Electro-Gravity Via Geometric Chronon Field

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Abstract. In De Sitter / Anti De Sitter space-time and in other geometries, reference sub-manifolds from which proper time is measured along integral curves, are described as events. We introduce here a foliation with the help of a scalar field. The scalar field need not be unique but from the gradient of the scalar field, an intrinsic Reeb vector of the foliations perpendicular to the gradient vector is calculated. The Reeb vector describes the acceleration of a physical particle that moves along the integral curves that are formed by the gradient of the scalar field. The Reeb vector appears as a component of an anti-symmetric matrix which is a part of a rank-2, 2-Form. The 2-form is extended into a non-degenerate 4-form and into rank-4 matrix of a 2-form, which when multiplied by a velocity of a particle, becomes the acceleration of the particle. The matrix has one U(1) degree of freedom and an additional SU(2) degrees of freedom in two vectors that span the plane perpendicular to the gradient of the scalar field and to the Reeb vector. In total, there are U(1) x SU(2) degrees of freedom. SU(3) degrees of freedom arise from three dimensional foliations but require an additional symmetry to exist in order to have a valid covariant meaning.

Matter in the Einstein Grossmann equation is replaced by the action of the acceleration field, i.e. by a geometric action which is not anticipated by the metric alone. This idea leads to a new formalism that replaces the conventional stress-energy-momentum-tensor. The formalism will be mainly developed for classical physics but will also be discussed for quantized physics based on events instead of particles. The result is that a positive charge manifests small attracting gravity and a stronger but small repelling acceleration field that repels even uncharged particles that have a rest mass. Negative charge manifests a repelling anti-gravity but also a stronger acceleration field that attracts even uncharged particles that have rest mass.

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1. Introduction

The motivation of this theory is to show that matter can be put into correspondence with an acceleration field. There are two ways that measurement of proper time by a physical clock between events will be shortened: either by gravity in which the clock moves along geodesic curves but in curved space-time or by other interactions that prevent the clock from moving along a geodesic curve. These two approaches have to appear in the equation of gravity in order to describe Nature by a fully geometric model. The latter is not anticipated by the metric tensor alone and therefore it requires a new approach.

In this work, we will study the gradient of a real scalar field P which is $P_i \equiv \frac{dP}{dx^i}$. If a physical particle moves along the integral curves that are formed by P_i then its velocity is $\frac{V^i}{c} = \frac{P^i}{\sqrt{P^s P_s}} \Rightarrow V^i V_i = c^2$ where c is the speed of light. For convenience, throughout the paper we will use the notation $Z \equiv N^2 \equiv \|P_s\|^2 = P^s P_s$. The next step is to calculate the acceleration of such a particle, based on P_i. Taking the exterior derivative of $\frac{P_i}{\sqrt{Z}} dx^i$ as a 1-form, we will derive a 2-Form, while we continue with differential geometry conventions, comma as derivative and semi-colon as covariant derivative, $Z,_i \equiv Z_i \equiv \frac{dZ}{dx^i}$ and for a vector field V_k, $V_k,_i \equiv \frac{dV_k}{dx^i}$ where x^i are the contravariant coordinates. Also, the covariant derivatives are defined as in differential geometry, $V_k;_i \equiv V_k,_i - \Gamma^s{}_{ki} V_s$ and $V^k;_i \equiv V^k,_i + \Gamma^k{}_{si} V^s$ where $\Gamma^k{}_{si}$ are the affine connection, also known as second-type Christoffel symbols. We derive,

$$d \frac{P_i}{\sqrt{Z}} dx^i = (\frac{P_i}{\sqrt{Z}}),_j dx^i \wedge dx^j = ((\frac{P_i}{\sqrt{Z}}),_j - (\frac{P_j}{\sqrt{Z}},_i))dx^i \wedge dx^j \Rightarrow$$
$$(\frac{P_i}{\sqrt{Z}}),_j - (\frac{P_j}{\sqrt{Z}},_i) = (\frac{P_i,_j}{\sqrt{Z}} - \frac{P_i Z_j}{2Z^{3/2}}) - (\frac{P_j,_i}{\sqrt{Z}} - \frac{P_j Z_i}{2Z^{3/2}}) = \frac{P_j Z_i}{2Z^{3/2}} - \frac{P_i Z_j}{2Z^{3/2}} \tag{1}$$

From which

$$d(\frac{P_i}{\sqrt{Z}})dx^i = (\frac{P_j z_i}{2Z^{3/2}} - \frac{P_i z_j}{2Z^{3/2}})dx^i \wedge dx^j = A_{ij} dx^i \wedge dx^j = -A_{ji} dx^i \wedge dx^j$$

We now contract this anti-symmetric matrix with our original vector,

$$\frac{U_i}{2} \equiv A_{ij} \frac{P^j}{\sqrt{Z}} = \frac{P_j Z_i}{2Z^{3/2}} \frac{P^j}{\sqrt{Z}} - \frac{P_i Z_j}{2Z^{3/2}} \frac{P^j}{\sqrt{Z}} = \frac{Z_i}{2Z} - \frac{Z_j P^j}{2Z^2} P_i \tag{2}$$

It is immediately evident that the vector $\frac{U_i}{2}$ is perpendicular to $\frac{P_i}{\sqrt{Z}}$ both from

$$\frac{Z_i}{2Z}\frac{P^i}{\sqrt{Z}} - \frac{Z_j P^j}{2Z^2} P_i \frac{P^i}{\sqrt{Z}} = \frac{Z_i P^i}{2Z^{3/2}} - \frac{Z_j P^j}{2Z^{3/2}} = 0$$

and from a contraction of an anti-symmetric matrix A_{ij} by $\frac{P^i}{\sqrt{Z}}\frac{P^j}{\sqrt{Z}} = 0$.

Physical meaning: A_{ij} transforms the vector $\frac{P_i}{\sqrt{Z}}$ to $\frac{U_i}{2}$ as a rotation and scaling transformation and is therefore, of rank 2. It can be extended to a non-degenerate matrix of rank 4, $\tilde{A}_{ij}$ which defines a field of acceleration, i.e. $\tilde{A}_{ij}\frac{V^j}{c} = \frac{a_i}{c^2} = g_{ij}\frac{1}{c^2}\frac{dV^j}{d\tau}$ where a_i is the covariant acceleration of the mass that interacts with the field, c is the speed of light, τ is proper time and g_{ij} is the metric tensor. The acceleration matrix $\tilde{A}_{ij}$ will be discussed later and will appear as the sum of two matrices $A_{ij} + B_{ij}$. If the A_{ij} and B_{ij} are real then $Det(A_{ij} + B_{ij}) = \pm Det(A_{ij} + \tilde{B}_{ij})$ for other choices of $\tilde{B}_{ij} \neq B_{ij}$.

$$A_{ij} = \frac{U_i}{2}\frac{P_j}{\sqrt{Z}} - \frac{U_j}{2}\frac{P_i}{\sqrt{Z}} = (\frac{Z_i}{2Z}\frac{P_j}{\sqrt{Z}} - \frac{Z_k P^k P_i}{2Z^2}\frac{P_j}{\sqrt{Z}}) - (\frac{Z_j}{2Z}\frac{P_i}{\sqrt{Z}} - \frac{Z_k P^k P_j}{2Z^2}\frac{P_i}{\sqrt{Z}}) = \frac{Z_i}{2Z}\frac{P_j}{\sqrt{Z}} - \frac{Z_j}{2Z}\frac{P_i}{\sqrt{Z}} \quad (3)$$

We identify this representation with foliation theory,(Reeb, 1948, 1952 [1] and Godbillon-Vey, 1971, [2],[3]). We can write $\omega \equiv \frac{P_i}{\sqrt{Z}}$ and $\eta \equiv \frac{U_i}{2}$ and we reach the Reeb representation $d\omega = \eta \wedge \omega$ where $\eta \equiv \frac{U_i}{2}$ is known as the Reeb vector [1] of the foliation that is perpendicular to the 1-Form ω. The representation of the vector η leads to a far simpler term than the one represented by the Reinhart-Wood formula [2]. For this cohomology class, the following holds,

$$\omega \wedge d\omega = \frac{P_k}{\sqrt{Z}}(\frac{P_j z_i}{2Z^{3/2}} - \frac{P_i z_j}{2Z^{3/2}})dx^k \wedge dx^i \wedge dx^j = (\frac{P_j P_k z_i}{2Z^2} - \frac{P_i P_k z_j}{2Z^2})dx^k \wedge dx^i \wedge dx^j = 0$$

The Godbillon-Vey 3-Form, of the foliation F that is perpendicular to the 1-Form ω is defined as $GV(F) = \eta \wedge d\eta$. Its De Rham Cohomology class is $[\eta \wedge d\eta] \in H^3(M,R)$ where here R denotes the real numbers. This cohomology class is an invariant of the foliation F and is a closed 3-Form. An interesting property of the Reeb vector is that its restriction to the foliation F integrates to 0 on each closed curve on F.

A generalization of (2) to the complex numbers is easily defined

$$\frac{U_i}{2} \equiv A_{ij}\frac{P^{*j}}{\sqrt{Z}} = \frac{Z_i}{2Z} - \frac{Z_j P^{*j}}{2Z^2} P_i \quad (4)$$

And $Z=(P_i P*^i + P*_i\, P^i)/2$ and because the metric tensor is symmetric and real, we can write $Z=P_i P*^i$. An interesting way to reach the Reeb vector $\frac{U_i}{2}$ is by the Lie derivative [4]

$$Lie(\frac{P*^m}{\sqrt{Z}},\frac{P_i}{\sqrt{Z}})=\frac{P*^m}{\sqrt{Z}}(\frac{P_i}{\sqrt{Z}}),_m+(\frac{P*^m}{\sqrt{Z}}),_i\frac{P_m}{\sqrt{Z}} \tag{5}$$

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

The first term becomes,

$$\frac{P*^m}{\sqrt{Z}}(\frac{P_i}{\sqrt{Z}}),_m=\frac{P*^m\,P_i,_m}{Z}-\frac{P*^m}{\sqrt{Z}}\frac{P_i Z_m}{2Z^{3/2}}=\frac{P*^m\,P_i,_m}{Z}-\frac{Z_m P*^m\,P_i}{2Z^2} \tag{6}$$

The second term is,

$$(\frac{P*^m}{\sqrt{Z}}),_i\frac{P_m}{\sqrt{Z}}=\frac{P*^m,_i\,P_m}{Z}-\frac{P*^m\,P_m Z_i}{2Z^2}=\frac{P*^m,_i\,P_m}{Z}-\frac{Z_i}{2Z} \tag{7}$$

We add (6) and (7) to get (5) and notice that $\frac{P*^m\,P_i,_m}{Z}+\frac{P*^m,_i\,P_m}{Z}=\frac{P*^m\,P_m,_i}{Z}+\frac{P*^m,_i\,P_m}{Z}$ from which (5) becomes

$$Lie(\frac{P*^m}{\sqrt{Z}},\frac{P_i}{\sqrt{Z}})=\frac{Z_i}{Z}-\frac{Z_i}{2Z}-\frac{Z_m P*^m\,P_i}{2Z^2}=\frac{Z_i}{2Z}-\frac{Z_m P*^m\,P_i}{2Z^2}=\frac{U_i}{2} \tag{8}$$

It is again the Reeb vector. It is important to say that the foliation F is covariant because its tangent vectors $T(F)$ consist of vectors which are perpendicular to $\omega\equiv\frac{P_i}{\sqrt{Z}}$ and orthogonality of vectors is invariant under local change of coordinates. The question that we should ask now, is how is the Reeb vector $\frac{U_i}{2}$ related to the curvature of the integral curves which are generated by ω? First of all, we have to notice that $Z=P_i P*^i$ is not constant and therefore $Z_k\equiv\frac{dZ}{dx^k}\neq 0$ unlike the case of a velocity of a particle $V_i V^i=c^2$. The squared curvature of the integral curves that are generated by P_i is expressible, according to differential geometry, by the measurement of how much the unit vector $\frac{P_i}{\sqrt{Z}}$ changes along an arc length parameterization t of the integral curves. Calculation of the second power of trajectory curvature of integral curves along a conserving field, can be left as an exercise to the reader but the author prefers to present its calculation. This calculation is valid for all integral curves that are generated by vector fields that are scalar gradients. In our case, the integral curves should not be geodesic if they pass through material fields.

