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### ENERGETIC AND QUANTIC POTENTIALS IN VALUES MULTIPLES OF *h*, DISTRIBUTED ON LENGTHS ADAPTED TO THE 6,048 RATIO BETWEEN THE FREE FALL ON EARTH AND MOON, CONFIRM THEIR ACCELERATIONS AND THE COMPACTION PROCESS OF THE EMW IN GRAVITY QUANTUM EVTD<sup>2</sup>

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**Abstract:** The paper is the complement and the encrypted justification for the assumptions already employed in [1], regard the consideration of the quantum gravitational potentials in quantum gravity  $EVTD^2$ . The revisited free fall of bodies allows phenomenological explanation of differences on Earth and the Moon. In [1], the conclusion attributes the acceleration of free fall to the quantum levels of active potential on segments of adapted and progressive lengths for a move away from the mass. Here, the major confirmation of the probable understanding of developments of this phenomenon is given, considering the constant and particular work of OME that initiates the gravitation force [2-9]. But it is more a question of evolutionary duration of simultaneous compaction on different quantum levels hierarchical lengths, occupied by these potentials generating corresponding accelerations. **Key words:** quantum compaction, quantum gravity, EVTD<sup>2</sup> theory, quanta substratum and potentials.

#### **1. INTRODUCTION**

Quanta gravitation, in EVTD<sup>2</sup> in energetic entities theory, advocates the mechanical compaction work of EMW (Electromagnetic Mother Wave), always available, on the diffuse energy quanta entities of the vacuum contained in  $EVTD^2$  [3-10]. This imposes a new geometry [2] in the context of this space-time. Concerned space-time is quantic size, time and, therefore also, in diffuse energy. The latter, specifically, due to the vibration of the substrate being the common substrate representative of dark matter and dark energy [4] and [17] which only differ by inverse pressures. This energy of substratum is the result of actions in vibratory alternated phases to Planck frequency of longitudinal OME. More the substratum energy can exist only with well-defined quantum levels within the EVTD<sup>2</sup>. Demonstration of  $E = mc^2$  [18], in  $EVTD^2$ , checks without postulate that mass is unique as being a realization and concentration of energy. There is demonstrated the strict equivalence between inertial mass and gravitational [19]. Energy is known for its potential to do work, and so, there is compatibility between the various quantum states of substratum that can be compacted and amalgamated by the OME. The gravity between two masses is dependent on distributions and locations of the quantum energy levels of the masses themselves. But more, these levels are hierarchical regressively outwards depending on their gravity potential, in the environment that is in compliance, a fully quantum energy spacetime. Thus, the generated gravitational fields are also distributed in composition quantum energy since they overlap, particularly, to the temporal and space structure  $EVTD^2$ . It is quantum mechanically organized by EMW formatting. This wave is jointly, also, the "engine" that generates the forces of gravity by compaction

and nearby of the gravitational potentials that are intimately related to their mass. Therefore an action on each is automatically reflected in the mass. In [1] was shown that a quantum energy for a given quantum potential level, stands on a particular segment normal length to field lines for a mass or between two masses. The length of these different segments (or quantum levels) is scalable and calculable depending on the circumstances. But as a general rule, the length of the levels increases by moving away from the mass [1]. Hypothesis about the characteristics of the free fall process in  $EVTD^2$ , have been formulated and used in [1]. This work is here a logical extension of [1], which brings the best demonstration of a probable certainty of the truth and existence of the process as previously described. The general rule of free fall highlights the different quantum levels lengths, which are proportional to the number of EVTD<sup>2</sup>lengths. This imposes more or less long times of compaction in a quantum level in its neighbor, which generates different fall distances in time. As levels are shortened during fall to the ground of the mass, it follows an accelerated fall because compaction time decreases by an  $EVTD^2$  in its neighbor in the decrease in the number of entities along the levels. Indeed, this requires a large number of EMW oscillations because the duration of compression is as important as the length of the level itself. In this process is imperative that previously, every level be fully compacted, and so, it can suddenly pass in its hierarchically higher neighbor level.

#### 2. QUANTUM LEVELS LENGTH ORGANIZING THE HIERARCHY OF POTENTIAL ON EARTH AND MOON

According [1] and in postulate, gravitational potentials levels can be expressed in value quantum (universal constant of quantum  $\Delta V_q$ ).

