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UDE Cosmology Without Higgs Boson and Without Graviton

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Abstract: Einstein formalism $E = m \cdot c^2$ describes relation between energy and mass. The missing equation is how mass is related with gravity. In this paper we will show that energy, mass and gravity which of a given particle have all origin in variable energy density of quantum vacuum. Quantum vacuum of Planck metrics is a fundamental arena of the universe. Every particle is made out of quantum vacuum energy and diminishes its energy density accordingly to the amount of its energy. Diminished energy density of quantum vacuum gives origin to inertial and to gravitational mass. Variable energy density of quantum vacuum is governing entire cosmic dynamics.

Keywords: Quantum Vacuum, Energy, Mass, Gravity, Higgs Boson, Graviton, Cosmology, Bijective Epistemology

1. Introduction

The beauty of physics is elegant simplicity. Since Max Planck we know that in every Planck volume V_P of space there is an enormous amount of energy:

$$E_P = m_P \cdot c^2 \qquad (1)$$

Empty space which origins from quantum vacuum of Planck metrics has it energy density ρ_{PE} which is:

$$\rho_{PE} = (m_P \cdot c^2) / V_P \qquad (2)$$

As every elementary particle exists in dynamic quantum vacuum as a fundamental arena of the universe the only possibility is that the energy of particle has origin in quantum vacuum. There is no other source known in physics which could provide energy for a given particle. This implies that a given particle with mass m and volume V will diminish energy density of space ρ_{qvE} in the centre of particle respectively to the amount of particle energy E and its volume V:

$$\rho_{qvE} = \rho_{PE} - \frac{m \cdot c^2}{V} = \rho_{PE} - \frac{E}{V} \qquad (3)[1]$$

Formalism (3) is also valid for massive objects. Going away from the centre of a given particle or material object, energy density of quantum vacuum increases according to the following formalism:

$$\rho_{qvE} = \rho_{PE} - \frac{3m \cdot c^2}{4\pi(r+d)^3} \qquad (4)$$

where m is the mass of given particle of material object, r is the radius of given particle or material object and d is the distance from the centre of given particle or material object to a given point T. When $d = 0$ one get energy density of quantum vacuum in the centre of particle or massive object. When $d = r$ one get energy density of quantum vacuum on the surface of particle or massive object. When $d \to \infty$ one get energy density of quantum vacuum in intergalactic empty space far away particle or stellar objects. This model of relation between mass and diminished energy density of

quantum vacuum is valid from the scale of elementary particles, to the scale of a black hole. Out of formalism (3) we can calculate mass m of a given elementary particle:

$$m = \frac{(\rho_{PE} - \rho_{qvE}) \cdot V}{c^2} \qquad (5)$$

Considering that $(\rho_{PE} - \rho_{qvE}) \cdot V$ is the energy E of a given particle we get out of formalism (5) known Einstein's formula $E = m \cdot c^2$. Formalism (5) shows with an elegant simplicity how are related energy and mass of a given particle with diminished energy density of quantum vacuum. For mass-less particle diminishing of energy density of quantum vacuum ρ_{qvE} in the area of a particle is flowing:

$$\rho_{qvE} = \rho_{EP} - \frac{E}{V_P} \qquad (6)$$

where ρ_{PE} is Planck energy density, E is energy of the mass-less particle and V_P is Planck volume.

Equation (5) is valid also for massive bodies. On the basis of Newton formula for gravity we will get out of equation (5) formalism which will describe how diminished energy density of quantum vacuum of two massive bodies generates gravity:

$$F_g = \frac{(\rho_{PE} - \rho_{1qvE}) \cdot (\rho_{PE} - \rho_{2qvE}) \cdot V_1 \cdot V_2 \cdot G}{r^2 c^4} \qquad (7)$$

2. Energy, Mass, Gravity Theory – EMG Theory

In the formalism (5) is expressed relation between energy and mass and diminished energy density of quantum vacuum. In formalism (7) is expressed relation of gravity force between two massive particles or two massive bodies which has origin in diminished energy density of quantum vacuum. Formalisms (5) and (7) confirm that energy, mass and gravity have the same origin in diminished energy density of quantum vacuum. This is so called Energy-Mass-Gravity Theory (EMG Theory) which units the concepts of energy, mass and gravity. EMG Theory is expressed in following equation:

$$E = m \cdot c^2 = \Delta E_{qv} = (\rho_{PE} - \rho_{qvE}) \cdot V \qquad (8)$$

where energy E of a given particle is made out of quantum vacuum energy ΔE_{qv} which diminishes Planck energy density ρ_{PE} of quantum vacuum in centre of a given particle or massive object with volume V respectively to amount of its energy E.

