

## DEVELOPMENT OF GERLOVIN'S THEORY (3)

### QUANTUM LEAP

As we have set forth in our previous article [1], the global and fundamental discovery of I.L. Gerlovin is a quantum-mathematical apparatus, able to describe the image of any function. In our case : the law of gravitation. When going from one subspace to another, and when supposing that one of these subspaces is a quantum black hole, the equations of tri-unity in the TFF have been obtained, which are identical to the equations of Einstein's GTR. In the language of quantum mechanics, it means that all these quantum images (mappings, transitions) can be called tunnel transitions, or *quantum leaps*, which are out of time and out of space.

One can draw the following careful conclusion: the TFF is a quantum theory, which links, via strong gravitation (quantum leaps), tensor gravity to quantum mechanics.

But a question remains open: how do these quantum leaps operate, physically ? In the TFF [2, p.166, #9.1], there is a great idea about describing quantum (discrete) motion of elementary particles through the structure of the physical vacuum. Unfortunately, these are only declarations, without physical justification: the present article is dedicated to the *physical description of these quantum leaps*.

### INTRODUCTION

All unresolved paradoxes of quantum mechanics are linked to the wave-corpuseular duality, which has no classical analogue. All the Elementary Particles (**EP**) are waves and particles at the same time, but this duality doesn't appear at the same time. If we detect some EP and this is an objective reality, in this case this EP is definitively a particle. And if no, it is a wave.

The motion of this EP in the medium of physical vacuum ( $\phi V$ ) has a wave nature, and is described by a wave function. But in the quantum world, there is no such motion. In atoms, there are no orbits. And the following suggestion has been made on this basis:

*Could we possibly demarcate the wave-corpuseular duality in two independent states: all the EP are corpuscles, and the wave function, as a principle without trajectory motion of the EP, virtually forms in the  $\phi V$  medium ?*

In order to demarcate corpuscles and wave function, let's use Dirac's so-called "hole theory of vacuum", as an analogue. Further we will talk about the discrete principle of motion (**quantum leap**), but first, let's prepare the ground for this.

### A DISCRETE QUANTUM VACUUM

The TFF is based on the following representations of the  $\phi V$ :

([2], p.164) "*it appears that the physical nature of all the equations of quantum mechanics is linked, in a way or in another, to the processes of interactions of the matter with  $\phi V$  ...*"

([2], p.149-150) "*it is clear that EP in the  $\phi V$  cannot exist without interacting with this  $\phi V$ . Therefore, there can't be any isolated – "nude" EP (NEP) ...*"

This allows us to consider the  $\phi V$  in interaction with EPs as a continuum-discrete subspace.

Hence, not « Nude EPs » form wave functions, but the continuous interactions between EPs and the  $\phi V$  explain the discrete nature of these interactions, i.e. the principle of quantization.

Let's have a closer look to the very structure of the  $\phi\mathbf{V}$ .

Contemporary view of the  $\phi\mathbf{V}$  says that this is a particular medium (a virtual world), which is the product of annihilation of almost all fossil matter, in the following proportions (according to the fossil, cosmic background radiation): one EP corresponds to  $10^9$  particles of fossil matter.

And indeed, during an electron-positron annihilation, or quark-antiquark, these pairs don't either disintegrate nor disappear: they enter into an extremely linked dipole state, with a minimal, but non-zero, energy (this corresponds to a polarization of the  $\phi\mathbf{V}$ ). At the same time, almost all their rest mass disappears.

On the other side, the virtuality shows that individual parameters of particles, including mass, are conserved in their virtual form. In the light of equivalence of mass and energy, this can be interpreted like B. Okun' [3] : it is not the mass of the particle (which is constant) which disappears, but the rest mass, which is scattered in the form of electromagnetic quanta.

The  $\phi\mathbf{V}$  is the medium-mediator for all types of interactions. In quantum electrodynamics (QED), it is a virtual electron-positron cloud. In quantum chromodynamics (QCD), it is a quark-gluon condensate. In the TFF, the  $\phi\mathbf{V}$  is considered as a medium similar to a crystalline grid, whose nodes are occupied by dipole pairs electron-positron, proton-antiproton (nowadays, it is a quark-antiquark pair, and it doesn't make great difference).

