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Newton's static potential $1/r$ as the space relief formed by dynamic inertons, carriers of the gravitational interaction

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Abstract

The real physical space is considered as a mathematical lattice packed by topological balls (or cells, or superparticles). Any deformed cell of such a mathematical lattice called the tessellattice is associated with the creation of matter, i.e. a particle. The motion of a particle represents an exchange dynamics, which means that the moving particle exchanges with the tessellattice by bits of fractal deformations carrying by inertons, excitations of the tessellattice. Such a dynamics allows the study in the framework of a specific Lagrangian and the corresponding Euler-Lagrange equations. The result shows that inertons scatter from the particle as a standing spherical wave. Since a spherical wave is specified by the law $1/r$, the following corollary suggests itself: those are the particle's inertons that carry the space deformation (or in other words, the gravitational potential) $1/r$ from the particled cell to the surrounding space inducing Newton's gravitational potential GM/r that hitherto has been interpreted as static.

Key words: space, tessellattice, gravitation, inertons, quantum mechanics

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1. Preliminaries

Finite-size scaling, or scaling laws are studied and applied now at length in many fields of physics. A power-law scale dependence is revealed in measured atomic and molecular systems [1], it is described geometrically in terms of fractals, Mandelbrot

[2], and algebraically in terms of the renormalization group, Wilson [3]. Nottale [4] has studied relativity in terms of fractality basing his research on the Mandelbrot's concept of fractal geometry. He introduced a scale-relativity formalism, which allowed him to propose a special quantization of the universe. In his theory, scale-relativity is derived from applications of fractals introduced as follows. The fractal dimension D is defined from the variation with resolution of the main fractal variable, i.e., the length l of fractal curve plays a role of a fractal curvilinear coordinate. He also introduced the topological dimension D_T determining it as $D_T = 1$ for a curve, 2 for a surface, etc. The scale dimension then was determined as $\delta = D - D_T$, namely:

$$\delta = \frac{d \ln l}{d \ln(\ell/\epsilon)}.$$

Then if δ is constant, the above relationship gives a power-law resolution dependence $l = l_0(\ell/\epsilon)^{\delta}$. Such a simple scale-invariant law was identified with a Galilean's kind of scale-relativistic law.

Basically, such approach shows that a trajectory of any physical system diverges due to the inner stochastic nature that is caused by the fractal laws.

In Nottale studies, fractality written in the Mandelbrot's terms is associated simply with the length of a curve. In recent works by Bounias and the author [5-8] we have derived fractal geometry from complete other mathematical principles. In our works we have reconsidered such basic notions as space, measure, and length, which allowed us to introduce deeper first principles for the foundation of fractal geometry. In those works it has uniquely been shown that the space organization on the submicroscopic scale (hypothetically $\sim 10^{-30}$ m) represents a mathematical lattice of empty sets, or a tesselated lattice of primary balls, which has been called the *tessellattice*. A peculiarity of the space at this range, which follows from an analysis of experimental data obtained in high-energy physics, has been associated with the presence of primary blocks, i.e. topological balls (or elementary cells, or superparticles), which are densely packed in the tessellattice forming the degenerate state of the real space.

The rigorous mathematical theory of space [5-8] has allowed us deeply examine such basic notions as the descent of matter, the foundations of quantum mechanics, the foundations of quantum gravity, and the foundation of quantum electricity. We have shown how space generates matter and physics laws. Matter, i.e. a primary particle, appears in the tessellattice as its local deformation. In other words, a particle is created from a cell (superparticle) whose volume has altered from that of surrounding degenerate cells. Thus the deformed cell is associated with the generation of a massive entity in the degenerate tessellattice.

Our concept is based on topology, set theory and fractal geometry. We in fact could prove that the real physical space is represented by a mathematical lattice:

$$\mathrm{F(U)} \cup \mathrm{(W)} \cup \mathrm{(c)} \tag{1}$$

where (c) is the set with neither members nor parts, accounts for relativistic space and quantic void, because (i) the concept of distance and the concept of time have been defined on it and (ii) this space holds for a quantum void since it provides a discrete topology, with quantum scales and it contains no "solid" object that would stand for a given provision of physical matter. The sequence of mappings of one into another structure of reference (e.g. elementary cells) represents an oscillation of any cell volume along the arrow of physical time.