Hence is a multiple *n* of  $\Delta V_q$  that will express the value of a *V* potential considered for a mass *m* in equivalent quanta of energy as shows the initial relationship mentioned in [1]:

$$V = n \cdot \Delta V_q = -\frac{G_N \cdot m}{d_n} = -\frac{G_N \cdot E_m}{c^2 \cdot d_n} . \quad (1)$$

With  $m = E_m/c^2$ , *n* being a natural number,  $d_n$ is the distance from the mass, where starts this potential in value of  $n \cdot \Delta V_q$ . The assignment of an acceptable value of the gravitational potential quantum  $(\Delta V_a)$ , in agreement with the corresponding potential energy quantum  $(\Delta E_q)$ , has not been formulated in [1]. But already, in  $EVTD^2$  theory, the photon is regarded as an electromagnetic shock - impulse propagating in a quantum space-time caused by an electron, for example [11-16], on the cubic structure  $EVTD^2$ . For Planck's physics, the photon is the energy quantified by a multiple of h quantum (in value of  $6,626068 \cdot 10^{-34}$  J.s). So, it appears coherent that in such energetic quantified space-time, the gravity potentials expressed in quantum energy can be formatted into levels and energy quanta of multiple values of h because the photon is already in agreement with this structural organization of the whole Universe. So, here it is postulated that the  $\Delta V_q = \Delta E_q = h$  (Planck quantum). In the previous relationship, the constant terms for a same mass *m* are brought together in a constant A which can be written as:  $\mathbf{\Gamma}$ C

$$A = -\frac{G_N \cdot E_m}{c^2 \cdot h} = -\frac{G_N \cdot m}{h} = C^{ste}, \text{ and then (1) is}$$

simply wrote as:

$$n = \frac{A}{d_n}.$$
 (2)

So, depending on *m*, and taking  $d_n$  equal to the radius of the spherical body, we can determine the natural number *n* of the level in *h* quanta, the nearest by the calculated decimal value for the potential located on the body's very surface. Equally, one can establish quantum positions of neighboring potentials whom decreasing quantum levels are known (*n*, *n*-1, *n*-2 etc.), i.e. for the same mass, this is written respectively:

$$d_n = \frac{A}{n}, \ d_{n-1} = \frac{A}{(n-1)} \text{ and } d_{n-2} = \frac{A}{(n-2)}$$

Then, the distance along which the quantum of level  $n \cdot h$  is settled and continues until the beginning of the next lower level (n-1) h, can be expressed. This quantic level length having the value  $n \cdot h$  is thus given by the relationship:

$$d_{n-1} - d_n = A\left(\frac{1}{n-1} - \frac{1}{n}\right) = \frac{A}{n(n-1)},$$
 (3)

and, also:

$$d_{n-2} - d_{n-1} = \frac{A}{(n-1)(n-2)}$$

With  $G_{N} = 6.6742 \cdot 10^{-11} \text{ N} \cdot \text{m}^2 \cdot \text{Kg}^{-2}$ , the universal gravitational constant, the previous *A*, with the known values for Earth of ray  $R_T = 6378 \text{ Km}$  and mass  $m_T = 5.9736 \cdot 10^{24} \text{ Kg}$  becomes:

$$A = -\frac{39.869 \cdot 10^{13}}{6.626068 \cdot 10^{-34}} = -6.017 \cdot 10^{47} N \cdot Kg^{-2} \cdot s^2.$$

On the other hand, the analogous constant *B* for Moon will take another value, according to its mass  $m_L = 7.348 \cdot 10^{22}$  Kg and ray  $R_L = 1737$  Km:

$$B = -\frac{49.04202 \, 10^{11}}{6.62606 \, 10^{-34}} = -7.4017 \cdot 10^{45} \, N \cdot Kg^{-2} \cdot s^2$$

Numerical values for the first quantum level lengths respectively, from Terrestrial and Lunar soils, infer of the modified relation (3). So, for the Earth we have for the first level, for example, the number  $n = A/R_T$  of *h* quanta, from the ground and, thus the numeric value is:

$$n = \frac{6.017 \cdot 10^{47}}{6.378 \cdot 10^6} = 9.434 \cdot 10^{40},$$

where n is a natural number. As to calculate the first quanta level length from terrestrial soil towards the space, can be used the relation (3) that is adapted in regressive quanta levels:

$$d_{n-1} - d_n = \frac{A}{n(n-1)} \approx \frac{A}{n^2}$$

because n was just defined as a big natural number. This gives the absolute value of length of the first quantum level from the ground:

$$|d_n - d_{n+1}| \approx \left| \frac{6.017 \cdot 10^{47}}{(9.434)^2 \cdot 10^{80}} \right| \approx 6.760647 \cdot 10^{-35} m.$$

A correlated approach and a similar calculation concerning the value of the first lunar quantum level (*r*) with the constant *B*,  $d_r$  and  $d_{r-1}$ , the positions of the first two levels are:

$$r = \frac{7.40176 \cdot 10^{45}}{1.737 \cdot 10^6} = 4.2613 \cdot 10^{39},$$
$$d_{r-1} - d_r \Big| \approx \frac{7.40176 \cdot 10^{45}}{(4.2613)^2 \cdot 10^{78}} \Big| \approx 40.76156 \cdot 10^{-35} m.$$

The lengths of the other quantum levels that are above terrestrial and lunar soils will be respectively in harmonious progressive hierarchy with each of their first level of base lengths. Thus, comparatively, they will always be in the same report on Earth and on the Moon for a moderate fall height.