Caution: The t parameterization may not be the time measured by any physical particle because the scalar field from which the vector field is derived may be the result of an intersection of multiple trajectories along which P is measured. However, a particle that follows the gradient curves will indeed measure t even if its trajectory is not geodesic. Let t be the arc length measured along the curves formed by the vector field P_μ. By differential geometry, we know that the second power of curvature along these curves is simply

$$Curv^2 = \frac{d}{dt}\frac{P_\lambda}{\sqrt{P_k P^k}}\frac{d}{dt}\frac{P_\mu}{\sqrt{P_k P^k}} g^{\lambda\mu} \tag{9}$$

such that $g^{\lambda\mu}$ is the metric tensor. (9) is an excellent candidate for an action operator. For convenience, we will write $Norm \equiv \sqrt{P^k P_k}$ and $\dot{P}_\lambda \equiv \frac{d}{dt}P_\lambda$. For the arc length parameter t. Here is the main trick, as was mentioned about $Z = Norm^2$, $Norm$ may not be constant because P_λ is not the 4-velocity of any particle, (to see an example of changing $Norm$, see "APPENDIX – The time field in the Schwarzschild solution"), An arc length parameterization along these curves is equivalent to proper time measured by a particle that moves along the curves, and in thereal numbers case, P can be indeed time. Unlike velocity's squared norms, Z is not constant.

Let W_λ denote: $W_\lambda = \frac{d}{dt}(\frac{P_\lambda}{\sqrt{P_k P_k}}) = \frac{\dot{P}_\lambda}{Norm} - \frac{P_\lambda}{Norm^3} P_k \dot{P}_\nu g^{k\nu}$

Obviously

$$W_\lambda P_k g^{\lambda k} = \frac{\dot{P}_\lambda P_k g^{\lambda k}}{Norm} - \frac{P_\lambda P_s g^{\lambda s}}{Norm^3} P_k \dot{P}_\nu g^{k\nu} = \frac{\dot{P}_\lambda P_k g^{\lambda k}}{Norm} - \frac{P_k \dot{P}_\nu g^{k\nu}}{Norm} = 0$$

Thus

$$Curv^2 = W_\lambda W^\lambda = \frac{\dot{P}_\lambda \dot{P}_\nu g^{\lambda\nu}}{Norm^2} - \frac{P_\lambda \dot{P}_s g^{\lambda s}}{Norm^4} P_k \dot{P}_\nu g^{k\nu} = \frac{\dot{P}_\lambda \dot{P}^\lambda}{Norm^2} - (\frac{P_\lambda \dot{P}^\lambda}{Norm^2})^2$$

Following the curves formed by $P_\lambda = P,_\lambda = \frac{dP}{dx^\lambda}$, the term $\frac{dx^r}{dt} = \frac{P_\lambda}{Norm}$ is the derivative of the normalized curve or normalized "velocity", using the upper Christoffel symbols, $P_\lambda;_r \equiv \frac{d}{dx^r}P_\lambda - P_s\Gamma^s_{\lambda r}$.

$\frac{d}{dt}P_\lambda = (\frac{d}{dx^r}P_\lambda - P_s\Gamma^s_{\lambda r})\frac{dx^r}{dt} = (P_\lambda;_r)\frac{P^r}{Norm}$ such that x^r denotes the local coordinates. If P_λ is a conserving field, then $P_\lambda;_r = P_r;_\lambda$ and thus $P_\lambda,_r P^r = \frac{1}{2}Norm^2,_\lambda$ and

$$Curv^2 = \frac{\dot{P}_\lambda \dot{P}^\lambda}{Norm^2} - (\frac{P_\lambda \dot{P}^\lambda}{Norm^2})^2 = \frac{1}{4}(\frac{Norm^2,_\lambda Norm^2,_k g^{\lambda k}}{Norm^4} - (\frac{Norm^2,_s P_r g^{sr}}{Norm^3})^2)$$

In the real case, we have achieved the Reeb vector,

$$U_m = \frac{(P^\lambda P_\lambda),_m}{P^i P_i} - \frac{(P^\lambda P_\lambda),_\mu P^\mu}{(P^i P_i)^2} P_m = \frac{Z_m}{Z} - \frac{Z_\mu P^\mu}{Z^2} P_m \quad (10)$$

And our candidate for a trajectory curvature action

$Action = \frac{1}{4} U_m U^m$ where in the complex case

$$Action = \frac{1}{8}(U^*_m U^m + U_m U^{*m}) \quad (11)$$

Non-geodesic motion, as a result of interaction with a field, is not a geodesic motion in a gravitational field, i.e. it is not free fall. Moreover, material fields by this interpretation prohibit geodesic motion curves of particles moving at speeds less than the speed of light and by this, reduce the measurement of proper time. We return to the idea of acceleration by material fields.

We recall the work of TzviScarr and of Yaakov Friedman [5] which used an anti-symmetric matrix to map a 4-velocity vector V^μ to a 4-acceleration vector a_ν. Since (2),

$$\frac{U_\nu}{2} = \frac{a_\nu}{c^2} = A_{\mu\nu} \frac{V^\mu}{c} \quad (12)$$

such that c is the speed of light, where V^μ is the 4-velocity of a material frame and $A_{\mu\nu}$ is the Scarr-Friedman matrix [5]. The known relation $a_\nu V^\nu = 0$ is obvious.

The real valued action above (11), will lead to a very different energy momentum tensor than that of a simple real valued scalar Klein Gordon energy momentum tensor, instead of $\frac{\eta^2}{m}(2P_\mu P_\nu - P^\lambda P_\lambda g_{\mu\nu}) - mc^2 P^2 g_{\mu\nu}$ we will see $\frac{c^4}{8\pi K}\frac{1}{4}(U_\mu U_\nu - \frac{1}{2} g_{\mu\nu} U_\lambda U^\lambda - 2U^k;_k \frac{P_\mu P_\nu}{P_s P^s})$ where $U_\mu = \frac{Z_\mu}{Z} - \frac{Z_k P^k}{Z_2} P_\mu$ and where $Z_\mu = dZ/dx^\mu$ and $Z = P_s P^s$ and $P_\mu = dP/dx^\mu$. The term $2U^k;_k \frac{P_\mu P_\nu}{P_s P^s}$ was not expected by the author. In almost flat geometry, considering $|U_0| << Max\{|U_1|,|U_2|,|U_3|\}$ leads to the interpretation of electric charge up to multiplication by a constant. Another perhaps more illuminating way is to look at the action $\tilde{F}_{\mu\nu} = \frac{1}{4}(A_{\mu\nu} + B_{\mu\nu})$ where $B_{\mu\nu}$ is the anti-symmetric matrix that was mentioned just before (3) and $\frac{U_\mu U^\mu}{4}\sqrt{-g} = \frac{\tilde{F}_{\mu\nu}\tilde{F}^{\mu\nu}}{4}\sqrt{-g}$ such that $\sqrt{-g}$ is the volume coefficient term that appears in General Relativity. Unlike in the classical covariant electro-magnetic action, there is no mixed 4-current J^μ and vector potential A_μ component $A_\mu J^\mu \sqrt{-g}$ since such a term is redundant due to the unexpected $\frac{1}{4}(-2U^k;_k \frac{P_\mu P_\nu}{P_s P^s})$ term that will appear in the Euler Lagrange equations of the Lagrangian

$$\frac{U_\mu U^\mu}{4}\sqrt{-g} = \frac{\widetilde{F}_{\mu\nu}\widetilde{F}^{\mu\nu}}{4}\sqrt{-g} .$$

To summarize:

$$\frac{c^4}{8\pi K}\frac{\widetilde{F}_{\mu\nu}\widetilde{F}^{\mu\nu}}{4}\sqrt{-g} \neq -(\frac{F_{\mu\nu}F^{\mu\nu}}{4\mu_0} + A_\mu J^\mu)\sqrt{-g}$$

where μ_0 is the permeability constant of vacuum, $F_{\mu\nu}$ is the electro-magnetic tensor.

2. SU(2) X U(1) symmetries – partially symplectic space-time

There is, however, a problem with $A_{\mu\nu}$. There is a degree of freedom in the matrix $A_{\mu\nu}$ which is defined by two vectors, $\frac{P_i}{\sqrt{Z}}$ and by $\frac{U_i}{2}$. That means two additional vectors can be defined in order to express acceleration in the plane which is perpendicular to the local plane spanned by $\frac{P_i}{\sqrt{Z}}$ and $\frac{U_i}{2}$. We continue with the TzviScarr and Yaakov Friedman acceleration representation matrix [5] and for simplicity, we restrict our discussion to the real case. $A_{\mu\nu}$ is singular and we can easily define a matrix that rotates vectors in a plane perpendicular to both U_μ and to P_ν in order to extend $A_{\mu\nu}$ to a regular matrix by adding to $A_{\mu\nu}$ a second singular matrix, denoted by $B_{\mu\nu}$. That is the matrix

$$B^{\alpha\beta} \equiv \frac{1}{\sqrt{2}}\varepsilon^{\mu\nu\alpha\beta}A_{\mu\nu} \qquad (13)$$

where $\varepsilon^{\mu\nu\alpha\beta}$ is the Levi-Civita tensor (not symbol as the Levi-Civita symbol is a tensor density and not a tensor). It is easily verified that

$$(A^{\alpha\beta} + B^{\alpha\beta})(A_{\alpha\beta} + B_{\alpha\beta}) = A^{\alpha\beta}A_{\alpha\beta} + B^{\alpha\beta}B_{\alpha\beta}$$

and also

$$B^{\alpha\beta}B_{\alpha\beta} = \frac{1}{2}\varepsilon^{\mu\nu\alpha\beta}A_{\mu\nu}\varepsilon_{ij\alpha\beta}A^{ij} = \frac{1}{2}\varepsilon^{\mu\nu}{}_{ij}A_{\mu\nu}A^{ij} = \frac{1}{2}(\delta_i^\mu\delta_j^\nu - \delta_j^\mu\delta_i^\nu)A^{ij}A_{\mu\nu} =$$

$$\frac{1}{2}(A^{\mu\nu}A_{\mu\nu} - A^{\nu\mu}A_{\mu\nu}) = A^{\mu\nu}A_{\mu\nu}$$

Therefore $(A^{\alpha\beta} + B^{\alpha\beta})(A_{\alpha\beta} + B_{\alpha\beta}) = A^{\alpha\beta}A_{\alpha\beta} + B^{\alpha\beta}B_{\alpha\beta} = 2A^{\mu\nu}A_{\mu\nu}$ where δ_i^j is the Kronecker delta.In the real numbers case, there are two ways to extend $A_{\alpha\beta}$ to a regular matrix and to keep the norm of the acceleration vector after the extended matrix is multiplied by vectors perpendicular to both $\omega = \frac{P_\mu}{\sqrt{Z}}$ and to U_μ. These matrices are,

$$A_{\alpha\beta} + B_{\alpha\beta} \text{ and } A_{\alpha\beta} - B_{\alpha\beta} \tag{14}$$

and it is easy to see that $(A_{\alpha\beta} + B_{\alpha\beta})(A^{\alpha\beta} - B^{\alpha\beta}) = 0$ (14) is the matrix we have been looking for and it also results in an immediate degree of freedom in the representation of the acceleration matrix by two additional vectors to ω and U_μ but **not** in the matrix itself. (14) is quite similar to Dirac matrices but unlike them, it describes two acceleration planes and not a bi-spinor [6]. In particular, $\tilde{\gamma}_\alpha{}^\mu$ rotations in $SU(4)$, see [7], that do not affect $A_{\alpha\beta}$ may be applied to $B_{\alpha\beta}$. These rotations are in $SU(2)xU(1)$, $B_{\alpha\beta} = \pm\tilde{\gamma}_\alpha{}^\mu B_{\mu\nu}\tilde{\gamma}_\beta{}^\nu$ and $A_{\alpha\beta} = \tilde{\gamma}_\alpha{}^\mu A_{\mu\nu}\tilde{\gamma}_\beta{}^\nu$. There is no $SU(2)$ degree of freedom in $B_{\alpha\beta}$ itself but only in its representation vectors, i.e., the normalized gradient of a scalar and its Reeb vector. As was suggested in (14), the singular $A_{\alpha\beta}$ acceleration matrix is replaced with $A_{\alpha\beta} \to A_{\alpha\beta} + \tilde{\gamma}_\alpha{}^\mu B_{\mu\nu}\tilde{\gamma}_\beta{}^\nu$

In the complex case, consider $e^{i\theta}B_{\alpha\beta}$ instead of $B_{\alpha\beta}$. $e^{i\theta}$ is a $U(1)$ member at angle θ.

