Problem with gravity

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Abstract

A brief review of major publications regarding gravity reveals very little understanding of its nature. Here we show cases where gravity acceleration equals to force acceleration may be seen by its effect of dragging mass possessing particles and bodies through the spacetime frame understood as scalar quantum fields. This can be explained as spacetime movement relativity. In such a view, spacetime frame may be dragged and swallowed by mass-possessed bodies combining and moving space towards centre of all mass-possessed objects. As the spacetime convergent scalar field vectors, visualised as frame lines coming closer towards each other and point towards the mass centre, acceleration forces are created as a result. Such an effect may be sensed as gravity acceleration and measured at the planetary surface as mass weight.

Keywords — *Gravity,*

I. INTRODUCTION

The problem with the concept of gravity results from this simple fact, that everyone, regardless of the level of education, is well acquainted with the phenomenon of gravity. Everyday life forces us to constantly and sometimes laboriously overcome gravity. However, the problem does not end here. Although we already know a lot about how gravity interacts with material objects, although we can calculate the impact of gravity on body movements with great accuracy and how to plan the orbital motion of space probes to reach the most distant body of our Solar System without error, no one, regardless of their level of education, has very little understanding of its nature.

Fig 1- The likenesses of the great scholars associated which studied on gravity; Aristotle, Galileo and Newton.

Scientists have long been interested in the common sense of attraction. Already Aristotle believed that bodies move due to trends. He argued that soil, water, and other objects on the surface have a natural tendency to move towards the centre of the Universe. This centre in Aristotle's time was, of course, the Earth as was a generally accepted geocentric system of the world.

In fact, it was only around 1590 that Galileo began studying gravity when, at the age of 26, he published a small paper entitled De Motu (On Movement), which can be considered a pioneering study of the essence of gravity [1]. He started to study the speed of free fall of objects. When he realized that the speed of falling is too high to capture it in a laboratory with the chronometers that existed at that time, he decided to use for this purpose the curved tower in Pisa. This object seemed to be high enough to measure quite accurately the time of falling of objects released from the top terrace of the tower. Strangely enough, he noticed that objects falling from the tower are accelerating. Galileo measured this quantity, which we know today as the value of gravitational acceleration, which averages 9.8 m/s^2 on the surface of the Earth.

Fig 2: An Apollo 15 crew member, David Scott, performs the Galileo experience on the lunar surface while dropping a feather and a geological hammer. Both objects fell on the lunar surface simultaneously. (https://www.youtube.com/watch?v=KDp1tiUsZw8)

Releasing iron and wood spheres of various masses from the upper terrace, he noted that this value was not dependent upon the weight of the body, contrary to the teachings of Aristotle, who believed that heavier objects containing more water and earth would fall faster than lighter objects. The evidence of Galileo was very bold at the time, as it contradicted the generally observed behaviour of objects dropped in the atmosphere on the surface of the earth. The final evidence for our senses was a simple experiment performed before the eyes of television viewers by David Scott of the Apollo 15 crew, on August 2, 1971, on the surface of the Moon. As you can see in the film

(Fig. 2), he released a light feather and a heavy geological hammer at the same time. We saw it exactly on the screen as a light feather and a heavy hammer simultaneously fell on the atmosphere-free surface of the lunar soil.

The next milestone in the work on understanding gravity was the work published by Isaac Newton in 1687 under the Latin title "Philosophiae Naturalis Principia Mathematica", popularly known as "Principia" [2]. The principles of dynamics given for the first time by Newton proved to be extremely useful in calculating the trajectory of movement of celestial bodies. Edmund Halley, a friend of Newton's, used this law to calculate the orbits of comets and discovered that certain comets whose appearances were recorded in historical records were in fact the same space object moving in a strongly elongated elliptical orbit. This comet, known today as the Halley's Comet, entered every 75 years into the zone of inner planets where it orbits the Sun.

