PARITY VIOLATING HADRONIC DECAYS OF 1/2+ BARYONS IN CURRENT ALGEBRA SCHEME*

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Two body pv hadronic decays of charmed baryons are studied using current algebra techniques in the SU(4) framework. Weak decay amplitudes are calculated with and without 15-admixture. We also include the antisymmetric representations in the weak Hamiltonian.

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1. Introduction

Current algebra considerations have proven to be quite successful in explaining several properties of hadrons. For the non-leptonic decays [1] they have led to the well-satisfied relations like the Lee-Sugawara sum rule and the pv(Σ^+_+) = 0 and relate K → 2π and K → 3π decays. Such considerations have been extended to study the weak decays of charmed hadrons also [2].

We, in the present paper, employ the current algebra techniques to study the parity violating weak pionic decays of 1/2+ baryons. First, we work in the conventional picture, i.e., the GIM model [3] of weak interaction. For $\Delta C = 0, \Delta S = 1$ decays, the 20″-dominance of the weak Hamiltonian though giving $\Sigma^+_+ = 0$ leads to the well known Iwasaki relation [4]

$$\Lambda^0_- : \Sigma^+_0 : \Xi^-_- = 1 : -\sqrt{3} : 2, \tag{1.1}$$

which is violated by about 40%. The inclusion of 84 part does not improve the situation very much, since 84 contributions are proportional to Σ^+_+. To remove the discrepancy, we consider the 15-admixture [5], which can appear in the weak Hamiltonian due to the

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large mass difference of u and c quarks. For charm-changing weak decays, we then obtain decay amplitude sum rules in the Cabbibo enhanced mode. Determining reduced matrix elements from uncharmed decays, we calculate decay amplitudes for pionic decays with and without a 15-admixture to the weak Hamiltonian. In our study, we also include anti-symmetric representation, which may appear in many ways, e.g. the presence of right handed current [6], second class currents [7] and through the SU(4) symmetry breaking. In a semidynamical analysis [8] involving nonexoticity arguments it has been shown that parity violating pv decays of charmed baryons may acquire dominant contribution from the $15_A+45_A+45^*_A$ type of weak Hamiltonian. Moreover, starting with only left handed quarks, Melosh transformed weak Hamiltonian ($V^{-1}H_W V$) [9] can acquire a piece let $\times$ right current-current type which in symmetry formalism leads to 45, 45* representations. The presence of these pieces in the uncharmed sector is unwelcome due to the $\Delta I = 3/2$ term in their isospin substructure. However, we note that if 45, 45* appear through right handed current interaction, the uncharmed sector remains undisturbed.

In Section 2, we outline the details of the method. In Section 3, we discuss the $B(1/2)^+ \to B(1/2^+)+P(0^-)$ decay amplitudes in the GIM model. In Section 4, the unconventional representations are included in the weak Hamiltonian and results are compared with the GIM model. The summary is given in the last section.

2. *Preliminaries*

2.1. PCAC conditions

We assume PCAC condition [2] to be

$$\partial_\mu A^\mu_a = f_a m_a^2 \phi_a(x), \tag{2.1}$$

where μ is the Lorentz index, A^μ_a the axial vector current and $\phi_a(x)$ is the pseudoscalar field for the meson 'a' having mass m_a and decay constant f_a which is defined as

$$\langle 0| A^\mu_a(0)\, |\phi_b(p)\rangle = i\delta_{ab} p^\mu f_b. \tag{2.2}$$

Though the PCAC hypothesis is limited to only low-energy phenomena, we assume that the operator equation (2.1) is exact. It leads to the evaluation of matrix elements only at the zero momentum which lies outside the physical region. We assume that matrix elements show a gentle q-behaviour [2].

2.2. Calculation of matrix elements

We follow the standard procedure [1] to obtain decay amplitudes, i.e. the matrix element for the decay $B(p_1) \to B'(p_2)+P(q)$ to first order in weak interactions is given by

$$M = -i \int d^4x \langle B'(p_2)P(q)\, |H_W(x)\, |B(p_1)\rangle \tag{2.3}$$

$$= -(2\pi)^4 i\delta^4(p_1-p_2-q) M/(2q_0 V)^{1/2}, \tag{2.4}$$

where

$$M = (2q_0 V)^{1/2} \langle B'(p_2)P(q)\, |H_W(0)\, |B(p_1)\rangle, \tag{2.5}$$

which, using standard technique of LSZ can be written as

$$M(q) = i \int d^4x e^{-iq\cdot x}(q^2+m_a^2)$$
$$\langle B'(p_2)|\, T[\phi_n^m(x), H_W(0)]\, |B(p_1)\rangle, \tag{2.6}$$

$\phi_n^m(x)$ is the corresponding pseudoscalar field for the meson P(q), m and n are indices of the meson tensor.

