2) For the electromagnetic interaction, the constant G_C^F is not equal to zero, owing to the absence of pseudoscalar field components.

HADRON DECAYS OF BARYONS IN THE $\tilde{U}(12)$ SYMMETRY SCHEME

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In this letter we consider hadron decays of hyperons in the $\tilde{U}(12)$ symmetry scheme [1,2] (see also [3]), which is one of the possible relativistic generalizations of SU(6) symmetry.

The octet $1/2^+$(B) and the decuplet $3/2^+$(D) of baryons form representation 364 of the $\tilde{U}(12)$ group and are described by the completely symmetrical tensor $\Psi_{\{ABC\}}(p)$, which we write in the form

$$\Psi_{\{ABC\}}(p) = \sqrt{3/2}\,[(\frac{\gamma p}{m}+1)\gamma_\mu C]_{\alpha\beta} D_{\mu\gamma,\{ijk\}} + (1/\sqrt{6})\Big\{[(\frac{\gamma p}{m}+1)\gamma_5 C]_{\alpha\beta}\epsilon_{ij3}B^3_{\gamma,k}$$

$$+ \text{cyclic permutation of } d,\beta,\gamma \text{ and } i,j,k\Big\}$$

Here and throughout the capital Latin subscripts of the group $\tilde{U}(12)$ tensor (A, B, ... = = 1, ..., 12) correspond to the following pair of indices: the group SU(4) tensor (α, β, ... = = 1, ..., 4) and of the SU(3) tensor (i, j, ..., = 1, 2, 3). For example, A = (α, i), B = = (β, j), C = (γ, k), etc. (We retain the notation and the choice of representations used in [1, 2] for the γ matrices).

The pseudoscalar mesons (P) which enter in the representation 143 along with the vectors, will be described by the function

$$\Phi^A_B(p) = \left[(\frac{\gamma p}{\mu}+1)\gamma_5\right]^\alpha_\beta P^i_k$$

where μ is the "average" mass of the 0^--meson octet and P^i_k is the corresponding octet matrix. We note that the regular representation 143 of the "internally broken" [1, 2] $\tilde{U}(12)$ symmetry does not contain real scalar particles.

We begin with consideration of parity-nonconserving amplitudes, for the S-waves of which we have already obtained information [4-6] that agrees with experiment (see also [7]).

The transformation properties of the "weak" spurion H, which breaks $\tilde{U}(12)$ symmetry, is fixed uniquely in this case by the requirement that it transform in accordance with the representation 143, being pseudoscalar, and by the sixth component of the SU(3) symmetery vector. In other words,

$$H^A_B = (\gamma_5)^\alpha_\beta\,(\delta^i_3\,\delta^2_j + \delta^i_3\,\delta^3_j) \quad (1)$$

Taking CP-invariance into account, we can write for the matrix element

$$M_{pn} = a\overline{\Psi}^{\{ABC\}}(p_2)\left[\Phi_C^E(q)H_E^D - \Phi_E^D(q)H_C^E\right]\Psi_{\{ABD\}}(p_1) \qquad (p_1 = p_2 + q) \tag{2}$$

Calculation yields the following expression for M_{pn}:

$$M_{pn} = 3a\left\{(1/M^2)[P^2\delta_{\mu\nu} + 2q_\mu q_\nu]\overline{D}^{ijk}(p_2)D_{\nu,ij3}(p_1)P_k^2(q) + (1/3)(P^2/m^2)(\overline{B}B)_{F3}^k P_k^2(q)\right\} \tag{3}$$

where $P^2 = (p_1 + p_2)^2$, $(\overline{B}B)_{Fj}^i \equiv \overline{B}_t^i B_j^t - \overline{B}_j^t B_t^i$, M is the "average" mass decuplet, and m is the "average" mass of the baryon octet[1])

From (3) follow all relations between the S-wave amplitudes of hadron decays of the baryon octet, obtained in [4-6], and the relations $(\Lambda \to p\pi^-)_S = (2)^{-1/2}(\Omega^- \to \Xi^{0*}\pi^-)$, obtained in [5], is generalized with allowance for the D wave in the $\Omega^- \to \Xi^{0*}\pi^-$ decay.

The essentially new factor brought about by $\tilde{U}(12)$ symmetry with respect to parity non-conserving amplitudes is the deduction, which follows from (3), that the decays $\Omega \to \Lambda K^-$ and $\Omega \to \Xi\pi$ proceed with conservation of parity (i.e., only in the P-wave). A check on this statement is of undoubted interest.