However, there is a transformation of a cell involving some iterated internal similarity, which precludes the conservation of homeomorphisms. If N similar figures with similarity ratios $1/\rho$ are obtained, the Bouligand exponent (e) is given by

$$\mathrm{N} \cdot (1/\rho)^{\mathrm{e}} \;=\; 1 \tag{2}$$

and the image cell gets a dimensional change from D to $\mathrm{D}' = \ln(\mathrm{N})/\ln(\rho) = \mathrm{e} > 1$. In this case the putatively homeomorphic part of the image cell is no longer a continued figure and the transformed cell no longer owns the property of a reference cell.

A particled ball provides formalism describing the elementary particles proposed previously by the author in (see, e.g. Refs. [9-12]). In this respect, mass is represented by a fractal reduction of volume of a ball, while just a reduction of volume as in degenerate cells is not sufficient to provide mass. The mass M_A of a particled ball A is a function of the fractal-related decrease of the volume V of the ball

$$M_{\mathrm{A}} \propto (1/V_{\mathrm{part}}) \cdot (\mathrm{e}_{\nu} - 1)_{\mathrm{e}_{\nu} > 1} \tag{3}$$

where (e) is the Bouligand exponent, and $(\mathrm{e} - 1)$ the gain in dimensionality given by the fractal iteration. Just a volume decrease is not sufficient for providing a ball with mass, since a dimensional increase is a necessary condition.

A local deformation is unstable in the state of rest and represents a field particle, or more exactly, a quasi-particle (excitation) of the real space, which was called the *inerton* [9,10]. It is obvious that the motion of a particle in the tessellattice is accompanied by those tessellattice's excitations, i.e. inertons, which, therefore, are a substructure of the so-called wave-particle. A mechanics of the motion of a particle and its cloud of inertons moving in the tessellattice has been developed in previous papers by the author and it has been shown how such mechanics is reduced to the formalism of conventional quantum mechanics (see, e.g. Refs. [9-12]). It should be emphasized that such an idea, the motion of a particle through an aether substrate when the motion was accompanied by an aether perturbation, held sway over leading mathematicians and physicists of the end 19th and the beginning 20th centuries (see, e.g. Poincaré [13]). Therefore, the idea deserves credit.

Two interaction phenomena have been considered [5-7]. First, the elasticity (γ) of the tessellattice favors an exchange of fragments of the fractal structure between the particled ball and the surrounding degenerate balls. In a first approach, the resulting oscillation has been considered homogeneous. Second, if the particled ball has been given a velocity, its fractal deformations collide with neighbor degenerate balls and exchanges of fractal fragments occur.

The velocity of the transfer of deformations is faster for non-fractal deformations and slower for fractal ones, at slowering rates varying as the residual fractal exponent (e_i). The motion of the system constituted by a particled ball and its inerton cloud provides the basis for the de Broglie and Compton wavelength [9-12].

The system composed with the particle and its inertons cloud is not likely to be of homogeneous shape.

Inertons are carriers of inert properties of the particle and yet they represent a substructure of the particle's matter waves. Since the amplitude of inerton cloud Λ can much exceed the lattice constant (Λ determines the range of the wave ψ-function application), inertons are able to manifest themselves on the macroscopic scale and we have demonstrated this fact experimentally [14] (see also Refs. [15,16]). Moreover, in paper [14] we indeed could experimentally fix the so-called "aether wind" that the Earth experiences at its motion through the space. Therefore, we virtually proved that the quantum mechanical force whose carriers are inertons makes itself evident at the macroscopic range.

Other researchers also observed similar effects. In particular, see results by V. Maiboroda, A. Akimov et al. in Shipov [17], though the changes in samples examined were associated with the so-called "torsion radiation" that was introduced by Shipov as a primary field that allegedly was dominating over a vague physical vacuum long before its creation. An influence a new physical field on specimens was fixed also in Refs. [18-20] and others.

