The International Journal of Engineering and Science (IJES)
|| Volume || 7 || Issue || 3 Ver. I || Pages || PP 53-60 || 2018 ||
ISSN (e): 2319 – 1813 ISSN (p): 23-19 – 1805

Fall of Parity in Weak Interactions in the Light of New Physical Theories

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----------***ABSTRACT***----------
The laws of conservation are the most essential laws of physics. They are universal, strong and unshakable in space and time and are fulfilled always and everywhere. However in 1956 happened a wreck one of these laws. It was the law of conservation of parity for weak interactions. At first American scientists Lee Czun-dao and Yang Chzhen-nin proved theoretically that this law for weak interactions was not fulfilled. Then professor Wu Czyan-syun whith collaborators in Columbian University got the first experimental evidence of fall parity for weak interactions in β-disintegration of radioactive Cobalt-60. Physics outlived shock caused by the wreck one law of conservation. However arising up here questions (question about deep asymmetry of the world; how and why does nature distinguish right and left just in weak interactions; why electrons in the experiment of Mrs.Wu are distributed asymmetric) remain without an answer to the present times. First in this work it is showed that these incomprehensible phenomena and facts can find explanation from positions of new physical theories: Torsion Fields Theory of A. Akimov and Physical Vacuum Theory of G. Shipov.
KEYWORDS – *Conservation, law, parity, spin, torsion..*

Date of Submission: 10-03-2018 Date of acceptance: 26-03-2018

I. INTRODUCTION

The most essential laws of modern physics are the laws of conservation which are closely related to general properties of space and time. So for example the impulse conservation law is a consequence of space homogeneity, and the law of conservation of moment-of-momentum is a consequence of isotropic space. The energy conservation law follows from homogeneity of time [1, 2]. Except for the indicated properties there is another very important property. It is the symmetry of our space in relation to right and left.

It means that if simultaneously to change all directions in space on straight opposite, i.e. if to reflect space in a mirror and with the same to translate the right system of coordinates in left (Fig. 1) the physical laws will not change here. It is named the invariance of natural laws in relation to the inversion of coordinates. It follows from this that the right and left systems of coordinates are equivalent at description of natural laws. Expressed in ordinary language in may be said: that is reflected in a mirror is permitted by natural laws. For example, if to reflect some device in a mirror and then to make this "mirror device" the physical processes in both devices will follow on the same laws of physics [3 – 8]. From symmetry of space in relation to right and left another important law of quantum mechanics follows. It is the parity conservation law. It consists in the following.

Basis of mathematical apparatus of quantum mechanics is made with assertion that the state of the physical system or separate particle is characterized by some complex function which is named either wave or psi-function or amplitude of probability. At the inversion of coordinates (at a mirror reflection) can be realized only two states of the system. First: psi-function remains unchanging.

$$\psi(-x_1, -y_1, -z_1; -x_2, -y_2, -z_2; ...) = \psi(x_1, y_1, z_1; x_2, y_2, z_2; \ldots)$$

Second: psi-function changes its sign on opposite.

$$\psi(-x_1, -y_1, -z_1; -x_2, -y_2, -z_2; \ldots) = -\psi(x_1, y_1, z_1; x_2, y_2, z_2; \ldots)$$

In first case psi-function is even and the state of the system which is described by it is even. In second case psi-function is odd and the state of the system is also odd. This characteristic, parity of system, remain unchanging in the time. This is the parity conservation law: if the state of closed system possesses certain parity this parity is saved in the processes of physical transformations.

