“Unified 4-Dimensional Hyperspace Equilibrium” beyond Einstein 4-Dimensional, Kaluza-Klein 5-Dimensional and Superstring 10- and 11 Dimensional Curved Hyperspaces

The Origin of Mass, Electric Charge and Magnetic Spin

Author:	Wim Vegt
Country:	The Netherlands
Website:	http://wimvegt.topworld.center
Email:	j.w.vegt@topacademy.center
Calculations:	All Calculations in Mathematica 11.0 have been printed in a PDF File

Index

1.1 "Unified 4-Dimensional Hyperspace Equilibrium" beyond Einstein 4-Dimensional, Kaluza-Klein 5-Dimensional and Superstring 10- and 11 Dimensional Curved Hyperspaces

Albert Einstein, Lorentz and Minkowski published in 1905 the Theory of Special Relativity and Einstein published in 1915 his field theory of general relativity based on a curved 4-dimensional space-time continuum to integrate the gravitational field and the electromagnetic field in one unified field. Since then the method of Einstein's unifying field theory has been developed by many others in more than 4 dimensions resulting finally in the well-known 10-dimensional and 11-dimensional "string theory".

String theory is an outgrowth of S-matrix theory, a research program begun by Werner Heisenberg in 1943 (following John Archibald Wheeler's[3] 1937 introduction of the S-matrix), picked up and advocated by many prominent theorists starting in the late 1950's.

Theodor Franz Eduard Kaluza (1885-1954), was a German mathematician and physicist well-known for the Kaluza–Klein theory involving field equations in curved five-dimensional space. His idea that fundamental forces can be unified by introducing additional dimensions re-emerged much later in the "String Theory".

The original Kaluza-Klein theory was one of the first attempts to create an unified field theory i.e. the theory, which would unify all the forces under one fundamental law. It was published in 1921 by Theodor Kaluza and

extended in 1926 by Oskar Klein. The basic idea of this theory was to postulate one extra compactified space dimension and introduce nothing but pure gravity in a new (1 + 4)-dimensional space-time. Klein suggested that the fifth dimension would be rolled up into a tiny, compact loop on the order of 10^{-35} [m]

In classical unified field theory, the electromagnetic and gravitational interactions are defined by the field equations e.g.:

$$\partial_a \, \mathrm{F}^{ab} \, - \xi \, \mathrm{R}_a^b \, \mathrm{A}^a = - 4 \, \pi \, \mathrm{J}^b \text{ with } \xi = -2 \qquad (1.a)$$

where F^{ab} is the antisymmetric electromagnetic field tensor defined by the potential vector A^a, R_a^b is the Ricci curvature tensor of the hypersurface, and J^b is the electric current density vector. The electromagnetic field equation differs from the Einstein-Maxwell equation by a curvature-coupled term[1] $\xi \, \mathrm{R}_a^b \, \mathrm{A}^a$.

Till now the continuing of the method of Einstein's unifying field theory in a 4-dimensional curved space-time continuum in curved multi-dimensional hyperspaces has not resulted in a successful Grand Unified Field Theory which explains the discrete values for electric charge, magnetic spin and the mass of all known elementary particles.

The fundamental question is: Is a hyperspace curved multi-dimensional approach like the the 11-dimensional Superstring theory the only way to combine fundamentally different fields into one Grand Unifying Theory. Or is there a different way?

In this new theory a fundamentally different path has been chosen. In the basic theory of the "Lorentz-Einstein-Minkovski" transformations (1905) two fundamentally different fields, the electric field and the magnetic field have been integrated into one 4-dimensional theory expressed by the electromagnetic potential 4-vector A^a.

Instead of defining the electric field and the magnetic field separately in a curved 6- or 7-dimensional hyperspace, both fields are integrated by the common fundamental effect of the force density f^a. The electric field and the magnetic field are fundamentally different but have "the same origin" A^a and "the same effect" of a force density f^a acting on an arbitrary electromagnetic field configuration (particle or field).

Instead of focusing on the differences in the separate fields and putting the differences in the separate fields in separate dimensions, this theory focusses on that what is in common. The "Origin" and the "Effect".

There is only one Origin for all the different fields (gravitational field, electromagnetic field etc.). There is only one single common effect, the force density f^a acting on a field configuration (elementary particle or field).

This theory focusses on that what is in common. The resulting force densities f^a which have to equal zero at any time at any place in any direction to realize a Universe in Harmony and Equilibrium integrating in this way the very different fields in a Unified 4-dimensional Space-Time continuum.

In this new fundamentally different approach the different interactions (gravity, electromagnetic interaction etc.) has not been interpreted as a curvature of a hyperspace in a 5-, 10- or 11 dimensional space (string theory) .

The new theory has been based on the single concept of "Fundamental Harmony within the Universe". A Unified Field Theory which results in the confinements of electromagnetic radiation (light) within dimensions smaller than 10^{-85} [m], carrying discrete values (positive or negative) for electric charge in monopole, di-pole or multipole configurations, carrying discrete values (positive or negative) for magnetic string in monopole, di-pole or multipole configurations and carrying (electromagnetic) mass with the property of inertia according Newton's second law of motion.