The three laws proclaimed by Newton are extremely important. The first law was actually a repetition of what Galileo had previously discovered about the inertia of bodies. According to this law, if no force is applied to an object, it is either at rest or moving at a constant speed in a straight line. A cosmonaut drifting in an empty space shall move in a straight line and at a constant speed indefinitely if no external forces are acting on him. The object will move because it has a property called momentum depending on the speed and mass of the moving object. This right is a consequence of the momentum maintenance principle.

Newton's second law went further than Galileo's knowledge and deals with the influence of force on moving objects. Newton noted that acceleration is the result of force applied to mass. This law probably links the effect to the cause for the first time. Objects in space don't move slowly, but they accelerate as a result of force.

Newton's third law binds each force action on a body to an equivalent reaction force acting on that body in the opposite direction. These three laws inspired Newton to apply them to falling objects. The first and second laws say that falling bodies are accelerated because there is a force pushing them down. Newton, in his work on the law of universal gravity, to predict the power of gravity acting on distant bodies, made two assumptions. The first was that the gravity force is a function of the second degree power and that it must be measured not from the surface but from the centre of the bodies. The third law made it clear that forces act in pairs, so gravity should be common. It has now become clear that it is not only the Earth that attracts the falling apple, but the apple also attracts the Earth by gravity. Summarizing this, interaction of masses (M and m) of bodies in an second power function of distance between their central point (r), the attraction force acting between these bodies (F) and the gravity constant (G), is given by a simple formula.

$$F = G(Mm/r^2)$$

The relationship presented by this formula helped to calculate the orbits of celestial bodies with sufficient accuracy, except for the closest planet to the Sun, Mercury. Despite very accurate measurements of Mercury's position in its movement around the Sun, its orbit determined by Newton's formula differed from that measured by instruments. So an inexplicable problem has arisen. In fact, already at the time of the appearance of Newton's ideas, despite the successes of the practical establishment of orbits of celestial bodies, were very difficult to accept by the scientific circles of those times, because they promoted the unheard of for those times possibility of the influence of material bodies at a distance, through a completely empty space. In spite of the excellent knowledge of gravitational forces and works showing the practical application of these laws in astronomy and geophysics, the nature of gravity still remained completely unknown.

II. DISCUSSION

Many years passed before a modest official of the patent office in Bern, Albert Einstein, published in 1905 a work known today as the special theory of relativity [3].

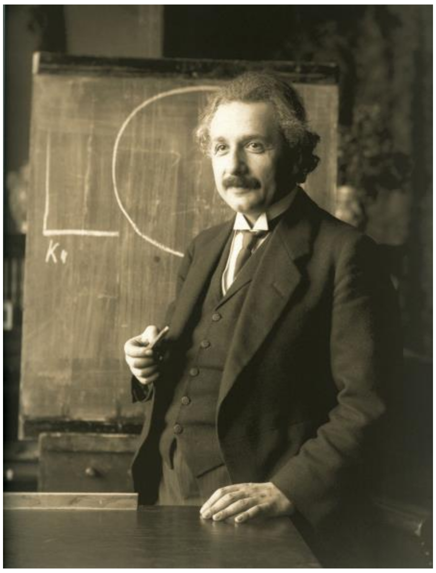

Fig. 3 Albert Einstein in 1921.

Einstein modelled his theories in thought. He began to imagine how moving observers see phenomena from their point of view. This mental analysis led Einstein to the first postulate that could be formulated as follows. "An observer will never be able to observe independent movement except in relation to other objects". This means that the laws of physics are the same for every observer, regardless of their movements, as long as they are not accelerated.

The second postulate of this theory was that the speed of light is constant and will be the same for all observers, regardless of their movement in relation to the light source.

