UDC 539.123-539.12.01

Remarks to the Standard Theory of K^0, $\bar{K}^0$ Meson Oscillations. S-Strangeness and CP-Violation in Weak Interactions in System of K^0, $\bar{K}^0$ Mesons

Kh. M. Beshtoev

Institute of Applied Mathematics and Automation of KBSC of RAS
Nalchik, Kabardino-Balkarskaya Republic, Russia

Usually it is supposed that K^0, $\bar{K}^0$ meson oscillations are realized through K_S, K_L meson states. It is necessary to remark that K_S, K_L meson states are produced at CP violation in the weak interactions, besides these states are nonorthogonal states. Since K_S, K_L meson states are nonorthogonal states they cannot generate K^0, $\bar{K}^0$ meson oscillations. For this aim can be used only orthogonal states. In reality at strangeness — S violation K^0, $\bar{K}^0$ mesons are transformed into superpositions of orthogonal K_1^0, K_2^0 meson states. Then through these K_1^0, K_2^0 meson states there are realized oscillations of K^0, $\bar{K}^0$ mesons. Further K_1^0, K_2^0 states at CP violation are transformed into superpositions of K_S, K_L meson states and then arise interference of K_S, K_L meson states but not oscillations. This picture is well in agreement with experiments. So we come to conclusion: K^0, $\bar{K}^0$ meson oscillations are realized through K_1^0, K_2^0 mesons, but not through K_S, K_L.

Key words and phrases: mesons, weak interactions, oscillations, interference, strangeness, parity, violation, oscillations theory

1. Introduction

This work is devoted to the discussion of K^0, $\bar{K}^0$ meson oscillations.

K^0, $\bar{K}^0$ mesons are produced in strong interactions and their strangeness — S are $S_{K^0} = +1$, $S_{\bar{K}^0} = -1$, and they consist of s, d quarks; then $\bar{K}^0 = s\bar{d}$ and $K^0 = \bar{s}, d$. Since K^0, $\bar{K}^0$ consist of quarks that participate in weak interactions, then after their production there take place changes generated by weak interactions; there take place violation of strangeness — S and CP parity. Then, at violation of strangeness — S neutral K^0, $\bar{K}^0$ mesons are transformed into superposition of K_1^0, K_2^0 mesons:

$$K^0 = \frac{K_1^0 + K_2^0}{\sqrt{2}}, \quad \bar{K}^0 = \frac{K_1^0 - K_2^0}{\sqrt{2}}, \tag{1}$$

where K_1^0, K_2^0 mesons are eigenstates of the weak interaction that violates strangeness. Before the discovery of CP violation, it was assumed [1] that K^0, $\bar{K}^0$ meson oscillations arise though K_1^0, K_2^0 mesons. After the detection of CP violation [2,3] in literature [4,5], it was assumed that K^0, $\bar{K}^0$ meson oscillations go through K_S, K_L mesons — eigenstates of weak interactions violating CP parity. Then, it is necessary to assume that (below we will give a more detailed consideration of this issue)

$$K^0 \simeq \frac{K_S + K_L}{\sqrt{2}}, \quad \bar{K}^0 \simeq \frac{K_S - K_L}{\sqrt{2}}. \tag{2}$$

It is necessary to remark that in modern literature [4, 5] there is no mentioning of the existence of K_1^0, K_2^0 mesons. This issue demands a more detailed investigation.

Now lets proceed to the discussion of the following problem: how in reality there arise oscillations of K^0, $\bar{K}^0$ mesons?

Received 18th March, 2016.

