The Continuum Theory: Part I Gravity

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Abstract

A new theory is developed that deals with the source of gravity, whereby evidence introduced indicates that gravity originates from quantum motions in a 4-Dimensional (4D) electric scalar potential that permeates the universe as stationary aether (totally coupled to mass). Local-couplings of mass with this aether raises the base 4D scalar potential of the continuum. The aether couples with mass quanta constituents to develop a flux field via electrostatic resonant fluctuations at Planck length scales. The theory does not originate from preconceived ideas but rather evolves from a certain gravitational phenomenon and the attempts to scientifically explain this phenomenon. A stationary aether changes the fundamental notions of particles and forces in quantum mechanics, and provides a new interpretation for the geometric theory of gravity. As covered in Part II, the theory also introduces mechanics for the speed of light, new definitions for mass and for time, and introduces a universe whereby the big bang is just a part of a repeating cycle. Based on this theory (Part II), manipulating time or propelling the space-time to circumvent the speed of light becomes permissible.

1. Introduction

In this paper a theory of the space-time continuum will be developed that encompasses gravity (Part I), matter, energy, and time (Part II), which also offers a hypothesis about the creation of the universe. The theory was first developed to explain observations of a certain phenomenon that turns out to involve gravity. This step-by-step development leads into a theory, which is different than the standard model, but unlike the standard model, in this theory there is no absolute quantity in nature, and every fundamental quantity involves some kind of mechanism.

The derivations in this theory bring back the aether (ether) theory as a stationary aether (totally coupled to mass); a luminiferous aether made of a 4-Dimensional (4D) Electric Scalar Potential (ESP) field. This aether constitutes the space-time continuum that permeates the known universe and beyond, which is different than the *Minkowski space-time*. The null result of the *Michelson-Morley* (M-M) *experiment*, supposedly excluded the existence of the aether as has been adapted by Physicists during the 20th century. Even though, Michelson himself did not exclude the possibility that aether that is totally motionless with respect to matter could exist, and in 1895 Poincaré argued that experiments like that of M–M show that it seems to be impossible to detect the absolute motion of matter or the relative motion of matter in relation to the aether. Einstein supported the aether theory as evident from his 1920 U. of Leiden address '*According to the general theory of relativity space without ether is unthinkable; for in such space there not only would be no propagation of light, but also no possibility of existence for standards of space and time…"* Nikola Tesla also supported this theory as evident from his lecture delivered before I.E.E., London, February, 1892, "*…and my conviction has grown strong that, to whatever kind of motion light may be due, it is produced by tremendous electrostatic stresses vibrating with extreme rapidity*."

From the derived equations, the continuum theory makes predictions that cannot be explained by the standard model. For instance, the theory through an additional gravitational component (also attractive but relatively small in magnitude) predicts that satellite galaxy orbits should over time align with their host galactic plane as recently observed. The theory also supports a highest degree of degenerate state of matter with no singularities, and black holes possessing sustained oscillations as some observations have shown. The theory explains the mechanics of the *equivalence principle* and shows that the so called fictitious forces are actually real forces of nature.

2. The Phenomenon and the Experimental Evidence

The phenomenon which gave rise to this theory may be controversial, but the reader is encouraged to keep an open mind. One day, back in the mid 1990's, the City engineer came to my front yard and proceeded to locate and mark a broken underground sewer line in order for a crew to dig out and repair. There were no blueprints for my old house and the only aid the City engineer had was a metallic L-shaped rod. The rod of approximately 9" - the long end and about 4" - the short end is carried like a pistol in a loose grip (free to move) like a bushing, with the arm tacked in to the side of the body, and the lower portion of the arm sticking out straight forward, parallel to the ground. The lower part of the arm is protruding forward at about the width of the body; neither shifted towards the inside of the

body nor towards the outside (away from the body). He proceeded with walking motion, perpendicularly towards where he thought the line of the pipe run should have been; sewer lines usually run approximately straight or perpendicular from the house towards the street. At some point during the walk, the rod turned 90° counter clockwise (rod carried in the right hand), which occurred when motion reached the sewer line, and at that point, the rod direction was in line with the pipe. Needless to say, the digging crew found the buried line in the exact spot the engineer marked couple days before, at a depth of approximately 12 feet under.

This event left me with a profound question of what could possibly be the scientific explanation for this phenomenon, and subsequently I have extensively and successfully replicated this experiment, with both metallic and wood made rods, with either underground or overhead pipes or simply material interfaces, like walls, etc. When the rod is held by the left hand, the rotation of the rod was instead, clockwise. If motion from the pipe proceeded backwards (after the rod already turned approximately 90° at the top of the pipe), the rod tended to unwind, rotating towards its initial position. So that in either the forward or the reverse motion, the rod seemingly points at the pipe or the material interface, at a point right in front of the center of the body.

At some point much later, I realized that the rod turning and pointing at the pipe (with either forward or reversed motion) was only possible by the existence of some gravitational attractive force, whose source location (as a gravitational source) was situated at the top of the pipe, right in front of the center of the body facing the pipe run. Since motion is involved, this gravitational force must arise from motion or velocity, inside a field gradient (dot product). Since a pipe in this case and the body were both involved in this experiment, this field must involve material interfaces. From the latter, it is known from electromagnetic fields theory[i,ii] that if an electric scalar potential,Φ, is distributed in a region of space, then if material interfaces exist inside this field region, the gradient of this field at these material interfaces changes to accommodate step discontinuities in the corresponding electric field, as the electric field is related to the electric scalar potential as $\boldsymbol{E} = -\nabla\Phi$.

