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The predictions of the SU(3) -symmetry for electromagnetic form factors [1] can be noticeably modified due to the symmetry breaking. The consideration of the symmetry breaking within the framework of the group-theoretical approach [2] results in a large number of additional amplitudes. Thus, one cannot always obtain the relations admitting the experimental check.

The aim of the present paper is to propose a more restrictive approach in which the decrease in the number of unknown parameters is achieved by imposing additional requirements condensing a number of general features of composite, quark-parton and some other dynamical models.

The main assumptions are the following:

1) We assume that in the transition matrix element

$$<0|j_\mu^{em}|B,\bar{B}> = \sum_n <0|j_\mu^{em}|n><n|B,\bar{B}> \qquad (1)$$

the dominating part is played by intermediate states of the hadron system which are the singlets and octets of the SU(3) -group. Note, that the absence of higher representations is automatically fulfilled within the quark-parton models $(3\times\bar{3} = 1+8)$ and in the models like the generalized vector dominance taking into account the exchange by arbitrary number of nonets of the vector mesons.

2) As is suggested in Ref. [3] we shall parametrize the vertex part of the transition $\Gamma_n = <0|j_\mu^{em}|n>$ in the broken SU(3) following the Okubo "nonet ansatz" [4]

$$\Gamma_n = \gamma_0 <\hat{Q}\hat{V}> + \gamma_1 <\hat{Q}\hat{V}\hat{\lambda}_8>, \qquad (2)$$

where $<\hat{A}> \equiv Sp\,\hat{A}$, $\hat{Q} = \hat{\lambda}_3 + \frac{1}{\sqrt{3}}\hat{\lambda}_8$, $\hat{\lambda}_i$ – are 3x3-matrices known in theory of the SU(3) -symmetry, and

$$\hat{V} = \mathrm{diag}\{\frac{"\rho^{\circ}"}{\sqrt{2}} + \frac{"\omega_8"}{\sqrt{6}} + \frac{"\omega_1"}{\sqrt{3}};\ -\frac{"\rho^{\circ}"}{\sqrt{2}} + \frac{"\omega_8"}{\sqrt{6}} + \frac{"\omega_1"}{\sqrt{3}};\ \frac{"\omega_1"}{\sqrt{3}} - 2\frac{"\omega_8"}{\sqrt{6}}\}. \qquad (3)$$

The symbols $"\rho^{\circ}"$, $"\omega_8"$ and $"\omega_1"$ do not refer to physical vector mesons but indicate only that intermediate states $|n\rangle$ are superpositions of the states with quantum number of labelled vector mesons.

3) The hadronic amplitudes $g(nB\bar{B}) \equiv \langle n|B,\bar{B}\rangle$ are parametrized according to the unbroken SU(3)-symmetry. In the composite model this assumption corresponds to the SU(3)-symmetry of the wave function of the baryon ground state.

4) Instead of the singlet "coupling constant" $g("\omega_1" B\bar{B}) \equiv g("\omega_1")$ we introduce a new parameter Λ, which is defined by the relation:

$$g("\omega_1") = \sqrt{2}(1+\Lambda)\, g("\omega_8" N\bar{N}). \qquad (4)$$

First we consider the case $\Lambda = 0$. This assumption corresponds to the disappearance of the coupling constant of the system, containing only "strange" quark and antiquark, with nucleons, i.e., it is equivalent to the fulfillment of the known OZI-rule /4,5,6/.

Under the above assumptions we can express the magnetic moments of all octet baryons through $\mu(P)$, $\mu(N)$ and $\mu(\Lambda)$:

$$\delta\mu(\Sigma^{\pm,0}) = \delta\mu(\Lambda)(1+2\mu(N)/\mu(P)), \qquad (5)$$

$$\delta\mu(\Xi^{0,-}) = 2\delta\mu(\Lambda)(1+\mu(N)/2\mu(P)), \qquad (6)$$

$$\delta\mu(\Lambda\Sigma^{\circ}) = 0, \qquad (7)$$

where

$$\delta\mu(B) \equiv \mu(B) - \mu(B)_{SU_3}, \quad \mu(\Sigma^-)_{SU_3} = \mu(\Xi^-)_{SU_3} = -\mu(P) - \mu(N),$$

$$\mu(\Sigma^+)_{SU_3} = \mu(P), \quad \mu(\Xi^{\circ})_{SU_3} = 2\mu(\Lambda)_{SU_3} = -\frac{2}{\sqrt{3}}\mu(\Lambda\Sigma^{\circ})_{SU_3} = \mu(N).$$

The numerical values of the magnetic moments are presented in the Table (all the values are in the units of nuclear magnetons).