2. The Theory of K^0, $\bar{K}^0$ meson oscillations

In the old theory of neutral K^0, $\bar{K}^0$ meson oscillations [6,7] constructed in the framework of Quantum Mechanics, it is assumed that:

1. K^0, $\bar{K}^0$ mesons are direct produced as superposition states of K_S, K_L meson states (see expr. (2)), i.e., $K^0 \cong \frac{1}{\sqrt{2}}(K_S + K_L)$ and $\bar{K}^0 \cong \frac{1}{\sqrt{2}}(K_S - K_L)$. This means that the K^0, $\bar{K}^0$ mesons have no definite mass, i.e. their masses may vary in dependence on the K_S, K_L mesons admixture in the $K^0, \bar{K}^0$ mesons states.
2. The mass eigenstates are K_S, K_L meson states, but not physical states of K^0, $\bar{K}^0$ mesons.
3. K^0, $\bar{K}^0$ meson oscillations are real (and indeed, K^0, $\bar{K}^0$ meson oscillations are real since masses of K^0 and $\bar{K}^0$ mesons are equal in agreement with CPT theorem [8]).

On the example of K^0, $\bar{K}^0$ mesons (eigenstates of the strong interactions), we can see that in duration of the time $10^{-21} sec$ (typical time of the strong interactions), the K_S, K_L mesons-eigenstates of the weak interactions at CP violation cannot be produced, since their typical time is 10^{-6}–10^{-8} sec. Besides, every particle must be produced on its mass shell and it will be left on its mass shell while passing through vacuum. It is clear that the above-considered picture has a defect and therefore calls for correction.

A statement that K^0, $\bar{K}^0$ mesons are direct produced as superposition of K_S, K_L mesons, leads to a conclusion that there is not necessity to take into account that K^0, $\bar{K}^0$ mesons have strangeness. Indeed, we have to proceed from the requirement that they have strangeness and they are transformed into superposition of K_1^0, K_2^0 mesons at violation of strangeness — S, i.e. $K^0 = \frac{1}{\sqrt{2}}(K_1^0 + K_2^0)$ and $\bar{K}^0 = \frac{1}{\sqrt{2}}(K_1^0 - K_2^0)$. In principle, we can assume that K^0, $\bar{K}^0$ mesons are transformed into superpositions of K_1^0, K_2^0 mesons; and then they are quickly transformed into superpositions of K_S, K_L mesons. But this process is a dynamic one, and CP violation is a very slow process; and then, there will arise a time delay (a gap) at CP violation, i.e., at generation of K_S, K_L states (see work [9]). Besides in [3,9] was shown that K_S, K_L states are nonorthogonal ones. Let us to consider it in more detail:

At the time of transition of K^0, $\bar{K}^0$ mesons in weak interactions into superpositions of K_1^0, K_2^0 mesons, there takes place strangeness — S violation. Then, obviously, K_1^0, K_2^0 mesons have no strangeness. In weak interactions there take place the following semi-leptonic decay of $K^0 \to \pi^- e^+ \nu_e$ and $\bar{K}^0 \to \pi^+ e^- \bar{\nu}_e$ mesons at strangeness — S violation. K_1^0 meson has CP parity $+1$, and main mode of its decay are $K_1^0 \to 2\pi$ mesons, while K_2^0 meson has CP parity -1 and main mode of its decay is $K_2^0 \to 3\pi$ mesons. It is necessary to remark that K_1^0, K_2^0 mesons also have semi-leptonic mode $\pi^- e^+ \nu_e$, $\pi^+ e^- \bar{\nu}_e$ decays, but since they are superpositions of $K^0, \bar{K}^0$ mesons, then their numbers are equal, and as stressed above, their strangeness equals to zero. In this case, there will arise oscillations [10]; and therefore, $K^0 \to \bar{K}^0$, $\bar{K}^0 \to K^0$ transitions will arise. Probabilities of such transitions are produced by the following expressions [7] (it is necessary to assume that K_1^0, K_2^0 meson states are quasistationary states until the time they will get transformed into superpositions of K_S, K_L mesons):

$$P(K^0 \to K^0) = P(\bar{K}^0 \to \bar{K}^0) = \frac{1}{4}\Big[e^{-\Gamma_1 t} + e^{-\Gamma_2 t} + 2e^{-\frac{(\Gamma_1+\Gamma_2)t}{2}} \cos\big((m_2 - m_1)t\big)\Big], \quad (3)$$

