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Quarks and Leptons in the Model of the Universe with a Minimum Initial Entropy

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Abstract

In this paper on the basis proposed by the author model of creation of the Universe as a part of the exfoliated space of the Super-Universe it is considered a scheme of weak interactions in two adjacent spaces: two-dimensional space (World-3) and our three-dimensional space (World-4). This analys is allowed us to treat the processes of weak interaction adequately describing the known experimental results. In particular, it has been shown that the bosons $W^{\pm}$ and Z^{o}, responsible for the weak interaction, must be a part of his in the World-3, and the other - in the World-4. In the process of the weak interaction a virtual boson is emitted and absorbed by the same particle (quark, hadron). This $W^{\pm}$ - boson during the existence turns into Z^{o}- boson, forming a particle-antiparticle pair (quarks in the World-3 and leptons in the World-4). Scattering and transformation of leptons is only possible on bosons $W^{\pm}$ and Z^{o}, emitted by nuclei. In addition, the paper describes the mechanisms of instability of tau-leptons: 1) inelastic interaction with nuclei for causing pions $\pi^{\pm}$ or π^{0} and tau lepton-neutrino, 2) the spontaneous decay of heavy leptons in the lungs, and 3) the reaction of the weak interaction.

Keywords: model of the origin and evolution of the Universe, the exfoliated space, the weak interaction, bosons, quarks, leptons.

Аннотация

В работе на основании предложенной автором модели возникновения Вселенной, как части расслоенного пространства Супер-Вселенной, рассмотрены схемы слабого взаимодействия в двух смежных пространствах: двумерном пространстве (Мире-3) и нашем трехмерном пространстве (Мире-4). Это рассмотрение позволило описать процессы слабого взаимодействия, адекватно описывающие известные экспериментальные результаты. В частности, в работе установлено, что бозоны $W^{\pm}$иZ^{o}, ответственные за слабое взаимодействие, должны существовать одной своей частью в Мире-3, а другой – в Мире-4. В процессе слабого взаимодействия виртуальный бозон излучается и поглощается одной и той же частицей (кварком, адроном). При этом $W^{\pm}$- бозон за время

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существования превращается в Z^0- бозон, образуя при этом пару частица-античастица (кварков в Мире-3 и лептонов в Мире-4). Рассеяние и превращение лептонов возможно только на бозонах $W^{\pm}$иZ^0, испущенных ядрами. Кроме того, в работе описаны механизмы нестабильности тау-лептонов: 1) неупругое взаимодействие с атомными ядрами, обуславливающее рождение пионов $\pi^{\pm}$ или π^0, а также тау-лептонное нейтрино, 2) спонтанный распад тяжелых лептонов на легкие и 3) реакции слабого взаимодействия.

Ключевые слова: модель возникновения и эволюции Вселенной, расслоенное пространство, слабое взаимодействие, бозоны, кварки, лептоны.

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In Reference [1] the author proposed a model of the emergence of our Universe with minimum initial entropy on the basis of the law of similarity and unity. At the same time our Universe is a part of the Super-Universe. In turn, the Super-Universe presented fiber space, and adjacent layers are different dimension of space per unit. Habitual for us three-dimensional space (four-dimension (3 + 1) Universe) is bordered by a two-dimensional space of quarks. Like the two-dimensional space is bordered by a one-dimensional space of diones. Finally, the one-dimensional space is bordered by a zero-dimensional space-time of a scalar Field-time. The information interaction exists between adjacent spaces through a single delocalized point. A zero-dimensional Field-time space could interact with other spaces and determine a program of evolution of the Universe.