If motion into a field is also involved to produce the gravitational force observed in this experiment, it is assumed that this cannot be an isolated condition, but rather this would be a general characteristic that gives rise to the existence of gravitational forces. If so, and because we know that stationary objects exert gravitational forces, this can only be consolidated if gravity is due to quantum particle motions inside such a field. Furthermore, if an electric scalar potential exists in the local region of the pipe (this experiment can be done anywhere as it has been) and a differential electric scalar potential is generated locally due to the electromagnetic properties of materials at material interfaces, this local electric scalar potential must be a universal field. From electromagnetic field theory it is known that the infinity potential is zero, which would violate this hypothesis. If however, a coupling exists between this aether ESP field and mass, and if this coupling force is stronger at quantum scales than the electric force generated by the electric pressure of this field, then the infinity potential (at the observable quantum scales) will still be zero. Based on that, another conclusion can be made that this field must penetrate the deepest quantum scales and this coupling is generated at Planck length scales. Furthermore, such coupling should involve temporal fluctuations of the field that generates a flux at these quantum scales, which perhaps makes this into a 4-dimension field.

For the dot product mentioned before and based on field theory[iii], if an observer is stationary in the presence of a field, he/she is observing the stationary rate of change of the field (say field A) with respect to time (i.e., $\partial A/\partial t$). If the observer is stationary and the field is passing through (same as if the field is stationary and the observer is moving through the field), he/she is also observing the spatial change of the field with respect to time (i.e., $\boldsymbol{V}\cdot\nabla A$).). These two effects taken together constitute the so called substantial derivative of the field, DA/Dt. Since motion is involved with this effect, the gravitational force observed should be a function of the substantial derivative of this unknown field as $\boldsymbol{F}_g = f(DA/Dt) = f(\partial A/\partial t + \boldsymbol{V}\cdot\nabla\mathrm{A})$

The stationary time rate of change of this field will be omitted, since as it will be seen later, this component will not affect the formulations for gravity. The component of the force that involves the gradient of the field can be made to be always attractive, like gravity, if (a) the sign of the velocity vector and the sign of the gradient of the field are always the same, regardless of the direction of motion (i.e., whether approaching or moving away from the source field), and (b) if the overall function has a sign that remains unaffected by either the velocity or the gradient of the field. The latter criterion would be satisfied if this equation is multiplied by a proportionality factor that is independent of these two quantities as $\boldsymbol{F}_g = a_1\boldsymbol{V}\cdot(\nabla A) + a_2 A(\nabla\cdot\boldsymbol{V})$. The reason that the second component that involves the divergence of the velocity field or is included is to reserve the possibility that this component can also produce a gravitational force (as it will be covered later), and as such the formulation of gravity would be instead, described by a general formulation of the gradient (i.e., $F_g = f[\nabla(\boldsymbol{V}A)]$). Later, it became apparent that instead of the spatial change, the second component in the equation should involve the time rate of change of the velocity vector or the acceleration of quantum particles, as $a_2 A(\mathrm{d}\boldsymbol{V}/dt)$.

Based on the experimental results and the analysis discussed, the field shapes and vectors responsible for generating this attractive gravitational force for 2 L-shaped rods (one each hand) is shown in Fig. 1. The field intensity emanating from the material interface or material discontinuity (source) is assumed to decrease away from such interface, as pictorially indicated by the thickness of the field lines. A sketch of the body is shown by the broken fill oval, with the lower arms extending out and the L-shaped rods positioned about where the squares are shown. The differential ESP due to the presence of the material interface of the body tends to attract these field lines by pulling and stretching them (as shown in Fig. 1) into a circular pattern emanating from the source, in the direction of the body. These field lines would also be expected to vary in intensity (with diminishing intensity away from the source), but for the sake of simplicity this is not shown in this figure. The vertical arrows signify the direction and magnitude of the velocity vector, which remains constant as motion proceeds towards this material interface. The dash arrows show the gradient of the field, whose direction changes as motion approaches the interface and its magnitude increases at the same time. The solid arrows signify the dot product of these other two vectors (i.e., $|\boldsymbol{V}||\nabla \mathrm{A}|\cos\theta$). The result of a vector dot product is scalar, and for this field depiction to be valid the assumption is that gravity or the gravitational law is a scalar field acting as a point source, which gives it vector qualities.

Based on this drawing for the shape of these fields and directions of these vectors, the force generated will be attractive, pointing in the direction of the source field (at the point situated right in front of the middle of the body and right on top of the material interface), independently whether motion is in the direction of the source or away.