From experiments and observations, we understand that the vacuum's grid should have, at first glance, contradictory properties: immobile, supraconductive, hyper-elastic, and at the same time, highly-dynamic ; these properties of the  $\phi\mathbf{V}$  are incompatible with both classical and quantum principles of motion. But how do **EPs** and **electromagnetic quanta** move?

According to the theory of Dirac, a positron is a hole (vacancy) of the  $\phi\mathbf{V}$ , i.e. an incomplete vacuum dipole. In the TFF, this is called a "nude elementary particle" (NEP).

In relation to the full symmetry of the  $\phi\mathbf{V}$ , we can presume that all real, genuinely elementary particles are vacancies (holes) of the  $\phi\mathbf{V}$ , i.e. again incomplete vacuum dipoles.

2

All the EPs, finding themselves in the vicinity of oscillating virtual particles (vacuum dipoles), give birth to absolutely real physical fields.

The change of distribution density of vacuum dipoles (excitation of the  $\phi\mathbf{V}$ ) correspond to the **laws of distribution of physical fields** (Coulomb, Newton, Yukawa).

We shall note that the TFF presents the proof ([2], p.166-167) that the de Broglie wavelength of a given EP corresponds to the length of free motion of this EP in the  $\phi\mathbf{V}$  medium ([2], p.164 (9.15)), and therefore corresponds to the grid pitch of the vacuum. And this is an unique particularity of the  $\phi\mathbf{V}$  of I. Gerlovin, and makes it different from other theories of the physical vacuum.

It appears that the wave properties of the EPs are derived in the TFF by the structure of the  $\phi\mathbf{V}$ .

We will show it with the example of hydrogen.

The de Broglie wavelength of the electron is prorate  $\sqrt{E}$  (E : energy).

The Coulomb law is linear with respect to the energy E, therefore around the electron, a grid (a virtual cloud) if formed, with a pitch equal to the de Broglie wavelength.

The nodes of the grids in atoms are distributed in a discrete and stationary form, and together, thanks to their permanent oscillations, they form a wave function.

The electron cannot find itself outside the nodes of the vacuum grid, and this is responsible for the formation of electron orbits in the  $\phi\mathbf{V}$ .

Now the ground has been laid, let's discuss the quantum leap.

## A DISCRETE PRINCIPLE OF MOTION (QUANTUM LEAP)

In the quantum world, there is no such “motion”: this is a fact and has been several times confirmed. There is like a non-energy quantum leap of the EP in the  $\phi V$  medium, with a transfer of state. This is the representation we can have of it.

Let's use one of the properties of the  $\phi V$  – the virtuality. As we know, all the EPs of a given class in the Universe are all identical and indistinguishable. Let's suppose, for instance, that the electron, as a hole of the  $\phi V$  (incomplete vacuum dipole), always tends to find a pair with the elements of the  $\phi V$  (in our case, a virtual positron). A virtual annihilation takes place, and a similar hole (electron) is formed, but at another place (the place where there was a vacuum dipole before).

In this case, a discrete and spontaneous “motion” of the electron has taken place, towards the domain of higher probability density of the wave function.

All this is perceived as a motion effect. There is here some similarity with the semi-conductors' holes : they also “move” in a discrete way.

But here, there is a problem with the energy. The linking energy in vacuum dipole is equal to the double of the rest energy of the electron (quark). In these conditions, how can a quantum leap happen ? We will show, in a pure classical manner, that the transfer of the virtual positron (antiquark) from the vacuum dipole to the real electron (quark) is a profitable process, from the energetic point of view.

In our previous article [1] there has been the following conclusion made:

*«As all the EPs find themselves in the **homogeneous gravity field of the Universe with**  $\phi_{univ} = -c^2$ , they get a rest energy  $E_o = mc^2$ , and the gravitational potential of the  $\phi V$  tending to zero, then between any EP, with respect to the  $\phi V$ , a difference of potential forms, equal to  $\Delta\phi = -c^2$ . And this is the necessary and sufficient condition to consider that all the EPs, with respect to the  $\phi V$ , are **QUANTUM BLACK HOLES**.».*

Indeed, the  $\phi V$  corresponds to the lowest possible energetic state of all quantum fields, and this is valid also for gravitation. Then, in the language of field gravitation, we can consider that the gravitational potential of the virtual vacuum ( $\phi_{\phi V}$ ) tends to zero.