2.1. Partially Symplectic space-time

For space-time to be symplectic, it is enough to show that for $A_{ij}=\frac{Z_i}{2Z}\frac{P_j}{\sqrt{Z}}-\frac{Z_j}{2Z}\frac{P_i}{\sqrt{Z}}$ there exists a $B_{ij}=\frac{W_i}{2W}\frac{Q_j}{\sqrt{W}}-\frac{W_j}{2W}\frac{Q_i}{\sqrt{W}}$ such that Q is a scalar function $W=Q_kQ^k$ such that $Q_k=dQ/dx^k$ is the K[th] derivative of Q, and $W_j=dW/dx^j$ with local coordinates x^s and the following holds: $P_iQ^i=P_iW^i=Z_iQ^i=Z_iW^i=0$ or in other words, the two forms A_{ij} and B_{ij} define transformations in perpendicular planes of the tangent space of space-time.

The result is that the following form is not zero $\frac{Z_i}{2Z}\frac{P_j}{\sqrt{Z}}\frac{W_s}{2W}\frac{Q_t}{\sqrt{W}}dx^i\wedge dx^j\wedge dx^s\wedge dx^t\neq 0$.

We define $\beta=(\frac{Z_i}{2Z}\frac{P_j}{\sqrt{Z}}+\frac{W_i}{2W}\frac{Q_j}{\sqrt{W}})dx^i\wedge dx^j$. It is immediate that β is the exterior derivative of the 1-Form $\omega=(\frac{P_i}{\sqrt{Z}}+\frac{Q_i}{\sqrt{W}})dx^i$ and that β is a closed form and obviously $\beta\wedge\beta=2\frac{Z_i}{2Z}\frac{P_j}{\sqrt{Z}}\frac{W_s}{2W}\frac{Q_t}{\sqrt{W}}dx^i\wedge dx^j\wedge dx^s\wedge dx^t$ which is a 4[th] order non-degenerate form. The demand for a manifold to be symplectic, is that there will be a 1-Form ω such that $\beta=d\omega$ and such that $\beta^n=\beta\wedge\beta\wedge...\beta$ will be of order $2n$ which is the dimension of the manifold and that β will be a closed form as in our case. By a theorem of Darboux [8], there exists a local basis (x^0,x^1,y^0,y^1) in which $\beta=x^0\wedge y^0+x^1\wedge y^1$ or in a more illuminating way,

$$\begin{pmatrix}0&-1&0&0\\1&0&0&0\\0&0&0&-1\\0&0&1&0\end{pmatrix}.$$

In a $2n$ dimensional Riemannian or Pseudo-Riemannian manifold, if there is a series of, n vectors, $\omega(1)=\frac{P(1)_\mu}{\sqrt{P(1)_\lambda P(1)^\lambda}}dx^\mu,\omega(2)=\frac{P(2)_\mu}{\sqrt{P(2)_\lambda P(2)^\lambda}}dx^\mu,...,\omega(2)=\frac{P(n)_\mu}{\sqrt{P(n)_\lambda P(n)^\lambda}}dx^\mu$ which have non-degenerate exterior derivatives and therefore non-degenerate Reeb vectors $U(1)_\mu,...,U(n)_\mu$ then show that the $n\,x\,n$ Gram determinant $Det(U(i)_\mu U(j)^\mu)$ is invariant for all such choices. In the real case, it can be shown that any other choice is reducible to $U(1)_\mu,...,U(n)_\mu$ by a composition of an $SO(n)$ transformation followed by a reflection which generalizes to $SU(n)$ and a reflection in the complex case.

3. SU(3) symmetry

We may want to express the acceleration matrix $A_{\alpha\beta}$ by three scalar fields that are defined in thefoliation F that is perpendicular to $\frac{P_i}{\sqrt{Z}}$. This is because P_i is a geometric object that defines foliations of space-time and can be conversely defined by the foliations. Another motivation is to show that $SU(3)$ that is seen in Quantum Chromo-Dynamics, may originate from geometry. By a theorem of Frobenius, necessary conditions for 3 vectors $h(j=1,2,3)$ to span the foliation F is that the vectors $h(s)$ areHolonomic if their Lie brackets depend on them $[h(i),h(k)]=\sum_{j=1}^{3}c_j h(j)$ for some coefficients c_j. The Lie brackets of each two vectors must depend on the vectors that span $T(F)$. We may write our 3 scalars a,b,c (here c is not the speed of light and not the previous coefficients but a scalar field) and their gradients that span the foliation's tangent space $T(F)$ as follows, $h_k(1)=\frac{d}{dx^k}a$, $h_k(2)=\frac{d}{dx^k}b$, $h_k(3)=\frac{d}{dx^k}c$.

We now express $A_{\alpha\beta}$ by $h_k(1)$, $h_k(2)$, $h_k(3)$ in a covariant formalism but we need some constraint on P_μ.

Condition: $P_\mu;^\lambda P*^\mu = P*_\mu;^\lambda P^\mu$

This condition is not trivial and in general, $P_\mu;^\lambda P*^\mu \neq P*_\mu;^\lambda P^\mu$.

Consider the following matrix:

$$D_{ij}=g_{ij}-a*_i a_j-b*_i b_j-c*_i c_j \tag{15}$$

and $a_i=\frac{\alpha_i}{\sqrt{(\alpha^\lambda\alpha*_\lambda+\alpha*^\lambda\alpha_\lambda)/2}}$ for some scalar function α whose gradient α_i is in the foliation perpendicular to P_μ etc. and in the same manner replace β_i by a normalized unit vector b_i and γ_i by a normalized $c_i=\frac{\gamma_i}{\sqrt{\gamma_\mu\gamma*^\mu+\gamma*_\mu\gamma^\mu}}$ vector. Also, we demand orthogonality, $a_i b*^i=a_i c*^i=b_i c*^i=0$. Obviously $D_{ij}a*^j=D_{ij}b*^j=D_{ij}c*^j=0$ and $D_{ij}\frac{P*^j}{\sqrt{Z}}=\frac{P*^i}{\sqrt{Z}}$ which then shows that $D_{ij}=\frac{P*_i P_j}{Z}$, $Z=(P_\lambda P*^\lambda+P*_\lambda P^\lambda)/2$. That is very interesting, because as was already said, we can represent $P*_i P_j$ by orthogonal fields that span the tangent space of the perpendicular foliation to P_j, namely T(F). Consider the following:

$$\begin{aligned}D_{ij};_k-D_{ik};_j&=\left(\frac{P*_i;_k P_j+P*_i P_j;_k}{Z}-\frac{P*_i P_j Z_k}{Z^2}\right)-\left(\frac{P*_i;_j P_k+P*_i P_k;_j}{Z}-\frac{P*_i P_k Z_j}{Z^2}\right)=\\&\left(\frac{P*_i P_k Z_j}{Z^2}-\frac{P*_i P_j Z_k}{Z^2}\right)+\left(\frac{P*_i;_k P_j}{Z}-\frac{P*_i;_j P_k}{Z}\right)\end{aligned} \tag{16}$$

Now comes a little trick:

$$(D_{ij};_k - D_{ik};_j)\frac{P^i P^{*j}}{Z} =$$

$$\left(\frac{P^*_i P_k Z_j}{Z^2} - \frac{P^*_i P_j Z_k}{Z^2}\right)\frac{P^i P^{*j}}{Z} + \left(\frac{P^*_i;_k P_j}{Z} - \frac{P^*_i;_j P_k}{Z}\right)\frac{P^i P^{*j}}{Z} =$$

$$\left(\frac{Z_j P^{*j} P_k}{Z^2} - \frac{Z_j}{Z}\right) + \left(\frac{P^*_i;_k P^i}{Z} - \frac{P^i P^{*j} P^*_i;_j P_k}{Z^2}\right)$$

By (4), it is obvious that the first two terms constitute minus twice the Reeb vector, $\frac{Z_j P^{*j} P_k}{Z^2} - \frac{Z_j}{Z} = -U_k = -2(\frac{U_k}{2})$. For the last two terms, we need a special condition $P_\mu;^\lambda P^{*\mu} = P^*_\mu;^\lambda P^\mu$ although usually $P_\mu;^\lambda P^{*\mu} \neq P^*_\mu;^\lambda P^\mu$. Then by this condition, $\frac{P^*_i;_k P^i}{Z} - \frac{P^i P^{*j} P^*_i;_j P_k}{Z^2} = \frac{U_k}{2}$ and therefore

$$(D_{ij};_k - D_{ik};_j)D^{*ij} = (D_{ij};_k - D_{ik};_j)\frac{P^i P^{*j}}{Z} = -\frac{U_k}{2} \tag{17}$$

Consider our assumption, $D_{ij} = g_{ij} - a^*_i a_j - b^*_i b_j - c^*_i c_j$ and we have obtained an expression of the Reeb vector by the orthonormal vectors that represent the foliation. The additives of (15) are tensors. This leads us to an open question as follows: Is the condition $P_\mu;^\lambda P^{*\mu} = P^*_\mu;^\lambda P^\mu$, the minimal condition which is needed for a representation of the Reeb vector by a_j, b_j, c_j as the sum of tensor terms ? In other words, is the condition $P_\mu;^\lambda P^{*\mu} = P^*_\mu;^\lambda P^\mu$ a necessity for the tensor representation of the acceleration matrix by the foliation scalars, a, b, c?

4. Invariance of the Reeb vector under different functions of P

Here we wish to explore another degree of freedom in the action operator of the "acceleration field" which results from the Reeb vector, as shown by a representative vector field $\frac{dP}{dx^i}$ which is tangent to a non-geodesic integral curve. We wish to show that P can be replaced with a smooth function $f(P)$ and that U_m is invariant under such a transformation.

We revisit our acceleration field and write $U_m = \frac{N^2,_m}{N^2} - \frac{N^2,_\mu P^{*\mu}}{N^4} P_m$ *s.t.* $Z = N^2 \equiv (P^{*i} P_i + P^{*i} P_i)/2$ (also found as Z in this paper) we can omit the comma for the sake of brevity the same way we write P_i instead of $P,_i$ for $\frac{dP}{dx^i}$ and write $U_m = \frac{N^2{}_m}{N^2} - \frac{N^2{}_\mu P^{*\mu}}{N^4} P_m$. We will prove the invariance of U_m where P is real, however, a similar proof is also valid where P is complex and where P is replaced with a smooth function of P.

Suppose that we replace P by $f(P)$ such that f is positive and increasing or decreasing, then $f(P)_i \equiv \frac{df(P)}{dx^i} = \frac{df(P)}{dP}\frac{dP}{dx^i} = f_p(P)P_i$. Let $N^2 \equiv \mathrm{P}^{\lambda}\mathrm{P}_{\lambda}$ then $\hat{N}^2 \equiv f(P)_{\lambda}\, f(P)^{\lambda} = N^2 f_p(P)^2$ and $\frac{\hat{N}^2{}_k}{\hat{N}^2} = \frac{N^2{}_k}{N^2} + \frac{2f_{pp}(P)}{f_p(P)}P_k$ but also

$$\hat{U}_k = \frac{\hat{N}^2{}_k}{\hat{N}^2} - \frac{\hat{N}^2{}_s f_p(P)P^s f_p(P)P_k}{\hat{N}^2} =$$

$$\frac{N^2{}_k}{N^2} + \frac{2f_{pp}(P)}{f_p(P)}P_k - \left(\frac{N^2{}_s}{N^2} + \frac{2f_{pp}(P)}{f_p(P)}P_s\right)\frac{f_p(P)P^s f_p(P)P_k}{N^2 f_p(P)^2} = \quad (18)$$

$$\frac{N^2{}_k}{N^2} - \frac{N^2{}_\mu P^\mu}{N^4}P_k = U_k$$

Which proves the invariance of the Reeb vector $\frac{U_k}{2}$ under different parameterizations of the scalar field P.

5. Energy density by an acceleration field – Reeb vector at the classical non-covariant limit

We now show, how much energy density does this term $\frac{1}{4}U_k U^k$ represent.

For a clock that moves along the integral curves, formed by $\frac{P_\mu}{\sqrt{Z}}$, we have from (2) and (11)

$$\frac{a_\mu}{c^2} = \frac{U_\mu}{2} \quad (19)$$

In special relativity, the squared curvature of a trajectory of a particle is expressible by its 4-acceleration, divided by the squared speed of light, $\frac{dV_\mu / c}{cd\tau} = \frac{a_\mu}{c^2}$ where the proper time τ differentiates the velocity V_μ and where τ is an arc-length parameterization.