3. Detailed Formulations of Gravity

By replacing the unknown field A with this electric scalar potential, Φ, the force of gravity can be expressed as $\boldsymbol{F}_g = a_1 \boldsymbol{V} \cdot \nabla\Phi + a_2 \Phi(\mathrm{d}\boldsymbol{V}/dt)$. Forces in SI are expressed in newton or $(\mathrm{kg\ m})/\mathrm{s}^2$ and the ESP has its unit in volt or $(\mathrm{kg \cdot m}^2)/(\mathrm{A \cdot s}^3)$. Based on that and focusing for now on the first component of this force, the units of a_1 would need to be $\mathrm{C \cdot s \cdot m}^{-1}$ or $\mathrm{q \cdot s \cdot m}^{-1}$, where C is Coulombs or units of A·s (A here stands for Amps), which can also be expressed in terms of q (electric charge). However, there is a choice to be made here, as the units of a_1 could instead be in C, and the units of Φ could be set to $\mathrm{volt*s*m}^{-1}$. The latter choice is more appropriate, as in such case this field will constitute a flux density which would be a time varying field, undergoing temporal fluctuations, whose strength or density will decrease with distance away from the source. Based on that, a change in variables is introduced here, whereby Φ remains as previously defined in units of (volt), and a new variable is introduce for the flux, Ψ, in units of volt*s, and another variable is introduced for the flux density, $\boldsymbol{\Lambda}$, in units of $\mathrm{volt*s*m}^{-1}$. That is, $\boldsymbol{\Lambda}_K = \Phi_K\, \mathrm{t_u}/r = \Psi_K/r$, is its corresponding gravitational flux field density, wherein r is the distance from the gravitational source field K, and $\mathrm{t_u}$ is a unit of time in s. Note that the units of $\mathrm{volt \cdot s}$ are defined as Weber, which is a magnetic flux.

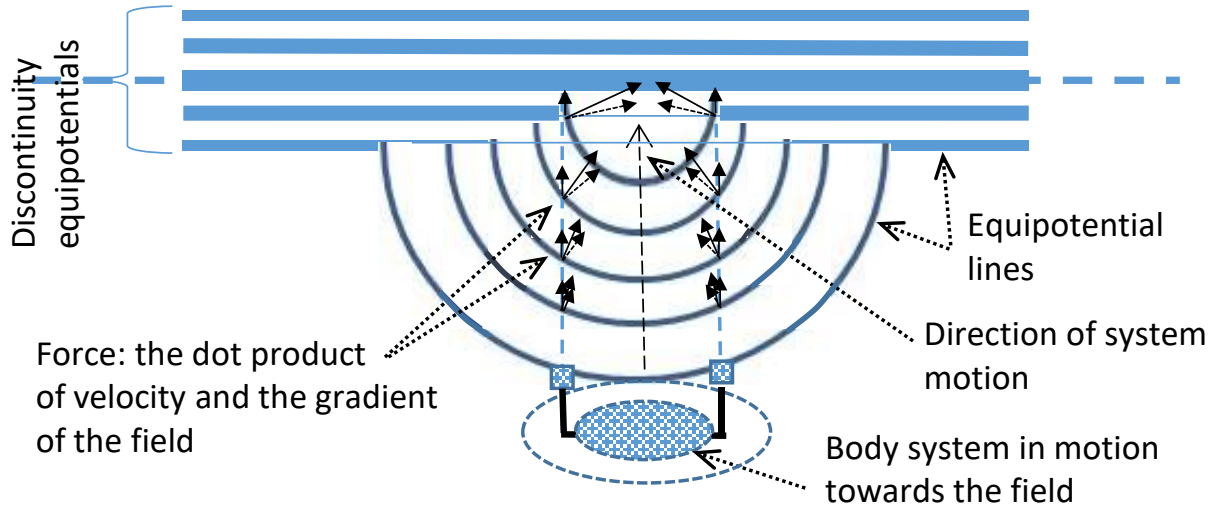

Figure 1. Depiction diagram of the field distribution developed by the presence of a material discontinuity and the body in motion towards the discontinuity; field equipotential lines shown by various thickness and circular shapes; body system in motion shown by the broken fill oval and square shapes; velocity vectors shown by vertical arrows, the gradient of the field shown by dash arrows; the resulting force shown by solid arrows.

However, it is anticipated that in this case the source and nature of this field would be different than that of a magnetic field.

3.1 The Newtonian Component of Gravity

With these variable definitions, the first component for the force of gravity can be restated as $\boldsymbol{F}_{g1} = q\boldsymbol{V}(\nabla \cdot \boldsymbol{\Lambda}_K)$, with $\boldsymbol{\Lambda}_K$ signifying a differential flux density (a vector field) generated by a gravitational source like the Sun or Earth, or by a material interface in the experiment, in the presence of the base aether continuum (subscript C) with flux, Ψ_{C}. The divergence of a vector field results in a scalar field, in which case the force direction will be along the velocity vector. This cannot satisfy gravity as an attractive force, and similarly to the prior assumption (i.e. that gravity is a scalar field), the divergence of the aether ESP flux density (a scalar quantity) is also assumed to act as a point source, which gives it vector properties due to the point source concept. It's worth noting that Einstein in his original formulations considered gravity to be a scalar field, and other subsequent theories have considered gravity as a scalar tensor vector.

This base continuum flux is anticipated to be constant, and only varying over very large cosmological distance, comparable to the size of the universe, as the universe is envisioned to constitute a high density expanding ether bubble inside the infinite expanse of the continuum aether cosmos. As can be seen in the last equation, this gravitational force is generated due to the coupling generated between this differential flux field and electrostatic charges via motion of these charges in this flux field. Since it is known that masses exert gravitational forces on each other, these charges must be the charges associated with matter of a certain mass, *m*, in the gravitational influence of the differential source field generated by mass, M_K. Based on that, q can be redefined by dividing and multiplying by mass to develop a new definition of charge per unit mass, q_M, and this equation of gravity can be restated as $\boldsymbol{F}_{g1} = q_M m\boldsymbol{V}(\nabla \cdot \boldsymbol{\Lambda}_K)$. The sign of the velocity vector is considered to be positive when motion is towards the source field, or towards increasing ESP, Φ_K. This new definition of charge per unit mass implies that there exists a base charge or space charge per unit mass, and since no such charge is presently observable at the resolvable quantum scales, this definition is assumed to be applicable at comparable Planck length scales.

