Unification of Gravity with Electromagnetism

Stephen Joseph Kennedy Ph.D.

December 14, 2023

Former Physics and Astronomy Lecturer; University of Massachusetts at Dartmouth dr.sjkennedy@gmail.com

Abstract

Maxwell wrote that he wanted to "leaven" his Treatise on Electromagnetism with Quaternions[1][2][3][4]. Maxwell died before doing this. Silberstein[5][6][7] and Conway[8][9] accomplished this partially.This presentation claims the Lorentz condition field is the gravitational potential. Resulting in a Gravitic-Electromagnetic unification.

Part I

Introduction

Whenever mass is created, even a small amount, an appropriate amount of gravity must be created also. According to an idea by Alan Guth[10] "gravitons" should have negative mass. When a "graviton" interacts with a positive mass, the positive mass, in order to conserve momentum, the positive mass must react by going in the direction of the graviton source. Since $E = mc^2$, Einstein's idea that energy and mass are the same thing, when something as simple as a hydrogen atom absorbs an electromagnetic wave of an appropriate frequency, the hydrogen atom's mass increases by $+\Delta m = \frac{hf}{c^2}$. The hydrogen atom must then increase (actually decrease) the energy of its gravitational field by $-\Delta m = \frac{-hf}{c^2}$. At first this seems to be at odds with classical electromagnetism, however, it is not as will be shown. If a negative mass graviton rides along with a positive mass photon it explains how a massive photon can go at the speed of light, while objects of finite mass are restricted by relativity from ever attaining this supposed universal speed limit. This is because $m = \frac{m_0}{\sqrt{1 - \frac{v^2}{c^2}}}$ so that the mass goes to infinity as velocity goes to the speed of light. Negative mass gravitons in a vacuum are not in conflict with the curved-distorted Euclidean space of general relativity, in fact they are why the space is distorted. The "tensor" basis of relativity, however, should be replaced by Hamilton's biquaternions or the equivalent Pauli Algebra. See figures 1A and 1B for "photo-graviton' absorption and emission. and also equations (9) and (9A). The electromagnetic-gravity unified "field" is a seven dimensional entity expressed by either a complex quaternion or in a slightly modified form as a Pauli quaternion ; $\overleftrightarrow{\mathscr{F}} = G - \overrightarrow{E} + i\overrightarrow{B}$ see equations (5) to (7) below and Figure 1A for clarification.