In the present work the author combines his research on the theory of the real physical space, submicroscopic mechanics constructed in a dozen of works (see, e.g. Refs. [9-12,12-15]) and de Broglie's ideas regarding i) a possible double solution theory that would describe quantum mechanics in the real space and ii) the necessary of the decay of the particle mass at its motion [21]. This will allow us to show how the space deformation, which is carried out by a particle's inertons, is developed around the particle and account for the inner reasons of the distribution of the space deformation in the form of Newtons's gravitational law GM/r.

2. The phenomenon of gravity

In the space beyond the range Λ there is no any information about the particle. This signifies that inertons should also be recognized as actual carriers of the gravitational interaction [10,14] and hence the gravitation should be considered as a pure dynamic phenomenon. So, the gravitational radius of a moving particle is restricted by the amplitude of particle's inerton cloud Λ. The velocity of inertons is rather larger than the speed of light, because the gravitational dynamics is not tested by photons (this was also indicated by Poincaré [13] who for his part referred to Laplace).

Consequently, gravitons of general relativity derived in the framework of the phenomenological approach, which neglected the existence of the matter waves, do not exist in the nature at all. The same result was obtained by Loinger [22]: starting from the Einstein-Gilbert equations, he showed that the solution in the form of so-called "gravitational waves" is not realistic. He pointed out that an alteration in the gravitational potential should be associated with the motion of the front of the metric tensor, but not a vague massless "gravitational wave".

A detailed study of the emission of inertons from a moving particle and their re-absorption points to the fact that the proper mass of the particle periodically decomposes, namely, oscillates between values $m_0/\sqrt{1-v^2/c^2}$ and m_0 within each de Broglie wavelength λ along a particle's path. [23]. Inertons remove volume ΔV (or in conventional physics' terms the mass $m_0 = M_0/\sqrt{1-v^2/c^2} - M_0$), from the particled cell, which has been hidden in its fractal wrinkles, and atomize this deformation in the space around the particle (see also Refs. [6,7]). This induces the deformation field in the space surrounding the particle. The mass of inertons changes from 10^{-70} to 10^{-45} kg [24].

2.1. The contraction of mass

In paper [9] a mechanism that brings to the appearance of the root $\sqrt{1-v^2/c^2}$ at the proper particle mass m_0 has been analyzed. By the mechanism, this is the space response to the particle motion, which contracts the particle and its deformation coat along an entire particle path. The deformation coat (or in other words, the space crystallite) screens the particle from the surrounding degenerate space. It has been argued [10] that the size of the coat coincides with the particle's Compton wavelength $\lambda_{\rm Com} = \frac{h}{Mc}$ that so far has remained rather an enigmatic quantum characteristic of canonical particles. Topology and fractal geometry [6,8] also gives an accurate account of the appearance of the root $\sqrt{1-v^2/c^2}$.

The particle's crystallite travels by a relay mechanism, i.e. states of oncoming superparticles changes from massless to massive when the particle moves to a new position in its path. The contraction of the volume of a moving particle becomes apparent through the increase of the particle mass, $M_0 \to M_0/\sqrt{1-v^2/c^2}$.

Major equations, which allow the analysis of the motion of a system {particle + its crystallite} are equations that describe the motion on an element of a liquid in hydrodynamics:

$$\rho \frac{d\vec{v}}{dt} = -\nabla P; \tag{4}$$

$$(\frac{\partial P}{\partial \rho})_{\rm entropy} = c^2. \tag{5}$$

Owing to the discreteness of space on the sub micro scale (hypothetically, $\sim 10^{-30}$ m) and its presentation in the form of the tessellattice, the motion of the crystallite, which is treated as a liquid element now, is also discrete. Then the substantial derivative is transformed to (compere with Ref. [9])

$$\begin{aligned} \frac{df(x)}{dx} &= \lim_{\Delta x \to x_0} \frac{f(x+\Delta x) - f(x)}{\Delta x} \\ &= \lim_{\Delta x \to x_0} \frac{\Delta f}{\Delta x} \end{aligned} \tag{6}$$

where x_0 stands for the size a of a cell (superparticle) of the tessellattice or for the minimum proper time interval τ that needs the particle to hop from one superparticle to another. Thus equations (4) and (5) change along the particle path as follows

$$\rho \frac{\Delta v}{\tau} = -\frac{\Delta P}{a}; \tag{7}$$

$$\frac{\Delta P}{\Delta \rho} = c^2. \tag{8}$$

With regard for Eq. (8), equation (7) becomes

$$\rho \, \Delta v \, \frac{a}{\tau} = -c^2 \Delta \rho. \tag{9}$$

Clearly the ratio a/τ is equal to the change in velocity $|\Delta v|$. What is the sign of this value?