The classical limit of a gravitational field is not covariant and that even worse, the classical field is intrinsic to the body of mass M that generates gravity; however, it is valid tool for the assessment of a physical model. We consider small mass at rest in a Newtonian (obviously not covariant) gravitational field. By the principle of equivalence, this mass is accelerated, otherwise it would freely fall. So, if a force field can keep small mass from falling, the field's classical limit of energy, is the same as the energy of the classical non-covariant gravitational field. This results hints at the energy of an acceleration field that opposes weak gravity. Summation of the squared norm of non-covariant 3-acceleration, a^2 of clocks that are kept from falling in the weak gravity generated by the mass M is

$$\iiint_{V=Volume} a^2 dV = \int_{r0}^{\infty}\left(\frac{(KM)^2}{r^2}\right)^2 4\pi\, r^2 dr = K\frac{4\pi KM^2}{r_0} \tag{20}$$

Where K is Newton's gravity constant. Now we calculate the non-relativistic and non-covariant negative potential energy $-E_g$,

$$\int_0^M \left(\frac{Km}{r_0}\right) dm = \frac{KM^2}{2r_0} = -E_g \tag{21}$$

So from (20) and (21)

$$\frac{1}{8\pi K}\iiint_{V=Volume} a^2 dV = -E_g \tag{22}$$

(22) implies the following relation between energy and the non-gravitational acceleration field that prohibits geodesic motion, where ρc^2 is the energy density and ρ is the mass density.

$$\frac{a^2}{c^4} = \frac{8\pi K\rho}{c^2} \Rightarrow Energy-Density = \frac{1}{2}\frac{a^2}{4\pi K} = \frac{a^2}{8\pi K} \tag{23}$$

where c is the speed of light. (23) dictates in four dimensions,

$$\frac{U_\mu U^\mu}{4} = \frac{a_\mu a^\mu}{c^4} = -\frac{8\pi K}{c^4} * \text{Energy} - \text{Density} \tag{24}$$

Note that unlike (24), (23) is not a covariant expression. What does it mean in the non-covariant classical limit of the electro-static field E. Since an electric field is also a form of an energy density, $Energy-Density = \frac{\varepsilon_0}{2}E^2$ where ε_0 is the permittivity of vacuum and from (24) we can infer the following non-covariant classical limit, $8\pi K\frac{\varepsilon_0}{2}E^2 = a^2$ where E^2 and a^2 are square norms of the 3-vectors $\vec{E}$ and $\vec{a}$. We can infer,

$$\sqrt{4\pi K\varepsilon_0}\,E = a \tag{25}$$

The acceleration in (25) is dauntingly small and very difficult to measure. It requires an immense field of 1 million volts over 1 millimetre to expose an acceleration of uncharged clocks, which is about 8.61cm/sec^2, less than 0.01 g, providing that there are no other fields that cancel out this acceleration. In fact, we will see below that charge also generates gravity and that for the choice $8\pi K$ in (23), the acceleration will be about 4.305 cm/sec^2. By the principle of parsimony, the fact that this acceleration field stores energy, i.e. $Energy-Density = \frac{a^2}{8\pi K}$ means that this acceleration is aligned with the electric charge, electro-static field curves because this can explain the electric charge attraction and repulsion by simply, increasing or decreasing the energy stored in such a weak acceleration field. As we shall see, if instead of $8\pi K$ we develop this theory such that $4\pi K$ divides the square norm of acceleration, no acceleration of neutral particles will be measured within a homogeneous electrostatic field. This is because, we will develop the Euler Lagrange equations of the Ricci scalar plus (11) and see that charge also generates gravity and not only inertial mass does.

We now use a covariant terminology of 4-acceleration a_μ and $a^2 \equiv a_\mu a^\mu$.

As a more general theory, we can write $Energy\_Density = -\frac{a^2}{\sigma K} = -\frac{a_\mu a^\mu}{\sigma K}$, such that $\sigma = 8\pi$.

Another important remark is that in the classical non-covariant limit, the divergence of the electric field can be written as,

$$\frac{U_\mu;^\mu}{2} = Div(\frac{U_\mu}{2}) = Div(a_\mu / c^2) \approx \frac{\sqrt{4\pi K\varepsilon_0}}{c^2} Div(E) = \frac{\sqrt{4\pi K\varepsilon_0}}{c^2}\frac{\rho}{\varepsilon_0} = \sqrt{\frac{4\pi K}{\varepsilon_0}}\frac{\rho}{c^2} \tag{26}$$

Such that ρ denotes charge density and not the previously defined energy density.

By experiments done by Hector Serrano, for NASA, the author believes that the acceleration field of even uncharged clocks in an electric field is towards the electron and out of the proton. A relation between charge and gravity can be developed, leading to unprecedented repercussions on the feasibility of Alcubierre Warp Drive, reference is given where it is discussed later.

There is a remark of Serrano [9], about a moving capacitor in vacuum, in a reply to Peter Liddicoat: *"Actually by the generally accepted definition of what constitutes high vacuum 10^-6 Torr is about in the middle. This pressure is about equal to low Earth orbit. More importantly at this pressure the 'Mean Free Path' of the molecules in the chamber is far too great to support Corona/Ion wind effects. We've tested from atmosphere to 10^-7 Torr with no change in performance either. However, I'm glad the results have you thinking. It looks simple, but trust me it's not"..*

Hector Serrano has mentioned in a patent [10], that a capacitor manifests weak thrust also in vacuum. Another indirect evidence is the Flyby Anomaly [11] which is possibly caused by ionosphere charge. For further evidence, see TimirDatta et. al. work as an elegant way to focus field lines by metal cone and plane and to observe an effect [12]. The author believes the acceleration of charge-less particles in an electric field is from positive to negative. In section 9 it is shown that there is an electro-gravitational effect opposite in direction to the acceleration of an uncharged particle in an electro-static field. There is at least informal evidence that the elecro-gravitational effect shows thrust of the entire dipole towards the positive direction [9] and the author does not imply asymmetrical capacitors of 1 - 0.1 Pico-Farad with 45000 Volts. It is shown that such capacitors - according to the calculations in section 9, assuming a roughly approximated acceleration proportional to the gravitational field – will not manifest any measurable effect of at least 1 micro Newton thrust. Most likely is that any measurable thrust, using such small capacitors, will be solely based on ionic wind.

6. Experimental problems – electron mobility

The down side of the non-geodesic acceleration is that it is about 10 orders of magnitude smaller than the accepted and known electric field interaction. For example, negative charge suspended above the Earth will cause charge to move in the ground. This charge will have a much stronger effect than the interaction with the acceleration field as is, and will cause a shielding effect i.e. the fields will cancel out within the Earth. Even the almost ideal insulator, i.e. diamond crystals, have impurities such as Nitrogen Vacancies [13] that allow charge carriers to move in the lattice i.e. high electron mobility. In the purest diamonds, the NV impurities are about 10^{18} nodes per cm^{-3} comparing to $1.77x10^{23}$ carbon atoms per cm^{-3}. The donor electrons lie deep in the band gap of 5.47eV, at about 1.7 eV.

7. Vaknin's theory

We quote here one of the four models of Vaknin [14] as follows: This work contains a possible realization of space-time as an ideal geometric object that becomes physically accessible only where a wave function which is called "chronon" collapses. The physical model is therefore of events and not of particles. This paper offers the idea that matter occurs where the Reeb vector is not zero. Showing consistency of this model with Quantum Mechanics is a very difficult task although it is possible to show that the energy of an electric field is stored in an acceleration field by replacement of the electro-magnetic tensor with the anti-symmetric acceleration field.

Vaknin's description of the realization of event is as follows:*"Time as a wave function with observer-mediated collapse. Entanglement of allChronons at the exact "moment" of the Big Bang. A relativistic QFT with Chrononsas Field Quanta (excited states.) The integration is achieved via quantumsuperpositions".*

The main difference between Vaknin's approach and the author's approach is that Vaknin's approach is algebraic where the author's approach is geometric. Thus, the outcome is two different theories that discuss a similar idea. We now show the simplest implementation of Vaknin's model as a quantization idea of time by collapsible events, as an additional constraint to the action

$\int_{\Omega^4} \frac{c^4}{\sigma K} Curv^2 \sqrt{-g} d\Omega^4$ where $\sigma = 8\pi$

Where $\sqrt{-g}$ is the root of the negative metric tensor determinant for the volume element, such that $P = \lim_{n\to\infty} \psi(1) + \psi(2) + ... + \psi(n)$ and such that: $\int_{\Omega^4} \psi(k)\psi^*(k)\sqrt{-g}d\Omega^4 = 1$ And $0 < j < k < \infty \Rightarrow \int_{\Omega^4} \psi(j)\psi^*(k)\sqrt{-g}d\Omega^4 = 0$.

The term c^4 is the speed of light to the power of 4 and K is Newton's gravity constant. $Curv^2$ is a generalization of the square norm of the Reeb vector to the complex numbers field,

$Curv^2 = \frac{(U_j U^{*j} + U^*_j U^j)}{8}$ where $\frac{U_j}{2} = \frac{Z_j}{2Z} - \frac{Z_k P^{*k}}{2Z^2} P_j = (\frac{Z_j P_s}{2Z^{3/2}} - \frac{Z_s P_j}{2Z^{3/2}})\frac{P^s *}{\sqrt{Z}}$

and $A_{sj} = \frac{Z_j P_s}{2Z^{3/2}} - \frac{Z_s P_j}{2Z^{3/2}}$ can be extended to a regular matrix $A_{sj} + B_{sj}$ where $B^{\alpha\beta} \equiv r\frac{1}{\sqrt{2}}\varepsilon^{\mu\nu\alpha\beta}A_{\mu\nu}$ and $\varepsilon^{\mu\nu\alpha\beta}$ is the Levi Civita tensor (not symbol) and $rr^* = 1$ due to a degree of freedom.

7.1. *Physical meaning:* The field $A_{js} + B_{js}$ will rotate and scale a scalar wave function φ of a particle, $\varphi_j = \frac{d\varphi}{dx^j}$ where $(A_{js} + B_{js})\varphi^{*s} = \frac{1}{c}\frac{d\varphi_j}{d\tau}$ and where τ measures proper time.

We generalize the acceleration field energy density from $-(\frac{a_j a^j}{8\pi K}) = -\frac{U_j U^j}{4}\frac{c^4}{8\pi K}$ to

$$-(\frac{a_j a^{*j} + a^*_j a^j}{16\pi K}) = -\frac{U_j U^{*j} + U^*_j U^j}{8}\frac{c^4}{8\pi K} \text{ and } \frac{a_j}{c^2} = \frac{U_j}{2}.$$

As we saw in (18), P does not have to be the proper time measured along curves. Instead, it can be a function of such proper time. (18) motivates the decomposition of P into wave functions because P does not have to be a monotonically increasing function of the proper time measured along integral curves formed by P_k. The problem is that P is not any wave function of a particle. The simplest physical interpretation of the ψ wave function is that it describes events in space-time and not particles. Therefore, P becomes a sum of wave functions and $P = \lim_{n\to\infty} \psi(1) + \psi(2) + ... + \psi(n)$ is a decomposition of the function P as a sum of wave functions.

As quantum states, these event wave functions $\psi(1)$, $\psi(2)$,... must be normalized to probability 1 on the space-time manifold and they should be independent of each other as was written in two integral constraints. The best motivation for the constraints $\int_{\Omega^4} \psi(k)\psi^*(k)\sqrt{-g}d\Omega^4 = 1$ and for $\int_{\Omega^4} \psi(k)\psi^*(j)\sqrt{-g}d\Omega^4 = 0 \text{ s.t. } k \neq j$ is given by Vaknin [14] and Storkin [15] where they emphasize that physical events are discrete. Storkin considers decreasing probability functions of the number of events in a given -volume, e.g. Poisson distribution within 2+1 dimensions Minkowsky space-time. Causal sets are partially ordered graphs of events along paths in space-time. The approach of this paper is more robust than that of Storkin because causal sets are the result of the order of events along the integral curves that are naturally formed by P_k along with the mentioned constraints that induce a countable set of wave functions.

