitudes.

II. THEORETICAL FRAMEWORK

The structure of the general weak current $\otimes$ current Hamiltonian H_w including short distance QCD effects for the charm changing Cabibbo-favored decays ($\Delta C=\Delta S=-1$) is

$$H_w=\widetilde{G}_F[c_1(\overline{u}d)(\overline{s}c)+c_2(\overline{s}d)(\overline{u}c)], \tag{1}$$

where $\widetilde{G}_F=(G_F/\sqrt{2})V_{ud}V_{cs}^*\cdot\overline{q_1}q_2\equiv\overline{q_1}\gamma_\mu(1-\gamma_5)q_2$ represents color singlet V-A current and the QCD coefficients at the charm mass scale are

$$c_1=1.26\pm0.04,\quad c_2=-0.51\pm0.05. \tag{2}$$

The effective weak Hamiltonian (1) transforms as an admixture of the **6*** and **15** representations of the SU(3) flavor, which can be expressed as

$$\begin{aligned}H_W^{\mathbf{6}^*}=&\sqrt{2}g_{8_S}\{\overline{B_m^a}P_b^mB^nH_{[n,a]}^b+\overline{B_b^m}P_m^aB^nH_{[n,a]}^b\}\\&+\sqrt{2}g_{8_A}\{\overline{B_m^a}P_b^mB^nH_{[n,a]}^b-\overline{B_b^m}P_m^aB^nH_{[n,a]}^b\}\\&+\frac{\sqrt{2}}{2}g_{10^*}\Bigg\{\overline{B_b^a}P_d^cB^bH_{[a,c]}^d+\overline{B_b^a}P_d^cB^dH_{[a,c]}^b\\&-\frac{1}{3}\overline{B_b^a}P_a^cB^nH_{[n,c]}^b+\frac{1}{3}\overline{B_c^a}P_d^cB^nH_{[n,a]}^d\Bigg\},\end{aligned} \tag{3}$$

$$\begin{aligned}H_W^{\mathbf{15}}=&\frac{\sqrt{2}}{2}h_{27}\Bigg\{\overline{B_b^a}P_d^cB^bH_{(a,c)}^d+\overline{B_b^a}P_d^cB^dH_{(a,c)}^b\\&-\frac{1}{5}\overline{B_b^a}P_a^cB^nH_{(n,c)}^b-\frac{1}{5}\overline{B_c^a}P_d^cB^nH_{(n,a)}^d\Bigg\}\\&+\frac{\sqrt{2}}{2}h_{10}\Bigg\{\overline{B_b^a}P_d^cB^bH_{(a,c)}^d-\overline{B_b^a}P_d^cB^dH_{(a,c)}^b\\&+\frac{1}{3}\overline{B_b^a}P_a^cB^nH_{(n,c)}^b-\frac{1}{3}\overline{B_c^a}P_d^cB^nH_{(n,a)}^d\Bigg\}\\&+\sqrt{2}h_{8_S}\{\overline{B_m^a}P_b^mB^nH_{(n,a)}^b+\overline{B_b^m}P_m^aB^nH_{(n,a)}^b\}\\&+\sqrt{2}h_{8_A}\{\overline{B_m^a}P_b^mB^nH_{(n,a)}^b-\overline{B_b^m}P_m^aB^nH_{(n,a)}^b\},\end{aligned} \tag{4}$$

where the QCD coefficients c_1 and c_2 get absorbed in the reduced amplitudes $g's$ and $h's$. Here, $B^a\equiv(-\Xi_c^0,\Xi_c^+,\Lambda_c^+)$, and B_b^a denote the antitriplet of charmed baryons and octet baryons, respectively. P_b^a denotes 3×3 matrix of the uncharmed pseudoscalar meson nonet

*Present address: Department of Physics, Punjabi University, Patiala-147 002, India.

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$$P_b^a = \begin{pmatrix} P_1^1 & \pi^+ & K^+ \\ \pi^- & P_2^2 & K^0 \\ K^- & \overline{K^0} & P_3^3 \end{pmatrix}, \tag{5}$$

with

$$P_1^1 = \frac{1}{\sqrt{2}}\{\pi^0 + \eta\ \sin\theta + \eta'\ \cos\theta\},$$

$$P_2^2 = \frac{1}{\sqrt{2}}\{-\pi^0 + \eta\ \sin\theta + \eta'\ \cos\theta\}, \tag{6}$$

$$P_3^3 = \{-\eta\ \cos\theta + \eta'\ \sin\theta\},$$

where θ governs the η-η' mixing and is related to the physical mixing as

$$\theta = \theta_{\rm ideal} - \phi_{\rm phy}. \tag{7}$$

The amplitude for the decay process $B_c \to BP$ is defined by

$$\langle B_f P | H_W | B_i \rangle = i\overline{u_{B_f}}\{A - \gamma_5 B\} u_{B_i}\phi_P, \tag{8}$$

where A and B are, respectively, s-wave and p-wave amplitudes and u_B are the Dirac spinors. This gives the decay rate

$$\Gamma(B_i \to B_f + P) = C_1\{|A|^2 + C_2|B|^2\} \tag{9}$$

and asymmetry parameter

$$\alpha = \frac{2\ \mathrm{Re}(A\overline{B^*})}{(|A|^2 + |\overline{B}|^2)}, \tag{10}$$

with $\overline{B} = \sqrt{C_2}B$. The kinematical factors C_1, C_2 are given by

$$C_1 = \frac{|p_c|}{8\pi}\frac{(m_i + m_f)^2 - m_p^2}{m_i^2}, \tag{11}$$

$$C_2 = \frac{(m_i - m_f)^2 - m_p^2}{(m_i + m_f)^2 + m_p^2}, \tag{12}$$

where p_c is the center-of-mass three-momentum in the rest frame of the parent particle. m_i, m_f are masses of initial and final state baryons, respectively, and m_p is the mass of the meson emitted.

III. NUMERICAL CALCULATIONS AND RESULTS

A. Cabibbo-favored mode

To illustrate the procedure, we discuss the main steps involved in the determination of the reduced amplitudes. Taking the H_{13}^2 component of the weak Hamiltonian in Eqs. (3) and (4), the decay amplitudes of various Cabibbo-favored decays of antitriplet charmed baryons are obtained [7,8,10]. There are seven reduced amplitudes in each of the PV and PC modes. Assuming **6*** dominance of the weak Hamiltonian, we reduce the number of unknown parameters from 7 to 3 in each of these modes.