Table 1: Classification of hadrons

The group	Particle name	Symbol		Weight (electron mass)	Electric charge	Quark structure
		particles	antiparticle			
Mesons	Pions	π0		264.1	0	$\pi^0 = u\bar{u} - d\bar{d}$
		π+	π–	273.1	1 –1	$\pi^+ = u\bar{d}$, $\pi^- = \bar{u}d$
	K-mesons	K+	K–	966.4	1 –1	$u\bar{s}$
		K0		974.1	0	$d\bar{s}$
	ηo-meson	η0		1074	0	$\eta^0 = c_1\left(u\bar{u} + d\bar{d}\right) + c_2\left(s\bar{s}\right)$
Baryons	Proton	p		1836.1	1 –1	uud
	Neutron	n		1838.6	0	udd
	Λ-hyperon	Λ0		2183.1	0	uds
	Σ-hyperons	Σ+		2327.6	1 –1	uus
		Σ0		2333.6	0	uds
		Σ–		2343.1	–1 1	dds
	Ξ-hyperons	Ξ0		2572.8	0	uss
		Ξ–		2585.6	–1 1	dss
	Ω–-hyperon	Ω–		3273	–1 1	sss

Such a structure of the Super-Universe causes of hadrons in the Universe (in the World-4) in result of the interaction between quarks in the World-3 and transmission of information about this interaction in the World-4. Thus, a single particle of World-4 can be assigned to a group of quarks World-3, which has in the zero approximation two or three quarks (Table 1)

The table 1 contains data on the particles, which are present in the structure of the first three quarks (light quarks). It is clear that there is a large series of particles, which are composed of more heavy quarks. Antiparticles to baryons are not shown in the table.

Since the particles have internal quark structure, they can be in an excited singlet or triplet state in the case of two-quark structures, or doublet and quartet states for three-quark structures.

The lifetime of π^+- and π^--mesons is $2.6\cdot10^{-8}$ s, and π^0-meson – $0.8\cdot10^{-16}$ s.

Strong interaction in the World-4 appears as one nucleon emits a π-meson, and the second absorbs it for 10^{-23} seconds. Such particles are called by virtual ones. To make these particles real, they must be free from interaction with nucleons. To do this, you need to provide pion energy to overcome the work function and providing kinetic energy (the analogue of the photoelectric effect).

Perhaps to clarify the calculations of the hadron's characteristics and the relevant interactions one should take into account a few such groups of quarks. Confirmation of this assumption is a creation of considerable number of elementary particles in inelastic collisions with high energy particles. It is not surprising according to Ref. [2] that a hadron is corresponded about 6000 particles in a hidden world. So, to describe the properties of proton in the zero approximation it is necessary to take into account three quarks, and with increased accuracy their number should be significantly increased (up to 6000). In a definite sense this is analogous to a solution of the polar molecule in water, when the solvation shell of a few water molecules is formed. There is also a far zone of molecules, whose influence can be taken into account by using the averaged macroscopic parameters of a solvent.

Thus, a nucleon can be associated with 6000 quarks and quarks that can be associated with 2000 nucleons. It is obvious that there is a certain correspondence between quarks and hadrons. However, it is not found so far the information link between the quarks and leptons. This paper is devoted to clarification of the last issue.

Weak interaction

The emergence of neutrons in the four-dimensional world is accompanied by a $W(Z^o)$- bosons responsible for weak interactions [3]. Since this interaction is accompanied by changes both neutrons and quarks, such bosons must be in three-dimensional and four-dimensional World.

If *$W(Z^o)$*- boson was emitted by a single particle, and was absorbed by another, there would be a super-strong interaction (heavy boson) between them. In reality, the radius of the weak interaction is $R \approx 2 \cdot 10^{-18}$ m [4], that is substantially smaller than the radius of the neutron. So over a lifetime these bosons do not go beyond the nucleon that makes it impossible for the emergence of super-strong interaction between the particles.