It is important to emphasize that we must suggest that canonical particles acquire an inoculating (initial) velocity non-adiabatically. Then the particle starts to move losing its initial velocity [9,10], which falls from v to 0 within odd sections $\lambda/2$ (the emission of inertons) and increases from 0 to v within even sections $\lambda/2$ (the re-absorption of inertons) of the particle path. Therefore, since $\Delta v = v_{\text{current value}} - v_{\text{initial}}$, we obtain that the sign is minus within the odd sections and is plus within the even sections.

Thus eq. (9) can be represented as follows:

$$\rho\,(v - v_0)(v_0 - v) = -(\rho - \rho_0)\,c^2 \qquad \text{odd sections;} \tag{10}$$

$$\rho\,(v_0 - v)(v_0 - v) = -(\rho_0 - \rho)\,c^2 \qquad \text{even sections.} \tag{11}$$

These equations result in equation for the density

$$\rho = \frac{\rho_0}{1 - \frac{(v_0 - v)^2}{c^2}}. \tag{12}$$

Since the solution for the velocity v is equal to [9,10]

$$v = v_0(1 - |\sin\frac{\pi t}{T}|), \tag{13}$$

equation (12) is reduced to the following

$$\rho = \frac{\rho_0}{1 - \frac{v_0^2}{c^2}|\sin\frac{\pi t}{T}|^2}. \tag{14}$$

Since the mass is proportional to the inverse volume of the particle (3), we can write relationship

$$\rho \propto \frac{1}{V_{\text{part}}^2} \tag{15}$$

and, therefore, taking into account Eqs. (3), (12), and (13) we obtain

$$M = \frac{M_0}{\sqrt{1 - \frac{v_0^2}{c^2}|\sin\frac{\pi t}{T}|^2}}. \tag{16}$$

Thus we have derived the law of behavior of the particle mass. The expression (16) is very important for the study of the particle dynamics at microscopic scales close to the de Broglie wavelength, because of the relation $\lambda = vT$. In the limit $t >> T$ where T is the period of the particle oscillations along its path, which is connected with the particle frequency $\nu = 1/2T$ [9,10], Eq. (16) is reduced to well-known expression

$$M = \frac{M_0}{\sqrt{1 - \frac{v_0^2}{c^2}}}. \tag{17}$$

2.2. The equations of motion

Having considered the generalized exchange dynamics of a particle's inertons whose emission and reabsorption result in the oscillation of the particle mass (16), we have to construct an appropriate Lagrangian. The Lagrangian should consist of : 1) terms that describe the kinetics of the particle and its inertons, which then should result in the formalism of conventional quantum mechanics, and 2) terms that reflect the behavior of mass of the system {particle + particle's inertons}.

Obviously the Lagrangian combined the kinetics and the mass dynamics of the system studied should be constructed on the basis of those proposed in Refs. [9,10] and [23]. Let us write the Lagrangian as follows

$$L = -M_0 c^2 \Big\{ 1 \; - \; \frac{1}{M_0 c^2} \Big[M_0 \dot{X}^2 + m_0 \dot{x}^2 - \frac{2\pi}{T} \sqrt{M_0 m_0} \, (X \dot{x} + v_0 x) \Big] \; - \; T^2 \Big[\dot{\mu}^2 + \dot{\vec{\Xi}}^2 - \hat{c} \dot{\mu} \nabla \vec{\Xi} \Big] \Big\} \tag{18}$$

and its value should be equal to

$$L = -M_0 c^2 \sqrt{1 - \frac{v_0^2}{c^2}}. \tag{19}$$

2.2.1. Kinetics of the system {particle + particle's inertons cloud}

It has been argued [23] that the kinetics of the particle and its inertons, which can be derived basing on the Lagrangian (15), is launched by collisions of the moving particle with the oscillating mode of the crystallite. The vibratory energy stored in the crystallite does not run low, because it is kept by the entire tessellattice.