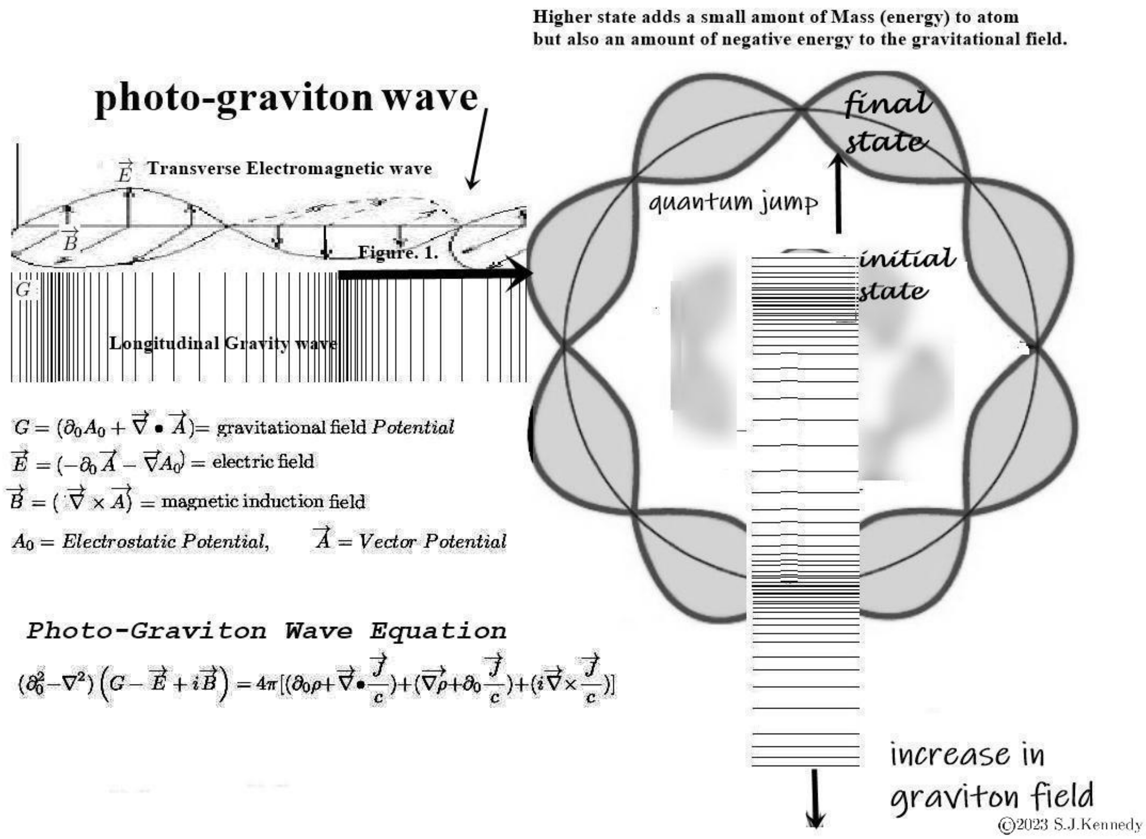


Figure*1A* The above is a model that depicts an electromagnetic wave associated with a photon having energy E= hf coupled to a gravity wave and posited graviton with Energy E= -hf together they have a zero mass, solving the paradox of how an energetic and therefore massive photon can travel at the speed of light. If both photon and graviton have spin 1 then the "photo-graviton" has spin 2 as some theories require. When the photo-graviton is absorbed by an atom as depicted by the Debroglie-Bohr model atom to the right , the photon and graviton split, with the energy and mass of the atom increasing and gravitational field associated with the mass increasing strength,while the mass of the gravitational field decreases.

