Electrogravity: On a scalar field of time and electromagnetism

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Abstract

It is possible to describe a universal scalar field of time but not a universal coordinate of time and to attribute its non geodesic alignment to the electromagnetic phenomena. A very surprising outcome is that not only mass generates gravity but also electric charge does.

Keywords: General Relativity, Time, Electromagnetism.

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1. Introduction – measurement of non geodesic deviation

The Result of the Geroch Splitting Theorem [1] is that a field of time can be defined. In simple geometries such as FRWL which are Big Bang geometries, such time also has an intuitive meaning; it is a scalar field and not a coordinate of time. It is the maximal time between each event of space-time and the Big Bang as a limit, measured by a physical clock that may experience forces. Such proper time can be measured along different curves and is therefore not traceable, not geodesic under forces and cannot be a coordinate that also requires a 4-direction. The existence of a non – traceable time is not a new idea and was postulated by the philosopher R. Joseph Albo [2] in the 14th century.

What information can a scalar field encode, that is not already predicted by the metric tensor of space time $g_{\mu\nu}$? The answer is non - geodesic motion. The motion equations of the theory of General Relativity predict only geodesic motion. This theory is based on two assumptions,

1) The basic assumption is that matter is encoded via acceleration in the gradients of scalar fields. This acceleration is known as a Reeb vector field [3] in odd dimensions but can also be defined in 4 dimensions. Actions are defined for 1 Reeb field, "electromagnetic", 2 Reeb fields "electro-weak" and 3 Reeb fields, "Strong". A definition can be made also for 4 Reeb fields but its physical meaning is not discussed in this paper. See appendix C, (65). The

motivation to use Reeb vector fields including a complex formalism can be seen in the paper by Yaakov Friedman [4]

2) The scalar fields quantization is $P = \sum_{k=1}^{\infty} P(k)$ such that $\int_{\Omega} \frac{P(k)P^*(j)+P(j)P^*(k)}{2}\sqrt{-g}d\Omega = 0$ if $k \neq j$ and $\int_{\Omega} \frac{P(k)P^*(j)+P(j)P^*(k)}{2}\sqrt{-g}d\Omega = 1$ if $k = j$ where $\sqrt{-g}$ is the volume element of space-time, where g is the determinant of the metric tensor.

We can describe non geodesic integral curves along a field $P_\mu \equiv \frac{dP}{dx^\mu}$ for the coordinates x^μ, also, P_μ need not be time-like in all events of space-time. We now define the square norm for real numbers as $Z \equiv \left|P_\lambda P^\lambda\right|$ and its gradient $Z_\mu \equiv \frac{dZ}{dx^\mu}$. We define a geometric object $\frac{U_\mu}{2}$ that will measure how much the field P_μ is not geodesic.

$$U_\mu = \frac{Z_\mu}{Z} - \frac{Z_k P^k}{Z^2} P_\mu \Longrightarrow \tag{1}$$

$$\frac{d}{dx^\nu}\frac{P_\mu}{\sqrt{Z}} - \frac{d}{dx^\mu}\frac{P_\nu}{\sqrt{Z}} =$$

$$\frac{P_{\mu,\nu}}{\sqrt{Z}} - \frac{P_\mu Z_\nu}{2Z^{\frac{3}{2}}} - \frac{P_{\nu,\mu}}{\sqrt{Z}} + \frac{P_\nu Z_\mu}{2Z^{\frac{3}{2}}} =$$

$$\frac{P_\nu Z_\mu}{2Z^{\frac{3}{2}}} - \frac{P_\mu Z_\nu}{2Z^{\frac{3}{2}}} =$$

$$\frac{1}{2}\left(\frac{Z_\mu}{Z}\frac{P_\nu}{\sqrt{Z}} - \frac{Z_k P^k}{Z^2}P_\mu\frac{P_\nu}{\sqrt{Z}}\right) - \frac{1}{2}\left(\frac{Z_\nu}{Z}\frac{P_\mu}{\sqrt{Z}} - \frac{Z_k P^k}{Z^2}P_\nu\frac{P_\mu}{\sqrt{Z}}\right) = \frac{U_\mu}{2}\frac{P_\nu}{\sqrt{Z}} - \frac{U_\nu}{2}\frac{P_\mu}{\sqrt{Z}}$$

But why to use, $\frac{1}{2}U_\mu = \frac{1}{2}\left(\frac{Z_\mu}{Z} - \frac{Z_k P^k P_\mu}{Z^2}\right)$ and not simply, $\frac{Z_\mu}{Z}$? The reason is that $\frac{U_\mu}{2}\frac{P^\mu}{\sqrt{Z}} = 0$.

It is easy to show that $\frac{U_\mu}{2}$ behaves as the acceleration of the unit vector $\frac{P_\mu}{\sqrt{Z}}$. See Appendix D for another way to derive the Reeb vector. In terms of a 4-acceleration a_μ, it is easy to see:

$$\frac{U_\mu}{2} = \frac{a_\mu}{c^2} \tag{2}$$

Where c is the speed of light. $\frac{U_\mu}{2}$ is the generalization of a Reeb vector [3] to 4 dimensions. Can this a_μ have a simple physical meaning of accelerating any neutral mass ? There is an experimental way to find out, once we analyze the electric field in the coming sections.

To describe a field that accelerates any unit vector, we need an anti-symmetric matrix of acceleration similar to the Tzvi Scarr & Yaakov Friedman's acceleration matrix [5].

The matrix $A_{\mu\nu} = \frac{U_\mu}{2}\frac{P_\nu}{\sqrt{Z}} - \frac{U_\nu}{2}\frac{P_\mu}{\sqrt{Z}}$ is insufficient for that purpose; however, it can be extended quite easily, by using the Levi-Civita alternating tensor [6], not the alternating Levi-Civita symbol,

We have $B_{\mu\nu} = \frac{1}{2}E^{\mu\nu\alpha\beta}A_{\alpha\beta}$ which define an acceleration matrix in a perpendicular plane to the plane spanned by $\frac{P_\mu}{\sqrt{Z}}$ and $\frac{U_\mu}{2}$. In the complex case we define the acceleration matrix: $F_{\mu\nu} = A_{\mu\nu} + \gamma B_{\mu\nu}$ where $\gamma \epsilon U(1)$. With a vector w^ν, $w^\nu w_\nu = c^2$, we derive its acceleration,

$$F_{\mu\nu}\frac{w^\nu}{c} = \frac{a_{\mu(w)}}{c^2} \tag{3}$$

$$\frac{1}{4}F_{\mu\nu}F^{\mu\nu} = \frac{U_\mu U^\mu}{4}$$

2. Electro-gravity

The action of gravity is defined as: $Action = Min\int_\Omega \left(R - \frac{1}{4ב}U^k U_k\right)\sqrt{-g}\, d\Omega$

The Euler Lagrange equations by the metric $g_{\mu\nu}$, by the scalar field of time P yield, Appendix A or [7]:

$$\frac{1}{4ב}\left(U_\mu U_\nu - \frac{1}{2}g_{\mu\nu}U_\lambda U^\lambda - 2U^k;_k\frac{P_\mu P_\nu}{Z}\right) = R_{\mu\nu} - \frac{1}{2}Rg_{\mu\nu} \tag{4}$$

$$W^\mu;_\mu = \left(-4U^k;_k\frac{P^\mu}{Z} - 2\frac{Z_\nu P^\nu}{Z^2}U^\mu\right);_\mu = 0$$

It is easy to prove without the right hand side that $\frac{1}{4ב}\left(U_\mu U_\nu - \frac{1}{2}g_{\mu\nu}U_\lambda U^\lambda - 2U^k;_k\frac{P_\mu P_\nu}{Z}\right);^\nu$=0 see Appendix B or [7]. (4) assumes $ב = 1$.

Theorem 1: If non-geodesic curves are prescribed to motion in material fields then zero Einstein tensor must implies $\frac{1}{2}U_\mu = 0$, i.e. $R_{\mu\nu} - \frac{1}{2}Rg_{\mu\nu} = 0 \Longrightarrow \frac{1}{2}U_\mu = 0$ i.e. geodesic motion.

Proof:

We contract both sides of (4) with $U^\mu U^\nu$ so $\left(U_\mu U_\nu - \frac{1}{2}g_{\mu\nu}U_\lambda U^\lambda - 2U^k;_k\frac{P_\mu P_\nu}{Z}\right)U^\mu U^\nu = 0 \Longrightarrow U_\lambda U^\lambda = 0$ because $U^\mu P_\mu = 0$ and now we contract both sides of (4) with $\frac{P^\mu P^\nu}{Z}$ so we have $\frac{P^\mu P^\nu}{Z}\left(U_\mu U_\nu - \frac{1}{2}g_{\mu\nu}U_\lambda U^\lambda - 2U^k;_k\frac{P_\mu P_\nu}{Z}\right) = -\frac{1}{2}U_\lambda U^\lambda - 2U^k;_k = 2U^k;_k = 0$ because $U_\lambda U^\lambda = 0$

and $\frac{P^{\lambda}P_{\lambda}}{Z} = 1$ so we get $U_{\mu}U_{\nu} - \frac{1}{2}g_{\mu\nu}U_{\lambda}U^{\lambda} - 2U^{k};_{k}\frac{P_{\mu}P_{\nu}}{Z} = U_{\mu}U_{\nu} = 0 \Longrightarrow U_{\mu} = 0$. In other words, motion must be geodesic and we are done.

Remember $\frac{U_{\mu}}{2} = \frac{a_{\mu}}{c^2}$ as acceleration and the equation of gravity by Einstein, using the dust energy momentum tensor from General Relativity,

$$\frac{8\pi K}{c^4}T_{\mu\nu} = R_{\mu\nu} - \frac{1}{2}Rg_{\mu\nu} \tag{5}$$

in (-,+,+,+) convention, we will use (5) further on, to show unique gravity by electric charge.

$$\frac{1}{4}U^{k}U_{k} = \frac{a^{k}a_{k}}{c^4} \tag{6}$$

(6) compared to Einstein's tensor means that the energy density in old physics terms can be seen as:

$$\frac{a^{k}a_{k}}{8\pi K ב} = EnergyDensity \Longrightarrow \frac{8\pi K}{c^4}EnergyDensity = \frac{a^{k}a_{k}}{ב c^4} = \frac{1}{4ב}U^{k}U_{k} \tag{7}$$

Where $ב = 1$ relates non geodesic acceleration to geometry, direct outcomes of (7) will be shown in (13) and (43). (7) means that the energy of the classical non-covariant electric field must be hidden in a very weak acceleration field

$$\frac{a^{k}a_{k}}{8\pi K ב} \cong \frac{1}{2}\varepsilon_0 E^2 \tag{8}$$

ε_0 is the permittivity of vacuum, K is Newton's constant of gravity, Which means

$$|a|^2 = 4\pi K\varepsilon_0 ב E^2 \tag{9}$$

and

$$\|a^{\mu}\| = \sqrt{4\pi K\varepsilon_0 ב}\|E\| \tag{10}$$

Indeed a very weak acceleration if $ב = 1$. However, there is a surprise:

$$\frac{1}{4ב}\left(U_{\mu}U_{\nu} - \frac{1}{2}g_{\mu\nu}U_{\lambda}U^{\lambda} - 2U^{k};_{k}\frac{P_{\mu}P_{\nu}}{Z}\right) = R_{\mu\nu} - \frac{1}{2}Rg_{\mu\nu} \tag{11}$$

Means that $\frac{1}{2ב}U^{k};_{k} = \frac{a^{k};_{k}}{c^2} = \sqrt{\frac{4\pi K\varepsilon_0 ב}{ב^2}}\frac{\rho}{\varepsilon_0 c^2} = \sqrt{\frac{4\pi K}{ב\varepsilon_0}}\frac{\rho}{c^2}$ where ρ is charge density.