In expression (18), M_0, X, and $\dot{X}$ are the mass, the particle position, and the velocity of the particle; T is the period of collisions between the particle and its inertons cloud; m_0, x, and $\dot{x}$ are the mass, the position, and the velocity of the center of mass of the inertons cloud.

The other part of the Lagrangian (18) includes the dimensionless variable $\mu = m/m_0$ that denotes the relative mass of the inerton cloud where m is the current value of the inerton cloud's mass and m_0 its initial value that characterizes the cloud at the moment of its emission from the particle. This second part of the Lagrangian describes the return motion of the inertons cloud that travels through the tessellattice strongly interacting with it as follows: along a path, the mass (the local deformation) is gradually transformed into the other kind of the tessellattice deformation, called the *rugosity*, which does not destroy the morphism of a cell, but translates the cell from its equilibrium position in the tessellattice. Such kind of the entire deformation of the tessellattice gives rise to its local tension. This elastic tension is removed by the energy stored in the tessellattice, or in other words, the tessellattice restores its initial state in which every cell occupies its own equilibrium position.

Once again, what is the rugosity $\vec{\xi}$ in terms of the tessellattice? Fig. 1 demonstrates the difference in two notions that our concepts operate with: the massive state of a cell of the tessellattice (Fig.1a) and the state of a cell in which the cell being topologically undistorted [6,8] shifts from its equilibrium position (in the case when a number of cells shifts, because the particle emits a could of inertons, we can talk about the "rugosity of the tessellattice", Fig. 1b).

In the Lagrangian (18), $\vec{\Xi} = \vec{\xi}/|\vec{\xi}_0|$ is the dimensionless vector that describes the rugosity of the tessellattice in the range covered by the inertons cloud, where $\vec{\xi}$ is the current value of the rugosity at the moment t and $\vec{\xi}_0$ its maximum value at a distance of Λ from the particle (recall that Λ is the amplitude of the inertons cloud, which shows how far from the particle the cloud spreads). We also assume that the start velocity of inertons $\hat{c}$ emitting from the particle may exceed the speed of light c, though the limiting velocity shows up in expression (17).

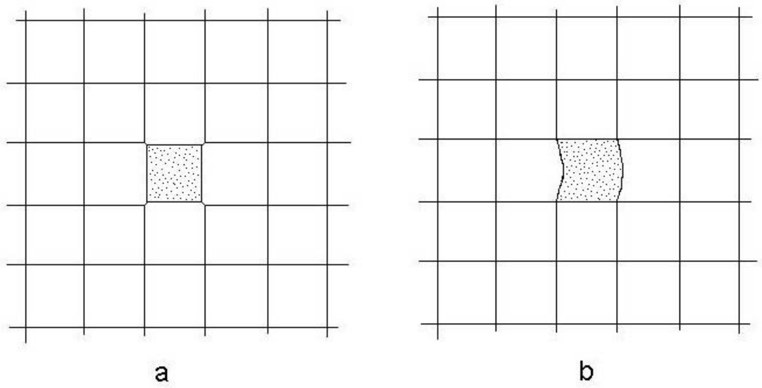

Figure 1: Two limiting cases for the state of an inerton from the particle's environment in the space net: (a) the deformation, i.e., the volume change is localized in the cell (here, the inerton mass $m_i \neq 0$); (b) there is no deformation in the cell (here, $m_i = 0$, or in other words, the volume of the cell does not distinguish from that of nearest cells) while the local deformation is completely transferred into the rugosity of the tessellattice (it is supposed that the inerton moves from the left, the particle location, to the right and backwards under the pressure on the side of the tessellattice).

