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A b s t r a c t

It is shown that the existence of the heavy axion proposed by Yang to explain the CP-invariance conservation in quantum chromodynamics contradicts the experimental data on the anomalous magnetic moment of muon.

At the recent time the question on the CP-parity conservation in quantum chromodynamics has been discussed invensively. As in non-Abelian calibration theories there exist pseudoparticle solution, CP-invariance can be violated. The invariance may be conserved by introduction of the global $U(1)$ -symmetry /1/. This results in the existence of a light pseudoscalar particle, the axion, /2,3/ with a mass of 0.01 to 1 MeV. The possibilities to observe the axion in the experiments have been discussed in Refs./2-5/.

However, the new works have been recently published /6,7/, which show that the axion with such a mass is, apparently, absent. In connection with this, the heavy-axion model has been proposed /8/, which contains no contradiction with the experiments considered in Refs./6,7/. Here we will show that the contribution of the axion in this model to the anomalous magnetic moment of muon contradicts the experiment.

The Lagrangian in interaction between the axion and the muon has the form:

$$\mathcal{L} = 2^{1/4} G^{1/2} m_\mu \cdot Z \cdot \bar{\mu} i\gamma_5 \mu a \tag{1}$$

Here Z is related to the axion mass as follows:

$$m_a = 100 \cdot Z \text{ keV} \tag{2}$$

In the model under consideration there is the following limitation on the axion mass: $m_a \simeq 3 \div 40$ MeV. It is easy to see that the contribution of axion to the anomalous magnetic moment of muon has the following form:

$$a_\mu^a = \frac{-\sqrt{2}\, G Z^2 m_\mu^4}{8\pi^2} \int_0^1 dx \frac{x(1-x)^2}{[m_\mu^2 (1-x)^2 + m_a^2 x]} \tag{3}$$

With an account of the axion mass limitation, one gets from (3):

$$9 \cdot 10^{-7} \leq -a_\mu^a \leq 16 \cdot 10^{-5} \qquad (4)$$

The contribution from the other weak-interacting particles is $a_\mu^w \sim \frac{\sqrt{2} G m_\mu^2}{(4\pi)^2}$, i.e. much less than $-a_\mu^a$. However, as it follows from the experiment, the allowable contribution $a_\mu^a + a_\mu^w$ lies within the following limits /9/:

$$a_\mu^a + a_\mu^w \approx (-23.5 \pm 39.7) \cdot 10^{-9}$$

that contradicts eq.(4) explicitly.

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