Energy and mass of relativistic particle in relation with diminished energy ΔE_{qv} of quantum vacuum is derived

from the formalism (8) and expressed in formalism (9):

$$E = \gamma \cdot m \cdot c^2 = \gamma \cdot \Delta E_{qv} = \gamma \cdot (\rho_{PE} - \rho_{qvE}) \cdot V \qquad (9)$$

where γ is a Lorentz factor.

Diminished energy density of quantum vacuum in the centre of a given particle or massive object causes "quantum vacuum pressure" (see figure 1) which gives origin to inertial mass (see figure 1) and to gravitational mass (see figure 2).
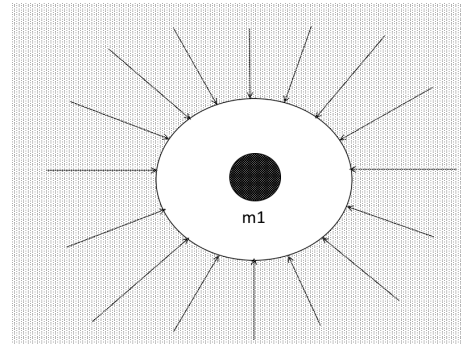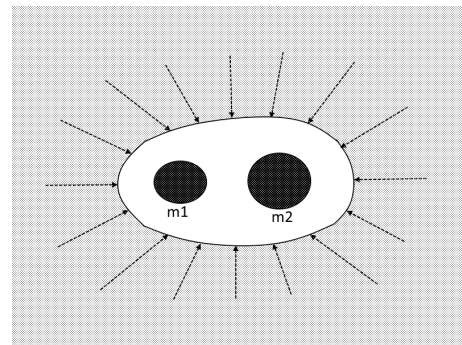

Figure 1. Inertial mass.

Figure 2. Gravitional mass.

Outer quantum vacuum has higher energy density as a quantum vacuum inside the particle or massive object. This "quantum vacuum pressure" generates inertial mass of a given particle or massive object. When two particles or massive bodies create an area of quantum vacuum with diminished energy density this causes that outer quantum vacuum with higher energy density is pushing towards the area with lower energy density. Area with diminished energy density of quantum vacuum always "follows" a given particle and gives it inertial and gravitational mass. A given particle and area of diminished energy density of quantum vacuum in which particle exists are inseparable.

Standard model shouldn't approach a given particle without quantum vacuum in which particle exists. Idea of 20th century physics that particles and fields can exist in an "empty space" deprived of physical properties is against Max Planck energy density model of universal space ρ_{PE} and has hindered development of physics for a century. Einstein himself was against the idea that space could exist without having physical properties: "To deny the ether is ultimately to assume that empty space has no physical qualities whatever. The fundamental facts of mechanics do not

harmonize with this view. For the mechanical behaviour of a corporeal system hovering freely in empty space depends not only on relative positions (distances) and relative velocities, but also on its state of rotation, which physically may be taken as a characteristic not appertaining to the system in itself. In order to be able to look upon the rotation of the system, at least formally, as something real, Newton objectivises space. Since he classes his absolute space together with real things, for him rotation relative to an absolute space is also something real. Newton might no less well have called his absolute space "Ether"; what is essential is merely that besides observable objects, another thing, which is not perceptible, must be looked upon as real, to enable acceleration or rotation to be looked upon as something real" [2].

In EMG Theory Higgs field's function is carried directly by variable energy density of quantum vacuum. Also gravitational field's function is carried directly by the variable energy density of quantum vacuum. EMG Theory does not require existence of hypothetical graviton and gravitational waves. Research of last decades confirms nonexistence of gravitational waves [3]. Few other papers expose "weakness" of Higgs mechanism and weakness of the idea that Higgs boson has its own mass [4], [5]. Recent paper reports in mathematical model of Higgs mechanism are contradictions: "The quite large numbers of contradictions of the Higgs boson theory which are described in this work make a basis for the expectation that this theory will be abandoned" [6].