$$P(K^0 \to \bar{K}^0) = P(\bar{K}^0 \to K^0) = \frac{1}{4}\Big[e^{-\Gamma_1 t} + e^{-\Gamma_2 t} - 2e^{-\frac{(\Gamma_1+\Gamma_2)t}{2}} \cos\big((m_1 - m_2)t\big)\Big], \quad (4)$$

and expression for asymmetry is determined by the following formula:

$$A^{12}_{th}(t) = \frac{[P(K^0 \to K^0, t) + P(\bar{K}^0 \to \bar{K}^0, t)] - [P(K^0 \to \bar{K}^0, t) + P(\bar{K}^0 \to K^0, t)]}{[P(K^0 \to K^0, t) + P(\bar{K}^0 \to \bar{K}^0), t] + [P(K^0 \to \bar{K}^0) + P(\bar{K}^0 \to K^0, t)]} = \\ = \frac{2\cos[(m_2 - m_1)t]e^{-(\Gamma_1+\Gamma_2)t/2}}{e^{-\Gamma_1 t} + e^{-\Gamma_2 t}}. \quad (5)$$

If we are to substitute numerical value of parameters ($\Gamma_1/\Gamma_2 = 580$, $\Delta m_{12} = 0.533 \cdot 10^{-12}$ MeV, $t' = t\Gamma_1$) in this expression, then we obtain:

$$A^{12}_{th}(t) = \frac{2\cos[0.474t']e^{-0.5t'}}{e^{-t'} + e^{-0.00175t'}}. \quad (6)$$

Figure 1 gives experimental data obtained in work [5] together with the curve obtained by using expression (6). It is necessary to stress that these data were interpreted in [5] as K^0, $\bar{K}^0$ oscillations via K_S, K_L mesons. It is important to stress that these states are nonorthogonal states [3, 9] therefore they cannot be used for oscillations generation. For this aim can be used only orthogonal states (i.e., K^0_1, K^0_2 orthogonal states).

We see that expression (6) for asymmetry is well in agreement with experimental data. Also, it is necessary to remark that the work [5] has not taken into account that at CP violation there has to be present phase $\delta = 43.5°$. This phase has to be present if it is suggested that there are produced superposition states of K_S, K_L mesons (see [10]). In a case of strangeness violation this phase does not appear. From Figure 1 we can make a conclusion that K^0, $\bar{K}^0$ mesons oscillations come to an end in region $t' \geq (7-8)$ ($t' = \frac{t}{\tau_c}$, where $\tau_c = 0.892 \cdot 10^{-10}$ sec.). These K^0, $\bar{K}^0$ meson oscillations come to an end, since these oscillations are realized via K^0_1, K^0_2 meson states; but since K^0_1 mesons decay quickly, then they will be existent mainly in present long living K^0_2 mesons. Then, condition for K^0, $\bar{K}^0$ meson oscillations is not fulfilled [11].

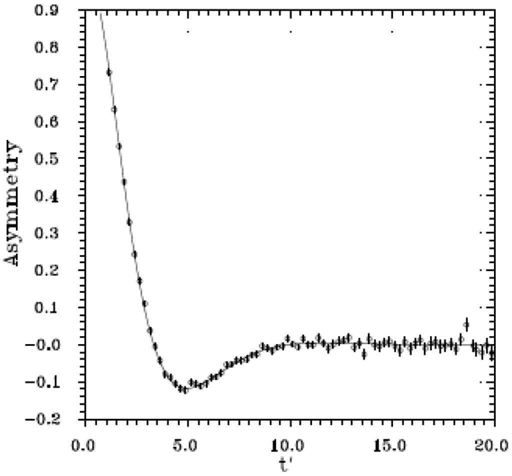

Figure 1. A curve obtained from expression (6) together with experimental data obtained in work [5].