A recent CLEO measurement [3] has reported the following set of PV and PC amplitudes (in the units of $G_F V_{ud} V_{cs}^* \times 10^{-2}$ GeV^2):

$$A(\Lambda_c^+ \to \Lambda\pi^+) = -3.0^{+0.8}_{-1.2} \quad \text{or} \quad -4.3^{+0.8}_{-0.9},$$
$$B(\Lambda_c^+ \to \Lambda\pi^+) = +12.7^{+2.7}_{-2.5} \quad \text{or} \quad +8.9^{+3.4}_{-2.4},$$
$$A(\Lambda_c^+ \to \Sigma^+\pi^0) = +1.3^{+0.9}_{-1.1} \quad \text{or} \quad +5.4^{+0.9}_{-0.7},$$
$$B(\Lambda_c^+ \to \Sigma^+\pi^0) = -17.3^{+2.3}_{-2.9} \quad \text{or} \quad -4.1^{+3.4}_{-3.0}. \tag{13}$$

It has been shown [10] that the present data on $B(\Lambda_c^+ \to p\overline{K^0})$ prefers the following set:

$$A(\Lambda_c^+ \to \Lambda\pi^+) = -3.0^{+0.8}_{-1.2}, \quad B(\Lambda_c^+ \to \Lambda\pi^+) = +12.7^{+2.7}_{-2.5},$$
$$A(\Lambda_c^+ \to \Sigma^+\pi^0) = +5.4^{+0.9}_{-0.7}, \quad B(\Lambda_c^+ \to \Sigma^+\pi^0) = -4.1^{+3.4}_{-3.0}. \tag{14}$$

Further, experimental branching ratio $B(\Lambda_c^+ \to \Xi^0 K^+) = (0.34 \pm 0.09)\%$ [10] yields,

$$|A(\Lambda_c^+ \to \Xi^0 K^+)|^2 + C_2|B(\Lambda_c^+ \to \Xi^0 K^+)|^2 = 14.42 \pm 3.82. \tag{15}$$

Various dynamical mechanisms considered for the charm baryon decays indicate that the PV mode of this decay is highly suppressed. This decay in the PV mode can neither occur through the spectator quark scheme nor from the equal time commutator (ETC) term of the current algebra. Even through the $(\frac{1}{2})^-$ baryon pole, it acquires a negligibly small contribution [11]. Therefore, taking $\alpha(\Lambda_c^+ \to \Xi^0 K^+) \approx 0$, we fix

$$|B(\Lambda_c^+ \to \Xi^0 K^+)| = \pm(16.52 \pm 2.19). \tag{16}$$

Using the decay amplitudes of $\Lambda_c^+ \to \Lambda\pi^+/\Sigma^+\pi^0/\Xi^0 K^+$, we express the reduced amplitudes as

$$g_{8_S} = \frac{1}{2}\left\{\frac{1}{\sqrt{2}}\langle\Sigma^+\pi^0|\Lambda_c^+\rangle - \sqrt{\frac{3}{2}}\langle\Lambda\pi^+|\Lambda_c^+\rangle - \langle\Xi^0 K^+|\Lambda_c^+\rangle\right\}, \tag{17}$$

$$g_{8_A} = \frac{1}{6}\left\{\frac{5}{\sqrt{2}}\langle\Sigma^+\pi^0|\Lambda_c^+\rangle - \sqrt{\frac{3}{2}}\langle\Lambda\pi^+|\Lambda_c^+\rangle + \langle\Xi^0 K^+|\Lambda_c^+\rangle\right\}, \tag{18}$$

$$g_{10} = \left\{\frac{1}{\sqrt{2}}\langle\Sigma^+\pi^0|\Lambda_c^+\rangle + \sqrt{\frac{3}{2}}\langle\Lambda\pi^+|\Lambda_c^+\rangle - \langle\Xi^0 K^+|\Lambda_c^+\rangle\right\}, \tag{19}$$

which can be used to determine the other decays. For instance, the $\Lambda_c^+ \to p\overline{K^0}$ decay amplitude is expressed as

$$\langle p\overline{K^0}|\Lambda_c^+\rangle=\frac{1}{\sqrt{2}}\{\sqrt{3}\langle\Lambda\pi^+|\Lambda_c^+\rangle-\langle\Sigma^+\pi^0|\Lambda_c^+\rangle\}$$
$$=-7.49\pm1.35 \quad \text{for } PV \text{ mode}$$
$$=+18.45\pm3.91 \quad \text{for } PC \text{ mode}, \qquad (20)$$

where the error is calculated using the average of errors given in Eq. (14). Thus we calculate

$$B(\Lambda_c^+\to p\overline{K^0})=(2.67\pm0.74)\%, \qquad (21)$$

and

$$\alpha=-0.99\pm0.39, \qquad (22)$$

which agrees with the observed experimental branching ratio of $(2.1\pm0.4)\%$ [1]. Following this procedure, we determine the branching ratio and asymmetry of the remaining Cabibbo-enhanced decays taking negative and positive signs of $B(\Lambda_c^+\to\Xi^0K^+)$. For $\Lambda_c\to\Sigma\pi$ decays, isospin symmetry yields

$$B(\Lambda_c^+\to\Sigma^0\pi^+)=B(\Lambda_c^+\to\Sigma^+\pi^0),$$
$$(0.87\pm0.20)\%=(0.87\pm0.22)\% \quad (\text{Expt.}) \qquad (23)$$

which holds well, and

$$\alpha(\Lambda_c^+\to\Sigma^0\pi^+)=\alpha(\Lambda_c^+\to\Sigma^+\pi^0)=(-0.45\pm0.31\pm0.06). \qquad (24)$$