Hence, we have:

- as the real electron (quark) has the highest energetic state  $\phi_{univ} = -c^2$ , and the virtual positron (antiquark) has the lowest energetical state  $\phi_{\phi V} \rightarrow 0$ , there is a potential force  $0 \rightarrow -c^2$  directed from the virtual dipole to the real electron (quark).

**A virtual annihilation happens, with the formation of a virtual dipole and the simultaneous formation of a new vacancy; the free fall of virtual particles towards real particles is similar to the free fall in the gravity field (weighlessness).**

This process doesn't consume energy. The quantum leap happens, and this discrete process actually happens all the time.

Let's have a look at how, from the point of view of « strong gravitation », we could describe the nature of “confinement” (the confinement of quarks in nucleons), which can get a fully different, gravitational explanation. In fact, confinement of quarks can be considered as a ‘gravitational collapse’.

What is behind this ?

The linking energy of quarks in nucleons is much higher than the rest energy of these same quarks, i.e. the potentials of nuclear fields (in TFF) are potential of strong gravitation, and they tend to the value:  $(-c^2)$ .

And here is the reason why there is such a gravitational collapse between quarks in the nucleon.

But why is it impossible to counter this collapse? We revert to the quantum leaps, as the density of virtual gluons inside the nucleon is always higher than in the outside: hence the virtual force inside the nucleon, between a gluon and a real quark, is always higher inside it than outside it.

We have no force to counter this energetic collapse: it is thus perpetual.

## CONCLUSIONS

1. With discrete motion in the  $\phi V$  medium, there is no resistance (aether wind): the contradictions between protagonists and antagonists of the aether are resolved.
2. In the atom, there are no orbital motions of the electrons. In QED it is considered that a grid (virtual cloud) forms around an electron, with a pitch equal to its de Broglie wavelength. In this version, the vacuum grid corresponds to its wave function.
3. The  $\phi V$  is all-pervading. Therefore any discrete motion can be explained to some extent as a kind of tunnel effect, as well as the paradox of interference patterns. Maybe, **the  $\phi V$  is virtually in advance of real events**, like in the two-slit experiments, for instance. The equipments used for the experiment are also quantum objects, and they form, in front of and after the slits, a vacuum grid for the interference patterns, i.e. the process of interference is set inside the  $\phi V$  even before it happens and is measured. A real quantum, or electron, transforms this pattern into reality. The electron, like a hole, doesn't "fly through" the slit: it gets accompanied by a virtual positron, with the formation, on the other side of the slit, of a new hole, i.e. the electron.
4. The speed of light, in all inertial and non-inertial systems of observation, is absolute, and doesn't depend on the speed of motion of the source of light, because in the quantum world there is no such "motion". The motion is a macroscopic, apparent phenomenon.

## References and bibliography:

1. Development of Gerlovin's theory. Strong gravitation.  
<http://www.physics-evolution.ru/forum>  
[http://docs.wixstatic.com/ugd/4b25f4\\_ecf07671a59b4b55808d955144efac32.pdf](http://docs.wixstatic.com/ugd/4b25f4_ecf07671a59b4b55808d955144efac32.pdf)
2. The unified theory of all interactions in matter, I. Gerlovin (Russian version), 1990, Leningrad, Energoatomizdat, parts 1-3  
[http://docs.wixstatic.com/ugd/4b25f4\\_1bc5bd276b64458b959fcfaa386906b0.pdf](http://docs.wixstatic.com/ugd/4b25f4_1bc5bd276b64458b959fcfaa386906b0.pdf)
3. The concept of masses (Mass, Energy, Relativity), L.B. Okun', УФН, July 1989  
<http://ufn.ru/ru/articles/1989/7/f/>
4. The unified theory of all interactions in matter, I. Gerlovin (Russian version), 1990, Leningrad, Energoatomizdat, parts 4-5  
[http://docs.wixstatic.com/ugd/4b25f4\\_fdedef2fe404f9b953f9dbeda602d06.pdf](http://docs.wixstatic.com/ugd/4b25f4_fdedef2fe404f9b953f9dbeda602d06.pdf)