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New View of Neutrino Nature

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Abstract

Within the 80 years that have passed since the neutrino hypothesis was formulated the existence of the macroscopic medium with the vacuum properties has been established. This allows us to suppose that the neutrino's weak interaction with the particles of our common world is due to their different nature. They are excitations of this very new medium and do not belong to our world.

The neutrinos are similar to the photons that are particles of the electromagnetic field in our world, the world that has the charged particles. Meanwhile, there are no particles in the vacuum, and it seems to us that they disappear from our world and the law of conservation of energy fails to operate. There is nothing unusual here. No "perpetuum mobile" can be realized from such "breach" of the law of conservation of energy in our world consisting of the particles and electromagnetic fields.

Introduction

This work is a continuation of the [1] that substantiates the hypothesis of the source of luminosity of the Sun, first expressed by L.D. Landau in 1932 [2]. The mechanism of apparition, on the Sun, of the photons, as if out of nothing, was first considered by S. Hawking in [3], by the example of the luminosity of the black holes. Now we can deal, in more detail, with the nature of the neutrino, the more so, that these topics are closely interrelated.

A.P. Grinberg wrote, in 1944, in [4]: One can hardly call another hypothesis that has such a peculiar place in the science as that of the existence of the neutrino. Without this hypothesis, one would have had to accept that at the β-decay the energy is lost without a trace and the law of conservation of energy is infringed. The physicists have, since the times of Lomonosov, been accustomed to that the law of conservation of energy is always fulfilled. As of today, this has become one-O-one wrong. The general theory of relativity (GTR) all of whose prognoses as of the existence of the qualitatively new, unknown, phenomena, that have all the time proved true in experiments, has no absolute time. In the GTR, the time is local; hence, it has no energy conservation law in the usual for us form. The law of conservation of energy does not exist in the micro world, either, due to the principle of uncertainty.

Thus, having encountered the new physical phenomenon, Pauli, and, after him, all the other physicists, began using it to explain the already existing concepts and notions. All this seemed quite natural. But, already in the next century, it became clear that the main lesson of the previous century consisted in that we must not spread our concepts of the world coming from everyday life on the sizes both much smaller and much greater than our environment. The time has shown that the world, the Universe, can significantly differ from our environment. Such new experimentally proven phenomenon is, today, the dark energy.

The Dark Energy

This work reports in a professional manner the forecast and the experimental discovery of the vacuum-like state of substance. This is the vacuum, uniformly distributed in the volume of the Universe. There are no vacuum condensations in the vicinities of stars, galaxies, and their clusters. Its mass forms 74% of the whole mass of the Universe. Other 22% of the mass of the Universe consists of the dark matter. In contrast to the dark energy, the dark matter consists of the particles of unknown nature, interacting with our world only via gravity. The dark matter forms halos around galaxies. No particles of the dark energy have been experimentally detected, yet; it seems they will be never detected, at all. The dark energy should, just as the neutrino, be considered a perturbation of the same vacuum-like medium. This means that 96% of the mass of the Universe consist of the vacuum and its perturbations, while only 4% of the mass of the Universe consist of the particles and electromagnetic field. This small share is what we deal with, supposing that the regularities we have revealed will for some reason be true for the remaining part of the Universe, as well.

We do not know the nature of the vacuum perturbations. We do not know the nature of the photons, either. For the one hand, a photon is a particle that appears when a system passes from one level of energy to another, lower, one. And when a photon meets an obstacle, a slot, it looks already like a wave. The photons appear at the accelerated movement of the charges, as well, while the acceleration is connected to the emergence of a gravitational field. A photon moving in a gravitational field changes its energy, depending on the direction and duration of the movement in a field of gravity. Generally speaking, we do not know whether the photon is a wave, particle, or even a third thing.

Meanwhile, the apparition of the neutrino is tightly connected with the apparition or disparition of the charges. As of the charge, we do not, in effect, know its nature, up to today. All we know is that the neutrino interacts with our particles quite weakly. And here we go [5,6].

Weak Interaction of Neutrino

In the dealing with the fundamental interactions, it is said that even if a neutrino takes part in an interaction, such interaction is weak [7]. Based on the assumptions on the neutrino's nature developed here, it seems all natural. The neutrino does not belong to our world; hence, its interactions with the particles of our world are weak. It describes the β-decay. The weak interaction carriers are the $W^{\pm}$ and Z^0 bosons with the approximate mass of 90 GeV. The constant of its interaction is of the order of 10^{-5}, while the constants of the electromagnetic interaction, equals, for comparison 1/137. The distance by which a neutrino must approach a common particle is of the order of 10^{-15} cm. This is almost 100-fold smaller than the size of the electron.

Indeed, as of today, we have the theory of weak interaction, but it is of the purely phenomenological character, and cannot serve as proof of anything when it comes to the nature of the neutrino. This resembles the mathematical description of the Sun's rotation around the Earth. In due time, an apparatus for such description was needed and was created. As of today, nobody recalls it.

The cross-section of the neutrino's interaction with the particles of our world is so small that on the Earth there's no possibility to shelter from them even beneath the whole mass of the Earth. Hence, the experiments where the chlorine in a mine shaft serves to detect neutrinos seem somehow strange. A neutrino acts on the chlorine nucleus, be it in a salt cellar, on a table, or deep underground.

For a neutrino whose energy is about 10 MeV, its interaction with an electron is possible to detect. In such event, the energy of the electron will be sufficient to form, when moving in a medium, the Cherenkov radiation cone. The direction of this cone's axis in an instrument lets us determine where the neutrino colliding with the electron has come from. It has turned out [8] that about 90% of all the recorded neutrinos come uniformly, from all directions. Before, it was thought, without any grounds, that all the neutrinos came from the Sun.

What has not been Observed

It has been established that 90% of the neutrino flux comes to the Earth uniformly, from all directions. Their origin is, apparently, not solar. Although, this relates, yet, to the about 10 MeV energy neutrinos. Nevertheless, most probably, the distribution of the lowest energy neutrinos does not differ very much. About 60 years ago, the possibility to detect the relict sea of the lower than 0,1 MeV neutrinos. They hoped that would be a discovery of the century. However, a hundred years later, there is still no discovery. It is still unclear, how many neutrinos are of such low energy and what is their origin. No one knows how to detect them, either.

Conclusion

So, up to now, we have studied only a not so large part of the Universe, consisting of the particles and electromagnetic fields, while the best part of it is occupied by the vacuum.

It has no particles. Maybe, it has no time, nor any, known to us, physical laws. In fact, this is what was before the Big Bang. As of today, we are learning this observing the quantum fluctuations of the vacuum that occur in our world near the boundary between our world and the vacuum. In our world we observe the disparition or apparition of the particles and perturbation as if from nothing.

The neutrino was proposed to save the law of conservation of energy. And the interactions became weak, due, largely, to the hypothesis on the existence of the neutrinos. Indeed, they may be described as particles but we do not know whether they really are the ones or this is just a formalism fit to describe them. Meanwhile, in effect, they are the vacuum excitations as supposed here. Only the quantum theory of gravity can give answer to this question. But this theory is still inexistent. Lately, the loop theory of gravity has emerged [9]. It differs from the common physical theories and even tries to answer the question of what was there before the Big Bang. This is a new page in the theoretical physics.

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