For $\Lambda_c^+\to\Sigma^+\eta$, we obtain

$$B(\Lambda_c^+\to\Sigma^+\eta)=(0.50\pm0.17)\% \quad \text{at } \phi_{\rm phy}=-10^0$$
$$=(0.55\pm0.19)\% \quad \text{at } \phi_{\rm phy}=-19^0, \qquad (25)$$

with the negative sign of $B(\Lambda_c^+\to\Xi^0K^+)$ and

$$B(\Lambda_c^+\to\Sigma^+\eta)=(0.97\pm0.23)\% \quad \text{at } \phi_{\rm phy}=-10^0,$$
$$=(1.23\pm0.28)\% \quad \text{at } \phi_{\rm phy}=-19^0, \qquad (26)$$

with the positive sign. A recent CLEO measurement [2]

$$\frac{B(\Lambda_c^+\to\Sigma^+\eta)}{B(\Lambda_c^+\to pK^-\pi^+)}=0.11\pm0.03\pm0.02, \qquad (27)$$

combined with $B(\Lambda_c^+\to pK^-\pi^+)=4.4\pm0.6\%$ [1] yields

$$B(\Lambda_c^+\to\Sigma^+\eta)=0.48\pm0.17, \qquad (28)$$

which seems to prefer the negative sign of $B(\Lambda_c^+\to\Xi^0K^+)$. Recently, the branching ratio of $\Xi_c^+\to\Xi^0\pi^+$ has also been measured in a CLEO-II experiment [4] to be $(1.2\pm0.5\pm0.3)\%$. For this mode we obtain values $(4.14\pm1.27)\%$ and $(0.07\pm0.02)\%$ for negative and positive signs of $B(\Lambda_c^+\to\Xi^0K^+)$, respectively. Thus experiments seem to prefer the positive sign. Therefore, in Tables I(a) and I(b), we give branching ratios of CF decays for both the signs, for the sake of comparison. The decays $\Xi_c^0\to\Lambda\overline{K^0}/\Sigma^0\overline{K^0}/\Xi^-\pi^+$ remain unaffected by the sign of $B(\Lambda_c^+\to\Xi^0K^+)$.

B. Cabibbo-suppressed mode

The effective weak Hamiltonian for these decays $(\Delta C=-1,\ \Delta S=0)$ is given by

$$H_w=\widetilde{G}'_F[c_1\{(\overline{u}d)(\overline{d}c)-(\overline{u}s)(\overline{s}c)\}$$
$$+c_2\{(\overline{d}d)(\overline{u}c)-(\overline{s}s)(\overline{u}c)\}], \qquad (29)$$

where $\widetilde{G}'_F=-(G_F/\sqrt{2})V_{ud}V^*_{cd}$ and other quantities have the usual meanings. Choosing $(H^2_{12}-H^3_{13})$ components of the weak Hamiltonian in Eqs. (3) and (4), decay amplitudes for various Cabibbo-suppressed decays are obtained [7,8]. As the same reduced amplitudes appear here, the CS decay amplitudes can be expressed in terms of those of the CF modes. In the following, we obtain some of these relations using **6*** dominance of H_w:

$$-\tan\theta_C\langle\Xi^0K^+|\Lambda_c^+\rangle=-\langle pK^-|\Xi_c^0\rangle=\langle\Sigma^+\pi^-|\Xi_c^0\rangle, \qquad (30)$$

$$\sqrt{2}\ \tan\theta_C\langle\Sigma^+\pi^0|\Lambda_c^+\rangle=-\langle n\overline{K^0}|\Xi_c^0\rangle=\langle\Xi^0K^0|\Xi_c^0\rangle, \qquad (31)$$

$$-\tan\theta_C\left\{\sqrt{\frac{3}{2}}\langle\Lambda\pi^+|\Lambda_c^+\rangle-\frac{1}{\sqrt{2}}\langle\Sigma^+\pi^0|\Lambda_c^+\rangle\right\}$$
$$=\langle\Sigma^-\pi^+|\Xi_c^0\rangle=-\langle\Xi^-K^+|\Xi_c^0\rangle, \qquad (32)$$

$$-\tan\theta_C\left\{\frac{1}{\sqrt{2}}\langle\Sigma^+\pi^0|\Lambda_c^+\rangle+\sqrt{\frac{3}{2}}\langle\Lambda\pi^+|\Lambda_c^+\rangle\right\}$$
$$=-\sqrt{2}\langle p\pi^0|\Lambda_c^+\rangle=-\langle n\pi^+|\Lambda_c^+\rangle=\langle\Xi^0K^+|\Xi_c^+\rangle, \qquad (33)$$

$$-\tan\theta_C\{-\sqrt{2}\langle\Sigma^+\pi^0|\Lambda_c^+\rangle+\langle\Xi^0K^+|\Lambda_c^+\rangle\}$$
$$=-\sqrt{2}\langle\Sigma^0K^+|\Lambda_c^+\rangle=-\langle\Sigma^+K^0|\Lambda_c^+\rangle=\langle p\overline{K^0}|\Xi_c^+\rangle, \qquad (34)$$

$$-\tan\theta_C\left\{\langle\Xi^0K^+|\Lambda_c^+\rangle-\sqrt{\frac{2}{3}}\langle\Lambda\pi^+|\Lambda_c^+\rangle\right\}$$
$$=\sqrt{\frac{2}{3}}\langle\Lambda K^+|\Lambda_c^+\rangle, \qquad (35)$$

$$-\tan\theta_C\left\{\sqrt{\frac{3}{2}}\langle\Lambda\pi^+|\Lambda_c^+\rangle-\frac{1}{\sqrt{2}}\langle\Sigma^+\pi^0|\Lambda_c^+\rangle\right.$$
$$\left.+\langle\Xi^0K^+|\Lambda_c^+\rangle\right\}=2\langle\Sigma^0\pi^0|\Xi_c^0\rangle, \qquad (36)$$

$$-\tan\theta_C\left\{-\langle\Xi^0K^+|\Lambda_c^+\rangle+\sqrt{\frac{3}{2}}\langle\Lambda\pi^+|\Lambda_c^+\rangle\right.$$
$$\left.-\frac{1}{\sqrt{2}}\langle\Sigma^+\pi^0|\Lambda_c^+\rangle\right\}=\sqrt{2}\langle\Sigma^0\pi^+|\Xi_c^+\rangle$$
$$=-\sqrt{2}\langle\Sigma^+\pi^0|\Xi_c^+\rangle, \qquad (37)$$

TABLE I. (a) Branching ratios and asymmetries of CF ($B_c \to BP$) decays for $B(\Lambda_c^+ \to \Xi^0 K^+) = -16.52 \pm 2.19$. (b) Branching ratios and asymmetries of CF ($B_c \to BP$) decays for $B(\Lambda_c^+ \to \Xi^0 K^+) = +16.52 \pm 2.19$.