In EMG Theory Higgs boson is not more that a characteristic flux of quantum vacuum energy released by collision of two protons. Higgs boson does not prove existence of Higgs field, it proves only that by the collision of two protons is released energy of quantum vacuum in amount of 125 GeV/c2 which after its life time of 10^{-22} seconds is turning back into quantum vacuum via some fermions which have a life time of $2.9 \cdot 10^{z-13}$ seconds [7].

Here is an official presentation of the idea of Higgs field appearance in the universe: "Just after the big bang, the Higgs field was zero, but as the universe cooled and the temperature fell below a critical value, the field grew spontaneously so that any particle interacting with it acquired a mass. The more a particle interacts with this field, the heavier it is. Particles like the photon that do not interact with it are left with no mass at all. Like all fundamental fields, the Higgs field has an associated particle – the Higgs boson. The Higgs boson is the visible manifestation of the Higgs field, rather like a wave at the surface of the sea" [8]. Introduction of Higgs field opens more questions in physics that it gives answers. The unanswered questions are: Which is the mechanism that builds Higgs field and out of what? How can Higgs boson which is artificially made particle and does not exist in the universe builds Higgs field? Why Higgs field does not interact with a photon which has its own energy E as any other elementary particle? How Higgs field and gravitational field are related? EMG Theory does not open these questions. In EMG Theory energy, mass and gravity

(from the scale of photon to the scale of stellar object) have all origin in variable energy density of quantum vacuum of Planck metrics.

3. Bijective Epistemology, Higgs Boson and Higgs Field

In 1935 Einstein, Podolski and Rosen (EPR) introduced a famous argument—directed to prove the incompleteness of quantum mechanics—that was based on the assumption of two fundamental starting-points: Einstein's definition of completeness of a theory and the criterion of physical reality. According to Einstein's definition of completeness of a physical theory, a theory can be considered complete if every element of physical theory has a counterpart in the physical reality [9].

In mathematics, bijective function or one-to-one correspondence is a function between the elements of two sets, where every element of one set is paired with exactly one element of the other set, and every element of the other set is paired with exactly one element of the first set.
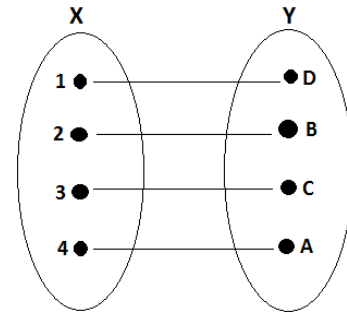

Figure 3. Bijective function.

$$f : X \rightarrow Y \qquad (10)$$

where set X is {1, 2, 3, 4} and set Y is {A, B, C, D}. For example, $f(1)$ = D.

EMG Theory is accordingly to the Einstein idea on completeness of a physical theory based on bijective function. Every element in the universe set X corresponds exactly to the one element in the model of the universe set Y. An observer in physical universe perceives five fundamental elements: space, energy, matter, changes and time. In order to build an adequate fundamental model of the universe, the observer uses a bijective function of the set theory, where each observed element in the universe set X corresponds exactly to one element in the model of the universe set Y:

$$X : \{O_X, C_X, T_X, M_X, E_X, S_X\}$$

$$Y : \{O_Y, C_Y, T_Y, M_Y, E_Y, S_Y\}$$

O_X - observer (which observes other 5 elements), C_X -

change, T_X - time, M_X - matter, E_X - energy, S_X - space

O_Y - model of the observer, C_Y - model of change, T_Y - model of time, M_Y - model of matter, E_Y - model of energy, S_Y - model of space.