This mental discovery of Einstein, led him to the well-known formula that binds the resting mass (m_0) of moving bodies to their energy (E).

$$E = m_0c^2$$

This relativistic relationship describes the energy of moving bodies and predicts that the energy of resting bodies is not equal to zero. On the contrary, it is immense (1 kg of mass is equivalent to the energy that is released at the explosion of a 20 Megaton of TNT). This postulate was equally difficult to comprehend by human minds until the first practical and spectacular explosions of atomic bombs showing the power contained in a small, microscopic amount of matter, which is transformed into energy while doing a huge amount of work, demolishing cities and evaporating people from which only shadows are left on the stones.

In 1916, Einstein published a general theory of relativity, mentally thinking about the observer watching the world from the position of an object being accelerated [4]. Anyway, this work would not have been known if it had not been referred to by the excellent Russian mathematician Alexander Friedmann, who in 1922 introduced the idea of the expanding Universe with its material bodies [4].

Einstein's work resulted in the conclusion that gravity and motion through space-time are closely linked. A law of independence was created, which states that the observer will not be able to distinguish forces resulting from acceleration from those resulting from gravity. An observer locked in a cabin will not be able to distinguish whether he is on the surface of a cosmic body with a given gravitational acceleration, or is in a space vehicle accelerated by a rocket engine to the same value of gravitational acceleration. Einstein in his work concludes that the forces of gravity, inertia and acceleration are related to the relationship between space and time. Gravity, seen from the position of the general theory of relativity, talks about how mass bends space-time continuum and how bent space-time continuum forces the mass to adjust the acceleration accordingly. So here, for the first time, we are dealing with the explanation of the nature of gravity as a curvature of space-time. Standing on the surface of the Earth we feel the force of gravity because the mass of our planet forces the bend of the space-time continuum in which we live, and the mass of our body responds to it by accelerating towards the centre of the Earth. Because the electromagnetic cohesion forces of the rocks of the Earth's crust resist our body, not allowing it to sink into the centre of the planet, we sense this as the weight of the body that oppose the Earth's acceleration.

As you can see, the theories of relativity have already given an insight into the nature of gravity for the first time in human history since the beginning of the 20th century. Einstein's both theories have extended the laws discovered by Newton and his predecessors to areas of experience and observation where masses and velocities are supremely greater than those encountered in everyday life on Earth. Thanks to these new relativistic extensions we learned that the gravitational field is a curved area of space-time, and about the equivalence of accelerations that a body moving in space-time can experience with the gravitational accelerations that it can experience on the surface of a massive body.

The theory of relativity, due to a relativistic correction in Newton's equations, allowed for more precise determination of orbits of cosmic objects, especially those whose orbits are located near very massive bodies. Such an example was the explanation of the puzzle of the inexplicable value of Mercury's long axis of orbit precession, which is 43.11 angular seconds per century faster than predicted from Newton's calculations. The proximity of the Sun's enormous mass is the reason for this apparent calculation inaccuracy, as this mass slows down the clocks on Mercury compared to those working on Earth.

The mass of the Sun also bends the space in which a ray of light arriving at us from distant stars. Astronomical observations made during the solar eclipse between 1919 and 1973 confirmed the foundation of Einstein's theory, showing that the stars that should be hidden behind the solar disk were, however, visible near its surface. The Sun acted as a kind of gravitational lens here, bending the space-time continuum around itself so that lines of light rays running from the stars hidden behind it, moving in the bent space, reached the observers on Earth. This shift was very small as it was 1.66 ± 0.18 angular seconds, but was perfectly in line with the calculations predicted by Einstein.

However, can such a minimal bend in space-time caused by the huge mass of the Sun, or a much smaller mass of our planet, be directly translated into the fatigue of the legs of a tourist climbing up a mountain? Undoubtedly, astronomical observations confirmed the minimal curvature of space-time around the Sun caused by its huge mass. However, there is no convincing explanation as to how this minuscule fold translates into the perceptible weight of bodies on Earth or their inertia when accelerating through empty space.