(a)

Decay	Asymmetry	BR (%)
$\Lambda_c^+ \to p\overline{K^0}$	-0.99 ± 0.39	2.67 ± 0.74
$\Lambda_c^+ \to \Lambda\pi^+$	-0.94 ± 0.24 [a]	0.79 ± 0.18 [a]
$\Lambda_c^+ \to \Sigma^+\pi^0$	-0.45 ± 0.32 [a]	0.87 ± 0.22 [a]
$\Lambda_c^+ \to \Sigma^+\eta$	0.92 ± 0.47 [b] (0.76 ± 0.43 [c])	0.50 ± 0.17 [b] (0.55 ± 0.19 [c])
$\Lambda_c^+ \to \Sigma^+\eta'$	-0.75 ± 0.38 [b] (-0.89 ± 0.46 [c])	0.20 ± 0.08 [b] (0.16 ± 0.06 [c])
$\Lambda_c^+ \to \Sigma^0\pi^+$	-0.45 ± 0.32	0.87 ± 0.20
$\Lambda_c^+ \to \Xi^0 K^+$	0.00	0.34 ± 0.09[a]
$\Xi_c^+ \to \Xi^0\pi^+$	0.03 ± 0.31	4.14 ± 1.27
$\Xi_c^+ \to \Sigma^+\overline{K^0}$	0.03 ± 0.29	4.18 ± 1.28
$\Xi_c^0 \to \Xi^0\pi^0$	0.72 ± 0.41	0.52 ± 0.15
$\Xi_c^0 \to \Xi^0\eta$	-0.96 ± 0.38 [b] (-0.95 ± 0.32 [c]	0.29 ± 0.08 [b] (0.37 ± 0.08 [c])
$\Xi_c^0 \to \Xi^0\eta'$	-0.63 ± 0.40 [b] (-0.60 ± 0.48 [c])	0.12 ± 0.05 [b] (0.08 ± 0.04 [c])
$\Xi_c^0 \to \Xi^-\pi^+$	-0.96 ± 0.38	1.30 ± 0.36
$\Xi_c^0 \to \Sigma^+K^-$	0.00	0.38 ± 0.10
$\Xi_c^0 \to \Sigma^0\overline{K^0}$	0.07 ± 0.67	0.11 ± 0.07
$\Xi_c^0 \to \Lambda\overline{K^0}$	-0.85 ± 0.36	0.68 ± 0.49

(b)

Decay	Asymmetry	BR (%)
$\Lambda_c^+ \to p\overline{K^0}$	-0.99 ± 0.39	2.67 ± 0.74
$\Lambda_c^+ \to \Lambda\pi^+$	-0.94 ± 0.24 [a]	0.79 ± 0.18 [a]
$\Lambda_c^+ \to \Sigma^+\pi^0$	-0.45 ± 0.32 [a]	0.87 ± 0.22 [a]
$\Lambda_c^+ \to \Sigma^+\eta$	-0.96 ± 0.34 [b] (-0.96 ± 0.32 [c])	0.97 ± 0.23 [b] (1.23 ± 0.28 [c])
$\Lambda_c^+ \to \Sigma^+\eta'$	-0.91 ± 0.40 [b] (-0.90 ± 0.45 [c])	0.24 ± 0.08 [b] (0.16 ± 0.06 [c])
$\Lambda_c^+ \to \Sigma^0\pi^+$	-0.45 ± 0.32	0.87 ± 0.20
$\Lambda_c^+ \to \Xi^0 K^+$	0.00	0.34 ± 0.09[a]
$\Xi_c^+ \to \Xi^0\pi^+$	-0.24 ± 0.23	0.07 ± 0.02
$\Xi_c^+ \to \Sigma^+\overline{K^0}$	-0.23 ± 0.22	0.07 ± 0.02
$\Xi_c^0 \to \Xi^0\pi^0$	-0.99 ± 0.37	0.78 ± 0.20
$\Xi_c^0 \to \Xi^0\eta$	0.14 ± 0.34 [b] (-0.25 ± 0.29 [c])	0.19 ± 0.06 [b] (0.25 ± 0.07 [c])
$\Xi_c^0 \to \Xi^0\eta'$	-0.99 ± 0.42 [b] (-0.99 ± 0.47 [c])	0.18 ± 0.06 [b] (0.15 ± 0.05 [c])
$\Xi_c^0 \to \Xi^-\pi^+$	-0.96 ± 0.38	1.30 ± 0.36
$\Xi_c^0 \to \Sigma^+K^-$	0.00	0.38 ± 0.10
$\Xi_c^0 \to \Sigma^0\overline{K^0}$	0.07 ± 0.67	0.11 ± 0.07
$\Xi_c^0 \to \Lambda\overline{K^0}$	-0.85 ± 0.36	0.68 ± 0.49

[a]Input.
[b]For $\phi_{\mathrm{phy}} = -10^0$.
[c]For $\phi_{\mathrm{phy}} = -19^0$.

$$-\tan\theta_C\left\{3\langle\Xi^0K^+|\Lambda_c^+\rangle - \sqrt{\frac{3}{2}}\langle\Lambda\pi^+|\Lambda_c^+\rangle - \frac{3}{\sqrt{2}}\langle\Sigma^+\pi^0|\Lambda_c^+\rangle\right\} = \sqrt{6}\langle\Lambda\pi^+|\Xi_c^+\rangle = -\sqrt{12}\langle\Lambda\pi^0|\Xi_c^0\rangle, \qquad (38)$$

We give the decay asymmetries and branching ratios for the CS decays, in Tables II(a) and II(b) for both the signs of $B(\Lambda_c^+ \to \Xi^0K^+)$. In the present analysis, we find that the decays $\Xi_c^+ \to p\overline{K^0}/\Lambda\pi^+$ and $\Xi_c^0 \to \Sigma^-\pi^+/\Xi^-K^+$ are dominant for both choices. Among the Λ_c^+ decays, $\Lambda_c^+ \to \Lambda K^+/p\eta$ and $\Lambda_c^+ \to \Sigma^+K^0$ are dominant for negative and positive signs of $B(\Lambda_c^+ \to \Xi^0K^+)$, respectively.