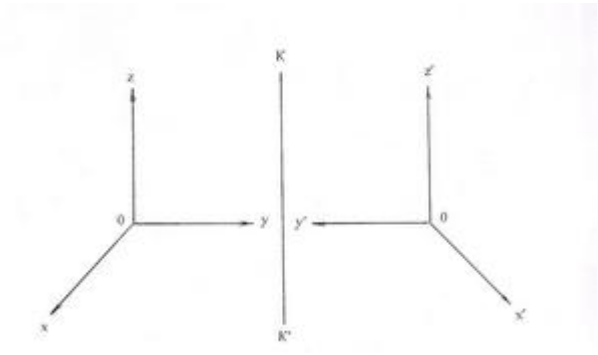

Fig.1 Inversion of coordinate KK̃ - mirror

In spite of the fact that nature is in a state of permanent development the laws of conservation remain universal and solid in space and time and building of modern physics reposes on them.

II. EXPERIMENTAL EVIDENCES OF FALL PARITY

In 50th of the last century was found out the row of experiments related to weak interactions in which the parity conservation law was violated. The most known of them are the experiments on study of disintegration of K-mesons which in one case disintegrate on three π-meson (τ-disintegration), in other case – on two π-meson (θ-disintegration). This phenomenon was got the well-known name "Enigma of "tau – teta" [3, 8, 9 – 11]. Such disintegration conflicted with the parity conservation law which was absolutely observed during a few ten of years for all other types of physical interactions: strong, electromagnetic, gravity. It put physics in a very difficult situation. Fs a law of the parity conservation is consequence of space symmetry in relation to right and left, it turned out that space was asymmetrical and differed from its mirror image. But it was hardness to trust in it. Beside was impossible to understand why is parity saved in other interactions. The attempts were made to decide this task as follows.

In 1956 the American scientists Lee Czun-dao and Yang Chzhen-nin researched this situation and came to the conclusion that in reality nobody ever proved the parity conversion law for weak interactions. This law was simply approximated on weak interactions because there were not reasons to suppose the presence of right-left asymmetry of space or separate particles [1, 12 – 14]. Moreover Yang and Lee offered the row of experiments which would be able to answer a question: how do weak interactions distinguish right and left? There are the experiments touching disintegrations of mesons, hyperons and radioactive Cobalt-60. They were carried in many laboratories of the world. All of them confirmed the hypothesis of Yang and Lee [9, 12 – 14]. However decide experiment was an experiment with Cobalt-60 executed in the Colombian University (USA) under the direction of Professor Wu Czyan-syun [9]. We will consider it in more detail.

III. EXPERIMENT WITH COBALT-60

A radioactive disintegration was studied in this experiment. As a β-active substance was taken radioactive Cobalt-60 which emits β-particles (electrons) and antineutrino growing into Nikel-60.

$$Co^{60} \rightarrow Ni^{60} + e^{-} + \tilde{\nu}$$

The spins of cobalt nucleus were oriented one-way by a magnet. A sample was preliminary cooled to the temperature -273,1°C to decrease intensity of thermo-motion of atoms which hinders the orienting action of magnetic field. After was studied the angular distributing of electrons in the direction of magnetic field (in the direction of cobalt nucleus spin) and in opposite direction.

An idea consisted in the following. If parity is saved the angular distributing of electrons will be identical, i.e. the identical amount of electrons will fly out in various direction (on the field and against the field). If parity is not saved the different amount of electrons will fly out in direction of spin and in opposite direction. Therefore asymmetry of the angular distributing of electrons would be evidence of non-conservation of parity.

This experiment was also executed at the mirror reflection of coordinates. "Mirror reflection device" was made by the change of current direction on the reverse direction in the solenoid spool that resulted in the change North Pole on South Pole of magnet. There was the analogical asymmetrical distributing of electrons ithe "mirror device" [9, 14].

Frequent experiments showed that in direction opposite the nucleus spin the more amount of electrons fly out in the spin coincident direction (Fig 2).