7.2. *Auto-rotation:* In this section, we will study the field of a particle, whose rest mass energy ispresumably stored in an acceleration field. The equation $(A_{js} + B_{js})\varphi^{*s} = \frac{1}{c}\frac{d\varphi_j}{d\tau}$ can be better understood, by recalling (8) and by replacing $\frac{P_k}{\sqrt{Z}}$ in (8) with φ_k, as in the following: $A_{js}\varphi^{*s} = Lie(\frac{P^{*\lambda}}{\sqrt{Z}}, \varphi_j) = \frac{P^{*\lambda}}{\sqrt{Z}}\varphi_{j,\lambda} + \left(\frac{P^{*s}}{\sqrt{Z}}\right)_{,j}\varphi_s$ in which the right hand side describes the acceleration of φ_s along the vector $\frac{P^{*\lambda}}{\sqrt{Z}}$. On the other hand, the left hand side, $A_{js}\varphi^{*s}$ describes the acceleration of φ^{*s} along $\frac{P_s}{\sqrt{Z}}$ which does not include the portion of the acceleration $B_{js}\varphi^{*s}$, and which results in the equation above. By (8), If we replace φ_s with $\frac{P_s}{\sqrt{Z}}$, we get $\frac{U_j}{2}$ on both sides of the equation. What is the meaning of φ_k ? Dirac's equation consists of spinors [6], and of matrix blocks as basis elements of the Lie Algebra of a rotation group. In Dirac's equation, φ_k is not the gradient of a scalar function, the indices correspond to orthogonal unit vectors and $\varphi_k\varphi^{*k}$ or

$(\varphi_k \varphi^{*k} + \varphi^*{}_k \varphi^k)/2$ can be reduced to a probability density. φ_k is not a vector in the usual sense of General Relativity because it transforms between different coordinate systems with the help of spin connections and not with the help of affine connections. The philosophy of the Dirac equation, stems from the motivation to represent spatial spin axes as three orthogonal quantum states and to predict their probabilities. Any measurement of a spin is either +spin or -spin, no matter from which angle the physical measurement is performed. This property of the spin is very different than that of the classical mechanics spin. The philosophy of this paper is very different than that of Dirac, because it is based on a fully geometric interpretation of matter as acceleration fields. We begin with a quest for φ_k that will be an ordinary vector, unlike in Dirac's equation. We know that if $\varphi_k \varphi^{*k}$ is a probability density, then by (24), if all the energy of the particle is in its acceleration field, then we must have $\frac{8\pi K}{c^4} \varphi_k \varphi^{*k} mc^2 = -\frac{U_k U^k}{4}$ which results in two equations, $A_{js} \varphi^{*s} = \frac{P^{*\lambda}}{\sqrt{Z}} \varphi_{j,\lambda} + \left(\frac{P^{*s}}{\sqrt{Z}} \right)_{,j} \varphi_s$ and $\frac{8\pi K}{c^4} \varphi_k \varphi^{*k} mc^2 = -\frac{U_k U^k}{4}$ where mc^2 is the energy of the particle and $\varphi_k \varphi^{*k} mc^2$ is the energy density of the particle. There is a new open problem and a new ongoing research which is intended to answer whether φ_k, as presented here, offers a useful way to describe matter on the quantum level.

8. General Relativity for the deterministic limit

By General Relativity, we have to add the Hilbert-Einstein action [16][17][18] to the negative sign of the square curvature of the gradient of the scalar field in order to replace the energy-momentum tensor in the Einstein's field equations. Negative means that the curvature operator is mostly negative. As before, we assume $\sigma = 8\pi$ (from the previously discussed term, $-a_\mu a^\mu / 8\pi K$ as an energy density).

$$
\begin{aligned}
&Z = N^2 = P_\mu P^\mu \text{ and } U_\lambda = \frac{Z_\lambda}{Z} - \frac{Z_k P^k P_\lambda}{Z^2} \text{ and } L = \frac{1}{4} U^k U_k \\
&R = Ricci \text{ curvature.} \\
&Min\ Action = Min \int_\Omega \left(R - \frac{8\pi}{\sigma} L \right) \sqrt{-g}\, d\Omega = \\
&Min \int_\Omega \left(R - \frac{1}{4} U^k U_k \right) . \sqrt{-g}\, d\Omega \text{ s.t. } \sigma = 8\pi
\end{aligned}
\tag{27}
$$

$\sqrt{-g}$ is a scalar density of the volume element, R is the Ricci curvature [16] and $\sqrt{-g}$ is the determinant of the metric tensor used for the 4-volume element as in tensor densities [17].

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 [18], 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 $\left(\frac{1}{2}R - \frac{8\pi}{\sigma}L\right)\sqrt{-g}$ by $\delta g^{\mu\nu}$.

The following Euler Lagrange equations have to hold,

$$(\frac{\partial}{\partial g^{\mu\nu}} - \frac{d}{dx^m}\frac{\partial}{\partial(g^{\mu\nu},_m)} + \frac{d^2}{dx^m dx^s}\frac{\partial}{\partial(g^{\mu\nu},_m,_s)})\left((\frac{1}{2}R - \frac{1}{4}U^k U_k)\sqrt{-g}\right) = 0$$

and

$$(\frac{\partial}{\partial p} - \frac{d}{dx^m}\frac{\partial}{\partial(P_m)} + \frac{d^2}{dx^m dx^s}\frac{\partial}{\partial(P,_m,_s)})\left((\frac{1}{2}R - \frac{1}{4}U^k U_k)\sqrt{-g}\right) = 0$$

$U^k U_k = \frac{Z_\mu Z^\mu}{Z^2} - \frac{(Z_s P^s)^2}{Z^3}$ 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 (33). Equations (33), (34) and (36) are however crucial.

$$L = \frac{(P^{\lambda} Z_{\lambda})^2}{Z^3} \;\; s.t. \; Z = P_{\mu} P^{\mu}$$

$$\frac{\partial (L\sqrt{-g})}{\partial g^{\mu\nu}} - \frac{d}{dx^m} \frac{\partial (L\sqrt{-g})}{\partial (g^{\mu\nu},_m)} =$$

$$\left(\begin{array}{l} -2\left(\frac{(P^{\lambda} P_{\lambda}),_s P^s}{Z^3} P_{\mu} P_{\nu} P^m \right);_m + \\ 2 \frac{(P^{\lambda} P_{\lambda}),_s P^s}{Z^3} (\Gamma_{\mu}{}^{i}{}_{m} P_i P_{\nu} P^m + \Gamma_{\upsilon}{}^{i}{}_{m} P_{\mu} P_i P^m) + \\ +2 \frac{(P^{\lambda} P_{\lambda}),_s P^s}{Z^3} (P_{\mu} P_{\nu});_m P^m \\ -2 \frac{(P^{\lambda} P_{\lambda}),_s P^s}{Z^3} (\Gamma_{\mu}{}^{i}{}_{m} P_i P_{\nu} P^m + \Gamma_{\upsilon}{}^{i}{}_{m} P_{\mu} P_i P^m) + \\ +2\left(\frac{(P^{\lambda} P_{\lambda}),_s P^s}{Z^3} \right) Z_{\mu} P_{\nu} - 3\left(\frac{((P^{\lambda} P_{\lambda}),_s P^s)^2}{Z^4} \right) P_{\mu} P_{\nu} \\ -\frac{1}{2} \frac{(P^{\lambda} Z_{\lambda})^2}{Z^3} g_{\mu\nu} \end{array} \right) \sqrt{-g} =$$

$$\left(\begin{array}{l} -2\left(\frac{(P^{\lambda} P_{\lambda}),_m P^m}{Z^3} P^k \right);_k P_{\mu} P_{\nu} \\ -2 \frac{(P^{\lambda} Z_{\lambda})^2}{Z^3} \frac{P_{\mu} P_{\nu}}{Z} + 2\left(\frac{(P^{\lambda} P_{\lambda}),_s P^s}{Z^3} \right) Z_{\mu} P_{\nu} + \\ -\frac{1}{2} \frac{(P^{\lambda} Z_{\lambda})^2}{Z^3} g_{\mu\nu} - \frac{(P^{\lambda} Z_{\lambda})^2}{Z^3} \frac{P_{\mu} P_{\nu}}{Z} \end{array} \right) \sqrt{-g} \qquad (28)$$

$$
\begin{aligned}
&L = \frac{Z^{\lambda} Z_{\lambda}}{Z^{2}} \ \ s.t.\ Z = P_{\mu} P^{\mu} \\
&\frac{\partial(L\sqrt{-g})}{\partial g^{\mu\upsilon}} - \frac{d}{dx^{m}} \frac{\partial(L\sqrt{-g})}{\partial g^{\mu\upsilon}{,}_{m}} = \\
&\left(\begin{array}{l}
-2(\frac{Z^{m} P_{\mu} P_{\upsilon}}{Z^{2}});_{m} \\
+2\frac{(\Gamma_{\mu}{}^{i}{}_{m} P_{i} P_{\nu} Z^{m} + \Gamma_{\upsilon}{}^{i}{}_{m} P_{\mu} P_{i} Z^{m})}{Z^{2}})+ \\
+2\frac{(P_{\mu} P_{\upsilon});_{m} Z^{m})}{Z^{2}} \\
-2\frac{(\Gamma_{\mu}{}^{i}{}_{m} P_{i} P_{\nu} Z^{m} + \Gamma_{\upsilon}{}^{i}{}_{m} P_{\mu} P_{i} Z^{m})}{Z^{2}})+ \\
+\frac{Z_{\mu} Z_{\nu}}{Z^{2}} - 2\frac{Z_{s} Z^{s}}{Z^{3}} P_{\mu} P_{\nu} - \frac{1}{2}\frac{Z_{m} Z^{m}}{(P^{i} P_{i})^{2}} g_{\mu\nu}
\end{array}\right)\sqrt{-g} = \\
&(-2(\frac{Z^{m}}{Z^{2}});_{m} P_{\mu} P_{\nu} \\
&-2\frac{Z^{\lambda} Z_{\lambda}}{Z^{2}} \frac{P_{\mu} P_{\nu}}{Z} - \frac{1}{2}\frac{Z_{k} Z^{k}}{Z^{2}} g_{\mu\nu} + \frac{Z_{\mu} Z_{\nu}}{Z^{2}})\sqrt{-g}
\end{aligned}
$$

$$
\begin{aligned}
&L = \frac{Z^{\lambda} Z_{\lambda}}{Z^{2}} \ \ s.t.\ Z = P_{\mu} P^{\mu} \\
&\frac{\partial(L\sqrt{-g})}{\partial g^{\mu\upsilon}} - \frac{d}{dx^{m}} \frac{\partial(L\sqrt{-g})}{\partial g^{\mu\upsilon}{,}_{m}} = \\
&\left(\begin{array}{l}
-2(\frac{Z^{m} P_{\mu} P_{\upsilon}}{Z^{2}});_{m} + 2\frac{(\Gamma_{\mu}{}^{i}{}_{m} P_{i} P_{\nu} Z^{m} + \Gamma_{\upsilon}{}^{i}{}_{m} P_{\mu} P_{i} Z^{m})}{Z^{2}})+ \\
+2\frac{(P_{\mu} P_{\upsilon});_{m} Z^{m})}{Z^{2}} - 2\frac{(\Gamma_{\mu}{}^{i}{}_{m} P_{i} P_{\nu} Z^{m} + \Gamma_{\upsilon}{}^{i}{}_{m} P_{\mu} P_{i} Z^{m})}{Z^{2}})+ \\
+\frac{Z_{\mu} Z_{\nu}}{Z^{2}} - 2\frac{Z_{s} Z^{s}}{Z^{3}} P_{\mu} P_{\nu} - \frac{1}{2}\frac{Z_{m} Z^{m}}{(P^{i} P_{i})^{2}} g_{\mu\nu}
\end{array}\right)\sqrt{-g} = \\
&(-2(\frac{Z^{m}}{Z^{2}});_{m} P_{\mu} P_{\nu} - 2\frac{Z^{\lambda} Z_{\lambda}}{Z^{2}} \frac{P_{\mu} P_{\nu}}{Z} - \frac{1}{2}\frac{Z_{k} Z^{k}}{Z^{2}} g_{\mu\nu} + \frac{Z_{\mu} Z_{\nu}}{Z^{2}})\sqrt{-g}
\end{aligned} \tag{29}
$$