TABLE II. Branching ratios and asymmetries of CS ($B_s \to BP$) decays for $B(\Lambda_c^+ \to \Xi^0 K^+) = -16.52 \pm 2.19$. (b) Branching ratios and asymmetries of CS ($B_c \to BP$) decays for $B(\Lambda_c^+ \to \Xi^0 K^+) = +16.52 \pm 2.19$.

Decay	Asymmetry	BR %	Decay	Asymmetry	BR %
	(a)			(b)	
$\Lambda_c^+ \to p\pi^0$	0.05	0.02	$\Lambda_c^+ \to p\pi^0$	0.05	0.02
$\Lambda_c^+ \to n\pi^+$	0.05	0.04	$\Lambda_c^+ \to n\pi^+$	0.05	0.04
$\Lambda_c^+ \to \Lambda K^+$	-0.54	0.14	$\Lambda_c^+ \to \Lambda K^+$	0.97	0.02
$\Lambda_c^+ \to \Sigma^+ K^0$	0.68	0.09	$\Lambda_c^+ \to \Sigma^+ K^0$	-0.98	0.12
$\Lambda_c^+ \to \Sigma^0 K^+$	0.68	0.04	$\Lambda_c^+ \to \Sigma^0 K^+$	-0.98	0.06
$\Lambda_c^+ \to p\eta$	-0.74 [a] (-0.69 [b])	0.21 [a] (0.17 [b])	$\Lambda_c^+ \to p\eta$	-0.45 [a] (-0.03 [b])	0.04 [a] (0.02 [b])
$\Lambda_c^+ \to p\eta'$	-0.97 [a] (-0.99 [b])	0.04 [a] (0.06 [b])	$\Lambda_c^+ \to p\eta'$	-0.99 [a] (-0.99 [b])	0.05 [a] (0.06 [b])
$\Xi_c^+ \to p\overline{K^0}$	0.87	0.19	$\Xi_c^+ \to p\overline{K^0}$	-0.98	0.36
$\Xi_c^+ \to \Lambda\pi^+$	0.65	0.23	$\Xi_c^+ \to \Lambda\pi^+$	-0.79	0.14
$\Xi_c^+ \to \Xi^0 K^+$	0.08	0.03	$\Xi_c^+ \to \Xi^0 K^+$	0.08	0.03
$\Xi_c^+ \to \Sigma^+\pi^0$	-0.89	0.28	$\Xi_c^+ \to \Sigma^+\pi^0$	-0.18	0.08
$\Xi_c^+ \to \Sigma^0\pi^+$	-0.90	0.28	$\Xi_c^+ \to \Sigma^0\pi^+$	-0.18	0.08
$\Xi_c^+ \to \Sigma^+\eta$	-0.75 [a] (-0.81 [b])	0.19 [a] (0.21 [b])	$\Xi_c^+ \to \Sigma^+\eta$	-0.98 [a] (-0.98 [b])	0.08 [a] (0.11 [b])
$\Xi_c^+ \to \Sigma^+\eta'$	-0.56 [a] (-0.14 [b])	0.02 [a] (0.02 [b])	$\Xi_c^+ \to \Sigma^+\eta'$	-0.99 [a] (-0.99 [b])	0.05 [a] (0.03 [b])
$\Xi_c^0 \to pK^-$	0.00	0.03	$\Xi_c^0 \to pK^-$	0.00	0.03
$\Xi_c^0 \to n\overline{K^0}$	-0.58	0.04	$\Xi_c^0 \to n\overline{K^0}$	-0.58	0.04
$\Xi_c^0 \to \Lambda\pi^0$	0.65	0.03	$\Xi_c^0 \to \Lambda\pi^0$	-0.79	0.02
$\Xi_c^0 \to \Sigma^+\pi^-$	0.00	0.03	$\Xi_c^0 \to \Sigma^+\pi^-$	0.00	0.03
$\Xi_c^0 \to \Sigma^0\pi^0$	-0.18	0.01	$\Xi_c^0 \to \Sigma^0\pi^0$	-0.89	0.04
$\Xi_c^0 \to \Sigma^-\pi^+$	-0.99	0.08	$\Xi_c^0 \to \Sigma^-\pi^+$	-0.99	0.08
$\Xi_c^0 \to \Xi^- K^+$	-0.92	0.06	$\Xi_c^0 \to \Xi^- K^+$	-0.92	0.06
$\Xi_c^0 \to \Xi^0 K^0$	-0.40	0.04	$\Xi_c^0 \to \Xi^0 K^0$	-0.40	0.04
$\Xi_c^0 \to \Lambda\eta$	0.26 [a] (0.83 [b])	0.005 [a] (0.003 [b])	$\Xi_c^0 \to \Lambda\eta$	-0.89 [a] (-0.88 [b])	0.02 [a] (0.009 [b])
$\Xi_c^0 \to \Lambda\eta$	-0.82 [a] (-0.77 [b])	0.02 [a] (0.02 [b])	$\Xi_c^0 \to \Lambda\eta'$	-0.99 [a] (-0.99 [b])	0.04 [a] (0.04 [b])
$\Xi_c^0 \to \Sigma^0\eta$	-0.75 [a] (-0.81 [b])	0.03 [a] (0.03 [b])	$\Xi_c^0 \to \Sigma^0\eta$	-0.98 [a] (-0.98 [b])	0.01 [a] (0.02 [b])
$\Xi_c^0 \to \Sigma^0\eta'$	-0.56 [a] (-0.14 [b])	0.003 [a] (0.002 [b])	$\Xi_c^0 \to \Sigma^0\eta'$	-0.99 [a] (-0.99 [b])	0.006 [a] (0.005 [b])

[a]For $\phi_{\rm phy} = -10^0$.
[b]For $\phi_{\rm phy} = -19^0$.