Some light in this matter was shed only by discoveries made in parallel to the theory of relativity of developing new science, quantum mechanics. While the theory of relativity dealt more with bodies and interactions on the cosmic scale, quantum mechanics dealt with the invisible universe hidden as if in the scale of subatomic size particles. Scientists working in these completely different fields of science repeatedly had doubts about the merits of the matter being beyond the possibilities of so far understood so-called common sense. Einstein himself was not convinced about the effectiveness of results of quantum mechanics research. Both these fields of science would seem to be completely incompatible.

Thanks to the development of the concept of quantum mechanics, it was understood that the seemingly empty space is filled with quantum fields which have some measurable energy. The discovery of the Higgs scalar field, which has been proposed by Peter Higgs since 1964, is the basis for giving mass to basic elementary particles such as quarks, electrically charged leptons and bosoms. For example, 99% of the resting mass of baryons (Fig. 4) results from the chromodynamic energy of rapidly oscillating gluons that bind together quarks, whose colour indicates the quantum number introduced to distinguish quarks in the same spin state [6]. Contrary to the name, colour has nothing to do with colour in the optical sense. This energy comes from a very fast exchange of gluons between the quarks and the gluons themselves. This is the sum of the kinetic energy of quarks with the energy of massless gluons transmitting strong nuclear interactions inside baryons in the so-called Yang-Mills field. In the theory of the Higgs field, the property of "mass" is a manifestation of potential energy transmitted to the basic molecules when they interact with the Higgs field, which contains mass in the form of potential energy.

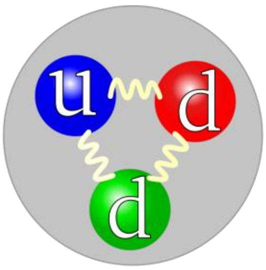

Fig 4: A schematic representation of baryon (here a neutron) composed of three quarks, associated with a strong gluon-transmitted interaction involving the exchange of gluons between quarks or between other gluons. Gluon carries the so-called colour charge, hence the name of the chromodynamic energy. (Wikipedia)

Thus, a small, basic part of the mass of material particles comes from the potential energy resulting from interaction with the Higgs field, and the rest, 99% of the mass results from the high-energy dynamics of subatomic elementary particles inside the baryon of atomic nuclei. In simple terms, this may be the mass problem. Despite the theoretical and experimental advancement, we haven't got anything new about the nature of gravity except supposing that the hypothetical particles proposed by Quantum gravity, called gravitons, as the carriers of gravity, can transmit to material bodies "information" to attract each other.

Since, as it results from the theory of relativity, the mass of material bodies is responsible both for the inertia of bodies and for the perceptible gravity, we will trace the mechanism behind these phenomena on the basis of examples. Therefore, we will be able to trace the experience in which we will place a cubical box with a photon closed in it.

The photon is a particle with no resting mass but it is never at rest. It travels through space-time at the speed of light and can have different energy values. This energy causes the photon to have a small mass equivalent to the Einstein formula of its energy. This fact in the macroscopic world is known from the force exerted by the pressure of light on material objects.

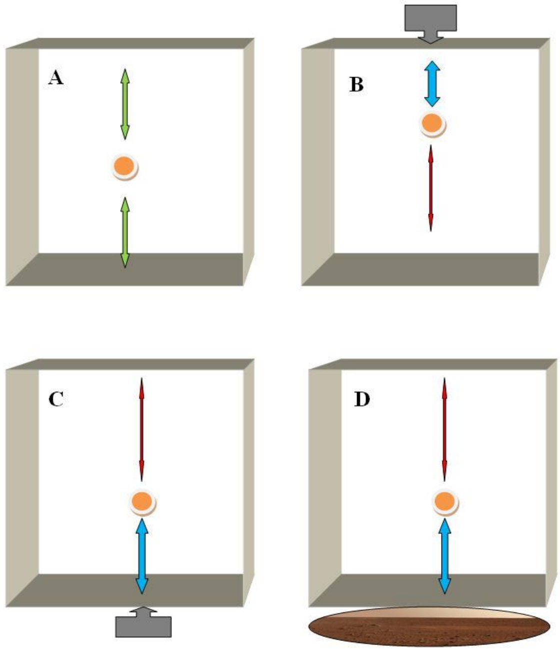

Fig 5: Diagrams showing the effect of acceleration on the photon's behaviour inside the closed system.