The Unified Field Theory has been based on the fundamental question for the existence of light (electromagnetic radiation). What are the fundamental boundaries which are required for a stable electromagnetic field configuration in which light can exist?

There is only one boundary condition. **"The electromagnetic field has to be in a perfect equilibrium (balance) with itself and its surrounding.**" And when an electromagnetic field interacts with a gravitational field, weak interaction or strong interaction **exactly the same boundary condition is required**. That is the single and only requirement.

From this single requirement follows one single equation. Equation (5) (gravity excluded) and Equation (5-a) (gravity included) in this manuscript.

John Archibald Wheeler [3] introduced in 1953 the concept of GEONS (**G**ravitational **E**lectr**O**-magnetic e**N**tities) in which electromagnetic radiation has been confined by its own gravitational field. To calculate the dimensions of these gravitational-electromagnetic confinements Wheeler based his calculations on the Einstein-Maxwell equations, the mathematical ground on which the Theory of General Relativity has been built and found electromagnetic-gravitational confinements with a diameter of several lightyears and a lifetime of several milliseconds. The results were very disappointing because an elementary particle with a diameter of several lightyears and a lifetime of a few milliseconds can hardly be considered as an elementary particle.

In the presented theory the electromagnetic-gravitational interaction has been grounded on Newton's third law. It has been grounded on the stability of electromagnetic-gravitational fields in a perfect equilibrium with itself and its surrounding. In table 1, electromagnetic-gravitational confinements have been presented for any harmonic (sinusoidal) frequency with an infinite lifetime and diameters varying from $<10^{-40}$ and $>10^{+40}$ [m] based on equation 5-a in a spherical coordinate system.

Because this fundamental approach in electromagnetic field configurations is different than the classical approach

by J. Maxwell and A. Einstein, a different result is expected. Instead of electromagnetic-gravitational confinements with a diameter of several lightyears and a lifetime of several milliseconds, presented by J. Wheeler in 1953, electromagnetic-gravitational confinements have been presented in Table 1 with diameters varying from $<10^{-40}$ [m] and $>10^{+40}$ [m] and an infinite lifetime for any harmonic frequency based on equation (5-a).

In a way comparable to the way that GEONS (**G**ravitational **E**lectr**O**-magnetic e**N**tities) are described by J. Wheeler in General Relativity by the Gravitational-Electromagnetic Equilibrium Equation [1,7,8,13,35,38] (the Einstein-Maxwell Equations) , Electromagnetic Confinements are described by the Dynamic Equilibrium Equation (5).

Newton's Third law has been generalized in all layers of Physics. There is no reason not to generalize Newton's third law also within electromagnetic fields. To generalize Newton's third law within Electromagnetic Field Configurations, the Divergence has been taken of the Stress Energy Tensor (3) , which results in Equation (4) to calculate the force densities f within the Electromagnetic Field Configuration.

The Energy Momentum Tensor[9] equals:

$$T^{ab} = \frac{1}{\mu_0}\left[F_{ac} F^{cb} + \frac{1}{4}\delta_{ab} F_{cd} F^{cd} \right] \qquad (1)$$

In which F_{ab} are the elements of the Maxwell Tensor defined by:

$$F_{ab} = \partial_b \varphi_a - \partial_a \varphi_b \qquad (2)$$

The four-vector potential φ_a is defined by: $\varphi_a = \left\{ i\,\varphi / c, \overline{A} \right\}$ where φ is the electric scalar potential, c the speed of light in vacuum and $\overline{A}$ is the magnetic vector potential[1,2,3]. Substituting (2) in (1) results in the Stress Energy Tensor[1,16,29] :

$$T^{ab} = \begin{bmatrix} w & -\frac{i}{c}S_x & -\frac{i}{c}S_y & -\frac{i}{c}S_z \\ -\frac{i}{c}S_x & \varepsilon_0 (E_x)^2 + \mu_0 (H_x)^2 - w & \varepsilon_0 E_x E_y + \mu_0 H_x H_y & \varepsilon_0 E_x E_z + \mu_0 H_x H_z \\ -\frac{i}{c}S_y & \varepsilon_0 E_y E_x + \mu_0 H_y H_x & \varepsilon_0 (E_y)^2 + \mu_0 (H_y)^2 - w & \varepsilon_0 E_y E_z + \mu_0 H_y H_z \\ -\frac{i}{c}S_z & \varepsilon_0 E_z E_x + \mu_0 H_z H_x & \varepsilon_0 E_z E_{xy} + \mu_0 H_z H_y & \varepsilon_0 (E_z)^2 + \mu_0 (H_z)^2 - w \end{bmatrix} \qquad (3)$$

In the absence of any Gravity, the force density f^a in the 3 directions of the 3 coordinates of the chosen 3-coordinate system follows from the (4-dimensional) Divergence of the (4-dimensional) Stress Energy Tensor [8,9,38] (3).

The Divergence of a Vector equals a Scalar. The Divergence of a Tensor equals a Vector. The 4-dimensional Divergence of the 4-dimensional Stress Energy Tensor (4) equals the 4-dimensional Force-density Vector.