Element of matter M_X, element of space S_X and element of energy E_X in the universe set X can be considered as elements of the subset EX (Energy subset of the universe set X). Element of matter M_Y, element of space S_Y and element of energy E_Y in the model set Y are elements of the subset EY (Energy subset of the model set Y). In the Universe set X we have four fundamental elements. In the model set Y we also have four fundamental elements:

$$
\begin{aligned}
&X:\{O_X, C_X, T_X, \{EX\}\} \\
&Y:\{O_Y, C_Y, T_Y, \{EY\}\} \\
&EX:\{E_X, S_X, M_X\} \\
&EY:\{E_Y, S_Y, M_Y\}
\end{aligned}
\qquad [9]
$$

Theoretically predicted Higgs field Hf is supposed to carry mass of elementary particles. Accordingly to the bijectve epistemology Higgs field Hf is an element of energy subset of the model set EY:

$$
EY:\{Hf_Y\}
$$

Higgs boson Hb physical existence is created by collision of two protons and has no existence apart of this collision. That's why Higgs boson Hb cannot be considered as an element of energy subset of universe set EX. Nonexistence of Higgs boson Hb in physical universe confirms that bijective function between Higgs boson Hb and Higgs field Hf is not valid:

$$
f : Hb_X \rightarrow Hf_Y \qquad (11)
$$

Invalidity of formalism (11) confirms between Higgs boson Hb and Higgs field Hf there is no bijective function. That's why Higgs boson does not prove existence of Higgs field. For example proton in the subset universe EX and proton's model in the subset model of the universe EY are related by bijective function:

$$
f : p_X \rightarrow p_Y \qquad (12)
$$

Proton p_X in the universe confirms existence of proton p_Y in the model.

4. Quantum Vacuum and Relative Speed of Clocks

Our recent research confirms [1] that curvature in space-time in general relativity is a mathematical expression of energy density of quantum vacuum. More space is curved less dense is quantum vacuum and slower is rate of clocks. In a fast airplane clocks run slower because kinetic energy of the airplane is additionally diminishing energy density of quantum vacuum as it can be seen in formalisms below:

$$
\rho_{qvE} = \rho_{PE} - \frac{m \cdot (c^2 + 0.5v^2)}{V} \qquad (13)[10]
$$

where m is the mass of airplane, where v is the speed of airplane and V is its volume. Formalism (3) describes energy density of quantum vacuum of a non moving airplane and formalism (13) represents energy density of quantum vacuum of moving airplane. Kinetic energy of airplane is energy of quantum vacuum. Formalism (13) shows that origin of kinetic energy is energy of quantum vacuum which is additionally concentrated in a moving massive body. When a massive object is stooped by a barrier and its velocity becomes zero, kinetic energy is transforming into heat and light.

Variable energy density of quantum vacuum is origin of "relative velocity of material changes" in special relativity (SR) as well as in general relativity (GR): "In the GPS system the satellite clocks run slower because of SR effect for 7microseconds a day, and because of GR effect they run faster for 45 microseconds a day. The combination of these two relativistic effects means that the clocks on-board each satellite should tick faster than identical clocks on the ground by about 38 microseconds per day (45-7=38)! This looks small, but the high precision required from the GPS system means that nanosecond accuracy is necessary, and 38 microseconds is 38,000 nanoseconds [11]. SR relativistic effect in GPS has origin in diminished energy density of quantum vacuum. GR effect has origin in increased energy density of quantum vacuum.

5. Orbital Time Diminishing by Binary Stars and Immediacy of Gravity

In 1974, the American physicist J. H. Taylor, along with his research group, observed a binary neutron star called PSR 19.16 +16. They noticed that the rotational speed of binary stars around their axes diminishes over time [12]. This is a fascinating observation and result, yet their interpretation of the data is questionable. They attributed the decrease of rotational speed to a reduction of the binary stars' masses. We consider this interpretation is valuable, however the reduced masses were considered to be due to gravitational radiation which requires existence of gravitational waves. Research of last decades confirms nonexistence of gravitational waves [3].

We have another explanation for mass diminishing: of binary stars. Mass of binary stars is diminishing energy density of quantum vacuum in the centre of binary stars to the value which is below minimal value required for stability of elementary particles. This causes that matter of binary

stars transform in energy of quantum vacuum. Similar process occurs in the centre of a black hole and is a part of permanent energy circulation in the universe [13].

In cosmological model Universe in Dynamic Equilibrium (UDE), universe is a non created system in a permanent dynamic equilibrium. UDE model preserves the ancient wisdom of snake Auroborus which eats her own tail:

Figure 4. Auroborus which represents cosmological UDE model.

