ANOMALIES (SELECTED TOPICS)

V. I. Zakharov[1,*]

[1] *Institute for Theoretical and Experimental Physics, Moscow, Russia*

The presentation is intended to be mainly pedagogical and covers the chiral anomaly and its most significant applications. Finally, we comment on recent issues, related to the lattice measurements.

PACS numbers: 11.10.Ef, 11.15.Bt, 11.15.Ha

1. INTRODUCTION

For the purposes of this review, by anomalies one can understand violations of the Ehrenfest theorem according to which all matrix elements of the classical equations of motion (considered as operators) vanish. Thus, anomaly is established if we find, for example, a nonvanishing matrix element of the Dirac equation for a charged particle:

$$\langle\bar{\psi}(\hat{D}+im)\psi\rangle \neq 0, \tag{1}$$

where $\hat{D}=\gamma_\mu D_\mu$ and D_μ is the covariant derivative and m is the mass of the charged particle.

.....

* Electronic address: maxitg@icloud.com

АНОМАЛИИ (ИЗБРАННЫЕ ТЕМЫ)

В. И. Захаров

Данный обзор имеет образовательный характер и посвящен киральным аномалиям и их наиболее существенным приложениям. Также рассматриваются современные вопросы решеточных измерений.

Figure captions

Fig. 1. Anomalous triangle graph. Momenta q, k_1, k_2 are carried by the axial current a^5_μ and two photons, respectively. The triangle corresponds to a fermion of small mass m.

Fig. 2. Imaginary part of the anomalous triangle graph. The intermediate fermions are on mass shell. (The signs are the same as in Fig. 1)

Fig. 3. Three-body intermediate state in the imaginary part. (The signs are the same as in Fig. 1)

Fig. 4. Radiative correction to the two-body contribution to the imaginary part. (The signs are the same as in Fig. 1)

Fig. 5. Graphic representation of the Banks–Casher evaluation of the quark condensate $\langle \bar{q} q \rangle$. Dashed lines with crosses represent external (vacuum) gluonic fields.