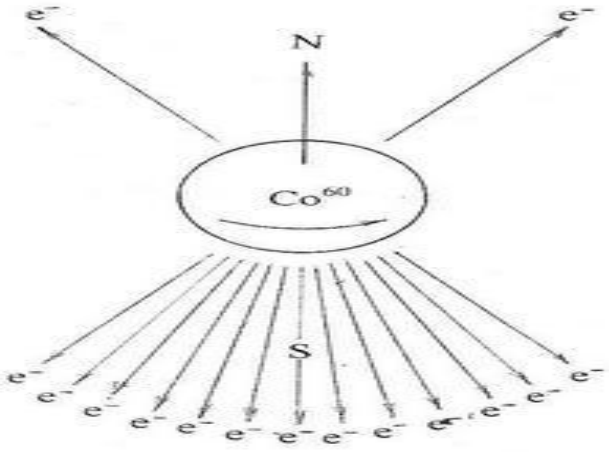

Fig.2. Oriented on the spins nucleus of Cobalt-60

N – North Pole of magnet and direction of nucleus spins
S – South Pole of magnet

This experience was repeated in many other laboratories in the world and the same result was got. Parity was not also saved in experiments with mesons and hyperons. Discovery of fall parity in weak interactions resulted in a difficult situation. The questions appeared on which physics could not find answers. We formulate them in a final kind.

1. What is the origin of the world asymmetry at the inversion of coordinates?
2. What is a reason of non-equality of flight out of electrons at β-disintegration?
3. Why is left-right asymmetry only in weak interaction and is not in all other(strong, electromagnetic, gravity)?

IV. SEARCHES FOR ANSWER TO THE PUT QUESTION

Foremost searches were directed on the exposure of reasons defiant violation of parity in weak interactions. There were only two reasons of this strange phenomenon.

The non-conservation of parity can be conditioned by space properties, i.e. space (not filled a matter) must differ with mirror reflection. In 60^{th} the model of such space was even offered with internal left-right asymmetry [8]. Such space possessed twisting and internal spirals, i.e. in every point there was a screw with right or with the left screw-thread. But then it was impossible to trust in it because space was considered homogeneous and the impulse conservation law ensured from it.

Other possible reason contacted with internal asymmetry of elementary particles [9, 15]. Essence of it consisted in that: in weak interactions the "combined inversion" took place. It meant that at inversion not only sings of coordinates changed on reverse but also particles changed on anti-particles. However by further experiments it was showed that it was not symmetry between particles and anti-particles. So the combined inversion did not rescue the parity conversion law for weak interactions.

A model in which for the violation of parity the hypothetical neutral heavy ($m > 5$ GeV) α-particles were responsible was also examined [16]. But these α-particles were not found.

There was a period when physicists again applied to the idea of Lee and Yang about "mirror particles" and "mirror matter" [9, 17]. Many attempts were done to find out them but while they had not success.

It should be noted that the quantum theory of the field explain this phenomenon very simply on the basis of Lagranzhian of weak interactions which consists of two elements: scalar and pseudo-scalar [18]. It is known that a scalar is even and pseudo-scalar is odd. Interference of the spin-states of these elements (scalar and pseudo-scalar) gives the looked after mirror-asymmetric effects. However the physical sense of these effects remains not clear.

Thus it is necessary to acknowledge the main questions of this problem remain opened today.

V. NEW PHYSICAL THEORIES AND ANSWERS FOR THE PUT QUESTIONS

5.1. Essence of new physical theories

At one time some scientists specified on that in the future possibly new theories will appear and they will be able to explain this phenomenon and with the same to remain symmetry of natural laws an spatial reflection [11, 19, 20]. In our view just the same theories are Theory of Physical Vacuum of G. Shipov [21, 22]

and Theory of Torsion Fields of A. Akimov [22 -24]. They cardinally changed our pictures of the world. In opinion of many scientists these theories make the new scientific paradigm of XXI century. Extraordinary in these theories is that they entered in Physics a new kind of interaction, fifth force, long-distance Torsion Field or Spin Field. Theory of physical vacuum proves that surrounding reality is a seven levels hierarchy of different forms of matter existence (Fig. 3).