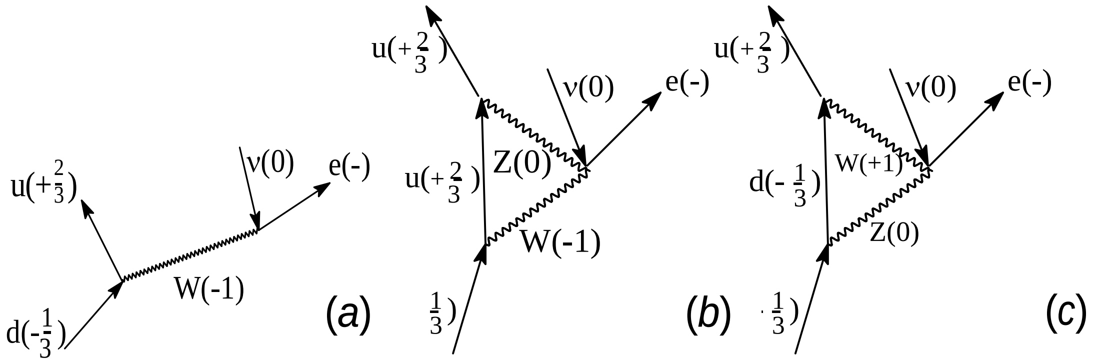

Fig. 1. The known Feynman diagram of the weak interaction (a) [3] and proposed in this paper diagrams (b) and (c) as a first step to the knowledge of the physics of weak interactions.

Currently, it is accepted a scheme of the weak interactions, according to which the d-quark emits W- boson, turning into u-quark (Figure 1a). In turn, the virtual W^--boson decays into a pair of real leptons: electron and antineutrino.

So, here one has the first contradiction in the accepted scheme of weak interactions. In addition, it is not clear why nature needs Z^o- boson.This approach to the problem should be considered erroneous. To solve the problem, let us consider a few steps of successive approximations, which allow describing the mechanism of the weak interaction.

In the case of the weak interaction a virtual boson must return to the particle, which emits it. Otherwise, this boson is responsible for the superstrong interaction. As the World-3 is electrically neutral, the number of d-quarks must be twice more than the number of u-quarks. In the accepted scheme of weak interaction d-quark turns into a u-quark, which violates the electrical neutrality of the World-3.
Furthermore, the particle (real or virtual) can not disappear in the same space to appear in another. **In each space something must be remained.**

Therefore it is necessary to change a scheme of weak interactions in a way that one particle emits and absorbs these bosons. ***The first step*** to changing this scheme is the understanding that during a life time a virtual particle has an ability to turn into another virtual particle with the creation of quarks or leptons (W- bosons and the Z^o-bosonbelong to the World-3 and the transmission of information via the World-4). Thus as a result of the weak interaction with other charged particles W^--boson must turn into Z^o-boson or vice versa (Figure 1, b and c):

The fact that free Z^o- boson (91.2 GeV) is more massive than the $W^\pm$- boson (80.4 GeV), does not prevent running such processes, since both are virtual bosons (associated with quarks). Moreover, the energy released during this conversion (the energy level of a massive virtual particle must lie much deeper) should allow the free lepton pair production, in particular the electron and electron antineutrino.

Such a process will not affect the energy distribution between leptons formed, whereby an electron can obtain an arbitrary amount of kinetic energy from zero to the maximum possible value.

Thus, the proposed scheme shows why we need Z^o- boson.

Since the instability manifests itself only in the neutron, one must assume that d-quark can emit bosons of the weak interaction only in the presence of a pair of quarks (ud). The structure of the proton also includes a pair of quarks (ud), but it is not able to activate an emission of u-quark. Yet β^+- active nuclei is known, which implies that u-quark could be activated by an additional interaction with the surrounding protons (β^+- activity exists only when there is an excess of protons).

The presence of activation of the weak interaction by neighboring nucleons can be seen in β^-- nuclear activity. While the characteristic decay time of the free neutron is $\tau \approx 840$ s, it is reduced to 0.797 s for ${}^{6}_{2}He$, to 0.176s for to ${}^{9}_{3}Li$, and to 0.0186 s for ${}^{13}_{5}B$-etc. [5]. Consequently, with increasing number of neutrons in the nucleus with excessed neutrons β^-- activity increases. We have the similar result for β^+- activity: the characteristic time of decay of the proton in the ${}^{10}_{6}C$ nucleus is 20.34 min, and ${}^{9}_{6}C$ - with a 19.48 s, in ${}^{13}_{7}N$ - 9.96 min, and ${}^{12}_{7}N$ - to 0.01095 s. We have the similar result in a case of the heavy nuclei.