Reporting the numerical evaluations of first two levels, without looking for major details (simple order of magnitude), of respectively for the ground ( $L_{PT}$ ) and the Moon ( $L_{PL}$ ), is found that the value for the Moon is **6.029** times larger than that of the Earth (despite the taken into account of the representative and rounded values in natural numbers):

$$\frac{L_{PL}}{L_{PT}} = \frac{40.76156 \cdot 10^{-35} m}{6.760747 \cdot 10^{-35} m} = 6.029$$

This value is very close to the report 6,048 of accelerations of free fall on Earth and on the Moon. So. here is highlighted that corresponding quantum levels length, relative to terrestrial and lunar potential levels, are inversely proportional exactly to the acceleration of free fall. Hence:

$$\frac{L_{PL}}{L_{PT}} \approx \frac{g_T}{g_L} \approx 6.04$$

From these findings we can mention that more the lengths of the quantum levels of gravitational potentials relating to a star will be Furthermore, these values of lengths of respective levels are of the order of the dimensions of the EVTD<sup>2</sup> entities (in units of  $10^{-35}$  m) which strengthens all this approach compared to the EVTD<sup>2</sup> theory. On the other hand, the postulate of *h* value for the quantum  $\Delta V_q = \Delta E_q$  in proven to be in good agreement of the EVTD<sup>2</sup> quantic gravity – it does not create any incompatibility.

In paper [1] was mentioned that the compaction of the length of one level, will be ultimately agglomerated to its neighbor, at the same rate for each constituent  $EVTD^2$ . So, more the quantum level is long, more the duration for it compacting is long. Wherefrom, it is essential to define an additional concept in order to explain the different speeds and acceleration of free fall.

This new concept to take into account can be a non-uniform process of more or less numerous simultaneous compaction, in neighboring and determined levels variously involved in one case or the other. Indeed, the compaction of an  $EVTD^2$ , of a same level, is not simultaneously with the other entities of this level; but piecemeal before moving to the next  $EVTD^2$ . But it is not forbidden to think that *for neighbor levels placed in a same suitable situation, they undergo a simultaneous vibratory compaction, in each of the levels, in time*. Indeed, EMW, as a wave propagating in the space-time, can act everywhere at the same time if this is suitable.

But a question can be placed relatively to the existence of these two types of compactions. On one hand, they can be simultaneous on neighboring levels and on the other hand, they must be in mono - compaction inside a same level. The beginning of the answer was mentioned in the work [1]: mechanically it seems logical to think that compaction of a level should be in and to the neighbor quantum level immediately above. This is imperative in quantum gravity to cause the force of gravitational attraction between two masses. So inside the level to be compacted the compression work cannot be done no matter how. Also in mechanics, the beginning of compaction must be at the end of the level to compact which is opposed to the receiving level of this

compaction. It cannot be considered that there is piecemeal compaction a little everywhere on the segment of the level. It is therefore a starting point and a sense of compression as the purpose be properly met. That is, as the action of a piston that compresses the mixture air - fuel to a spark plug in a cylinder. Thus, the process is gradual and uniform observing the blow after the fact. So a longer segment, particularly in the number of EVTD<sup>2</sup>, will require the use of more frequencies of EMW to finalize this work of compaction of the segment in its immediately neighbor, a little shorter than him.

Let us suppose that there is, on Earth and on the Moon, a vertical height, almost identical, where simultaneous compactions are generated by the "vibrational compression" engine EMW. This will result in greater efficiency and speed of this type of simultaneous works compared with the "mono work" on a single level. Indeed, this is to be determined: on Earth quantum levels are about six times more numerous than those, distributed on the same lunar height. Therefore a same quantum level on Earth will have approximately six times less entities  $EVTD^2$  as a level on the Moon. According what has been above mentioned there will be for the case of the Earth a simultaneous compaction on six levels occupying the same length as a single lunar level. On the latter it is, only the hit for hit that is possible because is no possibility of simultaneous relative compaction. We propose the following reasoning: it is assumed that it takes a period of time, for example  $6\Delta t$ , to fully compact this lunar level in its neighbor. It will be necessary, in simultaneous compaction on the six levels of the Earth a duration six times less i.e. a single  $\Delta t$ , so they are all compacted simultaneously. Thus, ultimately, for the time of  $6\Delta t$  on the Moon, compaction and consequently the fall height will be the length of a lunar level. While during the same duration  $6\Delta t$  on Earth there will be six times as simultaneous compaction and therefore six times faster: resulting in a height of fall which, will be six times greater. Thus the two circumstances that come to be mentioned cause the acceleration of free fall of bodies on Earth of 9.81  $m/s^2$  and on the Moon at 1,622  $m/s^2$ . In fact energy quanta compaction is done more and more rapidly, in the progress of the fall, what is also involved in