Then, what will there arise in the system of K^0_1, K^0_2 mesons? Since weak interactions violate CP parity, then K^0_1, K^0_2 mesons will be transformed into superposition states of K_S, K_L mesons (eigenstates at CP violation). It is important to remark that K^0, $\bar{K}^0$ cannot be direct transformed into superpositions of K_S, K_L mesons since they appear only at CP violation but not at strangeness violation. Also, it is necessary to remark that weak interactions with CP violation are a slow process, and it becomes strongly apparent at $t' \geq (7\text{–}8)\tau_c$ (see below), i.e., only at $t' \geq (7\text{–}8)\tau_c$ the main part of K_1^0, K_2^0 mesons has time to be transformed into superposition of K_S, K_L mesons; although such superposition states start appearing direct after the ascent of K_1^0, K_2^0 meson states).

Then, K_1^0, K_2^0 mesons are transformed in the following superpositions of K_S, K_L mesons:

$$\begin{aligned} K_1^0 &= \frac{1}{\sqrt{1+\varepsilon^2}}(K_S + \varepsilon K_L), \\ K_2^0 &= \frac{1}{\sqrt{1+\varepsilon^2}}(K_L + \varepsilon K_S). \end{aligned} \tag{7}$$

where $\varepsilon = |\varepsilon| e^{-i\delta}$.

Now there emerges the following question: Do oscillations between K_1^0, K_2^0 meson states take place via K_S, K_L mesons, or there takes place only interference between these K_S, K_L states? The problem of oscillations existence at CP violation was consider in work [9] in detail (see also work [12]). There following conclusion was made: all existent experimental data on CP violation are well in agreement with theoretical calculations in the case when there takes place interference between K_S, K_L states, but not oscillations. It means that at CP violation oscillations do not arise and these states are not orthogonal states. As an illustration, we consider a figure and some expressions from work [9].

K_S, K_L meson states are stationary states, and then their expressions for time dependence are determined by the following formulas:

$$K_S(t) = e^{(-im_S - \Gamma_S/2)t} K_S(0), \quad K_L(t) = e^{(-im_L - \Gamma_L/2)t} K_L(0), \tag{8}$$

where Γ_S, Γ_L, m_S, m_L are widths of decays and masses of K_S, K_L mesons.

Expressions for probabilities of interference of K_S, K_L mesons is obtained by using (8) and (7) have the following form:

$$\begin{aligned} &P(K^0, K_1 \to K_1, t) \simeq \\ &\simeq \frac{1}{2}\Big[e^{(-\Gamma_S t)} + |\varepsilon|^2 e^{(-\Gamma_L t)} + 2|\varepsilon| e^{(\frac{1}{2}(\Gamma_S + \Gamma_l)t)} \cos\big((m_L - m_S)t - \delta\big)\Big], \end{aligned} \tag{9}$$

$$\begin{aligned} &P(\bar{K}^0, K_1 \to K_1, t) \simeq \\ &\simeq \frac{1}{2}\Big[e^{(-\Gamma_S t)} + |\varepsilon|^2 e^{(-\Gamma_L t)} - 2|\varepsilon| e^{(\frac{1}{2}(\Gamma_S + \Gamma_l)t)} \cos\big((m_L - m_S)t - \delta\big)\Big]. \end{aligned} \tag{10}$$

An expression for asymmetry $A_{th}(t)$ obtained by using expr. (9), (10) has the following form:

$$\begin{aligned} A_{th}(t) &= \frac{P(\bar{K}^0, K_1^0 \to K_1^0, t) - P(K^0, K_1^0 \to K_1^0, t)}{P(\bar{K}^0, K_1^0 \to K_1^0, t) + P(K^0, K_1^0 \to K_1^0, t)} = \\ &= -\frac{2\varepsilon \cos[(m_L - m_S)t - \delta] e^{-(\Gamma_S + \Gamma_L)t/2}}{e^{-\Gamma_S t} + \varepsilon^2 e^{-\Gamma_L t}}. \end{aligned} \tag{11}$$