The Born contribution $M_B(q)$ and the continuum contribution $\tilde{M}(q)$ can be separated as

$$M(q) = \tilde{M}(q) + M_B(q). \tag{2.7}$$

Assuming gentle q-behaviour of $M(q)$ and employing the techniques of current algebra, we get

$$\tilde{M}(q) \approx \tilde{M}(0) = \frac{i}{f_a}[\lim_{q\to 0}\{q_\mu T_\mu + if_a M_B(q)\} - \langle B'(p_2)|\, [F_{n'}^{5m} H_W(0)]\, |B(p_1)\rangle], \tag{2.8}$$

F_n^{5m} are the axial charges of axial current A_μ for the corresponding meson ϕ_n^m.

Now the pv and pc decays can be separated looking at the commutation relations of weak Hamiltonian.

2.3. Commutation relations of weak Hamiltonian:

(*i*) GIM model

In our conventional (V–A) picture, weak Hamiltonian transforms [10] as

$$H_W^{\mathrm{GIM}} \sim 20'' + 84 \tag{2.9}$$

for the pv as well as pc modes. The weak Hamiltonian belonging to the adjoint representation 15 does not appear owing to the well-known GIM cancellations in SU(4). However, the GIM weak Hamiltonian with 20″ dominance has many unsatisfactory features [5] in both the charmed and the uncharmed sectors. Experimental data demand the introduction of 15-admixture [5] which, in fact, can appear through incomplete cancellations (du) ($\bar{u}$s)–($\bar{d}$c) ($\bar{c}$s) because of the large mass difference between the u and c quarks. We, in our study, include a possible 15-admixture. The (V–A) nature of weak currents leads to the following commutation relations [1]:

$$[F_n^{5m}, H_W^{pv}] = [F_n^m, H_W^{pc}], \tag{2.10}$$

$$[F_n^{5m}, H_W^{pc}] = [F_n^m, H_W^{pv}]. \tag{2.11}$$

Writing explicitly, we get

$$\begin{aligned}[F_n^{5m}, H_{[c,d]}^{[a,b]} + H_{(c,d)}^{(a,b)}] = {} & \delta_d^m(H_{[c,n]}^{[a,b]} + H_{(c,n)}^{(a,b)}) \\ & - \delta_n^a(H_{[d,c]}^{[b,m]} + H_{(d,c)}^{(b,m)}) \\ & + \delta_c^m(H_{[d,n]}^{[b,a]} + H_{(d,n)}^{(b,a)}) \\ & - \delta_n^b(H_{[c,d]}^{[a,m]} + H_{(c,d)}^{(a,m)}),\end{aligned} \tag{2.12}$$

$$[F_n^{5m}, H_b^a] = -\delta_n^a(H_b^m) + \delta_b^m(H_n^a). \tag{2.13}$$

The explicit evaluation of the pv decay amplitudes then needs the matrix elements of H_W between baryon states. We employ the SU(4) symmetry at this stage and express all the decay amplitudes in terms of reduced matrix elements $\langle 20'||20''||20'\rangle$, $\langle 20'||84||20'\rangle$. In the SU(4) limit, there is no contribution from the Born term to the pv decays, since the coupling of pv spurion to baryons, i.e., $\langle B'|H_W^{pv}|B\rangle$ vanishes due to the C-parity arguments. The contribution to the pv decay amplitudes, then, comes only from the equal time commutation term, i.e.,

$$M(B \to B'+P) = \frac{-i}{f_P} \langle B'|H_W^{pc}|B\rangle. \tag{2.14}$$

(*ii*) Unconventional interaction:

In addition to 15, 20″ and 84, 15 × 15 direct product contains antisymmetric representations 45 and 45* also, which may arise through unconventional interaction. We obtain the following commutation relations for $H_W^{45+45^*}$ and H_W^{15A}:

$$\begin{aligned}[F_n^{5m}, H_{(c,d)}^{[a,b]}+H_{[c,d]}^{(a,b)}] &= \delta_d^m(H_{[c,n]}^{[a,b]}+H_{(c,n)}^{(a,b)}) \\ &\quad +\delta_n^a(H_{[d,c]}^{[b,m]}+H_{(d,c)}^{(b,m)}) \\ &\quad -\delta_c^m(H_{[d,n]}^{[b,a]}+H_{(d,n)}^{(b,a)}) \\ &\quad -\delta_n^b(H_{[c,d]}^{[a,m]}+H_{(c,d)}^{(a,m)}),\end{aligned} \tag{2.15}$$

$$[F_n^{5m}, H_b^{a15A}] = -\delta_n^a(H_b^m)_{15S}-\delta_b^m(H_n^a)_{15S}+H_{[n,b]}^{[a,m]}+H_{(b,n)}^{(a,m)}. \tag{2.16}$$

Let us notice that the only difference between commutation relations (2.16) and (2.12) is the opposite sign for the middle two terms. In the case of 15_A commutation relations also, 2nd term has opposite sign in the two cases (Eqs. (2.13) and (2.16)). Now in the presence of (45+45*) piece, the Born term may contribute to the pv decay, since $\langle B'|H_W^{pv}|B\rangle$ does not vanish. We, however, neglect their effects in the present work.

3. *Decay amplitudes in GIM model*

3.1. 20″ dominance

Assuming the 20″ dominance for the GIM weak Hamiltonian, all the pv decay amplitudes of charmed and uncharmed baryons are obtained from

$$(\bar{B}_{[m,c]}^a \quad B_d^{[m,b]} \quad H_{[a,b]}^{[c,d]}), \tag{3.1}$$

thus involving only one reduced matrix element $\langle 20'||20''||20'\rangle$. For uncharmed sector, we obtain

$$\sqrt{2}\,\Lambda_0^0+\Lambda_-^0 = 0, \tag{3.2}$$

$$\sqrt{2}\,\Xi_0^0-\Xi_-^- = 0, \tag{3.3}$$

$$\sqrt{2}\,\Sigma_0^+ +\Sigma_-^- = 0, \tag{3.4}$$

$$\Sigma_+^+ = 0, \tag{3.5}$$

$$\Lambda_-^0 : \Sigma_0^+ : \Xi_-^- = 1 : -\sqrt{3} : 2, \tag{3.6}$$

(3.6) is the well known Iwasaki relation. For $\Delta C = \Delta S$ decay, we obtain the following relations for π emitting decays:

$$0 = \langle \Lambda\pi^+|\Lambda_1^{+\prime}\rangle = \langle \Sigma^0\pi^+|\Sigma_1^+\rangle = \langle \Omega_1^0\pi^+|\Omega_2^+\rangle, \tag{3.7}$$

$$0 = \langle \Xi_1^+\pi^+|\Xi_2^{++}\rangle = \langle \Xi_1^+\pi^0|\Xi_2^+\rangle = \langle \Xi_1^0\pi^+|\Xi_2^+\rangle, \tag{3.8}$$

$$\langle \Sigma^0\pi^+|\Lambda_1^{+\prime}\rangle = \langle \Lambda\pi^+|\Sigma_1^+\rangle, \tag{3.9}$$

$$\langle \Xi^0\pi^+|\Xi_1^{+\prime}\rangle = -\langle \Xi^-\pi^+|\Xi_1^{0\prime}\rangle, \tag{3.10}$$

$$\langle \Sigma^+\pi^+|\Sigma_1^{++}\rangle = -\langle \Sigma^-\pi^+|\Sigma_1^0\rangle, \tag{3.11}$$

$$\langle \Xi^0\pi^+|\Xi_1^+\rangle = -\langle \Xi^-\pi^+|\Xi_1^0\rangle, \tag{3.12}$$

$$\langle \Xi_1^{+\prime}\pi^+|\Xi_2^{++}\rangle = -\langle \Xi_1^{0\prime}\pi^+|\Xi_2^+\rangle, \tag{3.13}$$

$$-\sqrt{3}\,\langle \Sigma^0\pi^+|\Lambda_1^{+\prime}\rangle = -\sqrt{6}\,\langle \Xi^0\pi^+|\Xi_1^{+\prime}\rangle = \langle \Sigma^+\pi^+|\Sigma_1^{++}\rangle$$
$$= -\sqrt{2}\,\langle \Xi^0\pi^+|\Xi_1^+\rangle = -\sqrt{\tfrac{3}{2}}\,\langle \Xi_1^{+\prime}\pi^+|\Xi_2^{++}\rangle, \tag{3.14}$$