The second step. Since the law of conservation of electric charge must be performed in both worlds, a conversion process of the W- boson into Z^o must be accompanied by a creation of the pair of quarks, which have a total electric charge of -1 and the total spin s = 0. This is the same pair of quarks, which forms π - meson.

The experiment shows that the decay of the neutron produces a proton, an electron and an electron antineutrino (Figure 2). It may be, if a conversion reaction of the W$^-$- boson into Z^o is accompanied in the World-3 by formation of d + $\bar{u}$ pair in the associated (virtual) form with Z^o- boson. Since the quark matter density in the World-3 is quite large [1], it calls for interaction between a virtual particle $\bar{u}$ and real u. Under annihilation of this pair the energy is released to make free the d-quark. As a real particle, being fermion, can not become a virtual one, an interaction of the u quark with $\bar{u}$ can be only contacted with the simultaneous conversion of the d-quark in the virtual pair into free d-quark.

It is necessary to remember that the mass of the d-quark (~ 7 MeV/c^2) exceeds the mass of the u- quark (~ 5 MeV/c^2), that could interfere with the reaction of the weak interaction. However, the conversion W$^-$ → Z^o with releasing quite big energy will promote this reaction. In this case, the decay of a neutron into a proton and leptons are not accompanied by the release of γ-rays. Thus, a revised scheme of conversion of a neutron into a proton with the releasing leptons can be represented as follows (see Figure 2; second step):

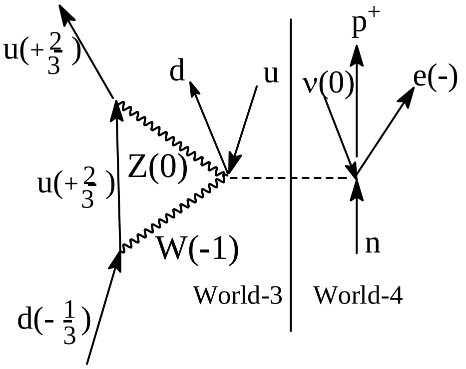

Fig.2. The second step to the treating physics of the weak interactions.

In this scheme, the appearance of a pair of quarks is accompanied by a pair of leptons.

Similarly the scheme in Figure 1c can be transformed in such way that a creation of virtual boson Z^o- with conversion into the W^+-boson will be primary. However, in this case, it will likely not enough energy for the leptons pair production. Consequently, thisschemecannotberealized.

In fact, the whole process of the weak interaction in the World-3 can be described as gross formula:

$$u+(udd)\rightarrow(uud)+d.$$

The process of replacing members of the bound quarks trio at the information level is replacement of a neutron by a proton with releasing an electron and an antineutrino.

Now let us consider ***the third step*** to treating the weak interaction. For a more detailed explanation of the weak interaction processes let us draw an attention to the fact that the bosons in World-3 must comply with the bosons in the World-4 (spatial metamorphosis by Gerlovin [2]). Therefore we call the bosons in the World-3 as $W_3^{\pm}$ and Z_3^0. As for bosons in the World-4, then we keep them old notation.

The processes in the World-3 and World-4 should be run in the synchronized[2] way because of the information interaction and spatial metamorphosis. The final diagram of the weak-interaction processes will be as follows:

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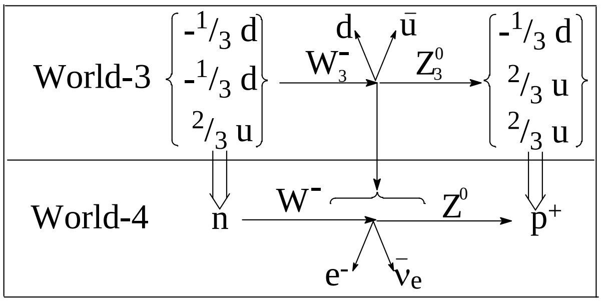
[2] In factbosonsof the weak interactionin the World-3 and World-4 are single particles, unitedat the information levelas a result ofthe spatialmetamorphosis.



It is clear that annihilation *u* + $\bar{u}$ with releasing free d-quark should take into account in this scheme. Simultaneously this scheme explains why there are parallels between the quark structure of matter in the World-3 and leptons in the World-4 (Table 2).