The diagram (Fig. 5A) shows the cross-section of a cubical box placed in an empty space, inside of which the photon is reflected vertically, jumping up and down the walls. Since there is no external force acting on the box, according to a special theory of relativity, we are not able to determine whether it is motionless or drifting at an unspecified speed, on natural falling lines in an unspecified direction. Since the photon hits both walls with the same energy, the box also does not feel any difference in internal pressure between the walls it hits.

However, when the box is affected by an external force, for example shown in (Fig. 5B) in the form of an arrow pushing the box down, the internal situation will change. Now the bottom wall, escaping as it were from the approaching photon, will lengthen its wavelength, which will reduce the perceived frequency of the photon's vibrations, shifting its spectrum to red, thus reducing the energy of the approaching photon. Thus, the light pressure exerted on the lower wall of the box will be less than on the upper wall of the box. The opposite will be true for the upper wall of the box, which will now be pressing on the photon jumping inside (Fig. 5B). In this case the wavelength of this photon will be shortened, the photon energy will increase and the light spectrum will shift to violet. The increase in photon energy will result in an increase in the weight of the photon being felt on the upper wall of the photon box. In this way, the pressure exerted on the top of the box will be felt as an inertia force opposing the acceleration of the box by applying an external force to it from above. The opposite image will be created if the external force is applied to the lower wall of the box (Fig. 5C). In this case, everything will be reversed and the pressure of the light reflected down and upwards in the photon will prevail in the direction of the lower wall of the box, which will cause the opposite inertia force to be applied. The photon bouncing down and upwards will prevail towards the bottom of the box, causing a force of inertia opposite to the return of the applied force to the bottom of the box.

What happens now when you place the box on the planet's surface in exchange for the accelerating force applied to the bottom of the box (Fig. 5D). The box will now be placed in the gravity field, and the photon jumping inside, after all endowed with a relativistic mass, is now affected by a gravitational force accelerating it when it moves downwards and slowing down when it rises to the upper wall. In such a case, the photon, attracted by the force of gravity, will hit the lower wall on the ground of the planet with more energy, and with less energy will hit the upper wall. Thus, the total perceived force exerted by the pressure of the photon will be towards the lower wall, similar to the case shown in (Fig. 5C) when an external force is applied to the lower wall. This observation will be in accordance with the theory of relativity, which states that the observer inside a closed system (in this case the photon closed inside the box) will not be able to distinguish between a force accelerating the box in space (e.g. a rocket engine) and a gravitational acceleration of the same value when the box rests on the surface of the cosmic body.

From the above experiment it can be seen that nothing will be felt inside the closed system when the system is at rest, or will move at a constant speed along the natural fall line until an external force is applied. Paraphrasing this situation one can imagine a buoy floating at a surface of water in a pond, where it will remain at rest. Similarly, a buoy will be floating on the moving waters of the river surface. Here, moved by the river's current (similar to the one enclosed in a falling elevator), a buoy will not feel any force acting on it. However, when a motor, attached to a buoy, is switched on, the force will be applied to it, analogously to the situation of the photon shown in the figures (Fig. 5B, C), on which the wall of the box will be affected by the accelerating force. Under acceleration in a water environment, a buoy's matter will feel a force opposing the movement of the water as a result of its interaction with the floating water molecules. A similar kind of acceleration will be felt by the described float when, moving freely in the river current, it encounters an unexpected obstacle in the form of a tree log lying across the current. A buoy will then stop at the log and the river current will press a buoy towards a log as if it were in the gravitational field described in the photon in Fig. 5D.