$$\langle \Sigma^+\pi^0|\Lambda_1^{+\prime}\rangle = \langle \Lambda\pi^0|\Sigma_1^0\rangle, \tag{3.15}$$

$$\langle \Sigma^+\pi^0|\Sigma_1^+\rangle = -\langle \Sigma^0\pi^0|\Sigma_1^0\rangle, \tag{3.16}$$

$$\sqrt{3}\,\langle \Sigma^+\pi^0|\Lambda_1^{+\prime}\rangle = \sqrt{3}\,\langle \Xi^0\pi^0|\Xi_1^{0\prime}\rangle = \langle \Sigma^+\pi^0|\Sigma_1^+\rangle$$
$$= \langle \Xi^0\pi^0|\Xi_1^0\rangle = \frac{\sqrt{3}}{2}\langle \Xi_1^{+\prime}\pi^0|\Xi_2^+\rangle. \tag{3.17}$$

Determining the average value for the reduced matrix element $\langle 20'||20''||20'\rangle$ from the uncharmed sector, we calculate the decay amplitudes for the charmed baryon decays as displayed in column (i) of Table I.

3.2. Inclusion of 84:

The inclusion of 84 component in the GIM Hamiltonian adds one more parameter, i.e., $\langle 20'||84||20'\rangle$.

In the case of $\Delta C = 0$, $\Delta S = 1$ decays, we find that Σ_+^+ acquire nonzero contribution from 84 piece, leading to pseudo $\Delta I = 1/2$ rule for Σ_+^+ decay i.e.

$$\sqrt{2}\,\Sigma_0^+ + \Sigma_+^+ + \Sigma_-^- = 0 \tag{3.18}$$

and

$$\sqrt{3}\,\Lambda_-^0 + \Sigma_0^+ = 1/\sqrt{2}\,\Sigma_+^+. \tag{3.19}$$

Since Σ_+^+ vanishes experimentally, 84 contribution to the uncharmed sector is negligible. Thus the $\Delta C = \Delta S$ decay amplitudes (column (i) of Table I) also remain unaffected in the presence of 84 part. However, if $20''$ enhancement factor for the charm changing

TABLE I[1]

Cabbibo enhanced ($\Delta C = \Delta S$) decay amplitudes

Decay \ pv H_W	GIM		GIM + unconventional interaction
	$20''/20''+84$	$20''+84+15$	$(\bar{c}s)_R$
$\Lambda_1^{+\prime} \to \Lambda\pi^+$	zero	zero	zero
$\Lambda_1^{+\prime} \to \Sigma^0\pi^+$	-5.94	$-4.69+2.33a$	$-0.48+2.33y+9.37x$
$\to \Sigma^+\pi^0$	5.94	$4.69-2.33a$	$0.48-2.33y-9.37x$
$\Xi_1^{+\prime} \to \Xi^0\pi^+$	-4.20	$-3.31+1.65a$	$-4.80+1.65y-3.31x$
$\Xi_1^{0\prime} \to \Xi^-\pi^+$	4.20	$3.31-1.65a$	$4.80-1.65y+3.31x$
$\to \Xi^0\pi^0$	5.94	$4.69-2.33a$	$6.80-2.33y+4.68x$
$\Sigma_1^{++} \to \Sigma^+\pi^+$	10.29	$8.12-4.04a$	$8.12-4.04y$
$\Sigma_1^+ \to \Lambda\pi^+$	-5.94	$-4.69+2.33a$	$-0.48+2.33y+9.37x$
$\to \Sigma^0\pi^+$	zero	zero	zero
$\to \Sigma^+\pi^0$	10.29	$8.12-4.04a$	$8.12-4.04y$
$\Sigma_1^0 \to \Sigma^-\pi^+$	-10.29	$-8.12+4.04a$	$-8.12+4.04y$
$\to \Lambda\pi^0$	5.94	$4.69-2.33a$	$0.48-2.33y-9.37x$
$\Sigma_1^0 \to \Sigma^0\pi^0$	-10.29	$-8.12+4.04a$	$-8.12+4.04y$
$\Xi_1^+ \to \Xi^0\pi^+$	-7.28	$-5.74+2.86a$	$-3.16+2.86y+5.74x$
$\Xi_1^0 \to \Xi^-\pi^+$	7.28	$5.74-2.86a$	$3.16-2.86y-5.74x$
$\to \Xi^0\pi^0$	10.29	$8.12-4.04a$	$4.47-4.04y-8.11x$
$\Xi_2^{++} \to \Xi^{+\prime}\pi^+$	-8.40	$-6.63+3.30a$	$-5.14+3.30y+3.31x$
$\to \Xi_1^+\pi^+$	zero	zero	$2.58+5.74x$
$\Xi_2^+ \to \Xi_1^{0\prime}\pi^+$	8.40	$6.63-3.30a$	$5.14-3.30y-3.31x$
$\to \Xi_1^0\pi^+$	zero	zero	$2.58+5.74x$
$\to \Xi_1^{+\prime}\pi^0$	11.88	$9.38-4.66a$	$7.27-4.66y-4.68x$
$\to \Xi_1^+\pi^0$	zero	zero	$3.65+8.11x$
$\Omega_2^+ \to \Omega_1^0\pi^+$	zero	zero	zero