So there is a parallel between the quarks and leptons, which indicates the relationship between them. Indeed, the lepton pairs (electron plus antineutrino) are formed from W- bosons in the single act with conversion of quarks in the weak interaction reactions. There are three pairs of quarks and leptons, three pairs. Interestingly, there are three pairs of hyhelithes. However, this parallel need the further studying.

Table 2. The parallels between the quark structure of matter in the World-3 and leptons and hyhelithes in the World-4.

Quarks	*d, u*	*s, c*	*b, t*
Leptons	e, ν_e	μ, ν_μ	τ, ν_τ
Hyhelithes[3]	^1_1H, ^2_1D	^3_2He, ^4_2He	^6_3Li, ^7_3Li

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[3] Hyhelith – the common name of group of the nuclei:hydrogen, helium and lithium

The attention is drawn to the fact that a sum of the color charges formed during the weak interaction of quarks is zero, as well as a sum of the lepton numbers of created leptons. The total electric charge of the particles in the World-3 and World-4 is the same. In both worlds there are formed a particle and an antiparticle. Thus, the spatial metamorphosis of the created quarks pair is a pair of the formed leptons.

It seems that a pair of the quarks and a pair of the leptons are the splittedstates of a single particle (boson) in the World-3 and single particle in the World-4, interconnected by a spatial metamorphosis. However, the spatial metamorphosis can combine several particles of the Hidden world with a single particle (or several particles) of the Manifested World, as seen by the example of hadrons. It is not surprising that the two particles of World-3 match just two particles of the World-4. Still cited particles can be found. Really, let us consider the scheme:

$$W^- \to \left(Z^0 + e^- + \overline{\nu}_e\right) \to Z^0 + e^- + \overline{\nu}_e \, .$$

The first process is isoenergetic to form an intermediate complex boson, which decays in a short time (<10^{-25} s) with forming a virtual boson Z^o and a free pair of leptons.

The analogous reaction occurs in the World-3. Thus, the particles related by a spatial metamorphosis in the World-3 and World-4 are the bosons $\left(Z_3^0 + d + \overline{u}\right)$and $\left(Z^0 + e^- + \overline{\nu}_e\right)$with a very short lifetime. Iftheboson Z_3^0 andfreepairofquarks $d + \overline{u}$ createdas a result of the $\left(Z_3^0 + d + \overline{u}\right)$boson separation, then the further interaction would lead to emission of the γ-quanta. If the virtual pair $d + \overline{u}$ firstly interacts with a free u- quark, then an emission of the γ-quanta will be absent.

Further it follows from structure of the final weak interaction process scheme that there is appeared a pair of quarks ($d, \bar{u}$), which is a part of the pion π^-.

It is not surprising that the charged pions decay to produce leptons. From the other hand, pions are sufficiently massive particles (264.1 and 273.1 electron mass), and the total mass of the appeared leptons (an electron and an electron antineutrino) in the decay of the neutron does not exceed the difference between the masses of the neutron and the proton (2.5309 electron mass). In the case of the nuclear β-activity energy of the formed leptons can increase by an order due to an energy of the active nucleus. This is not surprising, since the initial state in the weak interaction processes corresponds to the virtual particles with need of energy for his releasing, that is responsible for reduction of the created leptons energy. To confirm the described mechanism, let us remind that π^-mesons can decay in several ways: with and without emission of γ-quanta:

$$\pi^{\pm} \rightarrow \begin{cases} \mu^{\pm} + \nu_{\mu}(\tilde{\nu}_{\mu}) \\ e^{\pm} + \nu_{e}(\tilde{\nu}_{e}) \\ \mu^{\pm} + \nu_{\mu}(\tilde{\nu}_{\mu}) + \gamma \\ e^{\pm} + \nu_{e}(\tilde{\nu}_{e}) + \gamma \end{cases}$$

We draw attention to the fact that a decay of the charged pions into leptons occurs at the level of conservation of an energy and an electric charge in both Worlds. In the World-3 π^-- meson interacts with a free u-quark: $(d\bar{u}) + u \rightarrow ((u\bar{u}) + d) \rightarrow (u\bar{u})^* + d + \gamma$[4].This reaction uses the strong interaction, which leads to a small lifetime for π^--meson.