Now we can proceed to the Euler-Lagrange equations. For conventional variables X, $\dot{X}$ and x, $\dot{x}$ they are

$$\frac{d}{dt}\frac{dL}{d\dot{Q}} - \frac{\partial L}{\partial Q} = 0 \tag{20}$$

where $Q \equiv \{X, \dot{X};\, x, \dot{x}\}$, which bring about the solutions [9,10]

$$\dot{X} = v_0\Big(1 - \Big|\sin\frac{\pi t}{T}\Big|\Big); \tag{21}$$

$$X = v_0 t + v_0 \frac{T}{\pi}\Big\{(-1)^{[t/T]}\cos\frac{\pi t}{T} - \Big(1 + 2\big[\frac{t}{T}\big]\Big)\Big\}; \tag{22}$$

$$\dot{x} = (-1)^{[t/T]}\, \hat{c}\cos\frac{\pi t}{T}; \tag{23}$$

$$x = \frac{\Lambda}{\pi}\Big|\sin\frac{\pi t}{T}\Big| \tag{24}$$

where the notion $[t/T]$ means an integral part of the integer t/T. The connection with parameters of conventional quantum mechanics is reached through the relationships

$$\lambda = v_0 T, \quad \Lambda = \hat{c}T, \quad \nu = \frac{1}{2T}. \tag{25}$$

If we pass on to the de Broglie relationships for a particle

$$E = h\nu, \quad \lambda = \frac{h}{M v_0}, \tag{26}$$

we will derive the formalism of conventional quantum mechanics (the Schrödinger equation, etc.) [9,10].

2.2.2. Mass dynamics of the inertons cloud

Regarding the variables μ and $\vec{\Xi}$ in the Lagrangian (18), we have to use the Euler-Lagrange equations in the form (because of the function $\nabla\vec{\Xi}$, see e.g. ter Haar [25])

$$\frac{\partial}{\partial t}\frac{\partial L}{\partial \dot{q}} - \frac{\delta L}{\delta q} = 0 \tag{27}$$

where the functional derivative

$$\frac{\delta L}{\delta q} = \frac{\partial L}{\partial q} - \frac{\partial}{\partial x}\frac{\partial L}{\partial(\frac{\partial q}{\partial x})} - \frac{\partial}{\partial y}\frac{\partial L}{\partial(\frac{\partial q}{\partial y})} - \frac{\partial}{\partial z}\frac{\partial L}{\partial(\frac{\partial q}{\partial z})}. \tag{28}$$

The equations for μ and $\vec{\Xi}$ obtained from Eqs. (27) and (28) are

$$\frac{\partial^2 \mu}{\partial t^2} - \hat{c}\nabla\dot{\vec{\Xi}} = 0; \tag{29}$$

$$\frac{\partial^2 \vec{\Xi}}{\partial t^2} - \hat{c}\nabla\dot{\mu} = 0. \tag{30}$$

These equations can be uncoupled [23], which yields (Δ is the laplace operator)

$$\frac{\partial^2 m}{\partial t^2} - \hat{c}^2\Delta m = 0; \tag{31}$$

$$\frac{\partial^2 \vec{\xi}}{\partial t^2} - \hat{c}^2\nabla\cdot\nabla\vec{\xi} = 0 \tag{32}$$

(here we come back to dimensional variables: the mass m of the inertons cloud and the rugosity $\vec{\xi}$ induced in the range of the tessellattice covered by the inerton cloud).

Since the system studied features the radial symmetry, equation (31) should be rewritten in the spherical coordinates

$$m_{tt} - \hat{c}^2\frac{1}{r}(rm)_{rr} = 0 \tag{33}$$

(recall that in the spherical coordinates the Laplace operator is $\Delta = \frac{1}{r}\frac{\partial^2}{\partial r^2}(rm)$). Thus the wave equation (33) possesses the radial symmetry.