the observed acceleration of the fall of any body. So the duration of the corresponding compaction work will always be more long (less effective) early in the fall as it progresses. To note also that ongoing fall, the number of possible simultaneous compaction thus becomes increasingly large and also faster individually and temporally.

But above all, is not to forget one thing: the acquired fall speed will lead, due to the displacement of the mass and its potentials, a corresponding increase in compression levels. This will therefore add speed to the acquired speed and, there will always be an acceleration in free fall. This is possible because compaction are at a very high speed (close to the speed c) compared to the fall velocity. This acceleration is rated in a uniform manner by the constant frequency of EMW. But it is mostly the quantum levels lengths with their differentiated hierarchy and their more or less simultaneous compaction causing acceleration of bodies' free fall.

#### 4. CONCLUSION

The Newton law, relative to the force of gravity between two bodies, is obsolete, and non-recommendable in an attempt to explain the process of the free fall of bodies. Indeed it always takes into account the determined mass of the body in fall, while the observation of free fall on Earth indicates that it is the same for any mass. It is for this that it has not been used here, for the case of gravity on very close body from the other. A fully quantum gravity based principally on an energetic quantum space-time and also a "motor" whose work is represented by vibration of an electromagnetic wave-EMW were used. To be consistent with the particular quantum gravity work of EMW, it had to be involved a hierarchical representation in quantum levels of energy for gravitational potentials. Face to the problem of assigning a value per unit, if possible suitable, to the energy quanta for these levels, it seemed that in good coherence is the quantum h of Planck, which offered the most guarantee. This quantum h fits perfectly in the context of this approach and according to the results its use, appears in good correlation with this EVTD<sup>2</sup> gravity. More, the

lengths of these representative levels are scalable and influence the process of compaction of an entity in its neighbor. In fact there are two types of compression: the simultaneous and in piecemeal. This allowed clarifying on the different phenomena and processes which would be primarily involved in the free fall of bodies on various stars

It was established an exact correlation between, accelerations of fall in their report between that on Earth and that on Moon, and on the other hand, the ratio of lengths of quantum levels between that of the Moon on the Earth. These two inverse reports are equal, as it was found, in value of about 6.04.

The numerical determinations obtained in this work are in perfect agreement with the acceleration of free fall on Earth and on Moon. Assumptions used for understanding and calculations are be in good compliance, at least for the facts and the approach conclusions. This adds, once more a very convincing reasoning, with the high probability of actual accuracy of the  $EVTD^2$  entities theory structuring an energetic quantum space-time.

For special studies on this fall process, of an ultra-lightweight body compared to a body of big mass, for subatomic dimensions, it will be necessary to use the new geometry [2]. This geometry is consistent with EVTD<sup>2</sup> quantum space-time because it is based on an extrapolation of the infinitely small Euclidean point to a realistic size of the dimension of an  $EVTD^2$  entity. And, for example, in this quantum geometry, to take into account the best this space-time, the Pythagorean Theorem is obsolete and must be transformed.

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## Potențialele energetice și cuantice în valori multiple de *h*, repartizate pe lungimi adaptate raportului 6,048 ale căderii libere pe Pământ și pe Lună, verifică accelerațiile și procesul de compactare a OME în gravitație cuantică EVTD<sup>2</sup>

Lucrarea de față este complementara și justificarea numerică a ipotezelor deja menționate în [1], în ceea ce privește luarea în considerare a potențialelor gravitaționale cuantice EVTD<sup>2</sup>. Reevaluarea căderii libere a corpurilor permite explicații fenomenologice a diferențelor dintre Lună și Pământ. În [1], concluzia atribuie accelerația căderii libere nivelurilor cuantice ale potențialelor active pe segmente adaptate și progresive în depărtarea de masă. Aici este prezentată verificarea probabilității de înțelegere a evoluției acestor fenomene, prin considerarea lucrului mecanic constant și particular al OME ce inițiază forța gravitațională [2-9]. Dar este, mai ales, o problemă de durată evolutivă a diverselor compactări simultane pe lungimi ierarhizate pe niveluri cuantice, ocupate de potențiale, ce generează accelerațiile corespunzătoare.

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