C. Cabibbo-doubly-suppressed mode

For the Cabibbo-doubly-suppressed decays ($\Delta C = -\Delta S = -1$) the effective weak Hamiltonian is

$$H_w = \widetilde{G}_F''[c_1(\overline{u}s)(\overline{d}c) + c_2(\overline{d}s)(\overline{u}c)], \tag{39}$$

where $\widetilde{G}_F'' = -(G_F/\sqrt{2})V_{us}V_{cd}^*$. Here also the CDS decays can be expressed in term of the CF modes. Using **6*** dominance of the weak Hamiltonian, we obtain the following decay amplitude relations:

$$-\tan^2\theta_C\langle \Xi^0 K^+|\Lambda_c^+\rangle = \sqrt{2}\langle p\pi^0|\Xi_c^+\rangle = \langle n\pi^+|\Xi_c^+\rangle = -\sqrt{2}\langle n\pi^0|\Xi_c^0\rangle = \langle p\pi^-|\Xi_c^0\rangle, \tag{40}$$

$$-\tan^2\theta_C\left\{\sqrt{\frac{3}{2}}\langle \Lambda\pi^+|\Lambda_c^+\rangle - \frac{1}{\sqrt{2}}\langle \Sigma^+\pi^0|\Lambda_c^+\rangle\right\} = \sqrt{2}\langle \Sigma^0 K^+|\Xi_c^+\rangle = \langle \Sigma^+ K^0|\Xi_c^+\rangle = \langle \Sigma^- K^+|\Xi_c^0\rangle = -\sqrt{2}\langle \Sigma^0 K^0|\Xi_c^0\rangle, \tag{41}$$

$$-\tan^2\theta_C\left\{-\frac{3}{\sqrt{2}}\langle \Sigma^+\pi^0|\Lambda_c^+\rangle - \sqrt{\frac{3}{2}}\langle \Lambda\pi^+|\Lambda_c^+\rangle\right\} = \sqrt{6}\langle \Lambda K^+|\Xi_c^+\rangle = \sqrt{6}\langle \Lambda K^0|\Xi_c^0\rangle, \tag{42}$$

$$-\tan^2\theta_C\left\{-\sqrt{\frac{3}{2}}\langle \Lambda\pi^+|\Lambda_c^+\rangle - \frac{1}{\sqrt{2}}\langle \Sigma^+\pi^0|\Lambda_c^+\rangle + \langle \Xi^0 K^+|\Lambda_c^+\rangle\right\} = -\langle pK^0|\Lambda_c^+\rangle = \langle nK^+|\Lambda_c^+\rangle. \tag{43}$$

Calculated asymmetries and branching ratios of the CDS decays are given in the Tables III(a) and III(b). Among Ξ_c decays, $\Xi_c^+ \to \Sigma^+ K^0/\Sigma^0 K^+/n\pi^+/p\pi^0$ and $\Xi_c^0 \to \Sigma^- K^+$ are found to be dominant modes for positive as well as negative choices of $B(\Lambda_c^+ \to \Xi^0 K^+)$. However, branching ratios of Λ_c^+ decays show drastic differences between the two choices, even their decay asymmetries also acquire different signs.

IV. $B_c(\frac{1}{2})^+ \to C(\frac{3}{2})^+ + P(0^-)$ DECAYS

The matrix element for the baryon $(\frac{1}{2})^+ \to (\frac{3}{2})^+ + 0^-$ decay process is

TABLE III. (a) Branching ratios and asymmetries of CDS ($B_c \to BP$) decays for $B(\Lambda_c^+ \to \Xi^0 K^+) = -16.52 \pm 2.19$. (b) Branching ratios and asymmetries of CDS ($B_c \to BP$) decays for $B(\Lambda_c^+ \to \Xi^0 K^+) = +16.52 \pm 2.19$.

Decay	Asymmetry	BR % ($\times \tan^4 \theta_C$)
$\Lambda_c^+ \to pK^0$	0.03	3.15
$\Lambda_c^+ \to nK^+$	0.03	3.16
$\Xi_c^+ \to p\pi^0$	0.00	1.41
$\Xi_c^+ \to n\pi^+$	0.00	2.82
$\Xi_c^+ \to \Lambda K^+$	0.56	0.54
$\Xi_c^+ \to \Sigma^+ K^0$	−0.97	4.39
$\Xi_c^+ \to \Sigma^0 K^+$	−0.97	2.19
$\Xi_c^+ \to p\eta$	0.52 [a] (0.76 [b])	1.47 [a] (1.15 [b])
$\Xi_c^+ \to p\eta'$	−0.89 [a] (−0.80 [b])	1.41 [a] (1.68 [b])
$\Xi_c^0 \to p\pi^-$	0.00	0.79
$\Xi_c^0 \to n\pi^0$	0.00	0.40
$\Xi_c^0 \to \Lambda K^0$	0.56	0.15
$\Xi_c^0 \to \Sigma^0 K^0$	−0.97	0.62
$\Xi_c^0 \to \Sigma^- K^+$	−0.97	1.24
$\Xi_c^0 \to n\eta$	0.52 [a] (0.76 [b])	0.41 [a] (0.32 [b])
$\Xi_c^0 \to n\eta'$	−0.89 [a] (−0.80 [b])	0.39 [a] (0.47 [b])

(b)

Decay	Asymmetry	BR % ($\times \tan^4 \theta_C$)
$\Lambda_c^+ \to pK^0$	−0.19	0.06
$\Lambda_c^+ \to nK^+$	−0.19	0.06
$\Xi_c^+ \to p\pi^0$	0.00	1.41
$\Xi_c^+ \to n\pi^+$	0.00	2.82
$\Xi_c^+ \to \Lambda K^+$	0.56	0.54
$\Xi_c^+ \to \Sigma^+ K^0$	−0.97	4.39
$\Xi_c^+ \to \Sigma^0 K^+$	−0.97	2.19
$\Xi_c^+ \to p\eta$	−0.89 [a] (−0.72 [b])	1.88 [a] (1.12 [b])
$\Xi_c^+ \to p\eta'$	−0.94 [a] (−0.96 [b])	3.05 [a] (3.56 [b])
$\Xi_c^0 \to p\pi^-$	0.00	0.79
$\Xi_c^0 \to n\pi^0$	0.00	0.40
$\Xi_c^0 \to \Lambda K^0$	0.56	0.15
$\Xi_c^0 \to \Sigma^0 K^0$	−0.97	0.62
$\Xi_c^0 \to \Sigma^- K^+$	−0.97	1.24
$\Xi_c^0 \to n\eta$	−0.89 [a] (−0.72 [b])	0.53 [a] (0.32 [b])
$\Xi_c^0 \to n\eta'$	−0.94 [a] (−0.96 [b])	0.86 [a] (0.99 [b])

[a]For $\phi_{\rm phy} = -10^0$.
[b]For $\phi_{\rm phy} = -19^0$.

$$M = \langle D, P | H_w | B_c \rangle = i P_\mu \overline{w_D^\mu} (C - \gamma_5 D) u_{B_c} \phi_P, \quad (44)$$

where P_μ is the four-momentum of the meson and w^μ is the Rarita-Schwinger spinor for a spin $3/2^+$ particle. C and D denote the *p-wave* and *d-wave* amplitudes, respectively. The decay rate and asymmetry parameter are computed from

$$\Gamma(B_i \to B_f + P) = \frac{|p_c|^3 m_i (m_f + E_f)}{6\pi m_f^2} \{ |C|^2 + |\overline{D}|^2 \}, \quad (45)$$

TABLE IV. Branching ratios of CF ($B_c \to DP$) decays.