In UDE model the sum of energy in a given volume of universal space is constant:

$$E_{matter} + E_{dark.energy} + E_{dark.matter} + E_{electromagnetic} = K \quad (13)$$

Our research confirms that missing dark energy of the universe is energy of quantum vacuum itself [1]. Other research confirms neutrino has measurable mass [14] which means dark matter energy has its source in neutrino. In the universe these energies in equation (13) are in continuous transformation, their sum in a given volume of universal space is constant. Einstein's formalism $E = m \cdot c^2$ describes transformation of matter which is structured energy of quantum vacuum in electromagnetic energy which is a wave of quantum vacuum.

Idea of Standard model that mass and gravity are carried by particles is an attempt which has brought more questions that it has given answers. We find this attempt needs to be revised from the point of bijective epistemology: the phenomenon of "particle" in physics is related to the phenomena of "motion" and "time". Particles move in space and their motion has a certain numerical order which is time. In Newton formalism of gravity there is no symbol of time t because gravity is an immediate phenomenon which has no numerical order. Gravity cannot be transported by some particle which propagates with the light speed as is supposed for hypothetical graviton. Gravity and mass are immediate phenomena which have origin in the symmetry between energy of a given particle or massive body and diminished energy density of quantum vacuum. This fundamental symmetry of the universe is valid from the scale of massive particle to the scale of a given stellar object.

6. Evolution of Life as a Consistent Part of Universal Dynamics

Increasing of entropy in observable universe is only a part of cosmic dynamics and does not govern universe which as a whole has no entropy; it is a system which renovates itself continuously [13]. In such an universe evolution of life is understood as a continuous process of entropy diminishing which run in entire universe. It seems that in entire universe matter has tendency to develop in life and further in intelligent organisms.

In today physics homogeneity of the universal space is generally accepted. This means that universal space has the same physical properties on the large scale. Physical homogeneity of space means that physical properties which define circumstances for development of life are the same in entire universe. Physical homogeneity includes also biological homogeneity which means that evolution of life on the planet earth could be part of an universal process happening in entire universe; development of life could be a consistent part of cosmic dynamics.

Basic organic elements for development of life have been discovered in entire universal space [15]. This means that entire universal space is in the phase of "chemical evolution" which has been developed further in biological evolution on the planets similar to the Earth. NASA discovers planets similar to our planet Earth [16]. We cannot a-priory reject possibility that also some other civilizations are present on other planets of this vast universe.

Science in order to serve humanity needs to develop "cosmic approach" where every process that occurs on the planet Earth is examined as an universal process which is happening in the universe. Anthropocentrism and egocentrism belong to the 20th century science and should be left behind. We are living primarily in the universe, secondarily on planet Earth and our thinking in today science should follow this fact.

7. Bijective Epistemology of Four Forces Unification

In EMG Theory strong force and weak force are carried by particles which have a mass. Photon is a wave of quantum vacuum. Because of this light has the same speed regardless to the motion of inertial systems. When we are moving to the source frequency of light is increasing. When we move away from the source frequency of light is diminishing. Light speed remains unchanged. Accordingly to bijective epistemology photon is not "particle" because it has no mass which is characteristic only for particles. In photoelectric effect photon as a wave of quantum vacuum can also hit a single electron. There is no need to imagine photon as a particle in order photon could hit an electron.
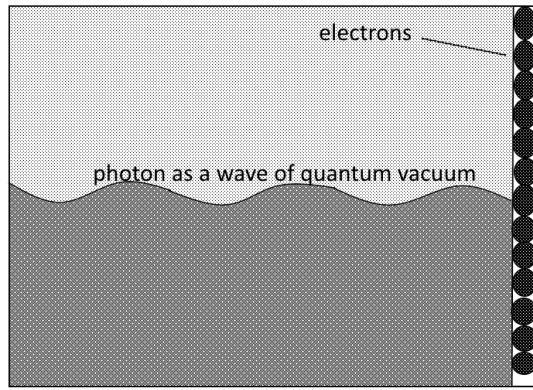
Figure 5. *Photon as a wave of quantum vacuum by photoelectric effect.*