This analogy, although not fully appropriate, and the representation of a single photon inside an empty box is a very simplified model in comparison with macroscopic bodies, it shows that material, mass-possessed bodies will always be subject to accelerations when an external force forcing them to change their direction of motion in the environment of quantum scalar fields of space-time. If this model has signs of probability, the reasoning may lead to an interesting conclusion. Well, the body remaining at rest on the surface of the planet is also subject to the acceleration felt as the force of gravity only that there is no visible movement accelerating through the quantum field of space-time as it was shown in Fig. 5B, C. The only logical solution to this paradox may be to assume ad hock that it is the quantum fields of space-time that move in relation to bodies endowed with mass, giving them acceleration.

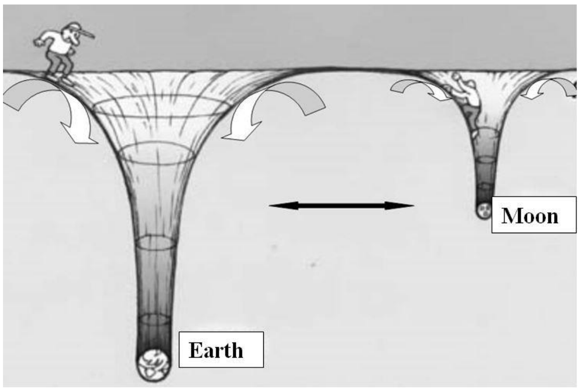

Fig 6: Visualisation shows Earth and Moon as gravitational wells absorbing the space-time continuum from between them, causing the phenomenon of gravitational attraction.

This shows us a world in which material bodies absorb space-time, curving it. As presented in (Fig. 6), the masses of the Earth and the Moon, by causing the absorption of space around them, cause a situation in which the "space pressure" between them will be smaller than that acting outside this system. Thus, a resultant force is created between these bodies, which tell them how to attract them towards each other.

So far there is no coherent quantum theory of gravity and it is not known how the scalar field of inflation is transforming into matter. One can loosely suppose that these high-energy gluons will draw energy directly from quantum fields and metaphorically speaking, winding up the space-time, passing this chromodynamic energy to the quarks, which translates into their relativistic mass. These, building the basic elements of the atom, create material bodies known to us, which would look like sucking holes of space causing the progressive movement of the quantum field towards the objects endowed with mass. Streams of this field will cause observable effect of mutual attraction with a force determined by a simple Newton equation with a relative correction if their masses are huge and their relative velocities are close to the speed of light in this field. It can be interjected here that gravity forces do not appear to be associated with the three main forces operating in nature and it is highly likely that their unknown nature is completely different. This is supported by a comparison of their power. Gravity forces are 39 orders of magnitude smaller than electromagnetic forces, and electromagnetic forces are only two orders of magnitude smaller than strong nuclear forces.

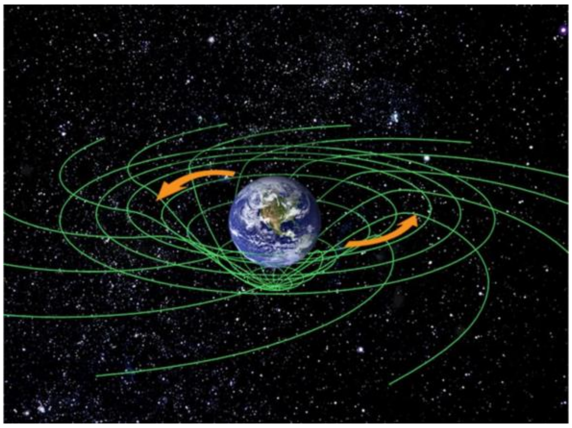

Fig 7: Artistic vision of the winding up of space-time pulled by the Earth's gravitational field studied in the GP-B space mission (NASA)