Decay	BR %
$\Lambda_c^+ \to \Delta^{++} K^-$	0.70 ± 0.40 [a]
$\Lambda_c^+ \to \Delta^+ \overline{K^0}$	0.23 ± 0.13
$\Lambda_c^+ \to \Sigma^{*+} \pi^0$	0.46 ± 0.18
$\Lambda_c^+ \to \Sigma^{*+} \eta$	0.21 ± 0.11 [b] (0.14 ± 0.10 [c])
$\Lambda_c^+ \to \Sigma^{*0} \pi^+$	0.46 ± 0.18
$\Lambda_c^+ \to \Xi^{*0} K^+$	0.23 ± 0.09 [a]
$\Xi_c^+ \to \Sigma^{*+} \overline{K^0}$	0.00
$\Xi_c^+ \to \Xi^{*0} \pi^+$	0.00
$\Xi_c^0 \to \Sigma^{*+} K^-$	0.13 ± 0.07
$\Xi_c^0 \to \Sigma^{*0} \overline{K^0}$	0.06 ± 0.04
$\Xi_c^0 \to \Xi^{*0} \pi^0$	0.26 ± 0.10
$\Xi_c^0 \to \Xi^{*0} \eta$	0.13 ± 0.06 [b] (0.08 ± 0.06 [c])
$\Xi_c^0 \to \Xi^{*-} \pi^+$	0.50 ± 0.20
$\Xi_c^0 \to \Omega^- K^+$	0.45 ± 0.18

[a]Input.
[b]For $\phi_{\rm phy} = -10^0$.
[c]For $\phi_{\rm phy} = -19^0$.

$$\alpha = \frac{2\,{\rm Re}(C\overline{D^*})}{(|C|^2 + |\overline{D}|^2)}, \quad (46)$$

where $\overline{D}$ is defined as

$$\overline{D} = \rho D, \quad \rho = \left\{ \frac{E_f - m_f}{E_f + m_f} \right\}^{1/2}. \quad (47)$$

E_f is the energy of the final state baryon in the rest frame of B_c and the other quantities have the usual meaning. The weak Hamiltonian for decuplet baryon-emitting decays is given by

$$H_W^{6*} = \sqrt{2} j_8 \{ \epsilon_{mdb} \overline{D}^{mnc} P_n^d B^a H^b_{[a,c]} \}, \quad (48)$$

$$H_W^{15} = \sqrt{2} k_8 \{ \epsilon_{mpb} \overline{D}^{mna} P_n^p B^c H^b_{(a,c)} \}$$
$$+ \sqrt{2} k_{10} \left\{ \epsilon_{mnd} \overline{D}^{mac} P_b^n B^d H^b_{(a,c)} - \epsilon_{mnb} \overline{D}^{mac} P_d^n B^d H^b_{(a,c)} \right.$$
$$\left. + \frac{2}{3} \epsilon_{mnb} \overline{D}^{mdc} P_d^n B^a H^b_{(a,c)} \right\}$$
$$+ \sqrt{2} k_{27} \left\{ \epsilon_{mnd} \overline{D}^{mac} P_b^n B^d H^b_{(a,c)} + \epsilon_{mnb} \overline{D}^{mac} P_d^n B^d H^b_{(a,c)} \right.$$
$$\left. - \frac{2}{5} \epsilon_{mnb} \overline{D}^{mdc} P_d^n B^a H^b_{(a,c)} \right\}, \quad (49)$$

where ϵ_{abc} is the Levi-Civita symbol and D_{abc} represents the totally symmetric decuplet baryons.

TABLE V. Branching ratios of CS ($B_c \to DP$) decays.

Decay	BR %
$\Lambda_c^+ \to \Delta^{++}\pi^-$	0.05
$\Lambda_c^+ \to \Delta^{+}\pi^0$	0.08
$\Lambda_c^+ \to \Delta^{+}\eta$	0.0005 [a] (0.000001 [b])
$\Lambda_c^+ \to \Delta^{+}\eta'$	0.002 [a] (0.002 [b])
$\Lambda_c^+ \to \Delta^{0}\pi^+$	0.08
$\Lambda_c^+ \to \Sigma^{*+}K^0$	0.006
$\Lambda_c^+ \to \Sigma^{*0}K^+$	0.01
$\Xi_c^+ \to \Delta^{++}K^-$	0.12
$\Xi_c^+ \to \Delta^{+}\overline{K^0}$	0.04
$\Xi_c^+ \to \Sigma^{*+}\pi^0$	0.07
$\Xi_c^+ \to \Sigma^{*+}\eta$	0.04 [a] (0.03 [b])
$\Xi_c^+ \to \Sigma^{*+}\eta'$	0.007 [a] (0.009 [b])
$\Xi_c^+ \to \Sigma^{*0}\pi^+$	0.07
$\Xi_c^+ \to \Xi^{*0}K^+$	0.06
$\Xi_c^0 \to \Delta^{+}K^-$	0.01
$\Xi_c^0 \to \Delta^{0}\overline{K^0}$	0.01
$\Xi_c^0 \to \Sigma^{*+}\pi^-$	0.009
$\Xi_c^0 \to \Sigma^{*0}\pi^0$	0.06
$\Xi_c^0 \to \Sigma^{*0}\eta$	0.008 [a] (0.004 [b])
$\Xi_c^0 \to \Sigma^{*0}\eta'$	0.004 [a] (0.004 [b])
$\Xi_c^0 \to \Sigma^{*-}\pi^+$	0.16
$\Xi_c^0 \to \Xi^{*0}K^0$	0.004
$\Xi_c^0 \to \Xi^{*-}K^+$	0.06

[a] For $\phi_{\rm phy} = -10^0$.
[b] For $\phi_{\rm phy} = -19^0$.