We subtract (28) from (29)

$$Z = P_\mu P^\mu \ and \ U_\lambda = \frac{Z_\lambda}{Z} - \frac{Z_k P^k P_\lambda}{Z^2} \ and \ L = U^\kappa U_k = \frac{Z_\lambda Z^\lambda}{Z^2} - \frac{(Z_k P^k)^2}{Z^3}$$

$$\left(\frac{\partial(L\sqrt{-g})}{\partial g^{\mu\upsilon}} - \frac{d}{dx^m}\frac{\partial(L\sqrt{-g})}{\partial g^{\mu\upsilon},_m}\right)U^\kappa U_k =$$

$$\begin{pmatrix} +2\left(\frac{(P^\lambda P_\lambda),_m P^m}{Z^3}P^k\right);_k P_\mu P_\nu + \\ 2\frac{(P^\lambda Z_\lambda)^2}{Z^3}\frac{P_\mu P_\nu}{Z} - 2\left(\frac{(P^\lambda P_\lambda),_s P^s}{Z^3}\right)Z_\mu P_\nu + \\ +\frac{1}{2}\frac{(P^\lambda Z_\lambda)^2}{Z^3}g_{\mu\nu} + \frac{(P^\lambda Z_\lambda)^2}{Z^3}\frac{P_\mu P_\nu}{Z} + \\ \left(-2\left(\frac{Z^m}{Z^2}\right);_m P_\mu P_\nu - 2\frac{Z^\lambda Z_\lambda}{Z^2}\frac{P_\mu P_\nu}{Z} - \frac{1}{2}\frac{Z_k Z^k}{Z^2}g_{\mu\nu} + \frac{Z_\mu Z_\nu}{Z^2}\right) \end{pmatrix}\sqrt{-g} =$$

$$\begin{pmatrix} +2\left(\left(\frac{(P^\lambda P_\lambda),_m P^m}{Z^3}P^k\right);_k - 2\left(\frac{Z^m}{Z^2}\right);_m\right)P_\mu P_\nu + \\ +2\frac{(P^\lambda Z_\lambda)^2}{Z^3}\frac{P_\mu P_\nu}{Z} - 2\frac{Z^\lambda Z_\lambda}{Z^2}\frac{P_\mu P_\nu}{Z} + \\ +\frac{1}{2}\frac{(P^\lambda Z_\lambda)^2}{Z^3}g_{\mu\nu} - \frac{1}{2}\frac{Z_k Z^k}{Z^2}g_{\mu\nu} + \\ +\frac{Z_\mu Z_\nu}{Z^2} - 2\left(\frac{(P^\lambda P_\lambda),_s P^s}{Z^3}\right)Z_\mu P_\nu + \frac{(P^\lambda Z_\lambda)^2}{Z^3}\frac{P_\mu P_\nu}{Z} \end{pmatrix}\sqrt{-g} =$$

$$\begin{pmatrix} +2\left(\left(\frac{(P^\lambda P_\lambda),_m P^m}{Z^3}P^k\right);_k - 2\left(\frac{Z^m}{Z^2}\right);_m\right)P_\mu P_\nu + \\ +2\frac{(P^\lambda Z_\lambda)^2}{Z^3}\frac{P_\mu P_\nu}{Z} - 2\frac{Z^\lambda Z_\lambda}{Z^2}\frac{P_\mu P_\nu}{Z} + \\ +U_\mu U_\nu - \frac{1}{2}U_k U^k g_{\mu\nu} \end{pmatrix}\sqrt{-g} = \quad (30)$$

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

$$L = \frac{(Z^s P_s)^2}{Z^3} \quad s.t.\ Z = P^\lambda P_\lambda \ and\ Z_m = (P^\lambda P_\lambda)_{,m}$$

$$\frac{\partial(L\sqrt{-g})}{\partial P_\mu} - \frac{d}{dx^\nu}\frac{\partial(L\sqrt{-g})}{\partial P_{\mu,\nu}} =$$

$$\left(\begin{array}{l} -4(\frac{(Z_s P^s)}{Z^3} P^\mu P^\nu)_{;\nu} + 4\frac{(Z_s P^s)}{Z^3}\Gamma_i{}^\mu{}_\nu P^i P^\nu + \\ +4\frac{(Z_s P^s)}{Z^3} P^\mu{}_{;\nu} P^\nu - 4\frac{(Z_s P^s)}{Z^3}\Gamma_i{}^\mu{}_k P^i P^k + \\ +2\frac{Z_m P^m Z^\mu}{Z^3} - 6\frac{(Z_m P^m)^2}{Z^4} P^\mu \end{array} \right)\sqrt{-g} = \tag{31}$$

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

$$L = \frac{Z^s Z_s}{Z^2} \quad s.t.\ Z = P^\lambda P_\lambda \ and\ Z_m = (P^\lambda P_\lambda)_{,m}$$

$$\frac{\partial(L\sqrt{-g})}{\partial P_\mu} - \frac{d}{dx^\nu}\frac{\partial(L\sqrt{-g})}{\partial P_{\mu,\nu}} =$$

$$\left(\begin{array}{l} -4(\frac{P^\mu Z^\nu}{Z^2})_{;\nu} + \frac{4}{Z^2}\Gamma_i{}^\mu{}_k P^i Z^k + \\ +\frac{4}{Z^2} P^\mu{}_{;\nu} Z^\nu - \frac{4}{Z^2}\Gamma_i{}^\mu{}_k P^i Z^k + \\ -4\frac{Z_m Z^m}{Z^3} P^\mu \sqrt{-g} \end{array} \right)\sqrt{-g} = \tag{32}$$

$$(-4(\frac{Z^\nu}{Z^2})_{;\nu} - 4\frac{Z_m Z^m}{Z^3})P^\mu\sqrt{-g}$$

We subtracted the Euler Lagrange operators of $\frac{(Z^s P_s)^2}{Z^3}\sqrt{-g}$ in (28) from the Euler Lagrange operators of $\frac{Z^\lambda Z_\lambda}{Z^2}\sqrt{-g}$ in (29) and got (30) and we will subtract (31) from (32) to get two tensor equations of gravity, these will be (33), and (36).

Assuming $\sigma = 8\pi$, where the metric variation equations (27), (28), (29) and (30) yield

$$Z = N^2 = P_\mu P^\mu \ , \ U_\lambda = \frac{Z_\lambda}{Z} - \frac{Z_k P^k P_\lambda}{Z^2}, L = \frac{1}{4}U_i U^i \ \text{ and } Z = P^k P_k$$

$$\frac{8\pi}{\sigma}\frac{1}{4}\begin{pmatrix} +2\left(\left(\frac{(P^\lambda P_\lambda),_m P^m}{Z^3}P^k\right);_k - 2\left(\frac{Z^m}{Z^2}\right);_m\right)P_\mu P_\nu + \\ +2\frac{(P^\lambda Z_\lambda)^2}{Z^3}\frac{P_\mu P_\nu}{Z} - 2\frac{Z^\lambda Z_\lambda}{Z^2}\frac{P_\mu P_\nu}{Z} + \\ +U_\mu U_\nu - \frac{1}{2}U_k U^k g_{\mu\nu} \end{pmatrix} =$$

$$\frac{8\pi}{\sigma}\frac{1}{4}(U_\mu U_\nu - \frac{1}{2}U_k U^k g_{\mu\nu} - 2U^k;_k \frac{P_\mu P_\nu}{Z}) = R_{\mu\nu} - \frac{1}{2}Rg_{\mu\nu} \qquad (33)$$

$$\text{s.t. } R = R_{\mu\upsilon}g^{\mu\upsilon}$$

$$\text{s.t. } R_{kj} = (\Gamma_{jk}{}^P),_p - (\Gamma_{pk}{}^P),_j + \Gamma_{p\mu}{}^P\Gamma_{jk}{}^\mu - \Gamma_{pj}{}^\mu\Gamma_{k\mu}{}^p$$

$R_{\mu\nu}$ is the Ricci tensor and $R_{\mu\nu} - \frac{1}{2}Rg_{\mu\nu}$ is the Einstein tensor [18].In general, by (27) and $\sigma = 8\pi$ (33) can be written as

$$\frac{1}{4}(U_\mu U_\nu - \frac{1}{2}U_k U^k g_{\mu\nu} - 2U^k;_k \frac{P_\mu P_\nu}{Z}) = R_{\mu\nu} - \frac{1}{2}Rg_{\mu\nu} \qquad (34)$$

If we consider Vaknin's model [14] of realization of space-time by collapse events $\psi(i = 1,2,3,\ldots.,n \to \infty)$ then we have to add the lambda * constraint to the action operator and the resulting Euler Lagrange equations for a vanishing metric variation are:

$$P = \lim_{n\to\infty} \psi(1) + \psi(2) + \cdots + \psi(n)$$

$$\int_{\Omega_4} \psi(\mathrm{k})\psi * (\mathrm{k})\sqrt{-g}d\Omega_4 = 1$$

$$0 < j < k \Rightarrow \int_{\Omega_4} \psi(\mathrm{j})\psi * (\mathrm{k})\sqrt{-g}d\Omega_4 = 0$$

$$\frac{1}{8}\left(U_\mu U *_\gamma + U *_\mu U_\gamma - \frac{1}{2}(U *^k U_k + U^k U *_k\right) g_{\mu\gamma} - 2(U^k;_k + U *^k;_k)\frac{(P_\mu P *_\gamma + P *_\mu P_\gamma)}{2Z} = R_{\mu\gamma} - \frac{1}{2}Rg_{\mu\gamma}$$
(35)

for some cosmological constant λ. Also, note our choice $\sigma = 8\pi$.

We can also see that the ordinary local conservation laws are modified if $U^k;_k \neq 0$ unless the local average around charge $(-2\overline{U}^k;_k \frac{\overline{P}_\mu \overline{P}_\nu}{\overline{Z}});^\nu = 0$ which is expected due to symmetry around the charge.

Charge-less field: The term $-2U^k;_k \frac{P_\mu P_\nu}{Z}$ in (33) 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:

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

The complimentary matrix $B^{\mu\nu} = \frac{1}{\sqrt{2}} A_{\alpha\beta}\varepsilon^{\alpha\beta\mu\nu}$ can be transformed to a real matrix due to the SU(2) x U(1) degrees of freedom and also be imaginary.From (31), (32) 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, $W^\mu = (\frac{\partial}{\partial P_\mu} - \frac{d}{dx^\nu}\frac{\partial}{\partial P_{\mu},_\nu})(U_k U^k \sqrt{-g})$

$$W^\mu =$$

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

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

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

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

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

$$W^\mu;_\mu = \left(-4U^\nu;_\nu \frac{P^\mu}{Z} - 2\frac{(Z_m P^m)}{Z^2}U^\mu\right);_\mu = 0 \qquad (36)$$

9. electro-gravity –unexpected gravity inducedby electric charge

We return to (35)

$$\frac{1}{4}(U_\mu U_\nu - \frac{1}{2}U_k U^k g_{\mu\nu} - 2U^k;_k \frac{P_\mu P_\nu}{Z}) - \frac{1}{2}\lambda PP* g_{\mu\nu} = R_{\mu\nu} - \frac{1}{2}Rg_{\mu\nu}$$

and see a startling property of the term $\frac{1}{4}(-2U^k;_k \frac{P_\mu P_\nu}{Z})$. In comparison, $\frac{1}{4}(U_\mu U_\nu - \frac{1}{2}U_k U^k g_{\mu\nu})$ looks like an energy momentum tensor of a perfect fluid and in contrast, $\frac{P_\mu P_\nu}{Z}$ consists of the unit vector $\frac{P_\mu}{\sqrt{Z}} = \frac{P_\mu}{\sqrt{P_k P^k}}$ which points to a perpendicular direction to U_μ.

The "source" of the Reeb vector U_μ can be defined by a non-zero $U^k;_k$ and its velocity need not be parallel to $\frac{P_\mu}{\sqrt{Z}}$. This property means that this term does not behave like as expected from an ordinary Energy – Momentum tensor. From (26) and from Einstein – Grossman's equation in vacuo,

We have that $-\frac{U^k;_k}{2} = \frac{\sqrt{\frac{4\pi K}{\varepsilon_0}\frac{\rho(\text{Charge})}{c^2}}}{\frac{8\pi K}{c^4}} = \rho(\text{Charge - Gravitational - Mass})c^2$ from which we infer

$\frac{\rho(\text{Charge - Gravitational - Mass})}{\sqrt{16\pi K\varepsilon_0}} = \rho(Gravitational - Mass)$ or in terms of charge Q and mass M instead of charge density and mass density,

$$M_{\text{Charge-Gravitational-Mass}} = \frac{\pm Q}{\sqrt{16\pi K\varepsilon_0}} \tag{37}$$

This means that charge can cause gravity or anti-gravity and its sign is opposite to the acceleration field around the charge. A more general form is

$M_{\text{Charge-Gravitational-Mass}} = \frac{\pm Q}{\sqrt{2\sigma K\varepsilon_0}}$ where $\sigma = 8\pi$, K is Newton's gravity constant and ε_0 is the permittivity of vacuum.