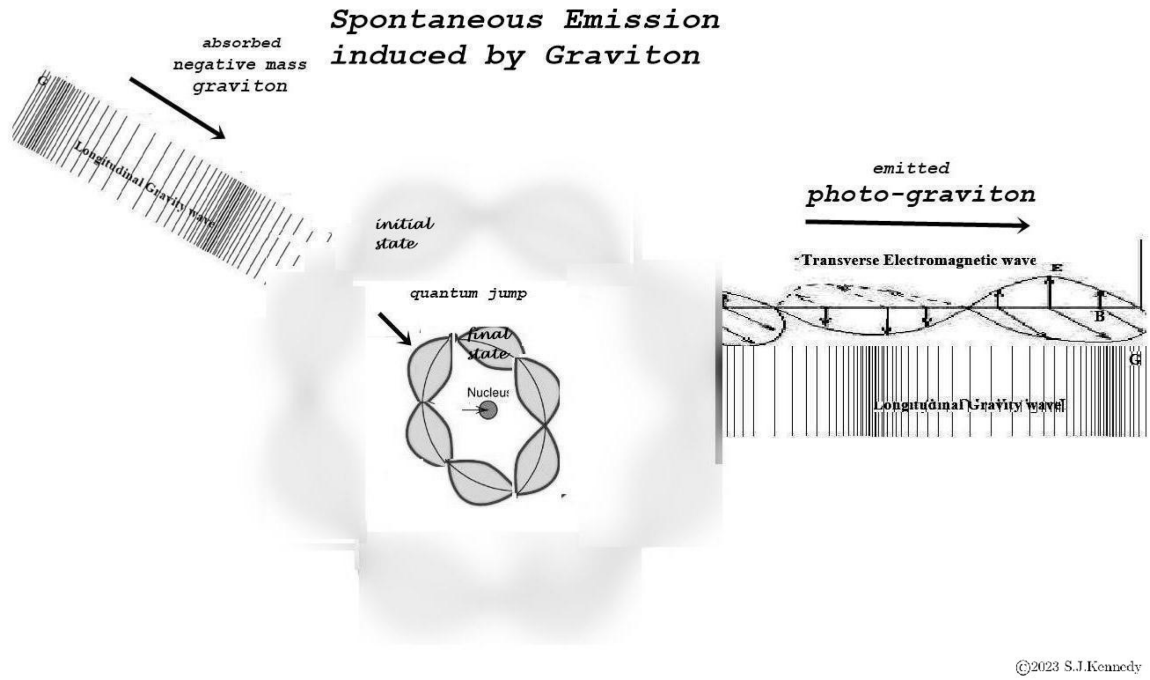


Figure 1B This depicts the reverse effect of photo-graviton absorbtion depicted in Figure 1A. An excited Atom (or in general any quantum state) emits a photo-graviton after interacting with a free graviton.

See Sakurai ref [25] p42-43 spontaneous emmision in dipole approximation use Vector potential part of gravitational field to get standard result.

1 Explanation for Crookes Radiometer's Counter Intuitive Motion. Experimental confirmation of Photo-gravitons.

The zero mass photo-graviton explains the unresolved observations in the so-called Crookes radiometer. The standard explanation was disputed by Maxwell and later Einstein[1]. The model presented in figures 1A and 1B suggests that the reflected part of the Crookes Radiometer does not respond to the zero mass photo- graviton while the absorbing side, absorbs only the positive-mass electromagnetic part of the photo-graviton while the negative mass part of the photo-graviton becomes part of the gravitational field; causing the radiometer to spin in the observed direction.

[1]See Wikipedia article on "Crookes Radiometer"