Decay amplitudes for the CF, CS, and CDS modes are obtained by taking the H^2_{13}, $(H^2_{12} - H^3_{13})$, and H^3_{12} components of the weak Hamiltonian [8,10]. Here, we have four unknown reduced amplitudes in each of the PV and PC modes. Dynamically, in contrast to $B(\frac{1}{2})^+ \to B(\frac{1}{2})^+ + P(0)^-$ decays, the description of $B(\frac{1}{2})^+ \to D(\frac{3}{2})^+ + P(0)^-$ is considerably simpler. It has been shown [12] that the prime feature of these decays is that they are factorization forbidden and arise only through W-exchange diagrams. Also Kohra [13], while performing a quark-diquark analysis, has observed that most of the quark diagrams allowed for $(\frac{1}{2})^+ \to (\frac{1}{2})^+ + 0^-$ decays are forbidden for $(\frac{1}{2})^+ \to (\frac{3}{2})^+ + 0^-$ decays due to the symmetry property of the decuplet baryons. There exist only two independent diagrams which correspond to

$$A = d_1 \overline{D^{1ab}} B_{[2,a]} M^3_b + d_2 \overline{D^{3ab}} B_{[2,a]} M^1_b. \tag{50}$$

This amounts to the constraints

$$k_8 = \frac{1}{3} k_{10}, \quad k_{27} = 0, \tag{51}$$

TABLE VI. Branching ratios of CDS ($B_c \to DP$) decays.

Decay	BR % ($\times \tan^4\theta_C$)
$\Lambda_c^+ \to \Delta^{+}K^0$	0
$\Lambda_c^+ \to \Delta^{0}K^+$	0
$\Xi_c^+ \to \Delta^{++}\pi^-$	3.00
$\Xi_c^+ \to \Delta^{+}\pi^0$	4.79
$\Xi_c^+ \to \Delta^{0}\pi^+$	4.39
$\Xi_c^+ \to \Sigma^{*0}K^+$	0.99
$\Xi_c^+ \to \Sigma^{*+}K^0$	0.45
$\Xi_c^+ \to \Delta^{+}\eta$	0.03 [a] (0.0001 [b])
$\Xi_c^+ \to \Delta^{+}\eta'$	0.38 [a] (0.39 [b])
$\Xi_c^0 \to \Delta^{+}\pi^-$	0.28
$\Xi_c^0 \to \Delta^{-}\pi^+$	3.73
$\Xi_c^0 \to \Delta^{0}\pi^0$	1.36
$\Xi_c^0 \to \Sigma^{*-}K^+$	0.56
$\Xi_c^0 \to \Sigma^{*0}K^0$	0.06
$\Xi_c^0 \to \Delta^{0}\eta$	0.01 [a] (0.00002 [b])
$\Xi_c^0 \to \Delta^{0}\eta'$	0.11 [a] (0.11 [b])

[a] For $\phi_{\rm phy} = -10^0$.
[b] For $\phi_{\rm phy} = -19^0$.

for the **15**-part of the weak Hamiltonian in our model. Thus, the number of unknown reduced amplitudes is reduced to 2 (j_8 and k_8). Generally, the W-exchange diagram contributions to the PV mode are small and are invariably suppressed due to the centrifugal barrier for $B \to D + P$ decays. Therefore, we ignore them in the present analysis. The experimental values [1]

$$B(\Lambda_c^+ \to \Delta^{++}K^-) = (0.7 \pm 0.4)\%, \tag{52}$$

$$B(\Lambda_c^+ \to \Xi^{*0}K^+) = (0.23 \pm 0.09)\%, \tag{53}$$

then yield (in $G_F V_{ud} V^*_{cs} \times 10^{-2}$ GeV^2)

$$k_8 = -9.10 \pm 4.15, \quad j_8 = -77.14 \pm 12.45. \tag{54}$$

Using these, we calculate the branching ratios, which are listed in the second column of Tables IV, V, and VI, for Cabibbo-enhanced, -suppressed, and -doubly-suppressed modes, respectively. In the Cabibbo-enhanced mode, $\Lambda_c^+ \to \Sigma^{*+}\pi^0/\Sigma^{*0}\pi^+$ and $\Xi_c^0 \to \Xi^{*-}\pi^+/\Omega^- K^+$ dominate, whereas Ξ_c^+ decays remain forbidden in the present model like in other theoretical models. In the CS sector, we find that the decays $\Lambda_c^+ \to \Delta^+\pi^0/\Delta^0\pi^+$, $\Xi_c^+ \to \Delta^{++}K^-/\Sigma^{*+}\pi^0/\Sigma^{*0}\pi^+$, and $\Xi_c^0 \to \Sigma^{*-}\pi^+$ are dominant. In the CDS mode, $\Lambda_c^+ \to \Delta^+K^0/\Delta^0K^+$ decays are forbidden and $\Xi_c^+ \to \Delta^{++}\pi^-/\Delta^+\pi^0/\Delta^0\pi^+$, $\Xi_c^0 \to \Delta^-\pi^+/\Delta^0\pi^0$ decays are dominant. We hope that the observation of these decays will decipher the strength of various weak decay mechanisms, particularly of the **15**-part of the weak Hamiltonian.

V. SUMMARY AND DISCUSSION

The two-body weak decays of charmed baryons Λ_c^+, Ξ_c^+, and Ξ_c^0 into an octet or decouplet baryon and a pseudoscalar meson are analyzed in the framework of SU(3) flavor symmetry, for Cabibbo-enhanced, -suppressed, and -doubly-suppressed modes. We fix the unknown reduced amplitudes from certain measured Cabibbo-enhanced modes and then predict the branching ratios and asymmetries of various decays. This work was motivated by the observation that various dynamical models used for studying these decays do not come close to explaining the data on Λ_c decays. In the flavor symmetry approach various processes responsible for the decays are lumped together in the reduced amplitudes. However, the results obtained here, may be affected by the SU(3) symmetry breaking, as is evident from the charm meson decays [14] and the Λ_c and Ξ_c^0 lifetimes [1]. In the present framework, the inclusion of the SU(3) symmetry-breaking effects would introduce a large number of parameters which cannot be determined with the available data.

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