Now remember the term $\frac{1}{4ב}\left(-2U^{k};_{k}\frac{P_{\mu}P_{\nu}}{Z}\right)$ and the relation $\frac{P^{\mu}P^{\nu}}{Z} \approx \frac{V^{\mu}V^{\nu}}{c^2}$ where $\frac{P^{\mu}}{\sqrt{Z}}$ is equivalent to a normalized velocity vector $\frac{V^{\mu}}{c}$, in Special Relativity $V^{\mu} = \frac{(c,v_x,v_y,v_z)}{\sqrt{1-v^2/c^2}}$, so we get

$$\frac{1}{8\pi K}\frac{U^{\mu};_{\mu}}{2ב}\frac{P^{\mu}P^{\nu}}{Z^2} \approx \frac{1}{8\pi K}\sqrt{\frac{4\pi Kב}{ב^2\varepsilon_0}}\cdot\frac{\rho_{charge}V^{\mu}V^{\nu}}{c^4} = \frac{1}{8\pi Kc^4}\sqrt{\frac{4\pi K}{ב\varepsilon_0}}\rho_{charge}V^{\mu}V^{\nu} \qquad (12)$$

But that can only mean that charge density behaves like mass density and therefore for charge Q:

$$M = \frac{Q}{\sqrt{16\pi K\varepsilon_0 ב}} \qquad (13)$$

Assuming $ב = 1$ where ε_0 is the permittivity of vacuum and K is Newton's constant of gravity, M is a gravitational mass, from (13) ± 1 *Coulombs* is equivalent to $\pm\mathbf{5.802135215} * \mathbf{10^9}$ **Kg**.

Caveat: $\frac{P^{\mu}}{\sqrt{Z}}$ is not geodesic unless $\frac{1}{2}U_{\mu} = 0$. So $\rho_{charge}\frac{P_{\mu}P_{\nu}}{Z}$ does not behave as inertial mass.

Theorem 2: If the electromagnetic energy is not zero and the charge density $U^{k};_{k}$ is zero in a domain D of space-time then U_0 is never 0 in all events of D.

Proof:

We write the Einstein - Grossmann equation (4) in its dual form, $R_{\mu\nu} = T_{\mu\nu} - \frac{1}{2}g_{\mu\nu}T^{\alpha}_{\alpha} = \frac{1}{4ב}\left(U_{\mu}U_{\nu} - \frac{1}{2}g_{\mu\nu}U_{\lambda}U^{\lambda} - 2U^{k};_{k}\frac{P_{\mu}P_{\nu}}{Z} - \frac{1}{2}g_{\mu\nu}g^{ij}\left(U_iU_j - \frac{1}{2}g_{ij}U_{\lambda}U^{\lambda} - 2U^{k};_{k}\frac{P_iP_j}{Z}\right)\right) = \frac{1}{4ב}\left(U_{\mu}U_{\nu} - \frac{1}{2}g_{\mu\nu}U_{\lambda}U^{\lambda} - 2U^{k};_{k}\frac{P_{\mu}P_{\nu}}{Z} - \frac{1}{2}g_{\mu\nu}U^{\lambda}U_{\lambda} + g_{\mu\nu}U_{\lambda}U^{\lambda} + g_{\mu\nu}U^{k};_{k}\right) = \frac{1}{4ב}(U_{\mu}U_{\nu} + U^{k};_{k}(g_{\mu\nu} - 2\frac{P_{\mu}P_{\nu}}{Z}))$. If $U_0 = 0$ in D then there exist local coordinates such that only the P_0 component of P_{μ} is not zero. We assumed $U^{k};_{k} = 0$. Since $U_0 = 0$, $R_{00} = 0$ so the electromagnetic energy is zero. On the other hand, since U_{μ} is not zero, P_{μ} cannot be geodesic and therefore P_0 cannot be the only component of P_{μ} which is not zero along geodesic coordinates. Note: If there is a time-like curve γ around which U_{μ} is in relative motion in different events of every small D that contains γ, then R_{00} is not zero in D.

Note: There is one obvious peculiarity about charge generated gravity, $\frac{P^{\mu}}{\sqrt{Z}}$ is not the velocity of the charge. It is dictated by a scalar field of space-time!

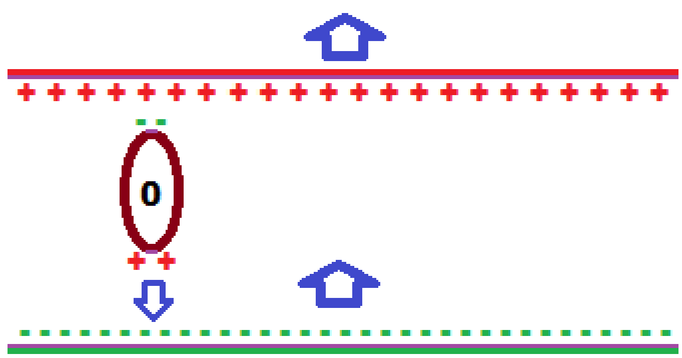
Note: From (10) and (13), if a^{μ} has a simple physical interpretation as a field that accelerates any neutral mass then we have to take (13) into account as an opposite effect. The result is that a field of 1,000,000 volts over 1 mm distance will accelerate any neutral particle at 8.61 cm * sec^{-2} and with taking into account (13) it will be less due to an opposite gravitational effect, see (14) be reduced to 4.305 cm * sec^{-2}.

The quantization of P is into a sum of event wave functions and has the physical meaning of Sam Vaknin's realization chronons [8]. The theory is easily expanded to 2 and to 3 Reeb vectors where the Lagrangian has U(1) SU(2) SU(3) symmetry if orientation is preserved, otherwise the symmetry group contains also reflections, see also an SU(4) Lagrangian, Appendix C.

3. Ceramic capacitors

In this section we will examine gravitational propulsion, not an Alcubierre's warp drive because the Alcubierre [9] extrinsic curvature condition $(K_i{}^i)^2 - K_{ij}K^{ij} < 0$ will not hold in the same geometry as in the Alcubierre warp drive bubble. However, a negative plate below and a positive plate above will manifest weak acceleration upwards as the negative gravity will push the positive plate upwards and the negative plate will be pulled by the positive plate above it. The main problem is that due to the dielectric material, the mass of the dielectric material will not be gravitationally repelled by the negative plate. Only a small portion of the mass of the capacitor will be affected in a highly dielectric material.

Fig. – Only a small portion of the mass, in purple, is affected.



It is easy to see from (13) that in the classical limit near the plate, the gravitational field is mostly affected by charge density. By (13) the gravitational acceleration is

$$a \cong \frac{4\pi KQ}{A*\varepsilon*\sqrt{16\pi K\varepsilon_0 \beth}} = \frac{V}{d\sqrt{\beth}} * \sqrt{\pi K\varepsilon_0} \Longrightarrow \delta Weight \cong \frac{V}{d\sqrt{\beth}} * \frac{M_{dielectric}}{g}\sqrt{\pi K\varepsilon_0} = \frac{V\rho A}{g\sqrt{\beth}}\sqrt{\pi K\varepsilon_0} \quad (14)$$

where K is Newton's gravitational constant, Q is charge, A is area, ρ is the dielectric layer's density and M is its mass and ε_0 is the permittivity of vacuum, ε is the relative dielectric constant, assuming $\beth = 1$. Suppose we have a 1000Pf ceramic capacitor and we charge it with 10000 Volts and the area of the plates is 1 cm^2. The charge on the plates is then 10^{-5} Coulombs and its density 10^{-1} Coulombs per square meters. Now we want to calculate the approximate acceleration that the upper positive plate experiences due to the anti-gravity effect from the lower plate. Only a thin portion of the upper layer is affected, where the positive charge accumulates. A calculation shows: 0.48663510306 meters / sec^2. Dividing 0.4866351… meters/sec^2 by 9.81 meters / sec^2 we get 0.049606024776763 which is less than 5 percent relative to the gravity of the Earth. If instead of a dielectric material, an insulator with relative dielectric constant 1 is used for the same charge density of 10^{-5} Coulombs per 1 cm^2, a weight loss of the insulating slab should be measured at about 0.0496 of its weight. With a high relative dielectric constant, the affected mass could be well below 1 milligram and it will lose 0.0496 of its weight. This renders the measurement of such an effect very hard to achieve unless the dielectric material is saturated and can no longer shield the field of the plates such as in the H4D experiment [10]. In any other case, practically no measurable thrust is expected for an area $1cm^2$ with 10,000 Volts and scale resolution worse than 10^{-4} grams. In the case of saturation, at first the inertial dipole is expected to grow with the saturation of the dielectric material and with the amount of charge on the plates. [10] will be discussed later. The H4D lab [10] 69 mm radius and 2mm PMMA thickness capacitor with 20,000 volts, weight loss is at least **0.0015509 grams**, however the thickness of the metal plates is 1mm. It is sufficient to have a low frequency AC ripple from the DC power supply to churn the electrons on the plates such that not only a thin layer of the plates will be charged, also with an AC ripple, of typically 150 VAC for 20000 Volts DC, the induced gravitational field can no longer be considered static. Under such conditions (14) is no longer valid.

4. Thrust from 1000 Pf capacitor with two metallic plates and 10000 volts

Assumptions: Most of the dielectric mass is not completely shielded from the plate fields and the attenuation of the influence of the external dipole on the mass within the induced dipole is by a factor ε^{-1}, where ε is the relative dielectric constant. If this assumption does not hold true then (14) is invalid. Such a problem may occur at least theoretically even if in total the dielectric constant is low only because of low mass density. A second assumption is that dielectric dipoles are evenly distributed within the dielectric layer. A third assumption is a low alternating current – AC component in the power supply and that the influence of the Inertial Dipole on the metal plates is negligible due to the charge concentrating on the metallic surfaces which are in contact with the dielectric material. A high AC component might disrupt electrons alignment on the plates and if the plate's thickness is not negligible then (14) is no longer valid. Also, if the dielectric material reaches saturation and the metallic plates are thick in relation to the dielectric layer, the charge distribution on the plates can no longer be limited to the contact surfaces with the dielectric layers which also results in (14) being no longer valid.

Suppose we have a high voltage ceramic capacitor of 1000Pf of **Ta2O5** [11] with each plate area $1cm^2$ which is charged by 10,000 volts. The permittivity of vacuum is about 8.8541878128 * 10^{-12} Farads*meter^{-1}. So we can calculate the distance d between the plates, 8.8541878128 * 10^{-12} Farads * metere^{-1} * 10^{-4} meters^2 * d^{-1} * 25 = 10^{-9} Farads. That means d ~ 0.22135469532 * 10^{-1} mm or d ~ 0.22135469532 * 10^{-2} cm. Now we take into account the weight density of the Ta2O5 which is 8.2 grams perm $1cm^3$ volume. So we have 8.2 * 1cm * 1cm * 0.22135469532 * 10^{-2} cm = 0.01815108501624 grams. At 10000 volts the weight loss is of a portion of 0.04960602477676315711411588216388 of the weight of the dielectric material and the inertial dipole is attenuated by the relative dielectric constant 25 just as the electric field is. So we have 0.01815108501624 grams * 0.04960602477676315711411588216388 * 25^{-1} ~ ~**3.60161*10^{-5}**

grams weight loss. This estimate can be much lower in a multilayered capacitor where fields cancel out or when the dielectric constant is higher and the dipoles density is not uniform.

5. Martin Tajmar experimental null results analysis

Martin Tajmar [12] used a capacitor of a relative dielectric constant 4500 and a Teflon [13] capacitor with radius 50 mm and Teflon thickness d=1.5 mm and 10,000 Volts. The highly dielectric capacitor weight loss is way below the experiment **scale resolution 3 * 10^{-4} grams** due to division by 4500 of the charge which is 10^{-5} per 1000Pf capacitance. With a radius of 0.5cm, such a capacitor with say 6.02 grams * cm^{-3} density will lose about **2.077389 * 10^{-5} grams**. Next focus is on one of the Teflon capacitors. The gravitational acceleration on the face of the Earth, about g=9.80665 meter * sec^{-2}. By (14), the result is **7.5917876115 * 10^{-6} grams**. This result is smaller than the resolution of 3 * 10^{-4} grams. The results assume $ב = 1$ in (4), (7), (13).

6. Particle mass ratios

In this section Equation (4) is explored in a small infinitesimal sphere, where we assume a linear relation between radius r and acceleration $\frac{a^\mu}{c^2} = \frac{U^\mu}{2} = \frac{Z^\mu}{2Z} - \frac{Z^k P_k P^\mu}{2Z^2}$, see (1), (2). Our goal is to reduce (4) from a four dimensional Minkowsky geometry to a three dimensional Riemaniann geometry and then to a two dimensional Riemannian geometry of surfaces.