Since the force of gravity is generated by quantum motions inside a field, then this equation can also be written as the sum of the individual forces generated by quantum motions, as $\boldsymbol{F}_{g1} = q_M \sum_{i=1}^{n} m_i \, [\, \boldsymbol{V}_{\boldsymbol{ir}}(\nabla \cdot \boldsymbol{\Lambda}_{\boldsymbol{K}})]$, where m_i is the mass of quantum particle *i*, and $\boldsymbol{V}_{\boldsymbol{ir}}$ is its quantum particle tangential orbital velocity projected into the closest radial plane of the source field. The reason for this projection is because, what matters for the generation of this gravitational force is the motion of quantum particles with respect to the divergence of the vector field. Based on the velocities, abundance, and mass of particles, the force of gravity will be dominated by quark motions. If the overall mass is moving, then this motion will also be reflected in the quantum particle motions therefore, the average velocity of the particles of a given mass, *m*, would be $\overline{\boldsymbol{V}} = \overline{\boldsymbol{V}}_{\mathbf{r}} + \boldsymbol{V}_{\mathrm{mr}}$, where $\overline{\boldsymbol{V}}_{\boldsymbol{r}}$ is this mass weighted projected orbital velocity of quantum particles, and V_{mr} is the overall velocity of the mass with respect to the source field. Notice this mass weighted (average) projected orbital velocity for individual quantum particles will be a positive number in the context of the attractive gravitational force concept.

The divergence of the source field can be computed as $\nabla \cdot \boldsymbol{\Lambda}_K = \nabla \cdot (\Psi_k/r) = -\Psi_{\mathrm{k}}/r^2$, and by calculating the dot product with the previous assumption that this scalar aether field has vector properties, the equation of gravity can be rewritten as $\boldsymbol{F}_{g1} = -q_{\mathrm{M}} m(\Psi_{\mathrm{K}}/r^2)(|\overline{\boldsymbol{V}}_r| cos\theta_r + |\boldsymbol{V}_{\mathrm{mr}}| cos\theta_{\mathrm{mr}})\hat{\boldsymbol{r}}$. Notice the negative sign in this equation, which makes it consistent with Newton's universal law gravity (i.e., an attractive force). If a quantum particle orbital motion is sketched in such a projected plane, one may notice that these vectors (i.e., the tangential orbital velocity and the divergence of the field; a scalar considered here as a point source vectors) sweep 0 to 90° for each successive orbital quadrant. Thus, the average of this cosine sweep over a complete orbital would be the integral of the cosine function over a quadrant divided by its range, which is equal to $2/\pi$. Based on that, the equation of gravity can be expressed as $\boldsymbol{F}_{g1} = -q_M m(\Psi_K/r^2)(2/\pi|\overline{\boldsymbol{V}}_{\mathrm{r}}| + |\boldsymbol{V}_{\mathrm{mr}}| cos\theta_{\mathrm{mr}})\hat{\boldsymbol{r}}$. This force for instance, would be the force the Sun exerts on the Earth's mass, *m*, or the force the differential field in the experiment exerts on the rod mass. It may be noticed from this equation that the body with mass *m*, will exert a reciprocal gravitational force on the body *k*, and these forces will be equal, as $\boldsymbol{F}_{\mathrm{gm1}} = -q_M m(\Psi_K/r^2)(2/\pi|\overline{\boldsymbol{V}}_r| + |\boldsymbol{V}_{\mathrm{mr}}| cos\theta_{mr})\hat{\boldsymbol{r}}$, and $\boldsymbol{F}_{gM1} = -q_M M(\Psi_{\mathrm{m}}/r^2)(2/\pi|\overline{\boldsymbol{V}}_{\mathrm{r}}| + |\boldsymbol{V}_{\mathrm{Mr}}| cos\theta_{\mathrm{Mr}})\hat{\boldsymbol{r}}$. Except for the second components, which depend on the overall motion of the mass and these components may not be equal. The component of gravity that depends on the overall motion of a mass points in the same direction as the first component, but ordinarily it will be much smaller in magnitude, because of the differences in these velocities. However, the force observed in the experiment will be due to this component. Furthermore, this gravitational component contributes to the clumping of matter, it promotes circular orbits as the angle θ_{mr}= 90° for perfectly circular orbits, it also promotes orbit alignment with orbital planes, and it contributes to the Coriolis force.

Since there are inherent space charges associated with a unit of mass which are definable or observable at Planck length scales, the ESP generated by the aggregate charge of body *K*, should obey the voltage to charge relationship in electromagnetic field theory as $\Phi_K = Q_K/(4\pi\epsilon_o r_{\rm u})$, where r_u is a unit of distance from the center of the source *K* (i.e., 1 m in SI units). Utilizing the definition of space charge per unit mass q_M, the total space charge, Q_K, associated with source *K*, can be expressed as $Q_{\rm k} = q_{\rm M} M_K$, and the local differential ESP continuum potential, Φ_K, can be related to the mass M_K, of the body as $\Phi_K = q_{\rm M} M_K/(4\pi\epsilon_o r_u)$, or related to the flux Ψ_K, as $\Psi_K = [q_{\rm M} M_{\rm K}/(4\pi\epsilon_o r_u)]t_u$. By substituting this expression for Ψ_k, in the equation of gravity, this equation can be rewritten as (subscript *K* dropped for simplicity) $\boldsymbol{F}_{gm1} = [-q_{\rm M}^2 mM/(4\pi\epsilon_{\rm o} r^2)]\big((2/\pi)|\overline{\boldsymbol{V}}_{\rm r}| + |\boldsymbol{V}_{\rm mr}|cos\theta_{mr}\big)({\rm t_u}/{\rm r_u})\hat{\boldsymbol{r}}$. It may be noticed from this expression that the last factor points to a flux density, which can only be associated with the space unit charge, q_M, as a space charge flux density per unit mass, defined here as $q_a = q_{\rm M}({\rm t_u}/{\rm r_u})$. By substituting this expression, the equation of gravity can be expressed as

