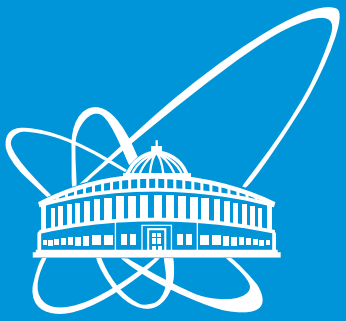

СООБЩЕНИЯ
ОБЪЕДИНЕННОГО
ИНСТИТУТА
ЯДЕРНЫХ
ИССЛЕДОВАНИЙ

Дубна

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Kh.M.Beshtoev

GREEN'S FUNCTION IN WEAK INTERACTIONS (IN MATTER) AND IMPOSSIBILITY OF REALIZING THE **MSW** EFFECT

2000

1 Introduction

In three different approaches-by using mass Lagrangian [1, 2], by using Dirac equation [3, 2], and using the operator formalism [4]- I discussed the problem of the mass generation in the standard weak interactions. The result was- the standard weak interaction cannot generate masses of fermions since the right components of fermions do not participate in these interactions. Then using this result in works [4] I have shown that the effect of resonance enhancement of neutrino oscillations in matter must not exist.

At present a number of works was published (see [5] and references there) where by using the Green's function method it was obtained that the weak interactions can generate the resonance enhancement of neutrino oscillations in matter (it means that the weak interaction can generate masses). As we see below this result is a consequence of using weak interactions interaction term $H_{\mu}^{int} = V_{\mu}\frac{1}{2}(1-\gamma_5)$ in inncorrect manner and in result they obtained that right components of the fermions participate in weak interactions.

Let us consider the equation for Green's function of fermions taking into account the standard weak interactions.

2 Equation for Green's Function in Weak Interactions

The Green's function method is frequently used for taking into account electromagnetic interactions and strong interactions (chromodynamics) effects [6]. The equation for Green's function has the following form:

$$[\gamma^{\mu}(i\partial_{\mu} - V_{\mu}) - M]G(x,y) = \delta^4(x-y), \qquad (1)$$

where V_μ characterizes electromagnetic or strong interactions and

$$iG(x,y) =< T\Psi(x)\bar{\Psi}(y) >_o .$$

It is necessary to mention that the Green's function method is a very convenient method for studying the electromagnetic and strong interaction effects since these interactions are left-right side symmetric interactions.

At present a number of works was published where Green's function was used for taking into account the weak interaction. There was shown that the weak interaction can generate masses, i.e. masses of fermions are changed in the weak interactions and then the resonance enhancement of neutrino oscillations appears in matter [5]. In this work we want to show that this result is a consequence of incorrect using a specific feature of the standard weak interactions, namely, that the right components of fermions do not participate in these interactions (i.e. $\Psi_R = \bar{\Psi}_R \equiv 0$).

Usually the equation for Green's function for fermion (neutrino) with weak interactions is taken in the following form:

$$[\gamma^\mu(i\partial_\mu - V_\mu) - M]G(x,y) = \delta^4(x-y), \tag{2}$$

where V_μ is

$$V_\mu = V_\mu \frac{1}{2}(1-\gamma_5) = V_\mu P_L. \tag{3}$$

It is supposed that the term (3) in Eq.(2) reproduces a specific feature of the weak interactions

$$V_\mu G(x,y) \to V_\mu \frac{1}{4}(1-\gamma_5)^2 T(\Psi(x)\bar{\Psi}(y)) = V_\mu T(\Psi_L(x)\bar{\Psi}_R(y)).$$

However, this operation is not correct since it does not reproduce the standard weak interaction. We see that, if we use directly the specific feature of these interactions, then the equation for Green's function we

must rewrite in the form

$$[\gamma^{\mu}(i\partial_{\mu} - V_{\mu}\left[\begin{array}{c}\Psi_R = 0\\ \bar{\Psi}_R = 0\end{array}\right]) - M]G(x,y) = \delta^4(x-y). \qquad (4)$$

Then the interaction term in Eq.(4) is

$$V_{\mu}\left[\begin{array}{c}\Psi_R = 0\\ \bar{\Psi}_R = 0\end{array}\right] T(\Psi_l\bar{\Psi}_R(\bar{\Psi}_R = 0) + (\Psi_R = 0)\Psi_R\bar{\Psi}_L) = V_{\mu}0 \equiv 0, \qquad (5)$$

and then Eq.(4) is transformed in the following equation:

$$[\gamma^{\mu}(i\partial_{\mu}) - M]G(x,y) = \delta^4(x-y), \qquad (6)$$

which coincides with the equation for free Green's function (i.e. equation without interactions). So, we see that the equation for Green's function with weak interactions (in matter) coincides with the equation for Green's function in vacuum.

3 Impossibility to Realize the Mechanism of Resonance Enhancement of Neutrino Oscillations in Matter

In the previous part we have obtained that the equation for Green's function of fermions with weak interactions has the form (6). It is a consequence of the fact that the right components of fermions (neutrinos) do not participate in the weak interactions. It means that the weak interaction cannot generate masses (see also works [1-4]) and, correspondingly, the weak interactions do not give a deposit to effective masses of fermions (neutrinos) therefore, the mixing angle cannot be changed in weak interactions (in matter) and it coincides with mixing angle in vacuum. Hence, the mechanism of resonance enhancement of neutrino oscillations in matter (MSW effect) cannot exist.

Probably, the same result takes place for renormcharge $Q^2(t)$ (where t is a transfer momentum in square) of the weak interactions [7], i.e. renormcharge $Q^2(t)$ in the weak interactions does not change and $Q^2(t) = const$ differs from renormcharges $e^2(t), g^2(t)$ of the electromagnetic and strong interactions [8].

1 Conclusion

It was shown that the equation for Green's function of fermions (neutrinos) with weak interactions (i.e. in matter) coincides with the equation for Green's function of fermions in vacuum. This result is a consequence of the fact that the right components of fermions do not participate in weak interactions. In result we have come to a conclusion: the mechanism of resonance enhancement of neutrino oscillations in matter (i.e. MSW effect) cannot exist.

In conclusion we would like to stress that in the experimental data from [7] there is no visible change in the spectrum of the B^8 Sun neutrinos. The measured spectrum of neutrinos lies lower than the computed spectrum of the B^8 neutrinos [8]. In the case of realization of the resonance enhancement mechanism this spectrum must be distorted. Also, the day-night effect on neutrinos regeneration in bulk of the Earth keeps within the mistakes [9], i.e. it is not observed.

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Бештоев Х.М. E2-2000-30
Функция Грина в слабых взаимодействиях (в веществе)
и невозможность реализации MSW-эффекта

Показано, что уравнение для функции Грина фермионов (нейтрино) со слабым взаимодействием в веществе совпадает с уравнением для функции Грина фермионов без взаимодействия, т.е. в вакууме. Это является следствием того факта, что правые компоненты фермионов не участвуют в слабых взаимодействиях. В результате мы приходим к заключению: механизм резонансного усиления осцилляции нейтрино в веществе (т.е. MSW-эффект) не может существовать.

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Beshtoev Kh.M. E2-2000-30
Green's Function in Weak Interactions (in Matter)
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It is shown that the equation for Green's function of fermions (neutrinos) with weak interactions in matter coincides with the equation for Green's function of fermions in vacuum. This result is a consequence of the fact that the right components of fermions do not participate in weak interactions. As a result we come to a conclusion: the mechanism of resonance enhancement of neutrino oscillations in matter (i.e. MSW effect) cannot exist.

The investigation has been performed at the Laboratory of Particle Physics, JINR.

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