An inherent contradiction of the electroweak theory is briefly presented below. A fundamental principle used herein is the correspondence between QFT and quantum mechanics. S. Weinberg has used the following words for describing this principle: "First, some good news: quantum field theory is based on the same quantum mechanics that was invented by Schroedinger, Heisenberg, Pauli, Born, and others in 1925-26, and has been used ever since in atomic, molecular, nuclear and condensed matter physics" (see [1], p. 49). This principle can also be found in pp. 1-6 of [2]. Hereafter, this relationship is called "Weinberg correspondence principle".

The following review article states "that neutrinos can no longer be considered as massless particles" (see [3], p. 1307). It means that the neutrino is an ordinary massive Dirac particle which is described by a 4-component spinor. (The argument also applies to a Majorana neutrino.) In the following lines it is proved that this property of the neutrino is inconsistent with expressions that have the factor $(1 \pm \gamma^5)$, which is an element of the electroweak theory (see [4], p. 308). Let us examine the following expression

$$[\bar{\psi}_e O(1 \pm \gamma^5)\psi_\nu]. \tag{1}$$

Here O represents an appropriate operator which operates on ψ_ν. It turns out that this expression does not hold for a massive Dirac neutrino. Indeed, operating with $(1 \pm \gamma^5)$ on a motionless spin-up Dirac spinor, one obtains

$$\begin{pmatrix} 1 & 0 & \pm 1 & 0 \\ 0 & 1 & 0 & \pm 1 \\ \pm 1 & 0 & 1 & 0 \\ 0 & \pm 1 & 0 & 1 \end{pmatrix} \begin{pmatrix} 1 \\ 0 \\ 0 \\ 0 \end{pmatrix} = \begin{pmatrix} 1 \\ 0 \\ \pm 1 \\ 0 \end{pmatrix}. \tag{2}$$

Here the γ matrices notation is that of [5], p. 17. For the simplicity of the notation, the factor which depends on space-time is removed from (2).

The right hand side of (2) is a Dirac spinor that has an infinite energy-momentum (see [5], p. 30). It means that the operator $(1 \pm \gamma^5)$ casts a motionless Dirac particle

into an unphysical state. Furthermore, products of two γ matrices are used for a boost of a Dirac particle (see [5], p. 21). Hence, $(1 \pm \gamma^5)$ commutes with the boost operator. For this reason, the operator $(1 \pm \gamma^5)$ casts *any* Dirac spinor into the unphysical state of an infinite energy-momentum. Certainly, this unphysical quantum state is not included in a Hilbert space. Hence, the required matrix elements cannot be calculated. This is an example showing that the factor $(1 \pm \gamma^5)$ is inconsistent with the Weinberg correspondence principle because a Hilbert space is a fundamental element of quantum mechanics (see [1], p. 49).

The factor $(1 \pm \gamma^5)$ is used for adapting the Standard Model to the experimentally proved $\mathbf{V} - \mathbf{A}$ property of the neutrino's weak interactions (see [6], pp. 217-220). The contradiction obtained above indicates that the Standard Model is inconsistent with the $\mathbf{V} - \mathbf{A}$ property of the neutrino's weak interactions.

References

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