We will calculate $\frac{\pm Q}{\sqrt{16\pi K\varepsilon_0}}$ for ± 20 Coulombs.

$\frac{\pm 1Coulomb}{\sqrt{16\pi\varepsilon_0 K}} =\sim \pm 5.8023x10^9 Kg$.

Multiplied by 20 we have

$\frac{\pm 20Coulomb}{\sqrt{16\pi\varepsilon_0 K}} =\sim \pm 1.1605x10^{11} Kg$.

This renders Alcubierre Warp Drive [19] a feasible technology by charge separation. Capacitors of several pico-Farads will not yield any measurable thrust [20] because they do not separate enough charge. However, separation of virtual charge that appears during transition states of electrons as they interact with photons, and by a short lived vacuum charge, is not ruled out because they can explain the effect known as EMDrive [21] by Warp Drive [19] caused by (37).

10. Total acceleration around electric charge

In the classical non-relativistic limit, acceleration a around a charge Q at radius r will be the result of (37) and by the acceleration field that prohibits geodesic motion, see (25),

$$-\delta a \approx \frac{-KQ}{r^2\sqrt{2\sigma K\varepsilon_0}} + \sqrt{\frac{\sigma K\varepsilon_0}{2}}\frac{Q}{4\pi\varepsilon_0 r^2} = \sqrt{\frac{\sigma K}{2\varepsilon_0}}\frac{Q}{r^2}(\frac{1}{\sigma} - \frac{1}{4\pi}) = g_{Electro\_gravity} - a \tag{38}$$

If $\sigma = 8\pi$ then $-\delta a \approx \sqrt{\frac{\sigma K}{2\varepsilon_0}\frac{Q}{r^2}(\frac{1}{8\pi}-\frac{1}{4\pi})} = g_{Electro\_gravity} - a$

$$-\delta a \approx \sqrt{\frac{4\pi K}{\varepsilon_0}\frac{Q}{r^2}(\frac{1}{8\pi}-\frac{1}{4\pi})} = -\sqrt{\frac{K}{16\pi\varepsilon_0}\frac{Q}{r^2}}$$

which results in a sum of accelerations $\delta a \approx \sqrt{\frac{K}{16\pi\varepsilon_0}\frac{Q}{r^2}}$

11. Proof of conservation

Theorem: Conservation law of the real Reeb vector.

From the vanishing of the divergence of Einstein tensor and (33) in the paper, we have to prove the following:

$$\frac{1}{4}\left(U_\mu U_\nu - \frac{1}{2}U_k U^k g_{\mu\nu} - 2U^k;_k \frac{P_\mu P_\nu}{Z}\right);^\mu = G_{\mu\nu};^\mu = (R_{\mu\nu} - \frac{1}{2}Rg_{\mu\nu});^\mu = 0 \quad (39)$$

Proof:

From the zero variation by the scalar time field (36)

$$W^\mu;_\mu = \left(-4U^\nu;_\nu \frac{P^\mu}{Z} - 2\frac{(Z_m P^m)}{Z^2}U^\mu\right);_\mu = 0 \quad (40)$$

$$-\left(2U^\nu;_\nu \frac{P^\mu}{Z}\right);_\mu = \left(\frac{(Z_m P^m)}{Z^2}U^\mu\right);_\mu \quad (41)$$

$$\left(-2U^k;_k \frac{P^\mu P^\nu}{Z}\right);_\mu = \left(\frac{(Z_m P^m)}{Z^2}U^\mu\right);_\mu P^\nu - \left(2U^k;_k \frac{P^\mu}{Z}\right)P^\nu;_\mu = \left(\frac{(Z_m P^m)}{Z^2}U^\mu\right);_\mu P^\nu - U^k;_k \frac{Z^\nu}{Z} \quad (42)$$

Now let $t \equiv Z_m P^m$

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

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

so,

$$(-2U^k;_k \frac{P^\mu P^\nu}{Z});_\mu = -U^\mu;_\mu U^\nu + (\frac{t}{Z^2});_\mu U^\mu P^\nu \quad (43)$$

$$\left(U^{\mu}U^{\nu}-\frac{1}{2}U_{k}U^{k}g^{\mu\nu}-2U^{k};_{k}\frac{P^{\mu}P^{\nu}}{Z}\right);^{\mu}=$$

$$U^{\mu};_{\mu}U^{\nu}+U^{\mu}U^{\nu};_{\mu}-\frac{1}{2}(U_{k};_{\mu}U_{s}+U_{k}U_{s};_{\mu})g^{ks}g^{\mu\nu}-$$

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

$$U^{\mu}U^{\nu};_{\mu}-\frac{1}{2}(U^{s}U_{s});^{\nu}+(\frac{t}{Z^{2}});_{\mu}U^{\mu}P^{\nu}=0 \qquad (44)$$

Notice that

$$U^{\mu}U^{\nu};_{\mu}-\frac{1}{2}U^{s}U_{s};^{\nu}=$$

$$U^{\mu}\left((\frac{Z_{k}}{Z});_{\mu}-(\frac{t}{Z^{2}});_{\mu}P_{k}-(\frac{t}{Z^{2}})P_{k};_{\mu}\right)g^{k\nu}-$$

$$U^{s}\left((\frac{Z_{s}}{Z});_{k}-(\frac{t}{Z^{2}});_{k}P_{s}-(\frac{t}{Z^{2}})P_{s};_{k}\right)g^{k\nu}= \qquad (45)$$

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

Since $-(\frac{t}{Z^{2}});_{k}P_{s}U^{s}=0$

$$U^{\mu}U^{\nu};_{\mu}-\frac{1}{2}(U^{s}U_{s});^{\nu}+(\frac{t}{Z^{2}});_{\mu}U^{\mu}P^{\nu}=-U^{\mu}(\frac{t}{Z^{2}});_{\mu}P^{\nu}+(\frac{t}{Z^{2}});_{\mu}U^{\mu}P^{\nu}=0 \qquad (46)$$

and we are done.

Conclusion

An upper limit on measurable time from each event backwards to the "big bang" singularity as a limit or from a manifold of events as in de Sitter or anti - de Sitter, may exist only as a limit and is not a practical physical observable because it can only be theoretically measured. Since more than one curve on which such time can be virtually measured intersects the same event - as is the case in material fields which prohibit inertial motion, i.e. prohibit free fall - such a time can't be realized as a coordinate. Nevertheless, using such time as a scalar field, enables to describe matter as acceleration fields by using the gradient of the scalar field and it allows new physics to emerge by a replacement of the stress-energy-momentum tensor. One arrives at electro-gravity as a neat explanation of the Dark Matter effect and the advent of Sciama's Inertial Induction, which becomes realizable by separation of high electric charge. This paper totally rules out any measurable Biefeld Brown effect in vacuum on Pico-Farad or less, Ionocrafts due to insufficient amount of electric charge [20]. The electro-gravitational effect is due to field divergence and not directly due to intensity or gradient of the square norm. Inertial motion prohibition by material fields, e.g. intense electrostatic field, can be measured as a very small mass dependent force on neutral particles that have rest mass and thus can measure proper time. The non-gravitational acceleration should be from the positive to the negative charge. The electro-gravitational effect which is opposite in direction and half in intensity, requires large amounts of separated charge carriers and acts on the entire negative to positive dipole.

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Also, in the Book of Principals by the philosopher Rabbi Joseph Albo, essay 18 appears to be the first known historical account of what Measurable Time – In Hebrew "ZmanMeshoar" and Immeasurable Time "ZmanBiltiMeshoar" are. His Idea of the immeasurable time as a limit [22], is the very reason for 11 years of research and for this paper.

AppendixA– The time field in the Schwarzschild solution
Motivation: To make the reader familiar with the idea of maximal proper time from a sub-manifold and to calculate the background scalar time field of the Schwarzschild solution from that sub-manifold. We choose as a sub-manifold, a small 3 dimensional 3-spehere around the "Big Bang" singularity and therefore this example is limited to a "Big Bang" manifold. So, we want to connect each event in a Schwarzschild solution to a primordial sub-manifold a fraction of second after the presumed "Big Bang", with the longest possible curve under the assumption that no closed time-like curves occur.
In this limited case, the scalar field is uninteresting as it does not represent interactions with any charged particle or with other force fields and therefore, the Reeb vector is zero.
We would like to calculate $\dfrac{U_s U^s}{4} = \dfrac{1}{4}\left(\dfrac{(P_\lambda P^\lambda),_m (P_\lambda P^\lambda),_k g^{mk}}{(P_i P^i)^2} - \dfrac{((P_\lambda P^\lambda),_m P^m)^2}{(P_i P^i)^3}\right)$ in Schwarzschild coordinates for a freely falling particle. This theory predicts that where there is no matter, the result must be zero. The speed U of a falling particle from very far away, as measured by an observer in the gravitational field is

$$V^2 = \frac{U^2}{c^2} = \frac{R}{r} = \frac{2GM}{rc^2} \tag{A.1}$$

Where R is the Schwarzschild radius. If speed V is normalized in relation to the speed of light then $V = \dfrac{U}{c}$. For a far observer, the deltas are denoted by dt', dr' and,

$$\dot{r}^2 = (\frac{dr}{dt})^2 = V^2(1-\frac{R}{r}) \tag{A.2}$$

because $dr = dr'/\sqrt{1-R/r}$ and $dt = dt'\sqrt{1-R/r}$.

$$P = \int_0^t \left((1-\frac{R}{r}) - \frac{\dot{r}^2}{(1-\frac{R}{r})} \right)^{\frac{1}{2}} dt = \int_0^t \left((1-\frac{R}{r}) - \frac{\frac{R}{r}(1-\frac{R}{r})^2}{(1-\frac{R}{r})} \right)^{\frac{1}{2}} dt =$$

$$\int_0^t \left((1-\frac{R}{r})^2 \right)^{\frac{1}{2}} dt = \int_0^t (1-\frac{R}{r}) dt$$

which results in,

$$P_t = \frac{dP}{dt} = (1-\frac{R}{r}) \tag{A.3}$$

Here t is not a tensor index and it denotes derivative by t !
On the other hand

$$P = \int_0^r \left((1-\frac{R}{r})\frac{1}{\dot{r}^2} - \frac{1}{(1-\frac{R}{r})} \right)^{\frac{1}{2}} dr = \int_0^r \left(\frac{(1-\frac{R}{r})\frac{r}{R}}{(1-\frac{R}{r})^2} - \frac{1}{(1-\frac{R}{r})} \right)^{\frac{1}{2}} dr = \int_0^r \left(\frac{\frac{r-R}{R}}{\frac{r-R}{r}} \right)^{\frac{1}{2}} dr =$$

$$\int_0^r \sqrt{\frac{r}{R}} dr$$

Which results in

$$P_r = \frac{dP}{dr} = \sqrt{\frac{r}{R}} \tag{A.4}$$

Here, r is not a tensor index and it denotes derivative by r !
For the square norms of gradients, we use the inverse of the metric tensor,

So, we have $(1-\frac{R}{r}) \rightarrow (1-\frac{R}{r})^{-1}$ and $(1-\frac{R}{r})^{-1} \rightarrow (1-\frac{R}{r})$

So, we can write

$$N^2 = P_\lambda P^\lambda = (1-\frac{R}{r})P_r^{\,2} - (1-\frac{R}{r})^{-1} P_t^{\,2} = (1-\frac{R}{r})(\frac{r}{R}-1) = \frac{r}{R} + \frac{R}{r} - 2$$

$$N^2 = \frac{r}{R} + \frac{R}{r} - 2 \tag{A.5}$$

$N^2{}_\lambda = \dfrac{dN^2}{dx^\lambda}$ And we can calculate

$$\frac{N^2{}_\lambda N^{2\lambda}}{(N^2)^2}=\frac{(1-\frac{R}{r})^2(\frac{1}{R}-\frac{R}{r^2})^2}{(\frac{r}{R}+\frac{R}{r}-2)^2} \tag{A.6}$$

We continue to calculate

$$N^2{}_t P_t=(1-\frac{R}{r})^2(\frac{1}{R}-\frac{R}{r^2})\sqrt{\frac{R}{r}} \text{ and } \frac{N^2{}_t P_t}{(1-\frac{R}{r})}=(1-\frac{R}{r})(\frac{1}{R}-\frac{R}{r^2})\sqrt{\frac{R}{r}} \tag{A.7}$$

Note that here t is not a tensor index and it denotes derivative by t !

$$(1-\frac{R}{r})N^2{}_r P_r=(1-\frac{R}{r})(\frac{1}{R}-\frac{R}{r^2})\sqrt{\frac{r}{R}} \tag{A.8}$$

Please note, here r is not a tensor index and it denotes derivative by r !