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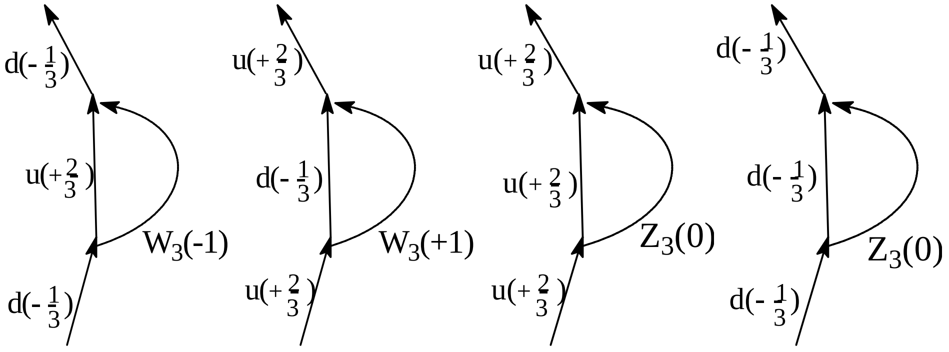
[4] Here $(u\bar{u})^*$ is a vacuum particle.

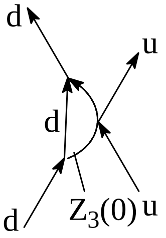
In this case, a free d-quark is appeared and a γ-quantum is emitted; the excess energy in the World-4 is spent on the creation of a pair of leptons, which accompany an appearance of quarks $d+\bar{u}$. Since a real pair of quarks $d,\bar{u}$ corresponds to the π^--meson, i.e. an energy is not wasted to release this pair from a virtual state, then an energy of the created pair of leptons will be significantly higher than an energy released in the neutron decay because of the weak interaction mechanism. We have already indicated that only a transfer of information exists between the exfoliated spaces.

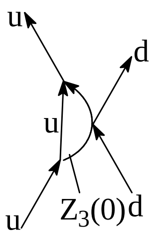
In the case of the weak interaction **it is carried information about a necessity of creation of the leptons pair by means of using energy, which is available in the World-4**.

Emission and absorption of the $W_3(\pm 1)$, or Z_3^0-bosons without the leptons pair production will look as follows:



But the scattering during interaction between quarks with Z_3^0- boson (all the processes run in the World-3) will be looked so:





Consequently, in this scheme of interaction W_3 and Z_3^0 - bosons remain virtual in the World-3. As a scattering is carried out on Z_3^0 – bosons, which are not sensitive to a kind of quarks, the scattering processes can occur in arbitrary pair of quarks, one of which emits a virtual Z_3^0 -boson, and second one is scattered on it.

The conditions for the Z_3^0 – boson emission are discussed above. Similarly the processes of scattering of electron and neutrino on the Z°- bosons will occur in the World-4. Naturally, Z^{o}- boson is emitted and absorbed by neutron (neutrons group) or by a group of protons. Scattering of neutrino on electron with participating the Z°- boson does not exist because leptons do not emit the weak interaction bosons. Consequently, we can register only electron or neutrino scattering on a neutron involving virtual bosons in the weak interaction reactions.

Well-known reactions involving neutrinos

Now let us consider the well-known reactions involving neutrinos.