The relations analogous to Eqs. (5)-(7) can be written for the form factors $G^B_E(q^2)$ and $G^B_M(q^2)$ at any q^2. We give only the consequence for the charge radii

$$\langle r^2\rangle^{\Lambda\Sigma^{\circ}}_{ch} = -\frac{\sqrt{3}}{2}\langle r^2\rangle^N_{ch} = 0.10 \pm 0.01\ fm^2 \qquad (9)$$

which can be checked by analysing the reaction $\Sigma^{\circ} \to \Lambda e^+ e^-$.

If one assumes $\mu(N)/\mu(P) = -2/3$, the relations (5)-(7) coincide with the results of the nonrelativistic quark model /10/ in which the SU(3)-symmetry breaking was taken into account in the magnetic moment of the strange quark: $\mu(\lambda) \neq \mu(\lambda)_{SU_3} = \mu(n)$. We should like to emphasize, however, that when deriving formulae (5)-(7), we do not make any assumptions concerning the nonrelativistic dynamics and character of the wave function symmetry with respect to the spin and space coordinates.

The estimation of the quantity Λ is of a particular interest nowadays. The essential difference of Λ from zero, i.e., a strong violation of the OZI-rule, might serve as an indication to the presence of the configuration with $q\bar{q}$ -pairs in the ground state of baryons. Unfortunately, the experimental errors in $\mu(\Sigma^-)$ and $\mu(\Xi^-)$ which are more sensitive to the quantity Λ are still large. Using the available data we obtain rather a wide range of possible values of Λ:

$$\Lambda = -0.6^{+2.2}_{-0.4}. \qquad (10)$$

The quantity Λ determines the ratio of nucleon coupling constants with the "ω" and "ϕ"-like states

$$r(\Lambda) = \frac{g_M("\phi" N\bar{N})}{g_M("\omega" N\bar{N})} = -\frac{\sqrt{2}\,\Lambda}{3+2\Lambda}, \qquad (11)$$

where

Table

Comparison of the experimental and calculated values of the baryon magnetic moments

Baryon	P	N	Λ	Σ^+	Σ^-	Ξ^0	Ξ^-	$\Lambda\Sigma^0$
$\mu_{exp.}^{(B)}$	2.79	-1.91	$-0.67^{(a)}$ ± 0.06	$2.62^{(a)}$ ± 0.41	$-1.48^{(b)}$ ± 0.37	-	$-1.93^{(a)}$ ± 0.75	$1.87^{+0.7}_{-0.3}$ (c
$\mu_{theor.}^{(B)}$ a) $\Delta = 0$	input	input	input	2.69 ± 0.02	-0.99 ± 0.02	-1.54 ± 0.08	-0.51 ± 0.08	1.66
b) $\Delta = 1,5$	- " -	-"-	-"-	2.67 ± 0.05	-0.72 ± 0.11	-1.61 ± 0.06	-0.31 ± 0.12	1.73 ± 0.02
c) $\Delta = -1$	- " -	-"-	-"-	2.72 ± 0.03	-1.38 ± 0.12	-1.41 ± 0.12	-0.81 ± 0.13	1.53 ± 0.04

(a) Data are taken from Ref. /7/ (b) Data are taken from Ref. /8/
(c) The value of $\mu(\Lambda\Sigma^0)$ is calculated according to $\tau(\Sigma^0) = (0.63 \pm 0.30) \cdot 10^{-19}$ sec /9/.

$$"\omega" = "\omega_8" \sin\theta + "\omega_1" \cos\theta ,$$
$$"\phi" = "\omega_8" \cos\theta - "\omega_1" \sin\theta , \qquad (12)$$

and we put $tg\theta = 1/\sqrt{2}$ in formula (11).

The numerical value $r(\Delta = -0.6) = 0.47$ is almost of the same magnitude but of the opposite sign as compared to the ratio of the Dirac-type coupling constants of "physical" ϕ-and ω-mesons with nucleons, recently obtained in Ref. /11/ from the analysis of nucleon form factors. It is seen from the Table that smaller in absolute values of $\mu(\Sigma^-)$ and $\mu(\Xi^-)$ correspond to the positive value $\Delta = 1.5$ ($r(\Delta = 1.5) = 0.35$). Due to great importance of realizing the limits of applicability of the OZI rule and possible role of configurations with $q\bar{q}$-pairs, it is extremely desirable to have more accurate experimental values of $\mu(\Sigma^-)$ and, in particular, of $\mu(\Xi^-)$.

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