$$\boldsymbol{F}_{gm1} = -q_{\rm M} q_{\rm a} \frac{mM}{4\pi\epsilon_{\rm o} {\rm r}^2}\left(\frac{\boldsymbol{2}}{\boldsymbol{\pi}}|\overline{\boldsymbol{V}}_{\rm r}| + |\boldsymbol{V}_{\rm mr}|cos\theta_{\rm mr}\right)\hat{\boldsymbol{r}} \tag{1}$$

with the unit vector $\hat{\boldsymbol{r}}$, having the same interpretation here as that defined for Newton's universal law of gravity. Note the space charge flux density, q_a, is a vector field, even though here it is stated as a scalar. The reason that this field is stated here as a scalar is because this charge field becomes the origins of the ESP flux density, $\boldsymbol{\Lambda}_{\rm K}$, and for convenience the vector properties of q_a are transferred to this resultant field. This expression for the force of gravity implies that space charges which are developed through the fundamental oscillations of mass quanta constituents with the continuum, couple trough these resonant fluctuations of the continuum aether to develop a space charge flux density, which is essential to the development of gravitational forces. Part II of the theory will identify this most fundamental constituent of matter and its origins. By equating the first term in Eq. (1) to Newton's universal law of gravity, the gravitational constant *G*, can be solved as

$$G = \left(\frac{1}{\boldsymbol{\pi}}\right)^2 \frac{q_M q_a |\overline{\boldsymbol{V}}_{\rm r}|}{\boldsymbol{2}\epsilon_{\rm o}}, \qquad \text{or} \qquad |G| = \left(\frac{{\rm q_M}}{\boldsymbol{\pi}}\right)^2 \frac{|\overline{\boldsymbol{V}}_{\rm r}|}{2\epsilon_{\rm o}} \tag{2}$$

This equation satisfies the units of the gravitational constant in (N m^2 kg^{-2}). Based on these definitions, one may determine that any source orientation and any quantum orbital projection should lead consistently to the same value of *G*. Since the value of *G* is proportional to this projected mass weighted orbital velocity of quantum particles (dominated by quark orbital velocities), the gravitational constant should increase with increasing forms of degenerate matter, as the particle velocities of such matter would increase in order to obey the *exclusion principle*. However, as the collapse of a black hole approaches singularity, at some point the exclusion principal will be violated. This will cause the particle velocities to decline and in turn cause the gravitational constant to decrease, in turn causing matter to relax and particle velocities to increase, with a proportional increase to the value of *G*, in turn causing the black hole to re-squeeze. This process should cause a sustained oscillation in black holes, whose frequency is perhaps inversely proportional to the mass of the black hole. As such, singularities of matter are not possible.

3.2 Radial Acceleration Component of Gravity – Radial Inertia

The original formulation of the force in terms of gradients (i.e., $\boldsymbol{F}_g = a_1\boldsymbol{V}\cdot\nabla\Phi + a_2\Phi(\nabla\cdot\boldsymbol{V})$) suggests that the possibility of the existence of an additional component of the gravitational force that involves acceleration needs to be considered. The spatial change or the divergence of the velocity field of quantum particles should not influence gravity, but the time change of the velocity vector, $a_2\Phi({\rm d}\boldsymbol{V}/dt)$, should effect gravity as this would be the well-known inertia force. For this reason, the above equation was replaced by $\boldsymbol{F}_g = a_1\boldsymbol{V}\nabla\Phi + a_2\Phi({\rm d}\boldsymbol{V}/dt)$. Based on earlier definitions, the second component of this equation that involves the time rate of change of velocity or acceleration can be expressed as $\boldsymbol{F}_{g2} = a_2\Psi_K/r({\rm d}\boldsymbol{V}/dt)$. By working out the units of the proportionality factor a_2, it can be determined that this factor has the same units as those found for q_a, except for the charge per unit mass conversion factor that was also applied to this quantity. Therefore, with this adjustment applied, $a_2 = q_a$, and by computing the derivative of velocity, the equation for the acceleration component of gravity can be rewritten as $\boldsymbol{F}_{g2} = q_a m(\Psi_K/r)\boldsymbol{a_r}$. With $\boldsymbol{a}_r$ being the radial acceleration component of the mass *m*, inside the source flux field. Since this component of gravity is due to acceleration, it should be an inertia force, and inertia forces resist acceleration. Therefore, the sign of the acceleration vector should be positive when motion of mass, *m*, is in the direction of the source field, like Earth's.