[1] The undetermined parameters a, x, y appear because of 15 contributions to the uncharmed sector.

decays is different for the uncharmed sector, a substantial contribution for the 84 part may be expected.

We notice that $H_W^{20''+84}$ maintains the relations (3.7), (3.9) to (3.13), (3.15), (3.16). The other relations are modified to:

$$\sqrt{3}\,\langle\Sigma^-\pi^+|\Sigma_1^0\rangle = \langle\Sigma^0\pi^+|\Lambda_1^{+\prime}\rangle + 2\sqrt{2}\,\langle\Xi^0\pi^+|\Xi_1^{+\prime}\rangle, \tag{3.20}$$

$$\sqrt{3}\,\langle\Xi^0\pi^+|\Xi_1^+\rangle = \sqrt{2}\,\langle\Sigma^0\pi^+|\Lambda_1^{+\prime}\rangle + \langle\Xi^0\pi^+|\Xi_1^{+\prime}\rangle, \tag{3.21}$$

$$\sqrt{2}\,\langle\Xi_1^{0\prime}\pi^+|\Xi_2^+\rangle = -\langle\Sigma^0\pi^+|\Lambda_1^{+\prime}\rangle - \sqrt{2}\,\langle\Xi^0\pi^+|\Xi_1^{+\prime}\rangle, \tag{3.22}$$

$$\sqrt{3}\,\langle\Xi_1^0\pi^+|\Xi_2^+\rangle = -\sqrt{3}\,\langle\Xi_1^+\pi^+|\Xi_2^{++}\rangle = \frac{1}{\sqrt{2}}\langle\Sigma^0\pi^+|\Lambda_1^{+\prime}\rangle - \langle\Xi^0\pi^+|\Xi_1^{+\prime}\rangle, \tag{3.23}$$

$$\sqrt{3}\,\langle\Sigma^0\pi^0|\Sigma_1^0\rangle = -\langle\Sigma^+\pi^0|\Lambda_1^{+\prime}\rangle - 2\langle\Xi^0\pi^0|\Xi_1^{0\prime}\rangle, \tag{3.24}$$

$$\sqrt{3}\,\langle\Xi^0\pi^0|\Xi_1^0\rangle = 2\langle\Sigma^+\pi^0|\Lambda_1^{+\prime}\rangle + \langle\Xi^0\pi^0|\Xi_1^{0\prime}\rangle, \tag{3.25}$$

$$\langle\Xi_1^{+\prime}\pi^0|\Xi_2^+\rangle = \langle\Sigma^+\pi^0|\Lambda_1^{+\prime}\rangle + \langle\Xi^0\pi^0|\Xi_1^{0\prime}\rangle, \tag{3.26}$$

$$\sqrt{3}\,\langle\Xi_1^+\pi^0|\Xi_2^+\rangle = -\langle\Sigma^+\pi^0|\Lambda_1^{+\prime}\rangle + \langle\Xi^0\pi^0|\Xi_1^{0\prime}\rangle. \tag{3.27}$$

3.3. 15-admixture

Because of vanishing Σ_+^+, the inclusion of 84 component does not improve the relation (3.6). In order to remove the discrepancy, we consider the 15 admixture to the GIM weak Hamiltonian $(20''+84)$ which gives

$$\sqrt{3}\,\Sigma_0^+ - \Lambda_-^0 + 2\Xi_-^- = -\sqrt{\tfrac{3}{2}}\,\Sigma_+^+. \tag{3.28}$$