We make the following assumption:

$$\frac{\|a^\mu\|}{c^2} = \frac{\xi}{rx} \tag{15}$$

Where, c is the speed of light, ξ is a coefficient that depends on the field as $r \to 0$ and the variable x changes with the density of the field as it passes through a two dimensional sphere. x is required because space-time curvature can cause such a sphere to be less than or more than $4\pi r^2$.

We also make other assumptions as follows:

1) Assumption 1: In small radii, the energy of the gravitational field depends on the area around the source of gravity. This assumption is consistent with the paper of Ted Jacobson [14].

2) Assumption 2: The area ratio that has a physical meaning is between a disk to which the unit vector $\frac{P^\mu}{\sqrt{Z}}$ points to and the weighted Euclidean sphere $ג * \pi r^2$ so $ג = 4$.

Mathematically and physically compelling explanation: We return to the principles of the chronon field by Sam Vaknin [8] in which the time arrow is defined via spin and thus via orientation: There are two orientations to be taken into account. The first is to orientation of the foliation that is perpendicular to $\frac{P^\mu}{\sqrt{Z}}$. The second is the plane within that foliation which is perpendicular to $\frac{P^\mu}{\sqrt{Z}}$ and to $\frac{U^\mu}{2}$. In each case only half of a 3D foliation and half of a plane can be related to energy and $\frac{1}{2}*\frac{1}{2}=\frac{1}{4}$.

Non rigid explanation: This idea is derived from a physical principle according to which a spin of a particle always either points to an observer or in the opposite direction. In this manner, the observer can only refer to the disc which is perpendicular to the spin axis and not to an entire sphere. An area ratio $\frac{\pi r^2}{4\pi r^2}=\frac{1}{4}$ means 0 gravity.
This assumption means that the delta area of a curved sphere divided by $4\pi r^2$ is $\frac{\delta\pi r^2}{\lambda*\pi r^2}$ and not $\frac{\delta 4\pi r^2}{4\pi r^2}$. There could be other explanations to this assumption including a choice of $32\pi K$ in (7) instead of $8\pi K$ and $\frac{1}{16}$ instead of $\frac{1}{4}$ in (4), however to the author's opinion, (43) does not support such other explanations.

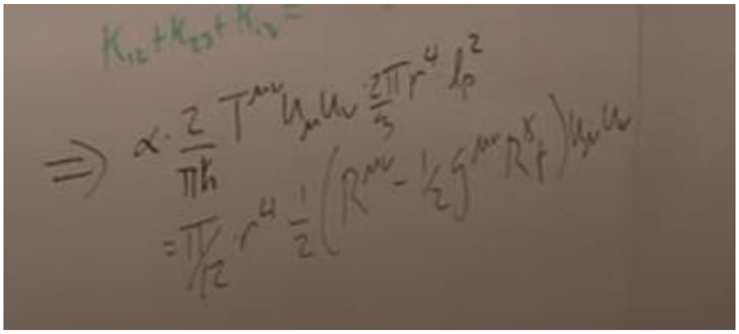
We revisit equation (4) and contract it twice with the unit vector $\frac{P^\mu}{\sqrt{Z}}$ which means a chosen time direction $\frac{1}{4\beth}\left(U_\mu U_\nu-\frac{1}{2}g_{\mu\nu}U_\lambda U^\lambda-2U^k{;_k}\frac{P_\mu P_\nu}{Z}\right)\frac{P^\mu P^\nu}{Z}=(R_{\mu\nu}-\frac{1}{2}Rg_{\mu\nu})\frac{P_\mu P_\nu}{Z}$

Since $U_\mu P^\mu=0$, and assuming $\beth=1$, we have around an electric charge by (15)

$$\frac{1}{\beth}(-\frac{1}{2}g_{\mu\nu}\frac{U_\lambda U^\lambda}{4}-\frac{1}{2}U^k{;_k})=\frac{1}{\beth}(-\frac{1}{2}\frac{\xi^2}{r^2x^2}\mp\frac{\xi}{r^2x})=(R_{\mu\nu}-\frac{1}{2}Rg_{\mu\nu})\frac{P_\mu P_\nu}{Z} \qquad (16)$$

We calculated the divergence of a field of a non-geodesic acceleration from intensity $\frac{\xi}{rx}$ to 0 along the distance r. The divergence $U^k{;_k}$ can be either positive or negative and depends on the sign of the electric charge of the electric charge. We now refer to Seth Lloyd lecture [15],

(Fig. 1) Area gain or loss in the direction of a unit vector:



As we see, to get the area loss on a disk which is perpendicular to the unit vector $\frac{P^{\mu}}{\sqrt{Z}}$ due to curvature, we need to multiply (16) by $\frac{\pi}{12}\frac{1}{2}r^4 = \frac{\pi}{24}r^4$.

$$\frac{1}{\beth}\left(-\frac{1}{2}\frac{\xi^2}{r^2x^2} \mp \frac{\xi}{r^2x}\right)\frac{\pi}{24}r^4 = \frac{1}{\beth}\left(-\frac{1}{2}\frac{\xi^2}{x^2} \mp \frac{\xi}{x}\right)\frac{\pi}{24}r^2 = AreaLossOfADisk \tag{17}$$

By our second assumption, the following has a physical meaning, where $\gimel = 4,\ \beth * \gimel = 1 * 4 = 4$

$$\left(-\frac{1}{2}\frac{\xi^2}{x^2} \mp \frac{\xi}{x}\right)\frac{1}{96} = \frac{1}{\beth * \gimel}\frac{1}{\pi r^2}\left(-\frac{1}{2}\frac{\xi^2}{x^2} \mp \frac{\xi}{x}\right)\frac{\pi}{24}r^2 = \frac{AreaLossOfADisk}{\gimel * \pi r^2} \tag{18}$$

But x should be a ratio between an area around a charge and Euclidean area. According to assumption 2. If x is greater than 1, then by 17, the non geodesic acceleration field density is decreased by a factor of $\frac{1}{x}$. If the area ratio is smaller 1 then the non geodesic field density is increased by $\frac{1}{x}$. So we must have the following equation:

$$x = 1 + \frac{AreaLossOfADisk}{4\pi r^2} \Leftrightarrow x - 1 = \frac{AreaLossOfADisk}{4\pi r^2}$$

And by (10) and (12), (18) becomes:

$$\left(-\frac{1}{2}\frac{\xi^2}{x^2} \mp \frac{\xi}{x}\right)\frac{1}{96} = \mathrm{x} - 1 \Leftrightarrow 1 + \left(-\frac{1}{2}\frac{\xi^2}{x^2} \mp \frac{\xi}{x}\right)\frac{1}{96} = x \Leftrightarrow \frac{192x^2 \mp 2\xi x - \xi^2}{192} = x^3 \tag{19}$$

The right hand side is expected to be positive around a negative charge and negative around a positive charge if we take into account the H4D experimental qualitative result [10] with imprecise balance.

We will first start with an assumption $\xi = \frac{4}{\pi}$. This assumption is based on Ettore Majorana's notebook [16]. It is also the well-known ratio between a star graph and a Steiner star in Euclidean spaces – *star Steiner ratio* in $\mathbb{R}^d$ [17]. The addition of a middle point in a ball can reduce the length of a star graph in relation to a star where the start graph is defined as straight lines between n-1 points and a single point on the sphere. And a Steiner star connects the points to the center. A physical meaning of such a ratio is that where there is a middle point, divergence of an acceleration field can be defined where there is no such point, no such divergence can be defined. For such a case a different value of ξ should be defined.

Then (19) yields two solutions as follows,

$$\frac{192{x_1}^2+2\xi x_1-\xi^2}{192}={x_1}^3 \Longrightarrow \frac{1}{x_1-1}\cong \mathbf{206.75133988502202} \tag{20}$$

This value is surprisingly very close to the mass ratio between the Muon and the electron!

$$\frac{105.6583745\text{MeV}}{0.5109989461\text{MeV}}\cong 206.7682826 \tag{21}$$

The following is an area ratio around a positive charge. The discussion about its meaning is postponed for now.

$$\frac{192{x_2}^2-2\xi x_2-\xi^2}{192}={x_2}^3 \Longrightarrow \frac{1}{1-x_2}\cong \mathbf{44.63955017596401} \tag{22}$$

Before we continue, we need to prove another theorem which has important implications to Quantum Gravity. The factor $\frac{96}{95}$ is, however, not final in what will be described as Steiner Trees.

Theorem 3: In Riemannian geometry, any computational model for the connection of a finite number of points on a sphere S2 and the center with radius r can converge in polynomial time only to a minimal graph of S2 not with radius r but with radius $r\frac{96}{95}$.

Proof: The proof of this theorem is a direct result of the complexity limit of the Minimum Steiner Tree. Finding the minimal length of such a graph is in polynomial time only above $\frac{96}{95}$ of the minimal graph length due to [18]. As a result, to connect all the points in the sphere and its center is possible in polynomial time only for $r\frac{96}{95}$ and we are done. The meaning of this theorem is very deep for most Quantum Gravity theories. For this specific theory, if acceleration depends on r^{-1} then physically the dependence must be on $\frac{95}{96}r^{-1}$. As a caveat, $\frac{96}{95}$ is not believed by the author to be an absolute limit to the hardness of the Steiner Tree problem. It is not difficult to see that for the choice of $\xi=\frac{95}{96}$, also see motivation in Appendix E, (74), (75), (79), the following polynomials yield,

$$\left(-\frac{1}{2}\frac{\left(\frac{95}{96}\right)^2}{a^2}+\frac{\frac{95}{96}}{a}\right)\frac{1}{96}=a \Longrightarrow \frac{192a^2+2\frac{95}{96}a-\left(\frac{95}{96}\right)^2}{192}=a^3 \; and \; \left(-\frac{1}{2}\frac{\left(\frac{95}{96}\right)^2}{b^2}-\frac{\frac{95}{96}}{b}\right)\frac{1}{96}=b \Longrightarrow$$

$$\frac{192b^2-2\frac{95}{96}b-\left(\frac{95}{96}\right)^2}{192}=b^3 \; and \; \frac{1}{(a-1)(1-b)}\cong \; \mathbf{12202.88874066467724} \tag{23}$$

$(a-1)(1-b)$ answers the question of what happens when the test particle is neutral.

Combining (20) and (23), the following holds:

$$\frac{(x_1-1)\mathbf{105.65837455}MeV}{1+(a-1)(1-b)} \cong \mathbf{0.5109989461}MeV$$

$$1+\frac{1}{96}\left(-\frac{1}{2}(1-\frac{1}{96})^2 a^{-2}+\left(1-\frac{1}{96}\right)a^{-1}\right)=a$$
$$1+\frac{1}{96}\left(-\frac{1}{2}(1-\frac{1}{96})^2 b^{-2}-\left(1-\frac{1}{96}\right)b^{-1}\right)=b$$
$$1+\frac{1}{96}\left(-\frac{1}{2}\left(\frac{4}{\pi}\right)^2 c^{-2}+\frac{4}{\pi}c^{-1}\right)=c$$
$$MuonMass*(c-1)=ElectronMass+ElectronMass*(a-1)(1-b) \tag{24}$$

By (23) the ratio is ~206.76828270441461654627346433699131011962890625

Where $ElectronMass*(a-1)(1-b)=\sim\mathbf{41.875}\ \boldsymbol{eV}/c^2$ looks like a new particle or resonance.