If we substitute value parameters $\delta = 43.5°$, $\Gamma_S = \frac{1}{\tau_c}$, Γ_L, $\varepsilon = 2.23 \cdot 10^{-3}$, $\Delta m_{LS} \cong \Delta m_{12}$ in (11), then we obtain:

$$A_{th}(t') = -\frac{2 \cdot 0.00223[\cos(0.477t - 0.751)]e^{-t'(581/1160)}}{e^{-t'} + (0.00223)^2 e^{-t'/580}}. \qquad (12)$$

Figure 2 shows a curve line obtained by the use of expression (12) together with experimental data obtained in work [3].

The asymmetry $A_{th}(t')$ connected with CP violation become nonzero at $t' > (7–8)$, i.e., CP violation begins to be evident not direct at $t_c = 0$, but at $t' > (7–8)$; and asymmetry connected with strangeness — S violation appears at $t' = 0$: (7–8).

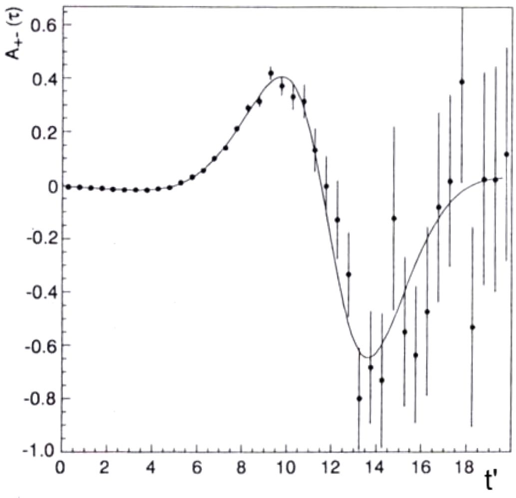

Figure 2. A curve line obtained by the use of expression (12) **together with experimental data obtained in work [3].**

Expression (12) is in agreement with experimental data obtained in [3] at CP violation. K_S, K_L meson states are stationary states (i.e., they have definite masses); further, since CPT is not violated, nothing will further arise.

Thus, from the above-considered experimental data we come to a conclusion that K^0, $\bar{K}^0$ mesons cannot be direct produced as superpositions of K_S, K_L mesons that are eigenstates at CP violation. If K^0, $\bar{K}^0$ mesons could be direct transformed into superpositions of nonorthogonal K_S, K_L meson states then there can arise only interference between K_S, K_L states but not K^0, $\bar{K}^0$ meson oscillations. Experiment [3] and calculation [9] has shown that at CP violation arises only interference but not oscillations.

As a matter of fact, K^0, $\bar{K}^0$ mesons have to be transformed into superpositions of K_1^0, K_2^0 mesons at violation of strangeness — S, and further there take place oscillations (it is important to remark that K_1^0, K_2^0 states are orthogonal quasistationary ones). Then K_1^0, K_2^0 mesons are transformed into superposition of K_S, K_L mesons; and then, there will take place interference between these states. Such picture is well in agreement with experimental data [3, 5]. As we see we cannot ignore K_1^0, K_2^0 meson states in the system of K^0, $\bar{K}^0$ mesons, and these two processes are realized at different time intervals.

We see that the idea that these both processes — oscillations and interference- can be realized only through K_S, K_L states, has no confirmation in the framework of the standard approach.

Therefore, we have to fulfill some adjustment to the theory of K^0, $\bar{K}^0$ oscillations. Following that, points 1–3 in the beginning of this section obtain the following form:

1. K^0, $\bar{K}^0$ mesons are produced in strong interactions, and at strangeness violation by weak interactions, they are transformed into superposition states of K_1^0, K_2^0 mesons (see expr. (1)); and K^0, $\bar{K}^0$ mesons are in their mass shell.
2. K_1^0, K_2^0 meson states are quasistationary states before CP violation, and they have definite masses.
3. K^0, $\bar{K}^0$ meson oscillations are real since masses of K^0 and $\bar{K}^0$ mesons are equal in agreement with CPT theorem [8].