EMF Theory offers elegant explanation of double slit experiment: every massive particle when moving in quantum vacuum also creates a wave of quantum vacuum. When we send electrons only through the upper slit, the waves of quantum vacuum created by electrons motion will also move through the down slit and this will create characteristic interference pattern.
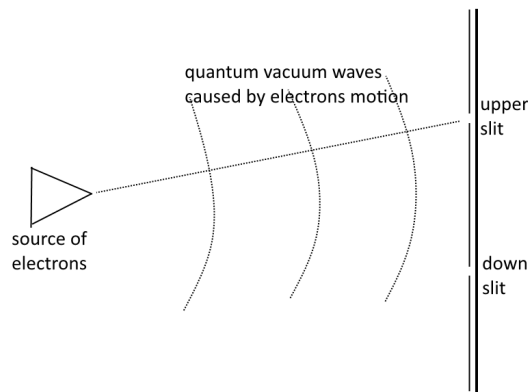
Figure 6. *Quantum vacuum waves by double slit experiment.*

In EMG Theory particle and wave are always together. Accordingly to bijective epistemology we cannot approach a given particle separately from the wave of quantum vacuum which is created by particle motion.

EMG Theory is development of Einstein's idea of "United field theory".

Figure 7. *EMG Theory as "United field theory".*

According to EMG Theory quantum vacuum is the fundamental energy field of the universe. Massive particles are different structures of quantum vacuum; photon is a wave of quantum vacuum. In EMG Theory phenomena of mass and gravity does not require existence of particles. Inertial mass and gravitational mass have origin in variable energy density of quantum vacuum.

8. Enlargement of Scientific Paradigm in Physics

In 20th century paradigm in physics was accepted that a given phenomena exists when we can detect it with instruments and measure it. Physics of 20th century statement was that what cannot be measured has no attribute to be considered "real phenomena". Observer in physics cannot be measured with instruments; however his existence is not disputable. Observer plays important role in physics. For example his measurement of fundamental time which is numerical order of changes running in quantum vacuum gives origin to "duration" of given phenomena which is emergent time. Without measurement of the observer there is no duration [17].

Observer as a consistent part of the universe requires enlargement of paradigm in physics in a sense that not only what can be measured but also what can be experienced is "real phenomena". Every physicist is experiencing the observer in his daily work. Observer is watching the mind building a mathematical model about given physical phenomena under examination. Observer is watching experiment and obtained experimental data which will prove or disprove mathematical model. Recent research shows that origin of the observer reaches beyond human mind and has origin in the Being (consciousness). In every human observation is a function of the Being [18]. In every physicist on the globe regardless nationality, religion and race, the same Being is functioning as the observer. From this point of view physics can have an important role in building intercultural dialog between different cultures.

In UDE cosmological model physical universe is governed by "mathematical universe", a non local phenomenon which pervades entire universe. Original idea of mathematical universe belongs to Max Tegmark [19]. Phenomena in the universe we can divide in two basic groups: nonlocal phenomena and local phenomena. Non local phenomena which are observer and mathematical universe are timeless, local phenomena which are quantum vacuum, photon, elementary particles and massive objects are temporal: they have certain numerical order. For example motion of photon as a wave of quantum vacuum has a certain numerical order which is fundamental time.

In UDE cosmological model quantum entanglement is a non local phenomenon in which mathematical universe plays a role of direct information medium between entangled particles. In mathematical universe information transfer is immediate, in quantum vacuum information moves with a light speed.

observer - non local and timeless	mathematical universe - non local and timeless
quantum vacuum - local and temporal	photon - local and temporal
elementary particles - locan and temporal	massive bodies - local and temporal

Figure 8. *Structure of the universe.*

In UDE model observer and mathematical universe have not necessary basis in "energy" in known sense of this world. In physics observer and mathematical universe are not types of energy which could be expressed with formalism $E = m \cdot c^2$. They are not "matter", they are not "energy"; they are something else. Today's physics is based upon a bivalent logic: a given phenomenon can be A (matter) or B (energy). Trivalent logic, which was developed in the last century by Polish mathematician Jan Lukasiewicz, permits that a thing can be A, B or even C. The observer and the mathematical universe are phenomena referred to as "C" in trivalent logic. How observer and mathematical universe act on ordinary energy and matter remains an open question. On the basis of our research results we propose a following model:

| |
|---|
| observer which has origin in Being-consciousness |
| mathematical universe |
| quantum vacuum |
| bio photons |
| microtubules of the brain |