We only needed a small correction to the 2014 Muon energy from **105.6583745 MeV** to **105.65837455 MeV** with electron energy **0.5109989461055 MeV** to arrive at the energy ratio and therefore mass ratio of the Muon and the electron. Is that a mere coincidence ? The extremely small ratio error and the choices of $\xi=\frac{4}{\pi}$ and $\xi=\frac{95}{96}$ highly disfavor a mere coincidence. The following Python code was used to reach the result in (24),

```
import numpy as np

x1 = 1
third = 1 / 3
f = 4 / np.pi # Ettore Majorana's ring of a disk, potential factor.
f2 = f * f

# Iterate to most stable root.
for i in range(2000):
    x1 = np.power((192 * x1 * x1 + 2 * x1 * f - f2) / 192, third)

a = 1/(x1 - 1) # Negative charge.

print('Xi = 4/Pi, a = %.48f' % a)

x3 = 1
x4 = 1
f = 95 / 96
f2 = f * f

# Iterate to most stable roots.
for i in range(2000):
    x3 = np.power((192 * x3 * x3 + 2 * x3 * f - f2) / 192, third)
```

```
    x4 = np.power((192 * x4 * x4 - 2 * x4 * f - f2) / 192, third)

c = 1/(x3 - 1) # Negative charge.
d = 1/(1 - x4) # Positive charge.

print('Xi = 95/96, c = %.48f, d = %.48f' % (c, d))
print('Xi = 95/96, c * d = %.48f' % (c * d))

print('Approximated mass ratio between the Muon and the electron %.48f'
      % (a * (1 + (x3-1)*(1-x4))))
```

How about null Reeb vectors $\frac{U_\mu}{2}\frac{U^\mu}{2} = 0$. It is not difficult to see that in this case, the unit vector $\frac{P_\mu}{\sqrt{Z}}$ should be space-like at least in the near vicinity of the test particle as $r \to 0$ and U^μ may not be all 0 at the center of a sphere but can be a null vector. With $\xi = \frac{4}{\pi}$ and $\xi = \frac{95}{96}$ we have in this case:

$$1 + \frac{1}{96}\left(\pm\frac{4}{\pi}c^{-1}\right) = 1 \pm \frac{c^{-1}}{24\pi} = c \tag{25}$$

and

$$1 + \frac{1}{96}\left(\pm\frac{95}{96}b^{-1}\right) = 1 \pm \frac{95b^{-1}}{96^2} = b \tag{26}$$

From (25)

$$c_1 = \frac{1+\left(1+\frac{1}{6\pi}\right)^{\frac{1}{2}}}{2} \cong 1.0130915\ldots,\ c_2 = \frac{1+\left(1-\frac{1}{6\pi}\right)^{\frac{1}{2}}}{2} \cong 0.986556\ldots \text{ and} \tag{27}$$

From (26)

$$b_1 = \frac{1+\left(1+\frac{95}{96*24}\right)^{\frac{1}{2}}}{2} \cong 1.010204037\ldots,\ b_2 = \frac{1+\left(1-\frac{95}{96*24}\right)^{\frac{1}{2}}}{2} = \frac{95}{96} \text{ and}$$

$$\frac{1}{c_1-1} \cong 76.38530,\ \frac{1}{1-c_2} \cong 74.3845968,\ \frac{1}{\sqrt{(c_1-1)(1-c_2)}} \cong 75.3783115, \tag{28}$$

$$\frac{1}{b_1-1} \cong 98.00042535,\ \frac{1}{1-b_2} = 96,\ \frac{1}{\sqrt{(b_1-1)(1-b_2)}} \cong 96.99505572 \tag{29}$$

We now look at:

$$\frac{\sqrt{(b_1-1)(1-b_2)}}{\sqrt{(c_1-1)(1-c_2)}} \cong 1.134361808^{-2} \tag{30}$$

Roots are attributed in this case to spin 1 or 2. It is easy to see that also:

$$(1 + (c_1 - 1)(1 - c_2))\left(\frac{(c_1-1)(1-c_2)}{(b_1-1)(1-b_2)}\right)^{1/4} \cong 1.134561453 \tag{31}$$

$$\approx \frac{91.1876\ GeV}{80.3725\ GeV}$$

Which is remarkably close to the ratio between the energy of the Z boson and the energy of the W boson and for W Boson of $80.3725\ GeV$ the relative error of this ratio is about 1/1528961.689.

Another research direction is to use the inverted value of $\xi = \frac{4}{\pi}$, i.e. $\xi = \frac{\pi}{4}$ in the negative and positive charge area ratio equations as in (24). That yields two new maximal roots ${a_1}^2 + \frac{1}{96}\left(-\frac{1}{2}\left(\frac{\pi}{4}\right)^2 + \frac{\pi}{4}a_1\right) = {a_1}^3$ and ${a_2}^2 + \frac{1}{96}\left(-\frac{1}{2}\left(\frac{\pi}{4}\right)^2 - \frac{\pi}{4}a_2\right) = {a_2}^3$ along with the older ones ${b_1}^2 + \frac{1}{96}\left(-\frac{1}{2}\left(\frac{4}{\pi}\right)^2 + \frac{4}{\pi}b_1\right) = {b_1}^3$ and ${b_2}^2 + \frac{1}{96}\left(-\frac{1}{2}\left(\frac{4}{\pi}\right)^2 - \frac{4}{\pi}b_2\right) = {b_2}^3$. Quite like the ratio in (30), we have, $\frac{\sqrt{(b_1-1)(1-b_2)}}{\sqrt{(a_1-1)(1-a_2)}} \cong \sqrt{\frac{201.6240447 * 86.46523917}{206.7513399 * 44.63955018}}$ ≅1.374383282 which is close to the following mass ratio between a Higgs Boson of 125.3267 GeV and a Z Boson of 91.1876 GeV which yields, 1.37438314, close to 1.374383282. It is interesting though not sufficiently accurate to draw any conclusion at this stage. The idea behind using charge equations without null Reeb vectors is because the Higgs boson is supposedly responsible for non zero mass. From (31) and using s instead of c, $\sqrt{(s_1-1)(1-s_2)} \cong 75.3783115 ...^{-1}$ and 91.1876 GeV $* \frac{\sqrt{(b_1-1)(1-b_2)}}{\sqrt{(a_1-1)(1-a_2)}} * (1 + (s_1-1)(1-s_2)) \cong$ 125.3487702 GeV. A similar $(1 + (s_1-1)(1-s_2))$ value was used in (29) as $(1 + (c_1-1)(1-c_2))$. If the reasoning here is correct, the Higgs boson interacts as an electric dipole.

Returning to (22) $\frac{1}{1-x_2} \cong \mathbf{44.63955017596401}$ and written as $\frac{1}{1-c}$,

$$\frac{80372.88\ \text{MeV}\ (1-c)}{1+\sqrt{(c_1-1)(1-c_2)}} \approx \mathbf{1776.91\ MeV} \tag{32}$$

The root, $\sqrt{(c_1-1)(1-c_2)}$ can be better understood as a result of taking the root of a determinant of a Gram matrix of two Reeb vectors in Appendix C or is related to spin 1. The value 1776.91 MeV will be discussed in (36) with a reference. A very surprising relation between Quarks and Leptons with the same $\frac{1}{1-c} \cong 44.63955017596401$ as in (22) is the relation between the **pole energy of the Bottom/Beauty Quark** [19], [20] and the anti-**Muon**, this time we take the Muon value that yields in (24) along with the denominator of (23), the exact mass ratio between the Muon and the electron $105.65837455\ MeV$ instead of the 2014 value $105.6583745\ MeV$,

$$\frac{105.65837455\ MeV}{(1-c)(1+(a-1)(1-b))}(1+\sqrt{(c_1-1)(1-c_2)})$$
$$= 44.63955017596401 * 105.65837455\ MeV$$
$$* (1 + 75.378311502572868277860789009693^{-1}) *$$

$(1 + 12202.88874066467724^{-1})^{-1} \cong 4{,}778.7223164425585113299$ MeV $\approx$ **4.78 GeV**

Which is equivalent to:

$$\frac{PoleEnergyOfBottomQuark*(1-c)}{(1+\sqrt{(c_1-1)(1-c_2)})} = \frac{MuonEnergy}{(1+(a-1)(1-b))} \qquad (33)$$

In which the root in the left denominator is attributed to spin 1.

7. The exact inverse Fine Structure constant

The fine structure constant is surprisingly reached through the mass ratio between the Tau lepton and the Muon. Recommended reading for this section is Appendix E, (70) - (79).

Note: The more advanced parts of this section require basic knowledge of electrical engineering and especially a good understanding of the trivial subject of Dissipation Factor and Loss Tangent.

The denominator $1+\sqrt{(c_1-1)(1-c_2)}$ in (32), (33) and $(1+(a-1)(1-b))$ in (24) can be used together to yield a nice result that seems to be more than just a mathematical coincidence. Consider the following:

$$1+\frac{1}{96}\left(-\frac{1}{2}\xi^2 {g_1}^{-2} + \xi {g_1}^{-1}\right) = g_1$$
$$1+\frac{1}{96}\left(-\frac{1}{2}\xi^2 {g_2}^{-2} - \xi {g_2}^{-1}\right) = g_2$$

$$\text{Such that } (g_1-1)^{-\frac{1}{2}} = \frac{1}{2}(1-g_2)^{-1} \qquad (34)$$

With biggest roots $g_1 \cong 1.003629541$ and $g_2 \cong 0.969877163$. g_1 means an area portion $\mathbf{275.51693^{-1}}$ is added around a negative charge and $\mathbf{33.19740^{-1}}$ of the area is subtracted around a positive charge, which reflects a possibly maximal allowed gravitational imbalance between negative and positive charge.

A calculation that uses an electronic datasheet yields,

$$\xi \cong \mathbf{1.5561985371903484},\ (g_1-1)^{-\frac{1}{2}} \cong \mathbf{16.59870203} \qquad (35)$$

which is close to the known mass ratio between the Tauon and the Muon, $\cong$16.817 where ξ denotes a maximal allowed coefficient. Multiplying this value by

$1+\sqrt{(c_1-1)(1-c_2)}$ from (32), (33) and dividing by $\left(1+(a-1)(1-b)\right)$ from (24) yields,

$$\frac{Muon\ 105.6583745\ MeV}{\left(1+(a-1)(1-b)\right)} \cong \frac{\sqrt{g_1-1}\ Tauon\ 1776.9127923826\ MeV}{(1+\sqrt{(c_1-1)(1-c_2)})} \qquad (36)$$

Which is ≅16.81752914. So this calculation predicts a Tauon energy of about **1776.9127923826 MeV** which agrees with [21].

$$\frac{2}{\cos(\xi)} \cong \frac{2}{\cos(1.5561985371903484)} \cong 137.011909869, \quad (37)$$

$$\tan^{-1}(95^2 96^2 (1-g_2)^{+4}) \cong 1.5561948778250207190765973767615 \quad (38)$$

remarkably approximate ξ ≅1.5561985371903484 from (34), (35).

$$Error = \frac{\xi - (95^2 96^2 (1-g_2)^4)}{\xi} \cong 425{,}263.6013281679051795882415713 3^{-1} \quad (39)$$

In terms of electrical engineering Dissipation Factor and Loss Tangent, we can write, $DF = \frac{95^2 96^2}{(1-g_2)^{-4}} \approx \tan(\xi)$ where the numerator is known as the Resistive Power Loss and the denominator as the Reactive Power Oscillation. It is expected that an oscillating charge will generate oscillation in area due gravity changes, however, it is not expected that the area portion that is lost due to gravity will appear as the power of 4. This is a very rare property that connects between trigonometry and the electro-gravity polynomials (34). We can get from this relation two insights, the first is that if (37) is not a mathematical coincidence, then the inverse Fine Structure constant should come out of a trigonometric function and a numbers relation. The second is that $95^2 96^2 (1-g_2)^4$ should be part of this equation. We may think that perhaps scaling of the value of ξ in a rational way, will yield the exact inverse Fine Structure Constant. So we want to find some d such that $\frac{2}{\cos\left(1.5561985371903484*(1+\frac{1}{d})\right)}$ will yield the constant we are looking for. We will soon find such d, $d \cong 606400.8$ that complies with [22] and we get, $\frac{2}{\cos\left(1.5561985371903484*(1+\frac{1}{606400.8})\right)} \cong 137.0359990462475253.$

Until now, d is not very interesting because we could not find d out of any new theory. Well, not very accurate. First, $\frac{1}{2}(1-g_2)^{-4} \cong 607276.5368006824282929 \approx 606400.8$ and $\frac{2}{\cos(1.5561985371903484*(1+2(1-g_2)^4))} \cong 137.0359643018112763$

If we test the following values for $d \cong 606400.8$ we get: $\frac{95^4}{d} \cong 134.3181357940161..$, $\frac{96^4}{d} \cong 140.0635619214..$ and the geometric average of these two values is $\left(\frac{95^4}{d}\frac{96^4}{d}\right)^{\frac{1}{2}} = \frac{95^2 96^2}{d} \cong 137.1607689$. It is not difficult to see the following:

As a result of the conclusions of (38), (39), the exact inverse Fine Structure Constant was found by the following, although some aspects of the following calculation are not resolved yet. We put together (20), (22), (34), (35), (37), $\frac{1}{2}(1-g_2)^{-4} \cong 607276.5368006824282929$, and from (35) $\xi \cong 1.5561985371903484$

$$1+\frac{1}{96}\left(-\frac{1}{2}\left(\frac{4}{\pi}\right)^2 a^{-2}+\frac{4}{\pi}a^{-1}\right)=a \Longrightarrow \frac{1}{a-1}\cong 206.75133988502202$$
$$1+\frac{1}{96}\left(-\frac{1}{2}\left(\frac{4}{\pi}\right)^2 b^{-2}-\frac{4}{\pi}b^{-1}\right)=b \Longrightarrow \frac{1}{1-b}\cong 44.63955017596401$$
$$d=(\frac{1}{2}(1-g_2)^{-4})^{\frac{1}{1+(a-1)(1-b)}}\cong \mathbf{606401.0372 \approx 606400.8}$$

$$\frac{2}{\cos\left(1.5561985371903484*(1+\frac{1}{d})\right)}\cong \mathbf{137.0359990368270076 \approx 137.035999037} \qquad (40)$$

Note: $p=((a-1)(1-b))^{-\frac{1}{2}}\cong 96.0691772148863$ is a very special number in the following property that bridges between area ratios and powers as follows, denote $s=\frac{1}{2}(1-g_2)^{-4}$ then $s^{(\frac{1}{1+(a-1)(1-b)})}\approx s(2-\frac{1}{96^2(a-1)(1-b)})$ or written as numbers 606401.0372 ~ 606401.0194 with a relative error of about 34,109,836.56^{-1}. An exact equality, $s^{\frac{1}{1+p^{-2}}}=s\left(2-\frac{p^2}{96^2}\right)\cong 606401.0371$, follows from replacing $p=\sim 96.0691772148863$ with p = ~96.06917582 with a relative error in $96.0691772148863=((a-1)(1-b))^{-1/2}$ of ~1.45953 * 10^{-8}. If the reader still thinks (40) is a fluke of chance, then this note does not agree with such a hypothesis. Also note that p comes from (20), (22) which resulted in (24). See Python code and it's more exact output in Appendix F.