Let us set the following initial conditions to the variable $m(r,\ t)$:

$$m(r,\ 0) = m(r); \tag{34}$$

$$\frac{\partial m(r,\ 0)}{\partial t} = 0; \tag{35}$$

the boundary condition

$$\frac{m(r,\ t)}{\partial r}\Big|_{r=\Lambda} = f(r,\ t). \tag{36}$$

The conditions (34)-(36) mean that the mass $m(r,\ t)$ initially has located in the center of coordinates of the system studied, i.e. in the particle, $m(r,\ t)|_0 = m(0,\ 0) = m_0$. Obviously the total mass of the inertons cloud is

$$m_0 = \frac{M_0}{\sqrt{1-\frac{v_0^2}{c^2}}} - M_0. \tag{37}$$

Due to the radial symmetry and in view of conditions (34)-(36), the solution to equation (33) is typical for a standing spherical wave, which features the dependance $1/r$:

$$m(r,\ t) = C\,\frac{m_0}{r}\,\cos\frac{\pi r}{2\Lambda}\,\Big|\cos\frac{\pi t}{2T}\Big| \tag{38}$$

where C is the constant and r varies from the particle size $r \sim 10^{-30}$ m to the amplitude of the inertons cloud $r = \Lambda \approx \lambda\hat{c}/v_0$.

The distribution of the inert mass of the particle is described by the amplitude of the mass of the inertons cloud

$$\frac{m_0}{r}\,\cos\frac{\pi r}{2\Lambda} \tag{39}$$

that oscillates in the space around the particle with the period T. Since an elementary mass is determined as a local deformation of the tessellattice (2) (see also Fig. 1a), the distribution of the inert mass of in the space around the particle is given by expression (39).

In the region of space between the particle's crystallite whose size is defined by the Compton wavelength $\lambda_{\rm Com} = \frac{h}{Mc}$ and the edge of the inertons cloud determined by the amplitude Λ, i.e. $\lambda_{\rm Com} < r < \Lambda$, the time-averaged distribution of the mass of the inertons cloud in the limit $v_0 << c$ becomes

$$m(r) = C\,\frac{v_0^2}{c^2}\,\frac{M_0}{r}. \tag{40}$$

If we multiply expression (40) by factor $-G/(C \cdot \frac{v_0^2}{c^2})$ where G is the gravitational constant, we obtain Newton's gravitational potential of the particle

$$U(r) = -G\frac{M_0}{r}. \tag{41}$$

Thus the gravitational potential (41), which is prescribed to a particle in conventional physics, is based on the availability of particle's standing inerton waves in the space tessellattice.

In paper [23] we have shown how this result spreads to the gravitational potential of a macroscopic object. As follows from expression (39), the gravitational interaction should also be a function of the absolute velocity v_0 at which the object moves in the tessellattice. It is an interesting result, because it can shed some light on experimentally confirmable deviations from Newton's law, such as the motion of the Mercury perihelion, the deviation of light by the sun, and the red shift, which have been predicted by the phenomenological theory of relativity, namely, the Einstein-Gilbert equations.

In the Lagrangian (18), the two kinds of terms describing the kinetics and the dynamics of the system {particle + its inertons} have been written in a first approximation in which the terms do not interference. However, even this prime approximation has been found successful. It has enabled us to prove that dynamic inertons in fact form a space relief that allows the interpretation in terms of the static gravitational potential of a particle.

3. Conclusion

In this paper based on the rigorous mathematical theory of the real physical space constructed by M. Bounias and the author [5-8] and the mechanics of canonical particles [9-12,14-15,23,24] in the real space considered as the tessellattice, we have shown that excitations of the tessellattice, inertons, caused by the motion of a particle in fact are carriers of both the quantum mechanical and gravitational interactions. Besides, we have shown that the phenomenon of gravity is caused by the defractalization of the contracted moving object. The deformation described in terms of inertonic mass (37) is periodically stripped from the object and atomized around it. Thus it is the contraction of the space around the object that generates the attractive potential in the form of Newton's gravitational law (41).

It is interesting to emphasized that a hundred of years ago Poincaré [13] indicated the main reasons for gravity. By Poincaré, the expression for the attraction should include two components: one is parallel to the vector that joins positions of both interacting objects and the second one is parallel to the velocity of the attracted object. Thus the velocity of an object must influence the value of its gravitational potential. Grand Poincaré was at the origin of topology, he understood how the generalized theory of space was important for physics. Now his ideas are sustained by the results presented in this work.

In the next work we shall demonstrate how dynamic inertons introduce a correction to Newton's gravitational law accounting for the effects predicted by the formal phenomenological theory of general relativity.

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