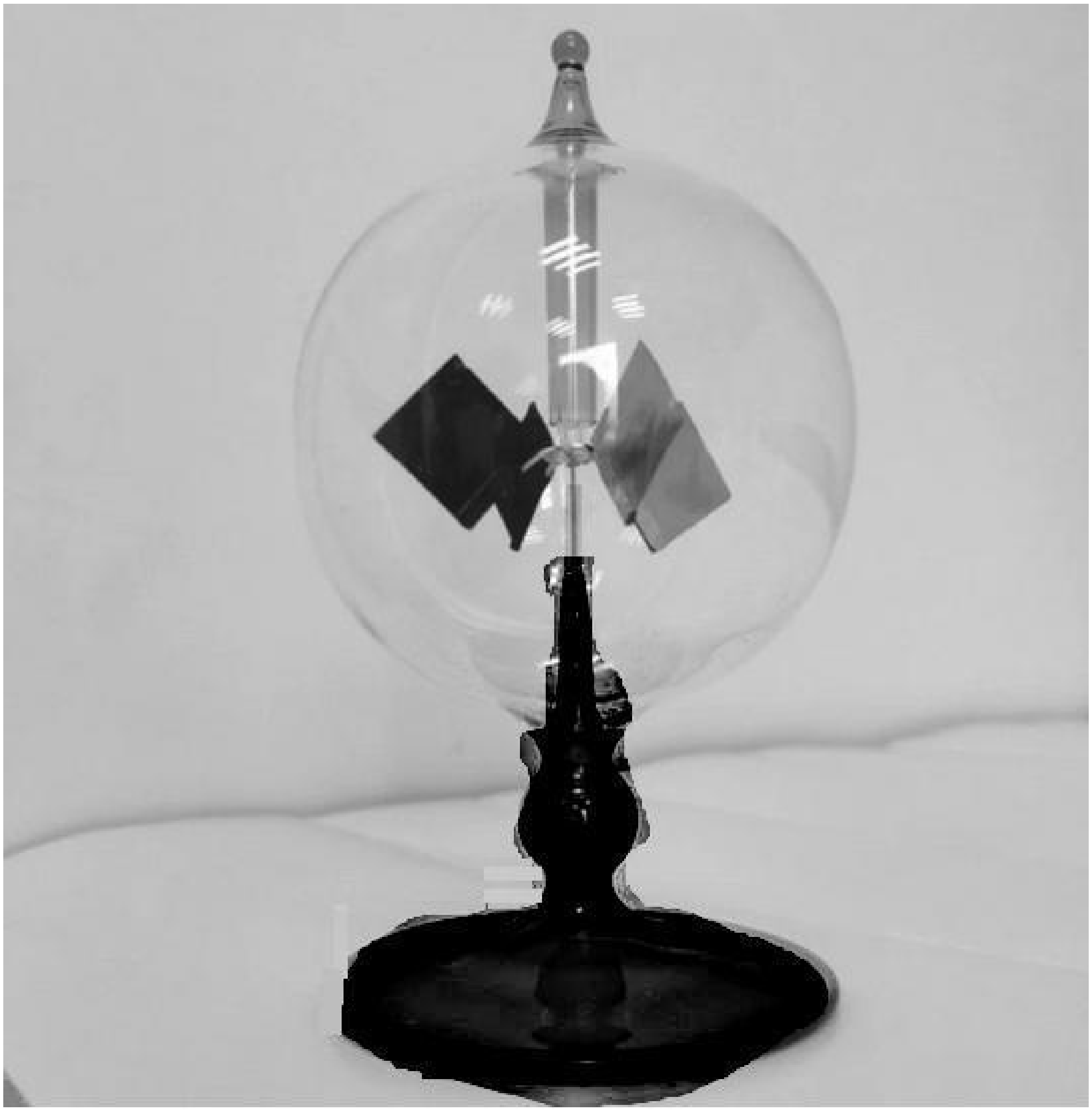


Figure 1 C. Crookes Radiometer, This was initially thought to measure radiation pressure. The mirrored side would hypothetically reflect back light in an elastic collision type of interaction acheiving double the impulse (momentum change) of the dark absorbing side which would be like an inelastic collision. Problem is the apparatus spins in the opposite direction. This has been mysterious since the 1870's with great physicists like Maxwell and later Einstein unable to come up with a plausible answer. They both rejected the standard explanation that air in the partial vacuum near the absorbing plane pushed the dark side. The photo-graviton model of Figures 1A ans 1B, suggests a simple resolution of the paradox.

2 Gravity breaking away from Mass.

The first solution of the general relativity gravity equation was by Karl Schwartzchild during world war I, his solution did not predict gravitational waves because he assumed spherical symmetry and time independence of the mass configuration (although his solution does predict black holes). Time dependent and non symmetric solutions were later discovered and they also predicted that parts of the gravitational field could break off from the mass that caused them in the form of gravitational waves. The first to "observe" these gravitational waves indirectly, were Joseph H. Taylor[2] and his graduate student Russell Hulse [11] of the University of Massachusetts from a binary pulsar system. Later experiments [12]confirmed the existence of these gravitational waves. Quantum gravity theories, of which this presentation is one, posit that gravity like electromagnetism is transferred in quanta which are called gravitons. In this model whenever mass is created, negative energy gravitons are created. empty space is then like a liquid and the gravitons are like bubbles in the liquid.