When the substitution for Ψ_K, is utilized again, this radial acceleration component of gravity can be rewritten as $\boldsymbol{F}_{g2r} = q_a^2[mM_K/(4\pi\epsilon_o r)]\,\boldsymbol{a}_{\mathrm{r}}$. Utilizing this equation and considering that the force exerted on 1 *kg* of mass in Earth's gravity is 9.8 N (*F=ma*), with $\boldsymbol{a}_r = g = 9.8$ m·s^{-2}, and with $|q_a| = |q_{\mathrm{M}}|$, q_a can be computed as $|\mathrm{q_a}| = |\mathrm{q_M}| = \sqrt{4\pi\epsilon_{\mathrm{o}}\mathrm{r}_E/\mathrm{M_E}} = \sqrt{4\pi(8.854\mathrm{e}-12)(6.371\mathrm{e}6)/5.972\mathrm{e}24} = 1.0895\mathrm{e}-14$. Thus, q_{M}=1.0895e-14 C·kg^{-1} and q_a=1.0895e-14 C·s·m^{-1}·kg^{-1}, which means that 1 kg of mass will possess a space charge of 1.0895e-14 C when this charge is viewed from the vantage point of the continuum, at Planck length scales. Using these calculated values, one can verify that the respective equation of gravity above can only be satisfied on Earth. The reason is because the base unit of mass, kg, is referenced with respect to kilograms on Earth. To make this equation universally applicable, for an accelerating mass in the radial direction on any space body, the factor (M_E/r_E)(r_K/M_K) is inserted, with r=r_K (r_E stands for the radius of Earth), and this equation for the accelerating component of gravity in a radial direction of a source body can be expressed as

$$\boldsymbol{F}_{g2r} = q_a^2 \frac{m}{4\pi\epsilon_{\mathrm{o}}} \frac{M_E}{r_E} \boldsymbol{a}_{\mathrm{r}} \tag{3}$$

This derivation proves that the inertia radial component of gravity is truly a free space inertia, as it is not depended on the radial flux field of the source at the location of the moving mass, and the factor (M_E/r_E) compensates for referring mass to kg on Earth.

Based on the calculated value of space charge per kg of mass, q_{M}, Earth's space charge can be calculated as $\mathrm{Q_E} = \mathrm{q_M M_E} = (1.0895\mathrm{e}-14)(5.9736\mathrm{e}24) = 6.5082\mathrm{e}10$ C. The equivalent space charge at the Earth's locale should be that of the Earth superimposed on the equivalent space charge of the base continuum, Q_{C}, as $\mathrm{Q_{El}} = \mathrm{Q_E} + \mathrm{Q_C}$. By utilizing the previous equation (i.e., $\boldsymbol{F}_{gm1} = -q_{\mathrm{M}}\boldsymbol{q}_a \frac{\mathrm{mM}}{4\pi\epsilon_{\mathrm{o}}\mathrm{r}^2}\left(\frac{\boldsymbol{2}}{\boldsymbol{\pi}}|\overline{\boldsymbol{V}}_{\boldsymbol{r}}| + |\boldsymbol{V}_{\mathrm{mr}}|cos\theta_{\mathrm{mr}}\right)\hat{\boldsymbol{r}}$ for the gravitational force between the Earth and the Sun and by neglecting the second component (it turns out $(|\boldsymbol{V}_{\mathrm{mr}}|cos\theta_{\mathrm{mr}})/(\frac{\boldsymbol{2}}{\boldsymbol{\pi}}|\overline{\boldsymbol{V}}_{\boldsymbol{r}}|) \approx 1.2e-4$; $\theta_{\mathrm{mr}} \approx 90^o - \cos^{-1}\left(\frac{Perihelion_E}{Aphelion_E}\right) = 75.3^o$; $|\boldsymbol{V}_{\mathrm{mr}}| = V_E = 3e4$ m/s; $|\overline{\boldsymbol{V}}_{\boldsymbol{r}}| \approx \frac{c}{3}$ (see below)), the projected mass weighted orbital velocity of quantum particles (dominated by quark velocities) can be expressed as $|\overline{\boldsymbol{V}}_{\mathrm{r}}| = 2(\pi\mathrm{r})^2\boldsymbol{F}_g\epsilon_{\mathrm{o}}/(\mathrm{q_M q}_a M_E M_S) = 2(1.503\mathrm{e}11\pi)^2(3.5104\mathrm{e}22)(8.854\mathrm{e}-12)/[(1.0895\mathrm{e}-14)^2(5.9736\mathrm{e}24)(1.9891\mathrm{e}30)]$ = 9.8264e7 m/s. For normal matter (as oppose to degenerate matter), this projected mass weighted orbital velocity of quantum matter amounts to approximately 33% of the speed of light. This projected velocity is not out of bounds, for instance, with the estimated orbital velocities of quarks in protons - approximately 50% the speed of light.

3.3 Tangential Acceleration Component of gravity – Free Space Inertia

A gravitational force experienced by an object accelerating in the tangential direction of the source's flux field is expected to be related to the flux field generated due to the base continuum temporal oscillations or equivalently to the base continuum charge, Q_{C}. Such a gravitational force should be the same as the commonly called *inertia force* or space inertia. As it is known, that the inertia force or in this case the tangential inertia force only depends on the mass of the object and is the same everywhere, independent of where the object is located (Earth, moon, etc.). The presence of this base continuum field would be expected to act locally the same way as a differential flux Ψ_K, when it comes to gravitational effects. The source field for the this acceleration component of gravity will be at the instantaneous location of the accelerating mass, as the accelerating space charges of the mass generate an electrostatic flux that causes a local coupling with the 4D ESP continuum aether. Thus, inertia forces are not fictitious, but rather such forces also have gravitational or electrostatic origins, definable at comparable Planck length scales.