VII	Absolute Nothing
VI	Primary Torsion Field
V	Physical Vacuum
IV	Plasma
III	Gas
II	Liquid
I	Solid

Fig.3. Seven levels of reality

First four levels are material states of matter. Further the field forms of matter follows. On the highest levels of reality our space has no physical description incident to the matter. Mass and charge absent there. There are only quantum whirls. Due to interaction of whirls information is passed. The information conservation law takes place here: the number of right whirls is equal to the number of the left whirls [21].

$$^{+}\Omega_{jk}^{\ i} = {}^{-}\Omega_{jk}^{\ i} \quad \text{or} \quad {}^{+}\Omega_{jk}^{\ i} + {}^{-}\Omega_{jk}^{\ i}$$

5.2. Fiton model of physical space of A. Akimov

Space is evident demonstrated with fiton model of Akimov [23, 24]. According to this model (Fig. 4)

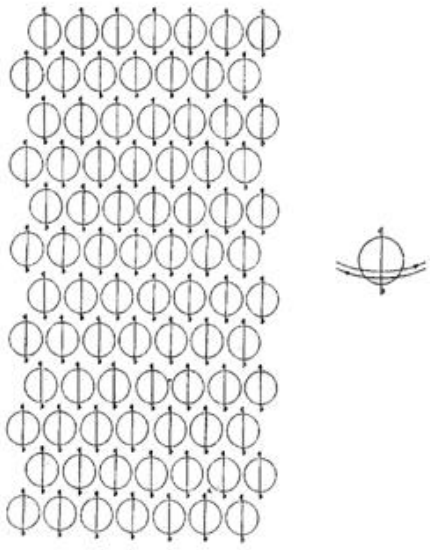

Fig.4. Fiton structure of Physical Vacuum. On the right the structure of separate fiton is shown

a physical vacuum consists not simply of quantum whirls but from separate elements – fitons. Every fiton consists of two whirls: with the left and right spin. By this picture we can easy image that at mirror reflection (at inversion of coordinates) such space does not pass to itself, as in every fiton right spin becomes left and left spin becomes right. And the width of Penrous' standart is opened out on 180°. Thus we get space which is represented on the picture 5b. This space is asymmetrical initial space (Fig. 5a).

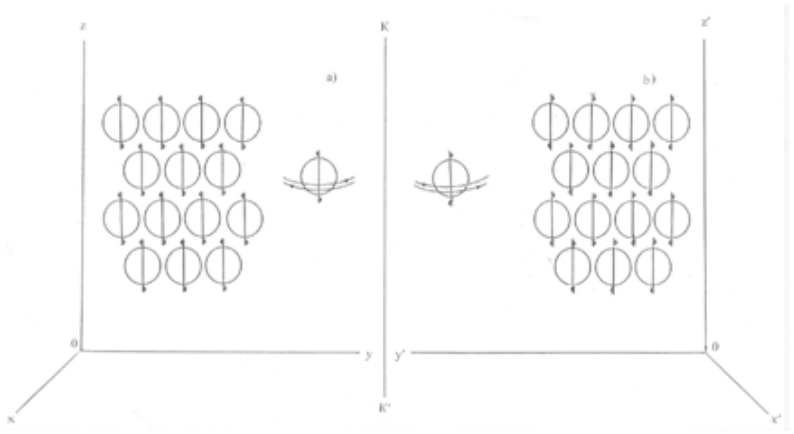

Fig. 5. Structure of space at inversion of coordinates
a) the initial state; b) the mirror state

From here it follows out that at inversion of coordinates it is necessary simultaneously to change not only the spins of particles but also spins of fitons of physical vacuum. Only then such "mirror" system of coordinate will be indeed equal in rights and equivalent for the real system of coordinates. It means if we reflected some real device in a mirror and then on this reflection as according to plan we made a "mirror" device it is not all yet. In order to this "mirror" device was equivalent to the real device we must else place it in "mirror" space (Fig. 4b). Only then all physical processes will flow in both devices (real and "mirror") on the same laws and parity of the physical system state will not be violated.