Neglecting 84 piece Lee-Sugawara relation follows from (3.28). This result is well known in current algebra considerations [1] in SU(3). In the charmed sector, $\Delta C = \pm\Delta S$ decay does not get disturbed, since 15 does not contain these modes. For $\Delta C = -1$, $\Delta S = 0$ modes also, 15 does not contribute, since 15 cancellations seem to persist even in the presence of the SU(4) breaking as the propagator in $(\bar{u}d\,\bar{d}c - \bar{u}s\,\bar{s}c)$ will remain degenerate. But numerical decay amplitudes would be small as now the effective value of the reduced matrix element $\langle 20'||20''||20'\rangle$ would reduce due to the 15 contribution to the uncharmed sector. In the column (ii) of Table I, we calculate the decay amplitudes in the presence of 15 admixture. Since $20''$ contribution cannot be separated out from those of 15, the decay amplitudes involve one parameter which will be fixed from charmed decay data.

4. *Decay amplitudes in unconventional interaction*

In the following, we include antisymmetric representations, like 15_A, 45, 45*, present in the 15×15 direct product [10]. These representations are not present in the left-handed current interactions. However, they can occur in several ways, like, through unconventional current [6, 7], Melosh transformation [9], or through SU(4) breaking interactions which may be expected to be significant due to the badly broken nature of SU(4).

For $\Delta C = 0$, $\Delta S = 1$, the inclusion of these gives

(*i*) $\Delta I = 1/2$ rule for Λ and Ξ^- decays,

(*ii*) Lee-Sugawara relation gets modified to

$$(\sqrt{3}\,\Sigma_0^+ - \Lambda_-^0 + 2\Xi_-^-) = \sqrt{\tfrac{3}{2}}\,(\sqrt{2}\,\Sigma_0^+ + \Sigma_-^-). \tag{4.1}$$

The $\Delta I = 1/2$ rule for Σ decays and the Lee-Sugawara relation do not follow because of the presence of $\Delta I = 3/2$ piece in the weak Hamiltonian. Since the experimental data satisfy these well-known relations, the effective contribution from $(45+45^*)$ to uncharmed decays should be negligible. Actually so far we have not gone into the source of these unconventional pieces. We may consider these pieces to be arising from the charm changing right handed current. Experimentally, there is no evidence for a right handed current involving u and d quarks [11]. But the possibility of a current of the kind $\bar{c}\gamma_\mu(1+\gamma^5)s \equiv (\bar{c}s)_R$

is not ruled out [12, 13]. The effect of such a piece would be most direct in D-semileptonic decays [14]. Even in D-meson hadronic decays, addition of a $(\bar{c}s)_R$ helps to understand $\Gamma(D^0 \to K^+K^-)/\Gamma(D^0 \to \pi^+\pi^-)$ ratio [15]. The y-distribution of dimuon events in ν_μN--scattering allows a (V+A) mixture [12]. With a $(\bar{c}s)_R$ current the various decay modes acquire the following additional terms:

$$\Delta C = 0, \Delta S = 1 \sim T^{34}_{42},$$

$$\Delta C = -1, \Delta S = -1 \sim T^{24}_{13},$$

$$\Delta C = -1, \Delta S = 0 \sim T^{34}_{13}. \tag{4.2}$$

Thus in the case of uncharmed decays, T^{34}_{42} part of $45+45^*$ behaves like the $\Delta I = 1/2$ term leading to $\Delta I = 1/2$ sum rules (3.2 to 3.4), $\Sigma^+_+ = 0$ and Lee-Sugawara sum rule. For charm decays, we calculate the decay amplitude values as given in column (iii) of Table I.

5. *Summary*

In this paper, we have discussed the pv weak mesonic decays of $1/2^+$ baryons in the channels $B(1/2^+) \to B(1/2^+)+P(0^-)$, employing current algebra techniques. In the uncharmed sector, we find that the GIM weak Hamiltonian $(20''+84)$ does not lead to satisfactory results and 15-admixture is considered to remove the discrepancy. For the charm changing decays of charmed baryons, we obtain several decay amplitude sum rules in the GIM model. The possibility of unconventional antisymmetric representations is also considered. These representations may appear in the weak Hamiltonian in several ways like the inclusions of right handed currents and/or second class currents or due to the SU(4) breaking. Decay amplitude sum rules are found to be the same in both the models for pionic modes. This is a consequence of the fact that

$$[F^5_k, H^{pv}_W] = [F_k, H^{pc}_W], \quad k = 1, 2, 3 \tag{5.1}$$

holds in the presence of antisymmetric component of weak Hamiltonian [16]. We evaluate the decay amplitudes for charmed baryons with and without 15-admixture and the unconventional interactions.

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