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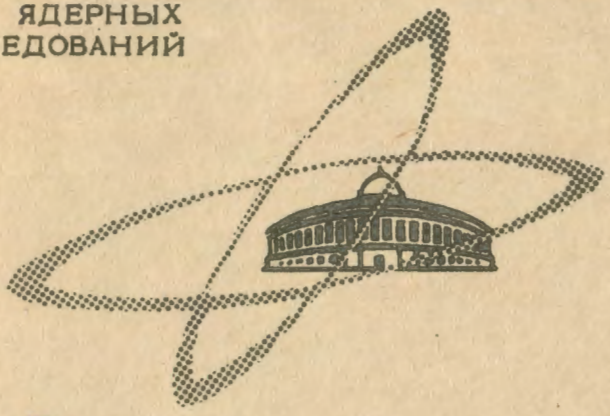

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ON THE RATIO OF THE AXIAL AND VECTOR CONSTANTS IN DYNAMICAL QUARK MODEL

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ON THE RATIO OF THE AXIAL AND VECTOR CONSTANTS IN DYNAMICAL QUARK MODEL

We consider the problem of the ratio of the axial and vector constants q_A/q_V in quark model. Let us assume that the motion of a quark entering the baryon in approximately determined by the Dirac equation:

$$(\hat{\partial} - M - V(r))\psi(\bar{r}) = 0 \,,$$

where M is the mass of the free quark, $V(r)$ is the radially symmetric scalar potential describing the interaction with the two other quarks. We denote the total angular momentum of the quark by $\bar{j} = \frac{\bar{\sigma}}{2} + \bar{L}$, where $\bar{\sigma}$ are the spin matrices, $\bar{L}$ is the orbital moment. Here we put that three quarks of equal spins can be placed on the minimum energy level $E = E_0$.

According to the results of ref.[1] we get the quark magnetic moment

$$\mu_A = \frac{eQ_A}{2E_0}(1-\Delta) \qquad \text{where} \qquad \Delta = \langle L_z \rangle = \frac{\int \psi_0^+ L_z \psi_0 \, dr}{\int \psi_0^+ \psi_0 \, dr} \,.$$

For the magnetic moment of the proton expressed in the Bohr magneton units we obtain

$$\mu_p = \frac{m_p}{E_0}(1-\Delta) \,. \qquad (1)$$

As was noticed by V.Matveev and B.Struminsky in this model

$$\frac{g_A}{g_V} = \frac{5}{3}(1-2\Delta) \,, \qquad (2)$$

Using the results of ref.[2] for Δ we have $\Delta = \frac{1}{6}$, From where

$$\frac{g_A}{g_V} = \frac{5}{3} \cdot \frac{2}{3} = 1,11 \,.$$

Eqs. (1) and (2) can be connected starting from the experimental value of the proton magnetic moment $\mu_p = 2.79$ and calculate $\frac{g_A}{g_V}$. We take into account the collective quark energy:

$$m = 3E_0 + Wj(j+1) \,.$$

For the nucleon and isobar

$$m_{\beta} = 3E_0 + \frac{3}{4}W \qquad (938.2\ \text{MeV}),$$

$$m_{\beta^*} = 3E_0 + \frac{15}{4}W \qquad (1236\ \text{MeV}).$$

As a result, $\Delta = 0.145$ and $\frac{g_A}{g_V} = 1.185$ are very close to the experimental value (1.19). As is seen, such a rough model can give good agreement with experiment.

In conclusion I express my gratitude to N.Bogolubov, A.Tavkhelidze, V.Matveev and B.Struminsky for valuable advice and discussion.

References

1. P.Bogolubov. Preprint P-2569, Dubna, 1966.
2. N.Bogolubov, B.Struminsky, A.Tavkhelidze. Preprint D- 1968, Dubna, 1965.

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