3. Conclusion

In the standard theory of K^0, $\bar{K}^0$ meson oscillations, it is assumed that K^0, $\bar{K}^0$ mesons are direct produced as superpositions of K_S, K_L mesons (indeed, K_S, K_L mesons are produced in weak interactions at CP violation). Then, K^0, $\bar{K}^0$ meson oscillations have to be realized through these K_S, K_L mesons and then these mesons are stationary states. In reality in weak interactions takes place violation of strangeness — S and CP parity. Eigenstates at strangeness - S violation are K_1^0, K_2^0 orthogonal meson states, and eigenstates at CP violation are non orthogonal K_S, K_L meson states. At strangeness violation, primary K^0, $\bar{K}^0$ mesons are transformed into superposition of K_1^0, K_2^0 mesons; and then there arise K^0, $\bar{K}^0$ meson oscillations. The K_1^0, K_2^0 states are quasistationary states. Further at CP violation, K_1^0, K_2^0 states are transformed into superpositions of K_S, K_L mesons; then, interference between these K_S, K_L mesons states arises instead of oscillations. The K_S, K_L states are stationary states. This picture is well in agreement with experiment [3, 5]. We see that standard theory of K^0, $\bar{K}^0$ meson oscillations is not in agreement with the experimental data. Indeed, K^0, $\bar{K}^0$ oscillations go through K_1^0, K_2^0 states, but not through K_S, K_L states.

References

1. L. B. Okun, Leptons and Quarks, Nauka, Moscow, 1982, in Russian.
2. J. H. Christenson, et al., Evidence for the Decay of the K_2^0 Meson, Phys. Rev. Lett. 13 (1964) 138.
3. A. Aposotolakis, et al., A Determination of the $\eta_\pm$ Violation Parameter from the Decay of Strangeness-Tagged Neutral Kaons, Phys. Lett. B458 (1999) 545.
4. J. Beringer, et al., Phys Rev. D 86 (2012) 010001.
5. A. Angelopoulos, et al., Measurement of the K_S, K_L Mass Difference Using Semileptonic Decays of Tagged Neutrak Kaons, Phys. Letters B444 (1998) 38.
6. V. Gribov, B. M. Pontecorvo, Neutrino Astronomy and Lepton Charge, Phys. Lett. B 28 (1969) 493.
7. S. M. Bilenky, B. M. Pontecorvo, Lepton Mixing and Neutrino Oscillations, Phys. Rep. C41 (1978) 225.
8. S. S. Shweber, An Introduction to Relativistic Quantum Field Theory, Nauka, Moscow, 1963, in Russian.
9. K. M. Beshtoev, About Absence of Oscillations at CP Violation and Presence of Interference between K_S, K_L Meson States in the System of K^0, $\bar{K}^0$ Mesons, Physics of Particles and Nuclei Letters 13 (2016) 46.
10. K. M. Beshtoev, S. Dubnicha, A. Z. Dubnichkova, Are K_1^0, K_2^0 Real Particles or They are Some Theoretical Fiction, 16^{th} Small Triangle Meeting, Pticie, October 5-8 (2014).

11. K. M. Beshtoev, About K^0, $\bar{K}^0$ Meson Oscillations at Strangeness Violation by Weak Interactions without and with Taking into Account Meson Decays, UFNIn Russian, arXive:hep-ph/1303.1815v.1.
12. K. M. Beshtoev, About Absence of Oscillations at CP Violation and Presence of Interference between K_S, K_L Meson States in the System of K^0, $\bar{K}^0$ mesons, JINR Communication E2-2014-63ArXive:1401.5989v2 [hep-ph].