Another result is by finding the variable s where a and b are given in (40):

$$\left(\frac{95^2*96^2}{s}\right)^{1+(a-1)(1-b)}=\frac{2}{\cos\left(\xi\left(1+\frac{1}{s^{\left(\frac{1}{1+(a-1)(1-b)}\right)}}\right)\right)}\Longrightarrow \qquad (41)$$

$$\left(\frac{95^2*96^2}{s}\right)^{1+(a-1)(1-b)}\cong 137.035999036428876252$$

Another idea is to solve the following equation where s is given and p is a variable:

$$s=(\frac{1}{2}(1-g_2)^{-4})\cong 607276.536800682428292930$$

$$\left(\frac{95^2*96^2}{s}\right)^{1+1/(p*p)}=\frac{2}{\cos\left(\xi\left(1+\frac{1}{s^{\left(\frac{1}{1+1/(p*p)}\right)}}\right)\right)}\Longrightarrow \qquad (42)$$

$$\left(\frac{95^2*96^2}{s}\right)^{1+1/(p*p)}\cong \mathbf{137.035999035747181551}, p\cong \mathbf{96.070666703058402}85$$

Combining (41) and (42) we find a numerical attractor at (42) with $s \cong$ $\mathbf{607276.536800682428292930126 2} \cong (\frac{1}{2}(1-g_2)^{-4})$, $s^{\left(\frac{1}{1+1/(p*p)}\right)} \cong$ $\mathbf{606401.064296812633983791}$, $\xi \cong \mathbf{1.5561985371903484}$ from (35). Before we close this discussion, it is nice to mention another relation $(1-\ln\left(\left(1+\frac{1}{137.035999035747181551}\right)^{137.035999035747181551}\right))^{-1} \cong 275.4045237287 \approx 275.51693 \cong$ $(g_1-1)^{-1}$ in (43.10). That is not a total surprise because $(1-\ln\left(\left(1+\frac{1}{z}\right)^{z}\right))^{-1} \approx 2z$ for big z.

8. The mass hierarchy

By (13) and considering the Planck mass $\sqrt{\frac{\hbar c}{K}}$ and the Fine structure constant Alpha:

$$\sqrt{\frac{\hbar c}{K} * \frac{e^2}{4\pi\varepsilon_0 \hbar c}} = \frac{2e}{2\sqrt{4\pi K\varepsilon_0}} = \frac{2e}{\sqrt{16\pi K\varepsilon_0}} = PlanckMass * \sqrt{Alpha} \tag{43}$$

So multiplication of the Plank mass by the square root of the Fine Structure Constant yields twice the electro-gravitational mass of a charge e ! If we take $\xi \cong 1.5561985371903484$ from (35) to be the maximal allowed field coefficient of an electric charge then the field around a single charge as a normalized quantity is obtained as

$$\frac{1}{\xi}\frac{1}{2} PlanckMass * \sqrt{Alpha} = \frac{1}{\xi}\frac{e}{\sqrt{16\pi K\varepsilon_0}} \tag{44}$$

Now we recall from (24) the following root a around a negative charge:

$$1 + \frac{1}{96}\left(-\frac{1}{2}\left(\frac{95}{96}\right)^2 a^{-2} + \left(\frac{95}{96}\right) a^{-1}\right) = a \cong 1 + 192.0463944^{-1} \tag{45}$$

We take from (24), (40), $(a-1)(1-b) \cong \frac{1}{206.75133988502202 * 44.63955017596401}$ and calculate

$$\left(\frac{\frac{1}{\xi}\frac{1}{2} PlanckMass * \sqrt{Alpha}}{M_e}\right)^{(a-1)(1-b)} \cong 1 + 192.04864774452^{-1} \tag{46}$$

Where $M_e \cong 0.5109989461\ MeV$, e is the electron's charge $1.602176634 \times 10^{-19}$ Coulombs, K is Newton's constant of gravity 6.674×10^{-11} $m^3 \cdot kg^{-1} \cdot s^{-2}$, Planck mass 1.22091×10^{22} MeV, from (40) $Alpha \cong 137.0359990368270076^{-1}$. The relative error between (46) and (45) is $\frac{192.04864774452 - 192.0463944}{192.0463944} \cong 85{,}227.266539382^{-1}$.

9. Interesting acceleration to radius coefficients relation

Consider the coefficients $\frac{95}{96}$, from (23) $\frac{4}{\pi}$, from (24) and $\xi =$ 1.556198537190348396563877031439915299415588 from (34), (35). Note the following table

ξ	$\xi\left(\frac{4}{\pi}\right)^{-1}$	$\xi\cdot 9\cdot\left(\frac{4}{\pi}\right)^{-1}$
$\frac{95}{96}$	0.7772169325287248897~$\frac{7}{9}$	6.994952392758524
$\frac{4}{\pi}$	$1=\frac{9}{9}$	9
1.5561985371903483965638770314399	1.22223547299109529~$\frac{11}{9}$	11.0001192569

Conclusion

The presented model predicts gravity not only by mass but also by electric charge. It offers a technological breakthrough by generating inertial dipoles and it offers mass ratios between particles that are not accessible through the Standard Model.

Appendix A: Euler Lagrange minimum action equations

We assume $\sigma = 8\pi$ (from the previously discussed term, $-a_\mu a^\mu / 8\pi K$ as an energy density).

$$\mathrm{Z} = N^2 = \mathrm{P}_\mu \mathrm{P}^\mu \text{ and } U_\lambda = \frac{Z_\lambda}{Z} - \frac{Z_k P^k P_\lambda}{Z^2} \text{ and } \mathrm{L} = \frac{1}{4}\mathrm{U}^{\mathrm{k}}\mathrm{U}_{\mathrm{k}}$$
$$R = Ricci \text{ curvature.}$$
$$Min\ Action = Min\int_\Omega \left(R - \frac{8\pi}{\sigma}L\right)\sqrt{-g}\,d\Omega =$$
$$Min\int_\Omega \left(R - \frac{1}{4}\mathrm{U}^{\mathrm{k}}\mathrm{U}_{\mathrm{k}}\right).\sqrt{-g}\,d\Omega \text{ s.t. } \sigma = 8\pi \tag{47}$$

The variation of the Ricci scalar is well known. It uses the Platini identity and Stokes theorem to calculate the variation of the Ricci curvature and reaches the Einstein tensor [23], as follows,

$\delta R = R_{\mu\nu}\delta g^{\mu\nu}$ and $\delta\sqrt{-g} = -\frac{1}{2}g_{\mu\nu}\delta g^{\mu\nu}\sqrt{-g}$ by which we infer $\delta(R\sqrt{-g}) = (R_{\mu\nu} - \frac{1}{2}Rg_{\mu\nu})\delta g^{\mu\nu}$ which will be later added to the variation of $\left((R - \frac{1}{4}U^j U_j)\right)\sqrt{-g}$ by $\delta g^{\mu\nu}$. The following Euler Lagrange equations have to hold,

$$\frac{\partial}{\partial g^{\mu\nu}} - \frac{d}{dx^m}\frac{\partial}{\partial g^{\mu\nu}{}_{,m}} + \frac{d^2}{dx^m dx^s}\frac{\partial}{\partial g^{\mu\nu}{}_{,m,s}}\left((R - \tfrac{1}{4}U^j U_j)\sqrt{-g}\right) = 0,$$

$$\frac{\partial}{\partial P} - \frac{d}{dx^m}\frac{\partial}{\partial P_{,m}} + \frac{d^2}{dx^m dx^s}\frac{\partial}{\partial P_{,m\,,s}}\left((R - \frac{1}{4}U^j U_j)\sqrt{-g}\right) = 0$$

$U^k U_k = \frac{Z_\mu Z^\mu}{Z^2} - \frac{(Z_s P^s)^2}{Z^3}$ which we obtain from the minimum Euler Lagrange equation because $U_\lambda P^\lambda = \frac{Z_\lambda P^\lambda}{Z} - \frac{Z_k P^k P_\lambda P^\lambda}{Z^2} = 0$. In order to calculate the minimum action Euler-Lagrange equations, we will separately treat the Lagrangians, $L = \frac{Z_\mu Z^\mu}{Z^2}$ and $L = \frac{(Z_s P^s)^2}{Z^3}$ to derive the Euler Lagrange equations of the Lagrangian $L = \frac{Z_\mu Z^\mu}{Z^2} - \frac{(Z_s P^s)^2}{Z^3} = U_\mu U^\mu$. The Euler Lagrange operator of the Ricci scalar $(\frac{\partial}{\partial g^{\mu\nu}} - \frac{d}{dx^m}\frac{\partial}{\partial (g^{\mu\nu},_m)} + \frac{d^2}{dx^m dx^s}\frac{\partial}{\partial (g^{\mu\nu},_m,_s)}$.