Going over to consideration of parity-conserving amplitudes, we note that the spurion H should in this case be a scalar 0^+. Two possibilities must then be distinguished.

No conditions of the type of the Bargmann-Wigner equations are imposed on the spurion (which has a zero 4-momentum). Then it can belong to representation 143 of the $\tilde{U}(12)$ scheme.

The other possibility is that the spurion is regarded, with respect to the transormation properties of "internally-broken" $\tilde{U}(12)$ symmetry, on an equal basis with real particles. In this case it should be transformed in accordance with the higher representations of $\tilde{U}(12)$ (4212, 5940).

We shall show here that the first alternative leades to contradiction with experiment for parity-conserving amplitudes. The second possibility will be considered by us in our next paper.

Thus, assuming that H belongs to the representation 143 0^+, we can write for a CP-invariant parity-conserving matrix element of hadron decays

$$M_{pc} = B_1\overline{\Psi}^{\{ABC\}}(p_2)[\Phi_C^E(q)H'^D_E + \Phi_E^D(q)H'^E_C]\Psi_{\{ABD\}}(p_1) + B_2\overline{\Psi}^{\{ABC\}}(p_2)\Phi_A^D(q)H'^E_B\Psi_{\{DEC\}}(p_1) \tag{4}$$

where $H'^A_B = \delta_\beta^\alpha\,(\delta_3^i\,\delta_j^2 + \delta_2^i\,\delta_j^3)$.

As a result of the calculation we obtain the following relations between the parity-conserving amplitudes of hadron decays of baryons

$$4(\Omega^- \to \Xi^{0*}\pi^-)_{pc} = -\,(3)^{1/2}(\Omega^- \to \Xi^0\pi^-)_P \tag{5a}$$

$$5(\Omega^- \to \Lambda K^-)_P = 6(6)^{1/2}(\Sigma^+ \to n\pi^+)_P \qquad (5b)$$

$$(5/12)(\Omega^- \to \Xi^0\pi^-)_P = (2/3)^{1/2}(\Lambda \to p\pi^-)_P - 2(\Sigma^- \to n\pi^-)_P \qquad (5c)$$

$$(2)^{1/2}(\Sigma^+ \to p\pi^0)_P = 2(\Sigma^- \to n\pi^-)_P + (2/3)^{1/2}(\Lambda \to p\pi^-)_P \qquad (5d)$$

$$5(\Xi^+ \to \Lambda\pi^-)_P = -\,(3/2)^{1/2}(\Sigma^- \to n\pi^-)_P - 2(\Lambda \to p\pi^-)_P \qquad (5e)$$

The amplitudes are determined as follows

$$(D \to DP)_{pc} = [1 + (2M/\mu)][(P^2/M^2)\delta_{\mu\nu} + (2q_\mu q_\nu/M^2)]\bar{D}_\mu\gamma_5 D_\nu P$$

$$(D \to BP)_P = [1 + (m + M)/\mu](q_\mu/m)(\bar{B}D_\mu)P$$

$$(B \to BP)_P = [1 + (2m/\mu)](P^2/m^2)(\bar{B}\gamma_5 B)P$$

If we assume that $(\Sigma^- \to n\pi^-)_P$ is close to zero [4-6], then it follows from (5e) that the asymmetry coefficient α for $\Lambda \to p\pi^-$ and $\Xi^- \to \Lambda\pi^-$ decays should have the same sign. This is in contradiction with experiment.

Experiment likewise contradicts the relation which follows from (5)

$$2(\Xi^- \to \Lambda\pi^-)_P + (\Lambda + p\pi^-)_P - \sqrt{3}\,(\Sigma^+ \to p\pi^0)_P = (2\sqrt{6}/5)\,(\Sigma^+ \to n\pi^+)_P = (1/3)(\Omega \to \Lambda K^-)_P$$

Our result shows the need for investigating the second already mentioned alternative concerning the transformation properties of the spurion H, which in turn is important for a clarification of the properties of the spurion in moderately strong interactions.

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1) We note that if we "exaggerate the accuracy" and introduce a difference between the masses of initial and final baryons, then the terms $\bar{D}D$ and $(\bar{B}B)_F$ will be preceded by factors of the type $[1 - (m_1 - m_2)/\mu]$ corresponding to the factors $[1 + (m_1 + m_2)/\mu]$ appearing in parity-conserving amplitudes [1, 2]. The squares of the masses in the denominator should be replaced in this case by $m_1 m_2$. The factor P^2 equals $(m_1 + m_2)^2 - \mu^2$.