The radial acceleration component of gravity discussed in the last section (i.e., $q_a m(\Psi_{\boldsymbol{K}}/r)\boldsymbol{a}_{\mathrm{r}}$) can also be utilized here to formulate the tangential space inertia force by as

$$\boldsymbol{F}_{g2t} = -q_a m(\Psi_{\boldsymbol{C}}/r_u)\boldsymbol{a}_{\boldsymbol{t}} \tag{4}$$

Notice the minus sign in the equation indicates that the free space inertia is an attractive force with respect to the instantaneous position of the accelerating mass, or with respect to the location of its source field.

The expression $\Psi_{\mathrm{C}}/r_{\mathrm{u}}$ pertains to the base continuum flux, where r_{u} is again a unit of distance, say 1 meter. By setting this equation equal to the well-known inertia force *F=ma,* and calculating the base continuum flux field, $\boldsymbol{\Lambda}_{\mathrm{C}}$=$\Psi_{\mathrm{C}}/r_u$, the following expression can be obtained: $\boldsymbol{\Lambda}_{\mathrm{C}} = 1/q_a$. Substituting in this equation the previous definition $\boldsymbol{\Lambda}_{\mathrm{C}} = \Phi_{\mathrm{C}}(t_u/r_u)$, the equivalent base charge Q_{C} of the base continuum aether can be solved as $Q_C =$

$(4\pi\epsilon_o/q_a)(r_u^2/t_u) = 4\pi(8.854\text{e}-12)/1.0895\text{e}-14 = 1.0212\text{e}4$ C. Following, the prior ESP equation $\Phi_K = q_{\text{M}}M_K/(4\pi\epsilon_o r_u)$, can be utilized to calculate the ESP of the base continuum aether, Φ_{C}, which turns out to be 9.1783e13 or 91.783 trillion volts. Note that the calculated equivalent charge of the base continuum aether is considerably less than the Earth's differential charge, Q_{E}. Therefore, Q_{C} could be neglected when Q_{E} is used in the calculations for near Earth locations.

3.4 The Combined Equation of Gravity

In the vicinity of a body of mass M_K an accelerating mass m is subjected (a) to the Newtonian or universal component of gravity, (b) to the gravity component associated with the overall instantaneous velocity of the mass, (c) to the gravitational radial acceleration component, and (d) to the free space inertia component of gravity or the tangential acceleration component. The combined gravitational force vector is the summation of all these components as

$$\boldsymbol{F}_g = q_a \frac{m}{4\pi\epsilon_{\text{o}}}\left[-\frac{q_M \text{M}_K}{r^2}\left(\frac{2}{\pi}|\bar{\boldsymbol{V}}_{\text{r}}| + |\boldsymbol{V}_{\text{mr}}|cos\theta_{\text{mr}}\right) + \frac{M_{\text{E}}}{r_{\text{E}}} q_a a_{\text{r}}\right]\hat{\boldsymbol{r}} - q_a m a_t |\boldsymbol{\Lambda}_{\text{C}}|\hat{\boldsymbol{t}} \tag{5a}$$

with the unit vectors $\hat{\boldsymbol{r}}$ having the same definition as that utilized in Newton's universal law of gravity, and $\hat{\boldsymbol{t}}$ being the tangential unit vector that points to the instantaneous location of the accelerating mass. Realizing that the base continuum can also be represented as an equivalent gravitational mass as $\text{M}_{\text{C}} = Q_{\text{C}}/q_{\text{M}} = 9.3731e17$ kg, this combined equation of gravity can also be expressed as

$$\boldsymbol{F}_g = q_a \frac{m}{4\pi\epsilon_{\text{o}}}\left[\left\{-\frac{q_M \text{M}_K}{r^2}\left(\frac{2}{\pi}|\bar{\boldsymbol{V}}_{\text{r}}| + |\boldsymbol{V}_{\text{mr}}|cos\theta_{\text{mr}}\right) + \frac{M_{\text{E}}}{r_{\text{E}}} q_a a_{\text{r}}\right\}\hat{\boldsymbol{r}} - \frac{\text{M}_{\text{C}}}{r_u} q_a a_{\text{t}}\hat{\boldsymbol{t}}\right] \tag{5b}$$

For the same magnitude of acceleration, calculating the value of the inertia terms in this equation, it can be shown that their magnitudes are equal as they should be for inertia forces (F=ma), which further supports the theory. Why the ratios in these terms turn out to be equal or the significance of this (i.e., $M_{\text{E}}/r_{\text{E}}$=$M_{\text{C}}/r_{\text{u}}$), may need to be further investigated.