And here we got answer to the first question: the world asymmetry is laid in twisting and internal spirals of itself space.

5.3. Torsion fields and their properties

Further we will consider experiment with radioactive Cobalt-60. However at the beginning we will short consider some positions of theory of torsion fields.

The source of the torsion field is a classic spin or quantum analog of angular moment of rotation. In macrocosm the source of the torsion fields are rotating masses.

In the surroundings of spinning object the torsion field is distributed as two spatial cones with right and left polarization. Thus the torsion field has axial symmetry unlike the electromagnetic and gravitational fields having central symmetry (Fig.6).

The torsion field is quantum whirls of space-time. It carries information without a transfer of energy. Therefore it yet named the informative field or by the field of consciousness.

The torsion fields are right and left depending on direction of spin. They possess highest penetrable ability. Speed of distribution of the torsion fields is equal endlessness.

Unlike electromagnetism the law of similarity operates in the torsion fields: of the some name charges (parallel spins) attract and the opposite charges (anti parallel spins) push off.

The torsion fields possess "memory". This memory is an exactly orientation of spins.

An object sensible to the action of the torsion field is a spin system.

All matters of Nature have the own individual torsion field. Superposition of torsion fields created by the atomic and nuclear spins of every molecule determinates the torsion field in the space around this molecule.

The spatial-frequency structure of the torsion fields is determined chemical compositions of molecules and their spatial configurations.

Complication and stability of spatial-frequency structure of the torsion fields is major condition for the carriers of information.

In the light of these positions we will consider experiment of Mrs. Wu.

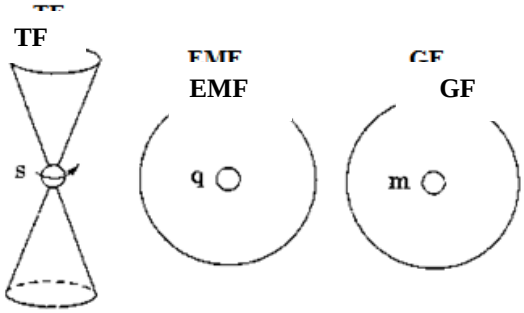

Fig.6. Structures of torsion, electromagnetic and gravity fields

5.4. Explanation of experiment with Cobalt-60

This experiment is explained on the basis of two features of torsion fields. First feature is the law of similarity: objects with parallel spins attract and the objects with anti-parallel spins push off. Second. If we have a magnet near the magnet besides the magnetic field there is always torsion field as two cones with the left and right spins. At the North Pole of magnet N the right torsion field always disposes and at the South Pole is left torsion field (Fig.7).

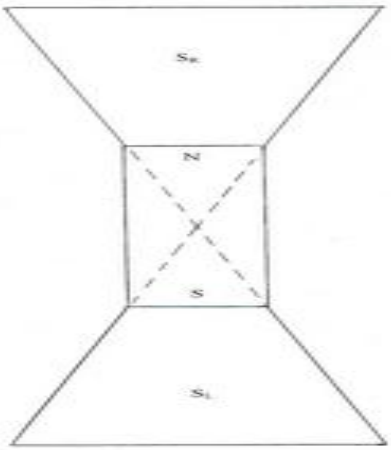

Fig.7. Torsion field of magnet
S_R – Right Torsion Field;
S_L – Left Torsion Field

Then the scheme of experiment will look like the following (Fig.8). Above the nucleus of Cobalt-60 there will be a spatial cone with the right torsion field and under nucleus of Cobalt-60 will be a spatial cone with the left torsion field. It is known in physics that at β-disintegration flying out electrons possess of the left spin [17, 18, 25, 26]. As the identically directed spins are attracted (according to law of similarity) it is fully naturally that electrons will be sent towards space with the left torsion field, i.e. towards the South Pole S of magnet (downward). They cannot fly in opposite direction (upwards) because there is the right torsion field there which pushes away the "left" electrons.