$N^2{}_\lambda P^\lambda=(1-\frac{R}{r})(\frac{1}{R}-\frac{R}{r^2})(\sqrt{\frac{r}{R}}-\sqrt{\frac{R}{r}})$ and

$$(N^2{}_\lambda P^\lambda)^2=(1-\frac{R}{r})^2(\frac{1}{R}-\frac{R}{r^2})^2(\frac{r}{R}+\frac{R}{r}-2) \tag{A.9}$$

So

$$\frac{(N^2{}_\lambda P^\lambda)^2}{(N^2)^3}=\frac{(1-\frac{R}{r})^2(\frac{1}{R}-\frac{R}{r^2})^2}{(\frac{r}{R}+\frac{R}{r}-2)^2} \tag{A.10}$$

And finally, from (A.6) and (A.10) we have,

$$\frac{(P^\lambda P_\lambda),_m (P^s P_s),_k g^{mk}}{(P_i P^i)^2}-\frac{(P^\lambda P_\lambda),_m P^m}{(P_i P^i)^3}=$$

$$\frac{N^2{}_\lambda N^{2\lambda}}{(N^2)^2}-\frac{N^2{}_\lambda P^\lambda}{(N^2)^3}=\frac{(1-\frac{R}{r})^2(\frac{1}{R}-\frac{R}{r^2})^2}{(\frac{r}{R}+\frac{R}{r}-2)^2}-\frac{(1-\frac{R}{r})^2(\frac{1}{R}-\frac{R}{r^2})^2}{(\frac{r}{R}+\frac{R}{r}-2)^2}=0 \tag{A.11}$$

which shows that indeed the gradient of time measured, by a falling particle until it hits an event in the gravitational field, has zero curvature as expected.

Appendix B – Planck Area Gravity – Based on a lecture by professor Seth Lloyd of the M.I.T combined with the Geometric Chronon model and its correlation with sub-atomic particles

Suppose we have an atomic length L , The speed of light is c so the maximal acceleration will be $\frac{c}{\frac{L}{c}}=\frac{c^2}{L}$. By the real case (33), $\frac{1}{4}(U_\mu U_\nu-\frac{1}{2}U_k U^k g_{\mu\nu}-2U^k;_k\frac{P_\mu P_\nu}{Z})=R_{\mu\nu}-\frac{1}{2}Rg_{\mu\nu}$

Then

$$\frac{1}{4}(U_\mu U_\nu - \frac{1}{2}U_k U^k g_{\mu\nu} - 2U^k;_k \frac{P_\mu P_\nu}{Z})\frac{P^\mu P^\nu}{Z} = (R_{\mu\nu} - \frac{1}{2}Rg_{\mu\nu})\frac{P^\mu P^\nu}{Z}$$

which becomes

$$-\frac{1}{8}U_k U^k - \frac{1}{2}U^k;_k = (R_{\mu\nu} - \frac{1}{2}Rg_{\mu\nu})\frac{P^\mu P^\nu}{Z} \qquad \text{(B.1)}$$

If the right-hand side if multiplied by $\frac{1}{2}$ and then by $\frac{\pi}{12}L^4$ then it yields the missing or added area to the sphere perpendicular to the unit vector $\frac{P^\mu}{\sqrt{Z}}$ [23], [24]. The term $\frac{1}{2}$ is required because $\frac{1}{2}(R_{\mu\nu} - \frac{1}{2}Rg_{\mu\nu})\frac{P^\mu P^\nu}{Z}$ is the sum of sectional curvatures of the infinitesimal 3-volume ball which is perpendicular to the vector P^μ. When this sum of sectional curvatures is multiplied by $\frac{\pi}{12}L^4$, it yields the area that is subtracted or added due to gravity or anti-gravity.

$$\frac{\pi}{24}(R_{\mu\nu} - \frac{1}{2}Rg_{\mu\nu})\frac{P^\mu P^\nu}{Z}L^4 = -Area \qquad \text{(B.2)}$$

Then by (B.1)

$$\frac{\pi}{24}(-\frac{1}{8}U_k U^k - \frac{1}{2}U^k;_k)L^4 = -Area \qquad \text{(B.3)}$$

We replace $-\frac{1}{2}U_k$ by 4-acceleration divided by c^2 and we have $-\frac{1}{2}U_k = \frac{c^2}{Lc^2} = \frac{a_k}{c^2} = \frac{1}{L}$ so (B.3) becomes

$$\frac{\pi}{24}(\frac{1}{2}\frac{1}{L^2} \pm \frac{1}{c^2}\frac{c^2}{L}\frac{1}{L})L^4 = \frac{\pi}{24}L^2(\frac{1}{2} \pm 1) = -Area \qquad \text{(B.4)}$$

Because $-\frac{1}{8}U_k U^k g_{\mu\nu} = \frac{1}{2}\frac{1}{L}\frac{1}{L} = \frac{1}{2}\frac{1}{L^2}$ and also $-\frac{1}{2}U^k;_k = \pm\frac{1}{c^2}\frac{c^2}{L^2}$

Which is either an addition to the area or subtraction from the area due to the divergence term $\frac{1}{4}(-2U^k;_k) = -\frac{1}{2}U^k;_k$ so, $-\frac{\pi}{24}L^2\frac{3}{2} = Area$ or $+\frac{\pi}{24}L^2\frac{1}{2} = Area$

Divide these areas by the area of the two-dimensional sphere $4\pi L^2$ and we have ratios,

$$\frac{-\frac{\pi}{24}L^2\frac{3}{2}}{4\pi L^2} = \frac{-\frac{1}{24}\frac{3}{2}}{4} = -\frac{1}{64} \quad \text{or} \quad \frac{+\frac{1}{24}\frac{1}{2}}{4} = +\frac{1}{192} \qquad \text{(B.5)}$$

But we didn't take into account that the geodesic motion prohibition field i.e. acceleration field changes its density on the sphere in accordance with increased or decreased area ratio α.
(B.4) can be rewritten as a more enlightening term,

$$1 + \frac{\frac{\pi}{24}(-\frac{1}{2}\frac{1}{\alpha^2 L^2} \pm \frac{1}{c^2}\frac{c^2}{L\alpha}\frac{1}{L})L^4}{4\pi L^2} = 1 + \frac{1}{96}(-\frac{1}{2}\alpha^{-2} \pm \alpha^{-1}) = \frac{4\pi L^2 + Area}{4\pi L^2} = \alpha \qquad \text{(B.6)}$$

Such that α is either bigger than 1 or smaller than 1 and denotes the increase or decrease in area. Note that the term α measures how much the square acceleration field changes as the area grows or dwindles.

The resulting equation is a cubic equation: $1+\frac{1}{96}(-\frac{1}{2}\alpha^{-2}\pm\alpha^{-1})=\alpha$ that can be easily solved numerically.

$$1+\frac{1}{96}(-\frac{1}{2}\alpha^{-2}\pm\alpha^{-1})=\alpha \Rightarrow$$
$$192\alpha^3=192\alpha^2\pm 2\alpha^{-1}-1 \Rightarrow \alpha^3=\frac{192\alpha^2\pm 2\alpha^{-1}-1}{192} \Rightarrow \alpha=(\frac{192\alpha^2\pm 2\alpha^{-1}-1}{192})^{\frac{1}{3}} \quad \text{(B.7)}$$

The area is increased or decreased by α and the portion of the area that changes is

$$\alpha \sim= 1.005208193610747100 \Rightarrow (\frac{1}{1-\alpha})^{-1} \sim= +(192.00515087160028...)^{-1}$$

around a negative charge or

$$\alpha \sim= 0.99207267636432284 \Rightarrow (\frac{1}{\alpha-1})^{-1} \sim= -(62.639539339674555...)^{-1}$$

around a positive charge. The problem is that there is no stable charged particle without spin and therefore our discussion could mean a temporary decomposition of electrically neutral Bosons into two energy states, one temporarily behaving like a negative charge and one like a positive one. The reasoning behind such a claim is that if matter is expressible by a weak acceleration field and the weak acceleration field energy is the energy of an electric field, then elementary neutral particles, even with zero magnetic momentum and with zero electric dipole, should have an internal electric field.

The question is how to infer such a structure. The idea is that area changes are relative to energy ratios even if they are changes due to charge electro-gravity and not due to inertial mass. It is a manifestation of a holographic principle [23], [24]. Our modest test will be to divide the Higgs energy by 2 and then either by 192.005150 ...,or by 62.6395393 .... That is by Beta = **384.010301743200560** or by Alpha =**125.279078679349110**.

For example: 125 GeV / 125.279078679349110 ~= **0.9977 GeV** which should be a Baryonic energy state. Another energy is 125 GeV / 384.01030174320056 ~= **325.5 MeV**

This energy is the model dependent vacuum constituent Quark energy according to Zhao Zhanget. al. [25].

According to this paper, no neutral particle can avoid having an internal structure, otherwise, the particle would not be able to manifest an acceleration field as energy. This leads to the possible model of BS Meson, Z Boson and Higgs Boson as either oscillating + and – charge such that both the magnetic and electric dipoles are zero, or as spinning + and - charge such that both magnetic and electric dipoles vanish. The problem is the Z and the Higgs bosons which are considered elementary particles. The Z boson mass is $91.1876 \pm 0.0021\, GeV/C^2$. If we split this mass into two charges, then 1/ 192.00515087160028 of area around the negative charge will be added, which is considered as proportional to mass [23]. But that portion is of half of the mass that splits to two charges, so we seek1/384.00258393161619 of the mass of the Z boson as having a physical meaning.

$$91.1876\, GeV/(384.0103) = 237.4613 \text{ MeV} \quad \text{(B.8)}$$

which is the energy difference between the Phi (previously Eta) and Omega Mesons !

By the Checkered Board Model and EMS [26] the mass of the up Quark deviates from the Standard Model's ~ 2.3 MeV/C ^{2} and is 237.31 MeV/C ^{2} according to that very same model, the down Quark is 42.39Mev/C ^{2} unlike the S.M. ~ 4.8 MeV/C ^{2}. The Z boson can contribute to mass fluctuations through half of its mass by area fluctuations around a positive charge too but that yields 727.87572 MeV and there is no known 727.876 MeV resonance in the particles world.

Here is a summary of the electro-gravity energy in the Planck scale around a positive and a negative charge that split an elementary boson and by this, these energies are beyond the Standard Model.

Table 1. Presumed Beta and Alpha energy ratios due to a splitting of an Elementary charge-less boson into positive and negative charge – a supposed process which is beyond the Standard Model. A second assumption is that the magnetic moments and the electric dipoles of such bosons are zero, therefore split charge should be fluctuating and so is the area around positive and negative charge.

	Energy delta (GeV)	**Energy sum (GeV)**	Area expansion ratio around e- r2=1.005208194 Beta=2/(r2-1) **1/384.0103087 of the energy**	Area contraction ration around e+ r1=0.984035643 Alpha=2/(1-r1) **1/125.27908 of the energy**
Higgs Boson energy portion	125 GeV *(1/Alpha-1/Beta)	125 GeV *(1/Alpha+1/Beta)	125 GeV/Beta	125 GeV/Alpha
Higgs Boson electro-gravitational energy	0.67226024 Delta of the last two cells in this row	1.323284428 About **1.323GeV** Sum of the next two cells	Gravitational energy delta around e- 0.325512095 GeV About **325.5 MeV**	Gravitational energy delta around e+ 0.997772333 GeV About **1.0 GeV**
Z Boson Energy portion	91.1876GeV *(1/Alpha-1/Beta)	91.1876GeV *(1/Alpha+1/Beta)	91.1876 GeV/Beta	91.1876 GeV/Alpha
Z Boson electro-gravitational-l energies	0.49041438 Delta of the last two cells in this row	0.965337049 About **0.965GeV** Sum of the next two cells	Gravitational energy delta around e- 0.237461334 GeV About **237.46 MeV**	Gravitational energy delta around e+ 0.727875715 GeV About **728 MeV**

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