Based on Eq. (5), the force of gravity experienced by a freefalling body in the gravitational field of another body with mass M_k, (e.g. a mass m, freefalling on Earth - $a_r = 9.8\, m/s^2$) will be

$$\boldsymbol{F}_g = q_a \frac{m}{4\pi\epsilon_{\text{o}}}\left[-\frac{2q_M \text{M}_K|\bar{V}_r|}{\pi r^2} + \frac{M_E}{r_E} q_a a_{\text{r}}\right]\hat{\boldsymbol{r}} = 0 \tag{6}$$

These gravitational force components, including the free space inertia force in Eq. (4) can be equated as $(q_a m/4\pi\epsilon_{\text{o}})[2q_{\text{M}}\text{M}_K|\bar{V}_r|/(\pi r^2)] = (q_a m/4\pi\epsilon_{\text{o}})(M_E/r_E)q_a a_{\text{r}} = q_a m(\Psi_{\text{C}}/r_u)a_t$, for $a_{\text{r}} = a_{\text{t}} = g_K$, where g_K is the gravitational acceleration on a space body, K. This equality constitutes Einstein's *equivalence principle* expressed in a classical sense, with the source of these forces clearly defined. Based on this equality, substituting g_K in place of a_r in Eq. (6), a relation emerges for the gravitational acceleration on any space body, K:

$$g_K = \frac{2}{\pi}\frac{q_M \text{M}_K|\bar{V}_r|}{q_a r_{\text{K}}^2}\frac{r_E}{M_E} \tag{7}$$

Equation (7) has been validated with known values of this quantity, within the accuracy of the derived parameters (i.e. emphasis was not placed here in deriving the value of these quantities with a high degree of accuracy). Equations (5) has been validated in part, for the individual and for some of the combinations of the gravitational force components. The gravitational acceleration on any space body K, is also known by the expression $g_K = GM_K/r_K^2$. By setting this equation equal to Eq. (7) and by substituting Eq. (2) for the gravitational constant, G, the equality can be solved for the permittivity of free space, ϵ_{o}, which results in the following expression:

$$\epsilon_{\text{o}} = \frac{q_a^2}{4\pi}\frac{r_E}{M_E} \tag{8}$$

By substituting the expression obtained in Eq. (8) for the permittivity of free space into Eq. (2), the following expression is obtained for the gravitational constant, which now becomes directly dependent on the fundamental parameters of the continuum aether as

$$G = \frac{2}{\pi}\frac{q_M|\bar{V}_r|}{q_a}\frac{r_E}{M_E} \quad (9)$$

Again, the factor of (M_E/r_E) in these equations compensates these parameters for referencing mass to kg on Earth.

Both the permittivity of free space of Eq. (8) and the gravitational constant of Eq. (9) agree with the known units of these parameters, and their calculated values agree within 3 decimal figures of the known values of these quantities (remember the emphasis in this development is not to calculate these values with a high degree of accuracy). Foreseeably, all cosmological constants and forces of nature could be fundamentally derived based on the theory introduced in this paper.

Based on the continuum theory, inertia forces are not pseudo-forces, rather, they are real gravitational force components. In general, all pseudo forces, like the Coriolis or the centrifugal force, etc., are gravitational forces according to this theory. For instance, if the instantaneous $\boldsymbol{DV}$ vector is drawn at any given moment in time during an object's rotation, one may realize that the centrifugal or inertia force generated ($\boldsymbol{F}=m\boldsymbol{a}$) will be in the opposite direction of the instantaneous $\boldsymbol{DV}$ vector with $\boldsymbol{a}=\boldsymbol{DV}/dt$, which is the same as the free space inertia force generated by an object accelerating in the base continuum, as described by Eq. (4).

4. Experiments

Experiments were conducted so far in order to semi-quantitatively validate the theory (i.e., experiments were not scientifically controlled). Three different types of light gage wires were used to construct springs to measure the forces exerted on three different L-shape rods sizes (different weights). Each springs was attached to a respective L-shape rod, with the other end of the spring affixed to a stationary rod attached to the arm. The spring constants were experimentally computed using Hooke's law ($F = kX$). Knowing the spring constants and the spring extensions in the experiment, the forces exerted on the rods were calculated.

The forces calculated are shown in table I. As shown in the table, these forces are relatively small, but not negligible. More scientifically control experiments will be conducted at some point in the future.

Table I. Force Measurements

L-shaped rod	Force (N)
1 - metallic	0.01
2 – wood (light)	0.02
3 – wood (heavier)	0.26

5. Conclusion

The continuum theory described in this paper brings back the ether (aether) theory, which prevailed during the 19th and the early part of the 20th century, as a stationary aether, totally coupled to mass. The theory was develop as consequence to scientifically explain a certain gravitational effect, which cannot be explained by present day physics. The emerged theory describes gravity as an electrostatic effect; as a coupling between mass quanta constituents with a 4 dimensional electric scalar potential flux field aether, which is observable at Planck length scales. In this theory as it will be further explained in Part II, nothing is absolute, not even the speed of light. Instead, there are underlying physics principles which should explain all universal constants and forces, including fictitious forces. In part II of the theory the definitions of mass and time will be developed. The continuum aether mechanics that give rise to the speed of light will also be described. The origins of the universe will be covered, including the conditions prior to the big ban explosion, which lead into a cycling universe. The speed of light cannot be violated. However, the speed of light can be circumvented and the technology required to achieve this will also be introduced. This theory is not in line with the standard model. However, the belief here is that any empirically or experimentally derived model, like the standard model with 19 free parameters and so many other constants, cannot possibly be a physics based model of nature, despite its predictions. Such a model can make verified predictions, if such predictions are derived from less than optimum scientific arguments, or if let's say, the empirically derived model sufficiently covers the possible solution spaces. The theory that was presented in this paper does not have these limitations.

The same field shapes and vectors (shown in Fig. 1) can also be explained by pure electrostatics, which does not involve quantum particle velocities. Such a formulations was carried out and similar continuum aether properties were derived with this approach. However, this alternative approach to gravity failed to satisfy the equivalence principle.

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