The reader may skip the following equations up to equation (53). Equations (53), (54) and (55) are however crucial.

$$L = \frac{(P_\lambda Z^\lambda)^2}{Z^3}\ s.t.\ Z = P_\mu P^\mu\ and\ Z_s \equiv Z,_s = \frac{dZ}{dx^s}$$

$$\frac{\partial(L\sqrt{-g}}{\partial g^{\mu\nu}} - \frac{d}{dx^m}\frac{\partial(L\sqrt{-g}\,)}{\partial g^{\mu\nu},_m}$$
$$= \left(-2\left(\frac{Z,_s P^s}{Z^3}P_\mu P_\nu P^m\right);_m + 2\left(\frac{Z,_s P^s}{Z^3}\right)\left(\Gamma^{i}_{\mu m}P_i P_\nu P^m + \Gamma^{i}_{\nu m}P_\mu P_i P^m\right)\right.$$
$$+ 2\left(\frac{Z,_s P^s}{Z^3}\right)\left(P_\mu P_\nu\right);_m P^m - 2\left(\frac{Z,_s P^s}{Z^3}\right)\left(\Gamma^{i}_{\mu m}P_i P_\nu P^m + \Gamma^{i}_{\nu m}P_\mu P_i P^m\right)$$
$$\left. + 2\left(\frac{Z,_s P^s}{Z^3}\right)Z_\mu P_\nu - 3\frac{(Z,_s P^s)^2}{Z^4}P_\mu P_\nu - \frac{1}{2}\frac{(Z,_s P^s)^2}{Z^3}g_{\mu\nu}\right)\sqrt{-g} =$$

$$\left(-2\left(\frac{Z,_s P^s}{Z^3}P^k\right);_k P_\mu P_\nu - 2\frac{(Z,_s P^s)^2}{Z^3}\frac{P_\mu P_\nu}{Z} - \frac{(Z,_s P^s)^2}{Z^3}\frac{P_\mu P_\nu}{Z} + 2\left(\frac{Z,_s P^s}{Z^3}\right)Z_\mu P_\nu - \frac{1}{2}\frac{(Z,_s P^s)^2}{Z^3}g_{\mu\nu}\right)\sqrt{-g} \quad (48)$$

$$L = \frac{Z^\lambda Z_\lambda}{Z^2}\ s.t.\ Z = P_\mu P^\mu, s.t.\ Z = P_\mu P^\mu\ and\ Z_s \equiv Z,_s = \frac{dZ}{dx^s}$$

$$\frac{\partial(L\sqrt{-g}}{\partial g^{\mu\nu}} - \frac{d}{dx^m}\frac{\partial(L\sqrt{-g}\,)}{\partial g^{\mu\nu},_m} = \left(-2\left(\frac{Z^m P_\mu P_\nu}{Z^2}\right);_m + 2\frac{(\Gamma^{i}_{\mu m}P_i P_\nu Z^m + \Gamma^{i}_{\nu m}P_i P_\mu Z^m)}{Z^2} + 2\frac{(P_\mu P_\nu);_m Z^m}{Z^2} - \right.$$
$$2\frac{(\Gamma^{i}_{\mu m}P_i P_\nu Z^m + \Gamma^{i}_{\nu m}P_i P_\mu Z^m)}{Z^2} + \frac{Z_\mu Z_\nu}{Z^2} - 2\frac{Z_s Z^s}{Z^3}P_\mu P_\nu - \left.\frac{1}{2}\frac{Z_m Z^m}{Z^2}g_{\mu\nu}\right)\sqrt{-g} = \left(-2\left(\frac{Z^m}{Z^2}\right);_m P_\mu P_\nu - \right.$$
$$\left. 2\frac{Z_s Z^s}{Z^3}P_\mu P_\nu - \frac{1}{2}\frac{Z_m Z^m}{Z^2}g_{\mu\nu} + \frac{Z_\mu Z_\nu}{Z^2}\right)\sqrt{-g} \quad (49)$$

We subtract (48) from (49)

$$Z = P_\mu P^\mu, s.t.\ Z = P_\mu P^\mu\ and\ Z_s \equiv Z,_s = \frac{dZ}{dx^s}, U_\lambda = \frac{Z_\lambda}{Z} - \frac{Z_k P^k P_\lambda}{Z^2}, L = U^k U_k = \frac{Z_\lambda Z^\lambda}{Z^2} - \frac{(Z_k P^k)^2}{Z^3}$$

$$\frac{\partial(L\sqrt{-g}}{\partial g^{\mu\nu}} - \frac{d}{dx^m}\frac{\partial(L\sqrt{-g}\,)}{\partial g^{\mu\nu},_m} = \left(+2\left(\frac{Z_m P^m}{Z^3}P^k\right);_k P_\mu P_\nu + 2\frac{(Z_m P^m)^2}{Z^3}\frac{P_\mu P_\nu}{Z} - 2\frac{Z_m P^m}{Z^3}Z_\mu P_\nu + \frac{1}{2}\frac{(Z_m P^m)^2}{Z^3}g_{\mu\nu} + \frac{(Z_m P^m)^2}{Z^3}\frac{P_\mu P_\nu}{Z} + (-2\left(\frac{Z^m}{Z^2}\right);_m P_\mu P_\nu - 2\frac{Z_\lambda Z^\lambda}{Z^2}\frac{P_\mu P_\nu}{Z} - \frac{1}{2}\frac{Z_\lambda Z^\lambda}{Z^2}g_{\mu\nu} + \frac{Z_\mu Z_\nu}{Z^2})\right)\sqrt{-g} =$$

$$\left(\left(+2\left(\frac{Z_m P^m}{Z^3}P^k\right);_k - 2\left(\frac{Z^m}{Z^2}\right);_m\right)P_\mu P_\nu + 2\frac{\left(P^\lambda Z_\lambda\right)^2}{Z^3}\frac{P_\mu P_\nu}{z} - 2\frac{Z^\lambda Z_\lambda}{Z^2}\frac{P_\mu P_\nu}{Z} + \frac{1}{2}\frac{\left(P^\lambda Z_\lambda\right)^2}{Z^3}g_{\mu\nu} - \frac{1}{2}\frac{Z_k Z^k}{Z^2}g_{\mu\nu} + \frac{Z_\mu Z_\nu}{Z^2} - 2\left(\frac{Z_s P^s}{Z^3}\right)Z_\mu P_\nu + \frac{\left(P^\lambda Z_\lambda\right)^2}{Z^3}\frac{P_\mu P_\nu}{Z}\right)\sqrt{-g} = \left(\left(+2\left(\frac{Z_m P^m}{Z^3}P^k\right);_k - 2\left(\frac{Z^m}{Z^2}\right);_m\right)P_\mu P_\nu + 2\frac{\left(P^\lambda Z_\lambda\right)^2}{Z^3}\frac{P_\mu P_\nu}{z} - 2\frac{Z^\lambda Z_\lambda}{Z^2}\frac{P_\mu P_\nu}{z} + U_\mu U_\nu - \frac{1}{2}U^\lambda U_\lambda g_{\mu\nu}\right)\sqrt{-g} =$$

$$\left(U_\mu U_\nu - \frac{1}{2}U^\lambda U_\lambda g_{\mu\nu} - 2U^k;_k\frac{P_\mu P_\nu}{z}\right)\sqrt{-g} \tag{50}$$

$$L = \frac{(Z^s P_s)^2}{Z^3} \quad s.t.\ Z = P^\lambda P_\lambda\ and\ Z_m = (P^\lambda P_\lambda),_m$$
$$\frac{\partial(L\sqrt{-g}\,)}{\partial P_\mu} - \frac{d}{dx^\nu}\frac{\partial(L\sqrt{-g}\,)}{\partial P_\mu,_\nu} =$$
$$\begin{pmatrix} -4(\frac{(Z_s P^s)}{Z^3}P^\mu P^\nu);_\nu + 4\frac{(Z_s P^s)}{Z^3}\Gamma_i{}^\mu{}_\nu P^i P^\nu + \\ +4\frac{(Z_s P^s)}{Z^3}P^\mu;_\nu P^\nu - 4\frac{(Z_s P^s)}{Z^3}\Gamma_i{}^\mu{}_k P^i P^k + \\ +2\frac{Z_m P^m Z^\mu}{Z^3} - 6\frac{(Z_m P^m)^2}{Z^4}P^\mu \end{pmatrix}\sqrt{-g} =$$
$$(-4(\frac{(Z_s P^s)P^\nu}{Z^3});_\nu P^\mu + 2\frac{Z_m P^m Z^\mu}{Z^3} - 6\frac{(Z_m P^m)^2}{Z^4}P^\mu)\sqrt{-g} \tag{51}$$

$$L = \frac{Z^s Z_s}{Z^2} \quad s.t.\ Z = P^\lambda P_\lambda\ and\ Z_m = (P^\lambda P_\lambda),_m$$
$$\frac{\partial(L\sqrt{-g}\,)}{\partial P_\mu} - \frac{d}{dx^\nu}\frac{\partial(L\sqrt{-g}\,)}{\partial P_\mu,_\nu} =$$
$$\begin{pmatrix} -4(\frac{P^\mu Z^\nu}{Z^2});_\nu + \frac{4}{Z^2}\Gamma_i{}^\mu{}_k P^i Z^k + \\ +\frac{4}{Z^2}P^\mu;_\nu Z^\nu - \frac{4}{Z^2}\Gamma_i{}^\mu{}_k P^i Z^k + \\ -4\frac{Z_m Z^m}{Z^3}P^\mu\sqrt{-g} \end{pmatrix}\sqrt{-g} =$$
$$(-4(\frac{Z^\nu}{Z^2});_\nu - 4\frac{Z_m Z^m}{Z^3})P^\mu\sqrt{-g} \tag{52}$$

We subtracted the Euler Lagrange operators of $\frac{(Z^s P_s)^2}{Z^3}\sqrt{-g}$ in (48) from the Euler Lagrange operators of $\frac{Z^\lambda Z_\lambda}{Z^2}\sqrt{-g}$ in (49) and got (50) and we will subtract (51) from (52) to get two tensor equations of gravity, these will be (53), and (55). Assuming $\sigma = 8\pi$, where the metric variation equations (47), (48), (49) and (50) yield

$$
\begin{aligned}
&\mathrm{Z} = N^2 = \mathrm{P}_\mu \mathrm{P}^\mu \;,\; U_\lambda = \frac{Z_\lambda}{Z} - \frac{Z_k P^k P_\lambda}{Z^2} \;,\; L = \frac{1}{4} U_i U^i \;\text{ and } \mathrm{Z} = \mathrm{P}^\mathrm{k} \mathrm{P}_\mathrm{k} \\
&\frac{8\pi}{\sigma}\frac{1}{4}\left(\begin{array}{l} +2((\frac{(\mathrm{P}^\lambda \mathrm{P}_\lambda),_\mathrm{m} P^m}{Z^3} P^k);_k - 2(\frac{Z^m}{Z^2});_m) P_\mu P_\nu + \\ +2\frac{(P^\lambda Z_\lambda)^2}{Z^3}\frac{P_\mu P_\nu}{Z} - 2\frac{Z^\lambda Z_\lambda}{Z^2}\frac{P_\mu P_\nu}{Z} + \\ +U_\mu U_\nu - \frac{1}{2} U_\mathrm{k} U^k g_{\mu\nu} \end{array}\right) = \\
&\frac{8\pi}{\sigma}\frac{1}{4}(U_\mu U_\nu - \frac{1}{2} U_\mathrm{k} U^k g_{\mu\nu} - 2U^k;_k \frac{P_\mu P_\nu}{Z}) = R_{\mu\nu} - \frac{1}{2} R g_{\mu\nu} \\
&\text{s.t. } R = R_{\mu\upsilon} g^{\mu\upsilon} \\
&\text{s.t. } R_{kj} = (\Gamma_{jk}{}^P),_p - (\Gamma_{pk}{}^P),_j + \Gamma_{p\mu}{}^P \Gamma_{jk}{}^\mu - \Gamma_{pj}{}^\mu \Gamma_{k\mu}{}^p
\end{aligned} \tag{53}
$$

$R_{\mu\nu}$ is the Ricci tensor and $R_{\mu\nu} - \frac{1}{2} R g_{\mu\nu}$ is the Einstein tensor [23]. In general, by (4) and $\sigma = 8\pi$, (53) can be written in $(-1,+1,+1,+1)$ metric convention, so $Z = |P_\mu P^\mu|$ as,

$$
\frac{1}{4}(U_\mu U_\nu - \frac{1}{2} U_\mathrm{k} U^k g_{\mu\nu} - 2U^k;_k \frac{P_\mu P_\nu}{Z}) = R_{\mu\nu} - \frac{1}{2} R g_{\mu\nu} \tag{54}
$$

Charge-less field: The term $-2U^k;_k \frac{P_\mu P_\nu}{Z}$ in (54) can be generalized to:

$-2((U^k;_k + U^{*k};_k)/2)\frac{(P_\mu P^*_\nu + P^*_\mu P_\nu)/2}{Z}$ and can be zero under the following condition:

$$
4(A_{\mu\nu};^\mu \frac{P^{*\nu}}{\sqrt{Z}} + A^*_{\mu\nu};^\mu \frac{P^\nu}{\sqrt{Z}}) = U_\mu U^{*\mu} + U^*_\mu U^\mu \Rightarrow U^k;_k + U^{*k};_k = 0
$$

Note: The complimentary matrix $B_{\mu\nu} = \frac{1}{\sqrt{2}} E^{\mu\nu\alpha\beta} A_{\alpha\beta}$, see few lines before (3), can be transformed to a real matrix due to the SU(2) x U(1) degrees of freedom and also be imaginary.