УДК 539.123-539.12.01

Замечания к стандартной теории осцилляции K^0, $\bar{K}^0$ мезонов. Нарушение странности — S и CP чётности в слабых взаимодействиях в системе K^0, $\bar{K}^0$ мезонов

Х. М. Бештоев

Научно-исследовательский институт прикладной математики и автоматизации
г. Нальчик, Кабардино-Балкарская республика, Россия

Обычно предполагается, что K^0, $\bar{K}^0$ мезонные осцилляции реализуются через K_S, K_L мезонные состояния. Нужно заметить, что K_S, K_L мезонные состояния возникают при нарушении CP чётности в слабых взаимодействиях, и кроме этого, эти состояния не являются ортогональными и поэтомуони не могут генерировать K^0, $\bar{K}^0$ мезонные осцилляции. На самом деле, при нарушении странности — S, K^0, $\bar{K}^0$ мезоны превращаются в суперпозиционные состояния ортогональных K^0_1, K^0_2 мезонных состояний, и далее через эти состояния возникают K^0, $\bar{K}^0$ осцилляции. В дальнейшем при CP нарушении K^0_1, K^0_2 мезоны превращаются в суперпозиционные состояния K_S, K_L мезонов, и далее возникает интерференция между этими K_S, K_L мезонными состояниями, но осцилляции при этом не возникают. Такая картина находится в хорошем согласии с экспериментом. Итак, приходим к заключению: осцилляции K^0, $\bar{K}^0$ мезонов реализуется через K^0_1, K^0_2 мезоны, а не через K_S, K_L мезоны.

Ключевые слова: мезоны, слабые взаимодействия, осцилляции, интерференция, странность, чётность, нарушение, теория осцилляции

Литература

1. *Окунь Л. Б.* Лептоны и кварки. — М.: Наука, 1982. — С. 77, 85.
2. *Christenson J. H. et al.* Evidence for the Decay of the K^0_2 Meson // Phys. Rev. Lett. — 1964. — Vol. 13. — P. 138.
3. *Aposotolakis A. et al.* A Determination of the $\eta_{\pm}$ Violation Parameter from the Decay of Strangeness-Tagged Neutral Kaons // Phys. Lett. — 1999. — Vol. B458. — P. 545.
4. *Beringer J. et al.* // Phys Rev. D. — 2012. — Vol. 86. — P. 010001.
5. *Angelopoulos A. et al.* Measurement of the K_S, K_L Mass Difference Using Semileptonic Decays of Tagged Neutrak Kaons // Phys. Lett. — 1998. — Vol. B444. — P. 38.
6. *Gribov V., Pontecorvo B. M.* Neutrino Astronomy and Lepton Charge // Phys. Lett. B. — 1969. — Vol. 28. — P. 493.
7. *Bilenky S. M., Pontecorvo B. M.* Lepton Mixing and Neutrino Oscillations // Phys. Rep. — 1978. — Vol. C41. — P. 225.
8. *Швебер С. С.* Введение в релятивистскую квантовую теорию поля. — М.: Наука, 1963.
9. *Beshtoev K. M.* About Absence of Oscillations at CP Violation and Presence of Interference Between K_S, K_L Meson States in the System of K^0, $\bar{K}^0$ Mesons // Physics of Particles and Nuclei Letters. — 2016. — Vol. 13. — P. 46.

10. *Beshtoev K. M., Dubnicha S., Dubnichkova A. Z.* Are K_1^0, K_2^0 Real Particles or They are Some Theoretical Fiction. — 2014. — 16^{th} Small Triangle Meeting, Pticie, October 5-8. 16^{th} Small Triangle Meeting, Pticie, October 5-8.
11. *Beshtoev K. M.* About K^0, $\bar{K}^0$ Meson Oscillations at Strangeness Violation by Weak Interactions without and with Taking into Account Meson Decays // УФН. — 2013.
12. *Beshtoev K. M.* About Absence of Oscillations at CP Violation and Presence of Interference between K_S, K_L Meson States in the System of K^0, $\bar{K}^0$ Mesons // JINR Communication E2-2014-63. — 2014. — ArXive:1401.5989v2 [hep-ph].