Figure 9. *Acting of non local phenomena upon local phenomena.*

In physics we are not inventing physical laws which govern particles and massive bodies behaviour. We are discovering these laws by entering with our minds into the realm of mathematical universe. The purest is our mind the more refine laws we will discover. The purity of scientific mind is empowered by the observer which has no identification with the mind. He sees mathematical models which describe this universe floating in the pure space of his inner vision which is the source of true inspiration in physics. He clearly distinguishes between models of the world and physical phenomena described by these models. One of the difficulties of today physics is that physicists think about physical phenomena in forms of mathematical models. Often

they do not distinguish between the phenomenon under examination and its mathematical model. Space-time is a classical example. We have been thinking in physics for a century that space-time model has a counterpart in physical universe where we have three spatial dimensions and one temporal dimension. This misconception was a main trouble in unification of quantum mechanics and General Theory of Relativity. Result of our research group confirms that time is not 4th physical dimension of space in which physical phenomena occur [13]. Solution for unification of quantum mechanics and General Theory of Relativity is the insight that particles and stellar objects both move in quantum vacuum where time is only a mathematical parameter of their motion.

9. Quantum Vacuum as a Super-Fluid and Antigravity

An adequate imagination based on bijective epistemology is a driving force of new discoveries in physics and technology. In General Relativity (GR) we imagine gravity as a curvature of space. In GR gravity is "geometrized". More space is curved stronger is gravity. We imagine this geometrized gravity model in figure below:
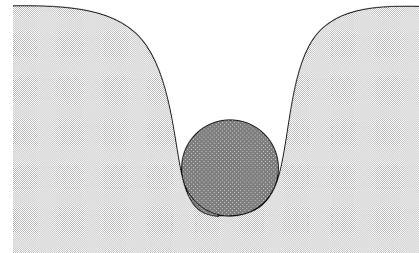
Figure 10. *Geometrized gravity.*

Our research confirms that geometry of space in GR is a mathematical model describing density of quantum vacuum. More space is curved, less dense in quantum vacuum [1]. Calculation shows that in centre of black hole density of quantum vacuum is smaller than in intergalactic space only for an infinitesimally small value [13]. A technical device which would increase minimally density of quantum vacuum could move in a direction opposite to gravity. Imagining quantum vacuum as a super-fluid medium [20] there is a possibility that we can build antigravity device which will be able to increase and to decrease density of quantum vacuum. When a device in the figure below will turn clockwise, density of quantum vacuum in device could diminish. When the device will turn in opposite direction, density of quantum vacuum in device could increase, device will move in direction opposite to the direction of gravity.
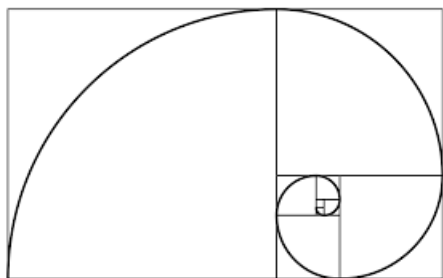
Figure 11. *Fibonacci shell.*

This model in order to be taken in a serious consideration needs experimental verification. An electromotor positioned vertically which would have on axis a kind of Fibonacci shell coated with a layer of a substance having a high density such as gold or osmium. Fibonacci shell could change its weight in accordance with its direction of rotation. Our proposal with Fibonacci shell is "heuristic"; it needs experimental verification which might give us some new understanding about antigravity. According to EMG Theory the only plausible model for antigravity is a technical device which will be able to increase and decrease density of quantum vacuum.

10. Conclusions

UDE cosmology and EMG Theory describe energy, mass and gravity with one element which is variable energy density of quantum vacuum. Energy, mass and gravity of a given particle or massive body are inseparable phenomena which are all carried by the variable energy density of quantum vacuum which is the driving force of cosmic dynamics on micro and macro scale.

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