3 Negative Mass.

. The main idea of this presentation is that there are, quanta of the gravitational field, which are called "gravitons. It is posited that these gravitons are part of electromagnetic waves from the completed form of Maxwell's equations [Maxwell said that he wanted to leaven electromagnetism with quaternions but his early death prevented that][1, 3, 4][2]. In this presentation complex quaternion (biquaternion) formulation is replaced by an equivalent Pauli quaternion (algebra) representation. Here,the Lorentz condition field,$(\partial_0 A_0 + \overrightarrow{\nabla} \bullet \overrightarrow{A}) \equiv G$, is claimed to be proportional to the Newtonian static gravitational potential. This abandons the idea of "gauge invariance" and the Yang-Mills[17] formulation of field theory. Electro-weak theory is later replaced by a modified version of the Majernik-Nagy Equation [18] for a Gravitic-Electromagnetic-weak unification (see appendix). The key idea is that gravitons have negative mass, see Alan Guth's argument[10]for why negative mass is accepted. It is claimed that old gravitons must have zero mass and spin 2 in order to conform with general relativity. It is posited that the combined electromagnetic wave gravitational wave has a total energy of hf-hf=0 and a spin = 1+1=2 as required by general relativity. The gravitational-electromagnetic wave "quanta" will be called "Photo gravitons". The quanta formerly known as the graviton which breaks away from the electromagnetic field will be called "the graviton" or the "free graviton" with a spin 1 and mass = -hf/c^2. The interaction of positive and negative mass should be a totally inelastic collision with the conservation of momentum and energy would look like a force on the positive mass in the direc-

[2]J.H. Taylor was a judge for my oral masters degree exam, which I passed easily, at UMass, a year before Hulse arrived. I also took a class (and had a cup of tea) with E.P. Wigner who was a visiting professor at the time. Wigner's office at Princeton was next to Einstein's and also his (Wigner's) Brother-in-law Dirac

tion that the negative mass came from. The interaction of two negative masses should be the same as two positive masses. Gravitons should be like holes in the vacuum, a type of vacuum cavitation, appearing to be spatial curvature. Saying that negative mass exists in the nothingness of a vacuum is like something being "less than nothing". It is sort of like explaining water to a fish . It was formerly believed that antimatter would have negative mass, however, recent experiments[20] have confirmed that this is not true,,i.e. ANTI-MATTER DOES NOT FALL UP! So that gravity itself is as far as is known (if you believe this presentation) is alone in having negative mass. The fact that gravity is weak compared to electricity and magnetism suggests that dynamic clouds of gravitons might evaporate into space and exist throughout the universe powered by black hole jets explaining so called dark matter and dark energy.

4 Biquaternions-Pauli Algebra

In 1834 Michael Faraday met with William Rowan Hamilton in Dublin Ireland.[13][14][15][16][3] It is speculated that Faraday expressed to Hamilton the need for a a mathematics to explain the strange experimental results he and others were getting in electricity and magnetism experiments because Hamilton then embarked on a search for a geometric algebra that could handle 3 dimensional space like complex numbers, (which worked for two dimensional space). It took Hamilton 9 years to come up with a 4 dimensional geometric algebra, (not three dimensional), but which lacked the commutative property of complex numbers but retained all the other properties. He called his discovery quaternions. A little later he allowed complex coefficients and called these biquaternions [see foot note 4], which are not to be confused with octonions (due to his biographer Graves [16] brother John later called Cayley numbers)) which are ordered pairs of quaternions but lack the quaternions associative property. Wolfgang Pauli used 2x2 matrices to study the quantum mechanics of of spin $\frac{1}{2}$particles. It turns out that if these 2x2 matrices are considered to be 3 unit vectors and 1 unit scalar then (when allowing complex coefficients) an 8 dimensional geometric algebra that is isomorphic to Hamilton's biquaternions is the result. [4]. Since living Physicists are more familiar with Pauli matrices than biquaternions, so-called Pauli Algebra will be used , however the objects contrary to "Clifford Algebra terminology" will be called Pauli quaternions.

[3] Biographer Robert Graves'[16] older brother John, a lawyer and amateur mathematician claimed he inspired Hamilton's quaternions (John's non associative "octonions"however were discovered by John and later Cayley), Hamilton's 9 year search started right after his meeting with Faraday, maybe there were multiple factors[13] in the quaternions discovery.