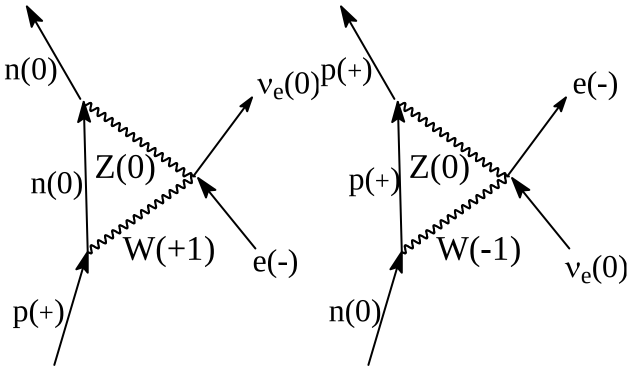
1. Reactions that were observed by Raines and Cohen:

$$p^+ + e^- \rightarrow \nu + n$$

and its inverse reaction

$$\nu + n \rightarrow p^+ + e^-.$$

These reactions can be described by the diagrams:



The first of these schemes allows to detect neutrino at a sufficiently high energy of the electron ($m_ec^2 >$ 1,3 МэВ), which was done. In addition, the similar reaction can be realized by means of the electron *K*-capture by atomic nucleus.

The neutrino is released and a charge of the atomic nucleus decreases by one. The second reaction can occur at any energy neutrino. At the same time neutrino disappears and the electron appears.

Both reactions are possible, as under transformation $W^{\pm} \rightarrow Z^{o}$ the necessary energy ($\geq$1.3 MeV)for the reaction is released.

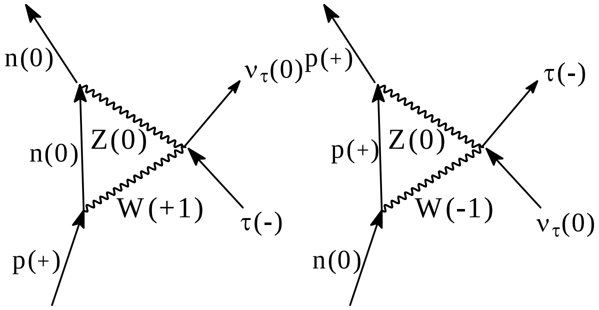
2. It is easy to see that it will be permitted a reaction of interaction between antineutrino and a proton, which can radiate the W^{+}- bosons in a nucleus with an excess of protons:

$$\overline{\nu}_e + p^{+} \rightarrow n + e^{+}$$

3. Finally, let us consider the reaction of the tau-lepton decay.

It is believed that this reaction runs in the framework of the weak interaction, which is contrary to the short lifetime of the tau-lepton ($2.9 \cdot 10^{-13}$ s).

Since the decay of the tau-lepton is not observed in the absolute vacuum, one could assume that it interacts with the atomic nuclei. The weak interactions manifest in a case if the tau-lepton interacts with the W^+- boson according to scheme of conversion of an electron into an electron neutrino. So, we will have a reaction:



These reactions will run at arbitrary energies of the tau-lepton ($m_\tau c^2$ = 1784,36 MeV)and sufficient energy of the tau neutrino ($E_{\nu\tau}$> 1783,06 MeV). It is important that the pions are not created, but only a change of a nuclear charge occurs.The first of these reactions is possible in a case of availability of the nuclei with an excess of protons, while the second reaction can take place on nuclei with excess of the neutrons.

However, the reaction of converting the tau-lepton within the weak interaction scheme is unlikely, and therefore slow in comparison with instability of the free neutron. It follows that such a reaction can not be described by the experimental data on the transformation of the tau-lepton. Rather, one should look for the reasons of instability of the tau-lepton in the framework of the strong interaction.

Tau-lepton, with a mass greater than the nucleon mass, can easily penetrate into the atomic nucleus and cause a deep inelastic collision. As a result of the collision it will be knocked out another particle - π^-, which will take on an electrical charge of the tau-lepton. Thus, instead of the tau-lepton the tau-lepton neutrino emitted from a nucleus. Consequently, the reaction will be as follows:

$$\tau^- + {}^{Z}X \rightarrow {}^{Z}X + \pi^- + \nu_\tau.$$

Here a nucleus (${}^{Z}X$) acts as a catalyst.