The answer for the second question consists herein. Unequal flight out of the β-disintegration electrons is explained by their left spin. Therefore by law of similarity of torsion fields these electrons are attracted with the left spins of the left torsion field which is located at the South Pole of magnet.

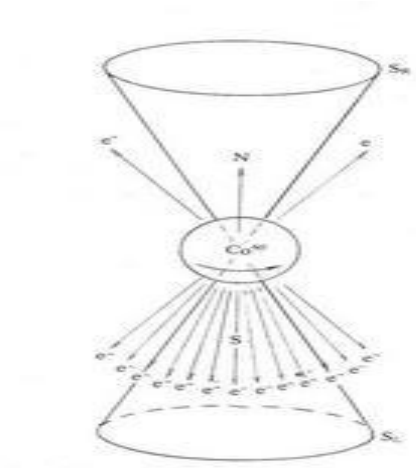

Fig.8. Scheme of experiment Wu taking into account the torsion field of magnet

N and S – North and South Poles of magnet;

S_R - space cone of the Right Torsion Field;

S_L – space cone of the Left Torsion Field

5.5. Hypothetical answer to the third question

Why do not other types of interactions "notice" space asymmetry? It is here possible to say a few suppositions. Presumably the reason consists in the size of constant of torsion interactions which unfortunately is not set yet. Possibly its size is comparable with the constant of weak interactions 10^{14} and then it strongly differ from the constants of other interactions: 1 (for strong), 7x 10^{-3} (for electromagnetic), 10^{-39} (for gravity). Therefore only weak interactions allow to react to the space polarized on the spins.

It is possible to bring here a next analogy over. If to roll a ball on uneven surface at very high speed of the ball the defects of road can be appear unnoticed. Something similar is observed in strong and electromagnetic interactions. The same effect will be observed at extraordinary small speed of ball (gravity interactions). But it is possible to choose such speed of ball when defects will be so much to distort the trajectory of its motion. For this reason transient strong and electromagnetic and extraordinary slow gravity interactions are not sensible to asymmetric of space.

In 60^{th} of the last century in physics same suppositions were spoken out that must exist another interaction which would be weaker than weak interaction but stronger gravity [19, 20]. Possibly it is fated to torsion field to become this interaction.

VI. NEW EXPERIMENT

In our view it would be expedient to carry out new experiment as experiment Wu. But here it is necessary additionally to use a torsion generator, for example generator of Akimov. The torsion generator of Akimov gives possibility to polarize space on spins and save this polarization some time. Just the same appearance it would be to create mirror space which takes place at the inversion of coordinates and which must be taken into account in such physical experiments. And then a "mirror device" in experiment of Mrs. Wu (created by the change of direction of current in the spool of solenoid) would be placed in "mirror space" created with torsion generator. In these conditions flights out of electrons would be symmetric and the parity would be saved.

VII. CONCLUSION

Fall parity in weak interactions testifies that our knowledge about surrounding world is not full.

The presented explanations are based on Physical Vacuum Theory and Torsion Fields Theory. They bring to understanding that the space is not symmetry. Asymmetry of space is caused by whirls which posses both right and by left spin. Whirls with different spins form fitons.

At mirror reflection of coordinate system the fiton spins change their sings and reflected space is not equivalent to initial space. This fact must be taken in account at the inversion of coordinates.

At the change of direction of coordinate axes it is necessary simultaneously to change directions of spins as particles so spins of space fiton. Then the laws of nature will remain symmetric at mirror reflection.

ACKNOWLEDGEMENTS

I express my deep gratitude the beautiful employees of Odessa Scientific National Library (Ukraine) Lyubov Kantarzhy and Susanna Mandel' for their invaluable help at the search of literary sources on this physical problem.

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L. Venger." Fall of Parity in Weak Interactions In The Light Of New Physical Theories " The International Journal of Engineering and Science (IJES) 7.3 (2018): 53-60