CM-P00057181

SU₆, CURRENT-CURRENT INTERACTION AND PARITY-VIOLATING

HYPERON DECAYS

W. Alles ^{*)}

CERN -- Geneva

^{*)} On leave from Istituto di Fisica dell'Università, Bologna and
from Istituto Nazionale di Fisica Nucleare (Sezione di Bologna).

Recently, several partially successful results have been obtained on non-leptonic decays ^{1),2)} assigning definite transformation properties under SU_6 ³⁾ to the effective non-leptonic weak interaction. Assuming a current-current interaction, PC invariance and an interaction transforming like a member of an octet under SU_3 , Gell-Mann ⁴⁾ has obtained for the S wave amplitudes the relation:

$$2\Sigma^- - \Lambda^- = -\sqrt{3} \Sigma_0^+ \quad (1)$$

Imposing the additional condition that this octet belongs to the representation 35 of SU_6 , Altarelli et al. and Suzuki ¹⁾ have obtained the two additional relations for the S wave amplitudes

$$\Sigma_0^+ - \sqrt{2} \Sigma_+^+ = -\frac{1}{\sqrt{3}} \Lambda_-^0 \quad (2)$$

$$\Sigma_+^+ = 0$$

(3)

One may ask further if some of the above relations will remain valid under more general conditions. We will show that relation (3), $\Sigma_+^+ = 0$, is valid in the framework of SU_6 under the quite general assumption of a current-current interaction and the $\Delta T = 1/2$ rule.

Bég and Pais ⁵⁾ have shown that in the static limit the assumption of the weak currents belonging to the representation 35 of SU_6 is in agreement with experiment; thus a current-current interaction will transform like the product:

2.

(4)

$$35 \otimes 35 = 1 \oplus 35 \oplus 35 \oplus 189 \oplus 280 \oplus 280 \oplus 405$$

only the symmetric representations 1, 35, 189 and 405 being possible for the interaction Lagrangian. The contribution of 35 to the $\Delta Y = 1$ decays has been studied in Ref. ¹⁾ and leads to relation (1) to (3). The representations 1 and 189 are contained only once in the product $56 \otimes \bar{56} \otimes 35$ and a straightforward calculation shows that by PC invariance their contribution to hyperon decays vanishes. The representation 405 is contained four times in the product $56 \otimes \bar{56} \otimes 35$ but again by PC invariance only one term is different from zero, i.e.:

$$\begin{aligned} 405_{\gamma\epsilon}^{\alpha\beta} = & B^{\alpha\mu\nu} \bar{B}_{\gamma\epsilon\mu} M_\nu^\beta + B^{\beta\mu\nu} \bar{B}_{\gamma\epsilon\mu} M_\nu^\alpha - B^{\alpha\beta\mu} \bar{B}_{\gamma\mu\nu} M_\epsilon^\nu - B^{\alpha\beta\mu} \bar{B}_{\epsilon\mu\nu} M_\gamma^\nu \\ & - \frac{1}{8} \left\{ \delta_\gamma^\alpha (B^{\lambda\mu\nu} \bar{B}_{\lambda\epsilon\mu} M_\nu^\beta - B^{\lambda\beta\mu} \bar{B}_{\lambda\epsilon\mu} M_\nu^\alpha) + \delta_\epsilon^\alpha (B^{\lambda\mu\nu} \bar{B}_{\lambda\gamma\mu} M_\nu^\beta - B^{\lambda\beta\mu} \bar{B}_{\lambda\gamma\mu} M_\nu^\alpha) \right. \\ & \left. + \delta_\gamma^\beta (B^{\lambda\mu\nu} \bar{B}_{\lambda\epsilon\mu} M_\nu^\alpha - B^{\lambda\alpha\mu} \bar{B}_{\lambda\epsilon\mu} M_\nu^\beta) + \delta_\epsilon^\beta (B^{\lambda\mu\nu} \bar{B}_{\lambda\gamma\mu} M_\nu^\alpha - B^{\lambda\alpha\mu} \bar{B}_{\lambda\gamma\mu} M_\nu^\beta) \right\} \end{aligned}$$

(5)

Imposing no condition on the transformation properties of the $\Delta Y = 1$ interaction one gets no relation, imposing only the $\Delta T = 1/2$ rule, that is, taking for the spurion the $Y = 1$, $T = 1/2$ of $35(8,1)$, $T = 1/2$ of $405(8,1)$ and $T = 1/2$ of $405(27,1)$ one gets apart from the known relations

given by the $\Delta T = 1/2$ rule, the relation

$$\langle \Sigma^+ \rightarrow n + \pi^+ \rangle_S = 0 \quad (3)$$

Imposing further the octet condition on the spurion, that is, putting to zero the contribution of $405(27,1)$, one gets the Gell-Mann relation (1). It seems to us that relation (3) is of a more fundamental nature, in SU_6 , than relation (2). Assigning the non-leptonic spurion to the representation 35 is possible in a current-current picture by constructing the products of currents with the appropriate Clebsch-Gordan coefficients. But, two other points of view would not approve this assignment of the non-leptonic spurion: first, the analogy with the symmetry breaking of strong interactions in SU_6 which does not transform like the representation 35⁶⁾, second, an extension of the model proposed by d'Espagnat⁷⁾, which assigns in the framework of SU_3 , the intermediate bosons to the representation 3 and the current-boson interaction to 3, thus realizing an octet spurion. The simplest extension to SU_6 of this model, would lead to the current-boson interaction transforming like $(\bar{3},1)$ of 21, and leading to a non-leptonic interaction transforming like $(8,1)$ of 35 and 405. It is worth while in this respect to point out that if one chooses the S wave amplitudes⁸⁾ fitting relations (1) and (3), relation (2) is fitted only qualitatively but not quantitatively.

R E F E R E N C E S

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