From (51), (52) we have, $\frac{d}{dx^\mu}(\frac{\partial}{\partial P_\mu} - \frac{d}{dx^\nu}\frac{\partial}{\partial P_\mu,_\nu})(U_k U^k \sqrt{-g}) = W^\mu;_\mu \sqrt{-g} = 0$

We recall, $W^\mu = (\frac{\partial}{\partial P_\mu} - \frac{d}{dx^\nu}\frac{\partial}{\partial P_\mu,_\nu})(U_k U^k \sqrt{-g})$

$$W^{\mu} =$$

$$(-4(\frac{Z^{\nu}}{Z^2});_{\nu} -4\frac{Z_{\mathrm{m}}Z^{m}}{Z^3})\mathrm{P}^{\mu} + 4(\frac{(Z_s P^s)P^{\nu}}{Z^3});_{\nu} P^{\mu} - 2\frac{Z_{\mathrm{m}}P^{m}Z^{\mu}}{Z^3} + 6\frac{(Z_m P^m)^2}{Z^4}P^{\mu} =$$

$$-4(\frac{Z^{\nu}}{Z^2});_{\nu} \mathrm{P}^{\mu} - 4\frac{Z_{\mathrm{m}}Z^{m}}{Z^3}\mathrm{P}^{\mu} +$$

$$+4(\frac{(Z_s P^s)P^{\nu}}{Z^3});_{\nu} P^{\mu} + 4\frac{(Z_m P^m)^2}{Z^4}P^{\mu}$$

$$-2\frac{Z_{\mathrm{m}}P^{m}}{Z^2}(\frac{Z^{\mu}}{Z} - \frac{Z_m P^m P^{\mu}}{Z^2}) =$$

$$-4((\frac{U^k}{Z});_k + \frac{U^k U_k}{Z})P^{\mu} - 2\frac{Z_{\mathrm{m}}P^{m}}{Z^2}U^{\mu} = 0$$

$$W^{\mu};_{\mu} = \left(-4U^{\nu};_{\nu}\frac{P^{\mu}}{Z} - 2\frac{(Z_m P^m)}{Z^2}U^{\mu}\right);_{\mu} = 0 \tag{55}$$

Appendix B: Proof of conservation

Theorem: Conservation law of the real Reeb vector.

From the vanishing of the divergence of Einstein tensor and (54), we have to prove the following in $(-1,+1,+1,+1)$ metric convention :

$$\frac{1}{4}\left(U_{\mu}U_{\nu} - \frac{1}{2}U_{\mathrm{k}}U^{k}g_{\mu\nu} - 2U^{k};_{k}\frac{P_{\mu}P_{\nu}}{Z}\right);^{\mu} = G_{\mu\nu};^{\mu} = (R_{\mu\nu} - \frac{1}{2}Rg_{\mu\nu});^{\mu} = 0 \tag{56}$$

Proof:

From the zero variation by the scalar time field (55)

$$W^{\mu};_{\mu} = \left(-4U^{\nu};_{\nu}\frac{P^{\mu}}{Z} - 2\frac{(Z_m P^m)}{Z^2}U^{\mu}\right);_{\mu} = 0 \tag{57}$$

$$-\left(2U^{\nu};_{\nu}\frac{P^{\mu}}{Z}\right);_{\mu} = \left(\frac{(Z_m P^m)}{Z^2}U^{\mu}\right);_{\mu} \tag{58}$$

$$\left(-2U^{k};_{k}\frac{P^{\mu}P^{\nu}}{Z}\right);_{\mu} = \left(\frac{(Z_m P^m)}{Z^2}U^{\mu}\right);_{\mu} P^{\nu} - \left(2U^{k};_{k}\frac{P^{\mu}}{Z}\right)P^{\nu};_{\mu} =$$

$$\left(\frac{(Z_m P^m)}{Z^2}U^{\mu}\right);_{\mu} P^{\nu} - U^{k};_{k}\frac{Z^{\nu}}{Z} \tag{59}$$

Now let $t \equiv Z_m P^m$

And we have $\left(\frac{t}{Z^2}U^{\mu}\right);_{\mu} P^{\nu} - U^{k};_{k}\frac{Z^{\nu}}{Z} = (\frac{t}{Z^2});_{\mu} U^{\mu}P^{\nu} + \frac{t}{Z^2}U^{\mu};_{\mu} P^{\nu} - U^{k};_{k}\frac{Z^{\nu}}{Z} =$

$$-U^{\mu};_{\mu} U^{\nu} + (\frac{t}{Z^2});_{\mu} U^{\mu}P^{\nu}$$

This is because $-\mathrm{U}^{\nu} = -\frac{\mathrm{Z}^{\nu}}{\mathrm{Z}} + \frac{\mathrm{t}}{\mathrm{Z}^2}\mathrm{P}^{\nu} \Longrightarrow -\mathrm{U}^{\mu};_{\mu}\frac{\mathrm{Z}^{\nu}}{\mathrm{Z}} + \frac{\mathrm{t}}{\mathrm{Z}^2}\mathrm{U}^{\mu};_{\mu}\mathrm{P}^{\nu} = -\mathrm{U}^{\mu};_{\mu}\mathrm{U}^{\nu}$. Note that $-\mathrm{U}^{\nu}$ is minus twice the real numbered Reeb vector. So,

$$(-2U^{k};_{k}\frac{P^{\mu}P^{\nu}}{Z});_{\mu} = -U^{\mu};_{\mu}U^{\nu} + (\frac{t}{Z^{2}});_{\mu}U^{\mu}P^{\nu} \tag{60}$$

Returning to the theorem we have to prove and using equation (60), we have to show,

$$\begin{aligned}
&\left(U^{\mu}U^{\nu} - \frac{1}{2}U_{\mathrm{k}}U^{k}g^{\mu\nu} - 2U^{k};_{k}\frac{P^{\mu}P^{\nu}}{Z}\right);^{\mu} = \\
&U^{\mu};_{\mu}U^{\nu} + U^{\mu}U^{\nu};_{\mu} - \frac{1}{2}(U_{\mathrm{k}};_{\mu}U_{s} + U_{\mathrm{k}}U_{s};_{\mu})g^{ks}g^{\mu\nu} - \\
&U^{\mu};_{\mu}U^{\nu} + (\frac{t}{Z^{2}});_{\mu}U^{\mu}P^{\nu} = \\
&U^{\mu}U^{\nu};_{\mu} - \frac{1}{2}(U^{s}U_{s});^{\nu} + (\frac{t}{Z^{2}});_{\mu}U^{\mu}P^{\nu} = 0
\end{aligned} \tag{61}$$

Notice that

$$\begin{aligned}
&U^{\mu}U^{\nu};_{\mu} - \frac{1}{2}U^{s}U_{s};^{\nu} = \\
&U^{\mu}\left((\frac{Z_{k}}{Z});_{\mu} - (\frac{t}{Z^{2}});_{\mu}P_{k} - (\frac{t}{Z^{2}})P_{k};_{\mu}\right)g^{k\nu} - \\
&U^{s}\left((\frac{Z_{s}}{Z});_{k} - (\frac{t}{Z^{2}});_{k}P_{s} - (\frac{t}{Z^{2}})P_{s};_{k}\right)g^{k\nu} = \\
&-U^{\mu}(\frac{t}{Z^{2}});_{\mu}P^{\nu}
\end{aligned} \tag{62}$$

Since $-(\frac{t}{Z^{2}});_{k}P_{s}U^{s} = 0$ because the Reeb vector is perpendicular to the foliation kernel $\frac{\mathrm{P}_{\lambda}}{\sqrt{\mathrm{Z}}}$, $\frac{\mathrm{P}^{\mathrm{k}}}{\sqrt{\mathrm{Z}}}\frac{\mathrm{U}_{\mathrm{k}}}{2} = 0$.

Equation (62) is also a result of $\ln(\mathrm{Z})_{,\mathrm{k}};_{\mu}\mathrm{U}^{\mu}\mathrm{g}^{\mathrm{k}\nu} = \ln(\mathrm{Z})_{,\mathrm{s}};_{\mathrm{k}}\mathrm{U}^{\mathrm{s}}\mathrm{g}^{\mathrm{k}\nu}$ and of $\mathrm{P}_{\mathrm{k}};_{\mu}\mathrm{U}^{\mu}\mathrm{g}^{\mathrm{k}\nu} = \mathrm{P}_{\mathrm{s}};_{\mathrm{k}}\mathrm{U}^{\mathrm{s}}\mathrm{g}^{\mathrm{k}\nu}$.

$$U^{\mu}U^{\nu};_{\mu} - \frac{1}{2}(U^{s}U_{s});^{\nu} + (\frac{t}{Z^{2}});_{\mu}U^{\mu}P^{\nu} = -U^{\mu}(\frac{t}{Z^{2}});_{\mu}P^{\nu} + (\frac{t}{Z^{2}});_{\mu}U^{\mu}P^{\nu} = 0 \tag{63}$$

and we are done.

Appendix C: Generalization to more than one Reeb vector

Given the previous fields $\frac{\mathrm{P}_{\mathrm{k}}}{\sqrt{\mathrm{Z}}}$ and $\frac{U_{\mu}}{2}$ and additional Reeb vector fields $\frac{U(2)_{\mu}}{2}$, $\frac{S_{\mu}}{2}$, $\frac{W_{\mu}}{2}$, $\frac{T_{\mu}}{2}$,

The following Lagrangian can be defined with the determinant of the metric g:

$$L = \begin{vmatrix} 1 & 0 \\ 0 & \frac{U^k U_k^* + U^{*k} U_k}{8} \end{vmatrix} \sqrt{-\mathrm{g}} +$$

$$\begin{vmatrix} 1 & 0 & \frac{\mathrm{P_k} U(2)^{*k} + \mathrm{P^*}_{\mathrm{k}} U(2)^{*k}}{2\sqrt{2\mathrm{Z}}} \\ 0 & \frac{U^k U_k^* + U^{*k} U_k}{8} & \frac{U(2)^k U_k^* + U(2)^{*k} U_k}{8} \\ \frac{\mathrm{P_k} U(2)^{*k} + \mathrm{P^*}_{\mathrm{k}} U(2)^{*k}}{2\sqrt{2\mathrm{Z}}} & \frac{U(2)^k U_k^* + U(2)^{*k} U_k}{8} & \frac{U(2)^k U(2)_k^* + U(2)^{*k} U(2)_k}{8} \end{vmatrix}^{\frac{1}{2}} \sqrt{-\mathrm{g}} +$$

$$\begin{vmatrix} 1 & \frac{p_\mu S^{*\mu} + p_\mu^* S^\mu}{2\sqrt{2\mathrm{Z}}} & \frac{p_\mu W^{*\mu} + p_\mu^* W^\mu}{2\sqrt{2\mathrm{Z}}} & \frac{p_\mu T^{*\mu} + p_\mu^* T^\mu}{2\sqrt{2\mathrm{Z}}} \\ \frac{p_\mu S^{*\mu} + p_\mu^* S^\mu}{2\sqrt{2\mathrm{Z}}} & \frac{S_\mu S^{*\mu} + S_\mu^* S^\mu}{8} & \frac{S_\mu W^{*\mu} + S_\mu^* W^\mu}{8} & \frac{S_\mu T^{*\mu} + S_\mu^* T^\mu}{8} \\ \frac{p_\mu W^{*\mu} + p_\mu^* W^\mu}{2\sqrt{2\mathrm{Z}}} & \frac{W_\mu S^{*\mu} + W_\mu^* S^\mu}{8} & \frac{W_\mu W^{*\mu} + W_\mu^* W^\mu}{8} & \frac{W_\mu T^{*\mu} + W_\mu^* T^\mu}{8} \\ \frac{p_\mu T^{*\mu} + p_\mu^* T^\mu}{2\sqrt{2\mathrm{Z}}} & \frac{T_\mu S^{*\mu} + T_\mu^* S^\mu}{8} & \frac{T_\mu W^{*\mu} + T_\mu^* W^\mu}{8} & \frac{T_\mu T^{*\mu} + T_\mu^* T^\mu}{8} \end{vmatrix}^{\frac{1}{3}} \sqrt{-\mathrm{g}} \tag{64}$$