Another reaction could be knocking from a nucleus of a neutral pion with the transformation of a proton into a neutron:

$$\tau^- + {}^{Z}X \rightarrow {}^{(Z-1)}Y + \pi^0 + \nu_\tau.$$

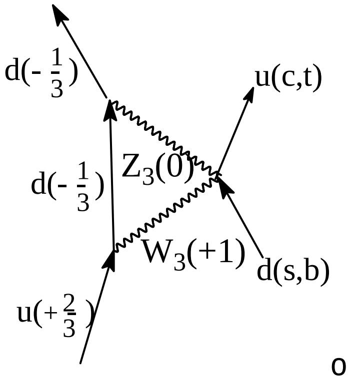
In addition, there is a possibility of spontaneous decay of the tau-lepton to form the light leptons:

$$\tau^- + \rightarrow \mu^- + \bar{\nu}_\mu + \nu_\tau.$$

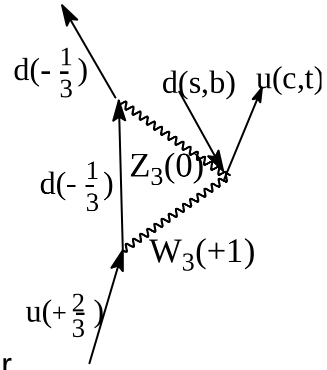
$$\tau^- + \rightarrow e^- + \bar{\nu}_e + \nu_\tau.$$

All of the considered reactions of the tau lepton should proceed with high efficiency, which corresponds to the results of experimental studies.

The reaction of decay of the tau-lepton within the weak interaction scheme will be accompanied by the reaction in the World-3:



or



Conclusion

In the paper we have considered the weak interactions mechanisms in the World-3 and World-4 on the basis of earlier proposed author’s model of an emergence of our Universe with a minimal initial entropy.

This analysis allowed us to treat the weak interaction processes in an adequate agreement with the known experimental results. Inparticular, ithasbeenfound:

1. Since the interaction between quarks in the World-3 leads to the appearance of hadrons in the World-4, the bosons $W^{\pm}$ and Z^{o}, responsible for the weak interaction, must exist due to the a spatial metamorphosis of one part in the World-3, and the other part in the World-4. There is an interaction between these parts at the information level, which synchronizes all processes taking place with the participation of these bosons.

2. In a process of the weak interaction in the World-3 a virtual boson is emitted and absorbed by the same quark. It may happen that during the existence emitted $W^{\pm}$-boson become a Z^{o}- boson, forming a quark-antiquark pair with opposite color charges and integer total electric charge. Synchronously with this process in the World-4 it is created a pair of leptons with zero total lepton charge and electric charge to be equal to the total electric charge in the World-3. Thus, the interaction between quarks in the World-3 leads to an appearance of the hadrons in the World-4, and an emergence of the quark-antiquark pair in the weak interaction process leads to an appearance of the lepton-antilepton pair (for example, an electron – an electron antineutrino) in the World-4.

3. Leptons can not emit virtual bosons $W^{\pm}$ and Z^{o}. The scattering and conversion of leptons is possible only on bosons $W^{\pm}$ and Z^{o}, emitted by nuclei. Similarly, in the World-3 it is possible running reactions of scattering and transformation of quarks.

4. The instability of the tau-lepton is only marginally described by the reaction of the weak interaction. Instead, the tau-lepton can decay within a scheme of the strong interaction, because it can easily penetrate into an atomic nucleus, causing inelastic collision with a creation of pions $\pi^{\pm}$ or π^{0} and tau-lepton neutrino. In addition, the reaction of spontaneous decay of the heavy leptons in the lungs effectively occur.

References

Petro O.Kondratenko. The birth and evolution of the Universe with minimal initial entropy// International Journal of Physics and Astronomy. / This issue.

I. L. Gerlovin. Basics of a unified theory of all interactions in matter. – Leningrad: Energoatomizdat. – 1990. – 433 pp. (in Russian).

R.Feynman.QED- a strange theory of light and substance.- M.: Nauka.–1988.–144 pp. (Russian Translation from English).

L. B. Okun.Weakinteraction // Physical encyclopedia / edited A.M. Prokhorov. — Moscow: Soviet Encyclopedia, 1994. — V. 4. — P. 552–556. — 704 pp. (in Russian).

Tables of physical quantities / Directory ed. I.KKikoin. – Moscow.: Atomizdat. – 1976. – 1008 pp.(in Russian).