The winding of space-time to material bodies has already been experimentally confirmed in the space mission "Gravity Probe B", (GP-B). The space probe was launched into orbit around the Earth in 2004 and the mission was completed in 2010 [7]. During the experiment, ultra-precise gyroscopic measurements of the Earth's gravitational field were performed. An effect was found in which the space-time matrix was wound around the rotating Earth like the spider web threads pulled up on a rotating stick put into it, as shown in Fig. 7. This experiment shows that a rotating, massive space body pulls the space-time matrix in the direction of the body's rotation. It would look as if the space-time continuum near the material bodies is an extension of this material body, in fact, bloomed from space. This experiment shows a kind of viscosity of space-time continuum in which, like a mixed liquid, the rotor torque can be transmitted further into the solution of quantum fields of space.

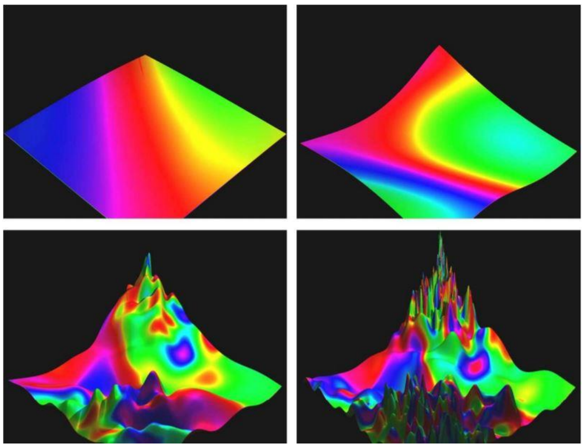

Fig 8: A computer simulation presented by Linde showing the process of evolution of the scalar field of the self-producing universe.

The colours represent three states of potential energy. The peaks of the "mountains" correspond to places in the space-time continuum where quantum fluctuations lead the scalar field to the Planck density. Each of such places in its understanding can be considered as a potential area of the new Big Bang, the creation of a new universe [8].

However, let us come back to the consideration where the gravitational acceleration comes from. If we try to assume that the material body absorbs the space, it happens in a progressive motion and there is no reason for this motion to be accelerated. But if we look carefully at the drawing in Fig. 7, we can clearly see that the lines of the “space-time matrix”, understood as a visualization of a vector quantum field, not only wind up on a rotating planet, but also converge to connect somewhere in the very centre of the Earth's mass. It may look similar to the meridian lines on the globe converging to a point in the region of the planet's poles. Thus, the bodies suspended in space where the matrix grid is not subject to any deformations can remain calm or float in a straight line like a buoy on the water surface carried by a river. However, if this network is disturbed, the body will be affected by an accelerating force. As the vector lines converge more and more towards each other, the body moving towards the point of convergence will be affected by the accelerating force. It is like measuring the velocity of water flow when the outlet of water will be more and more tapered. The water molecule that moves inside the pipe will be accelerated more and more as it moves closer to the outlet. This may support previously given presumption [9] that the Universe, may be a dynamic entity dominated, shaped and driven, not by dark forces, but by chance and competition between electromagnetic and gravitational forces.

III. CONCLUSIONS

The phenomenon of absorption of space by matter, if true, can be seen as the conserving of its mass. If we would effectively isolate matter from the quantum field that feeds it, it is likely that the matter would dissolve leaving a clean space inside the isolated area. This reasoning can lead to the conclusion that scalar quantum fields, including the already known Higgs field, can change the value of their potential energy in large areas of space. The fluctuation of field energy can, as shown in [8] (Fig. 8), create separate fragments of space-time in which material particles will spontaneously emerge from the empty space much frequently and last longer than in areas with low value of this field. Where quantum fields will take low values, the material particles will disappear, dissolving in space. Perhaps areas with high quantum field energy values abounding in material particles will form a kind of islands in space separated by unimaginably large areas of low energy value space-time void. In one of such islands of space with a relatively high value of potential energy we are just located and we call it our Universe.

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