Possibly a fifth force of Nature is described by the following SU(4) symmetry Lagrangian of 4 Reeb vectors: $\frac{\aleph_\mu}{2}, \frac{\beth_\mu}{2}, \frac{\gimel_\mu}{2}, \frac{\daleth_\mu}{2}$, with Hebrew letters Alef, Beit, Gimmel, Dalet,

$$\begin{vmatrix} \frac{\aleph_\mu \aleph^{*\mu} + \aleph_\mu^* \aleph^\mu}{8} & \frac{\aleph_\mu \beth^{*\mu} + \aleph_\mu^* \beth^\mu}{8} & \frac{\aleph_\mu \gimel^{*\mu} + \aleph_\mu^* \gimel^\mu}{8} & \frac{\aleph_\mu \daleth^{*\mu} + \aleph_\mu^* \daleth^\mu}{8} \\ \frac{\aleph_\mu \beth^{*\mu} + \aleph_\mu^* \beth^\mu}{8} & \frac{\beth_\mu \beth^{*\mu} + \beth_\mu^* \beth^\mu}{8} & \frac{\beth_\mu \gimel^{*\mu} + \beth_\mu^* \gimel^\mu}{8} & \frac{\beth_\mu \daleth^{*\mu} + \beth_\mu^* \daleth^\mu}{8} \\ \frac{\aleph_\mu \gimel^{*\mu} + \aleph_\mu^* \gimel^\mu}{8} & \frac{\gimel_\mu \beth^{*\mu} + \gimel_\mu^* \beth^\mu}{8} & \frac{\gimel_\mu \gimel^{*\mu} + \gimel_\mu^* \gimel^\mu}{8} & \frac{\gimel_\mu \daleth^{*\mu} + \gimel_\mu^* \daleth^\mu}{8} \\ \frac{\aleph_\mu \daleth^{*\mu} + \aleph_\mu^* \daleth^\mu}{8} & \frac{\daleth_\mu \beth^{*\mu} + \daleth_\mu^* \beth^\mu}{8} & \frac{\daleth_\mu \gimel^{*\mu} + \daleth_\mu^* \gimel^\mu}{8} & \frac{\daleth_\mu \daleth^{*\mu} + \daleth_\mu^* \daleth^\mu}{8} \end{vmatrix}^{\frac{1}{4}} \sqrt{-\mathrm{g}} \tag{65}$$

The determinant of two Reeb vectors can help to understand the roots in (30), (31), (32), and (33). It describes accelerations in two perpendicular planes. Three Reeb vectors describe accelerations in the foliation perpendicular to P_μ.

Appendix D: Another way to derive the Reeb vector

We may now write the Lie derivative [24] of $\frac{P_i}{\sqrt{Z}}$ with respect to the vector field $\frac{P^{*m}}{\sqrt{Z}}$,

$$Lie\left(\frac{P^{*m}}{\sqrt{Z}}, \frac{P_i}{\sqrt{Z}}\right) = \frac{P^{*m}}{\sqrt{Z}} \left(\frac{P_i}{\sqrt{Z}}\right)_{,m} + \left(\frac{P^{*m}}{\sqrt{Z}}\right)_{,i} \frac{P_m}{\sqrt{Z}} \tag{66}$$

In which the second term is positive because the differentiated $\frac{P_i}{\sqrt{Z}}$ vector has a low index.

The first term becomes,

$$\frac{P^{*m}}{\sqrt{Z}}\left(\frac{P_i}{\sqrt{Z}}\right)_{,m} = \frac{P^{*m}P_{i,m}}{Z} - \frac{P^{*m}}{\sqrt{Z}}\frac{P_i Z_m}{2Z^{3/2}} = \frac{P^{*m}P_{i,m}}{Z} - \frac{P^{*m}Z_m P_i}{2Z^2} \tag{67}$$

The second term is,

$$\left(\frac{P^{*m}}{\sqrt{Z}}\right)_{,i}\frac{P_m}{\sqrt{Z}} = \frac{P^{*m}{}_{,i}P_m}{Z} - \frac{P^{*m}P_m Z_i}{2Z^2} = \frac{P^{*m}{}_{,i}P_m}{Z} - \frac{Z_i}{2Z} \tag{68}$$

We add (67) and (68) to get (66) and notice that $\frac{P^{*m}P_{i,m}}{Z} + \frac{P^{*m}{}_{,i}P_m}{Z} = \frac{P^{*m}P_{m,i}}{Z} + \frac{P^{*m}{}_{,i}P_m}{Z} = \frac{Z_i}{Z}$ from which (66) becomes

$$Lie\left(\frac{P^{*m}}{\sqrt{Z}}, \frac{P_i}{\sqrt{Z}}\right) = \frac{Z_i}{Z} - \frac{Z_i}{2Z} - \frac{P^{*m}Z_m P_i}{2Z^2} = \frac{Z_i}{2Z} - \frac{P^{*m}Z_m P_i}{2Z^2} = \frac{U_i}{2} \tag{69}$$

Appendix E: 95/96, the precursor of the inverse Fine Structure Constant and of the muon/electron mass ratio

Results (24), (36), (40), (41), (42), were not reached immediately. There was one finding that was a total serendipity that later lead to these results. The observation was the following, given a scaling factor 1+d of area addition with d=1 as a maximal value, 1+d = 2.

$$(1+\alpha)^{95} < 2 \ \wedge (1+\alpha)^{96} > 2 \tag{70}$$

More precisely

$$\aleph = (2^{\frac{1}{96}} - 1)^{-1} \cong 137.999325615 \tag{71}$$

And

$$\beth = (2^{\frac{1}{95}} - 1)^{-1} \cong 136.5566369 \tag{72}$$

And the geometric average is:

$$\sqrt{\aleph\beth} \cong 137.27608605 \tag{73}$$

Which is close to the result from (40), 137.0359990368270076.

An immediate observation is

$$\aleph = \left(\frac{2-2^{\frac{95}{96}}}{2^{\frac{95}{96}}}\right)^{-1} \tag{74}$$

And

$$\beth = \left(\frac{2^{\frac{96}{95}}-2}{2}\right)^{-1} \tag{75}$$

Where we expressed a power which is close to 1, namely $\xi = \frac{95}{96}$ and $\xi^{-1} = \frac{96}{95}$. as such, ξ was nominated as polynomial coefficient because it is was in the range between 0 and 2, unlike $\xi = \frac{4}{\pi}$ which has a geometric interpretation thanks to Ettore Majorana, $\xi = \frac{95}{96}$ seems to have an algebraic meaning.

We continue with a rather surprising relation

$$\left(2^{\frac{1}{95*96}} - 1\right)^{-1} \cong 13{,}156.87877924 \tag{76}$$

And it is quite easy to notice the following:

$$\frac{1}{96(1+96^{-2})}\left(2^{\frac{1}{95*96}} - 1\right)^{-1} \cong 137.03595126474 \tag{77}$$

which is very close to the inverse Fine Structure Constant. Actually if we replace the factor $\frac{1}{96(1+96^{-2})}$ by $\frac{1}{n(1+n^{-2})}$ for some integer n, the closes result to the inverse Fine Structure Constant is when n=96

In fact

$$\frac{\left(2^{\frac{1}{95*96}}-1\right)^{-1}}{137.0359990368270076} \cong 96.010383196499723 \cong 96(1 + 96.1546032^{-2}) \tag{78}$$

See (40). The factor $\frac{1}{95*96}$ can be seen as

$$\frac{1}{95*96} = \frac{95}{96} + \frac{96}{95} - 2 \tag{79}$$

The factor $95 * 96$ is later found expression in (41), (42) is the final missing piece in the puzzle was the bridge between trigonometry and electro-gravitational polynomials (35) which resulted in: $\xi \cong 1.55619853719034839656387703143991529941558837890\,6$ and $\frac{1}{2}(1 - g_2)^{-4} \cong 607276.53680068242829293012\,62$, provided here with more accuracy if required for further research.

In (78) plugging in $\frac{4}{\pi}$ from (24) instead of 2 and dividing by $2 * 137.0359990368270076^2$ instead of by 137.0359990368270076 we get another indication of a deep theoretical relation,

$$\frac{\left(\left(\frac{4}{\pi}\right)^{\frac{1}{95*96}}-1\right)^{-1}}{2*137.0359990368270076^2} \cong 1 + (2 * 95.974269533437)^{-1} \tag{80}$$

Appendix F: The Python code for (40) and for the remark after (40) and its output

```
import numpy as NP


def function_cubic_viete(a, b, c, d): # If all roots are real.


    # Viete's formula when all roots are real.


    b2 = NP.longdouble(b * b)

    b3 = NP.longdouble(b2 * b)

    a2 = NP.longdouble(a * a)

    a3 = a2 * a


    p = (3 * a * c - b2) / (3 * a2)


    q = (2 * b3 - 9 * a * b * c + 27 * a2 * d) / (27 * a3)


    offset = b / (3 * a)


    t1 = 2 * NP.sqrt(-p / 3) * NP.cos(NP.arccos(NP.sqrt(-3 / p) \
                                          * (3 * q) / (2 * p)) / 3)
    t2 = 2 * NP.sqrt(-p / 3) * NP.cos(NP.arccos(NP.sqrt(-3 / p) * \
                                          (3 * q) / (2 * p)) / 3 -
                                 NP.pi / 3)
    t3 = 2 * NP.sqrt(-p / 3) * NP.cos(NP.arccos(NP.sqrt(-3 / p) * \
                                          (3 * q) / (2 * p)) / 3 -
                                 2 * NP.pi / 3)
    x1 = t1 - offset

    x2 = t2 - offset
```

```
    x3 = t3 - offset

    return (x1, x2, x3)

def function_fsc_polynomials(): # If all roots are real.

    fp_f, fp_a, fp_b = 1, 1, 1
    fp_start,  fp_end = 1.556, NP.pi / 2

    for i in range(2000):
        # Get the biggest roots. These are the closest to 1.
        # One is above 1 and one is below 1.

        fp_f = (fp_start + fp_end) * 0.5

        fp_a, _, _ = function_cubic_viete(1, -1, -fp_f / 96,
                                          (fp_f * fp_f) / 192)

        fp_b, _, _ = function_cubic_viete(1, -1, fp_f / 96,
                                          (fp_f * fp_f) / 192)

        fp_result_middle = 1/NP.sqrt(fp_a-1) - 0.5/(1-fp_b)

        if fp_result_middle >= 0:
            fp_end = fp_f
        else:
            fp_start = fp_f
```

```
fp_s = 1/(1 - fp_b)
fp_s *= fp_s
fp_s *= fp_s * 0.5
fp_xi = fp_f

print('1/(x1-1): %.42lf\n1/(1-x2): %.42lf' %(1/(fp_a-1), 1/(1-fp_b)))
print('Xi: %.42lf\ns=0.5/(1-x2)^4: %.42lf' %(fp_f, fp_s))

fp_f = 4 / NP.pi
# Get the biggest roots. These are the closest to 1.
# One is above 1 and one is below 1.
fp_a, _, _ = function_cubic_viete(1, -1, -fp_f / 96, (fp_f * fp_f) / 192)
fp_b, _, _ = function_cubic_viete(1, -1, fp_f / 96, (fp_f * fp_f) / 192)
fp_mul = (fp_a - 1) * (1 - fp_b)

fp_inv_fsc = 2 / NP.cos( fp_xi * (1 + 1/NP.power(fp_s,1/(1+fp_mul))))

print('Inv FSC: %.42lf' %(fp_inv_fsc))

fp_p2 = fp_mul
fp_start,  fp_end = fp_mul, fp_mul + 0.00001

for i in range(2000):
    # Get the biggest roots. These are the closest to 1.
    # One is above 1 and one is below 1.

    fp_f = (fp_start + fp_end) * 0.5
```

```
        fp_result_middle = \
            fp_s * (2 - 1/(96*96*fp_f)) - NP.power(fp_s, 1/(1+fp_f))

        if fp_result_middle >= 0:
            fp_end = fp_f
        else:
            fp_start = fp_f

    fp_p = 1/NP.sqrt(fp_mul)
    fp_miracle_p = 1/NP.sqrt(fp_f)
    fp_relative_p_error = fp_p / (fp_p - fp_miracle_p)

    print('P: %.42lf\nMiracle P: %.48lf\nRelative error in P: %.48lf^-1'
          % (fp_p, fp_miracle_p, fp_relative_p_error))

function_fsc_polynomials()

'''
Output when run from PyCharm and Python 3.6:
1/(x1-1): 275.516908918643935066938865929841995239257812
1/(1-x2): 33.197404050235356010034593055024743080139160
Xi: 1.556198537190348396563877031439915299415588
s=0.5/(1-x2)^4: 607276.536800682428292930126190185546875000000000
Inv FSC: 137.035999036827007557803881354629993438720703
P: 96.069177214886295246287772897630929946899414
Miracle P: 96.069175812725177365791751071810722351074218750000
Relative error in P:
68515077.183215767145156860351562500000000000000000000000^-1
'''
```

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