[4] Isomorphic is the mathematicians term for essentially the same thing except for a convoluted notation

Maxwell used quaternions to some extent in his treatise on Electromagnetism[4]. He did however want to use them more extensively as he expressed in a letter to Tait.

> ***"With regard to my dabbling in Hamilton [quaternions]. I want to leaven my book [treatise on Electricity and Magnetism] with [these] ...ideas".***
>
> ***letter to P.G. Tait November 2 1870[1]***

His early death, at age 48, prevented Maxwell from leavening his theory with quaternions as he told Peter Guthrie Tait in the above mentioned letter..

5 Quaternions

Hamilton's quaternions can be written as scalars (the real-like part) plus vectors (the hyper-imaginary part) as follows:

$$\overleftrightarrow{Q} = S + \overrightarrow{V}$$

The multiplication rule, vector analysis notation, is:

$$\overleftrightarrow{Q}_1 \overleftrightarrow{Q}_2 = (S_1 + \overrightarrow{V_1})(S_2 + \overrightarrow{V_2}) = (S_1 S_2 - \overrightarrow{(V_1} \bullet \overrightarrow{V_2})) + (S_1 \overrightarrow{V_2} + S_2 \overrightarrow{V_1} + (\overrightarrow{V_1} \times \overrightarrow{V_2}))$$

Hamilton a few months later in 1844 decided the allow complex scalars and vectors (bi vectors) calling the result "biquaternions" (they are called complex quaternions today).

6 Biquaternions[5] aka "complex quaternions"

$$\overleftrightarrow{Q}_B = (S_r + \overrightarrow{V_r}) + i(S_i + \overrightarrow{V_i})$$

The multiplication rule or full biquaternion product is basically using the real full quaternion product 4 times, which the reader can do, however we are now switching to the equivalent "Pauli quaternions". Pauli quaternions are the same as Hamiltons biquaternions and in a form that fits in with relativity a little easier. We make the distinction between Pauli quaternions and Pauli Algebra. The Pauli unit scalar and vectors 1 $\hat{\sigma}_1, \hat{\sigma}_2, \hat{\sigma}_3$,are like time and 3 dimensional space and allows the picturing of events like a Physicist while the Pauli algebra gives 2x2 matrix arrays more distant from reality for Mathematicians.

[5] The word biquaternion was co-opted by W. K. Clifford for a more general quaternion type object

7 Pauli quaternions

J.L. Synge [21] in applying biquaternions to relativity suggested calling the quaternion $ict + \overrightarrow{r}$ a Minkowski quaternion, note that it mixes an imaginary scalar with a real Hamilton vector. This type of quaternion shows up in Physics in the form of Pauli matrices. In order to bridge the gap between Pauli matrices and quaternions, the following Identity is made:

$$\hat{\sigma}_1 \equiv i\hat{i} \quad \hat{\sigma}_2 \equiv i\hat{j} \quad \hat{\sigma}_3 \equiv i\hat{k}$$

Note that the sigma hat symbols denote mutually orthogonal unit vectors not 2x2 matrices. This is a conceptual difference, with the Pauli quaternion units being denoted $(1,\ \hat{\sigma}_{1,}\ \hat{\sigma}_{2,}\ \hat{\sigma}_3)$ and Pauli matrices denoted $(\ I,\ \sigma_{1,}\ \sigma_{2,}\ \sigma_3)$[6]

A Pauli quaternion (really a disguised biquaternion) takes the form:

$$\overleftrightarrow{P} = (a_0+a_1\hat{\sigma}_1+a_2\hat{\sigma}_2+a_3\hat{\sigma}_3)+i(b_0+b_1\hat{\sigma}_1+b_2\hat{\sigma}_2+b_3\hat{\sigma}_3) = (a_0+\overrightarrow{a})+i(b_0+\overrightarrow{b})$$

8 Pauli Quaternion Differential Operator

The del operator in Pauli quaternion form is $\overrightarrow{\nabla} \equiv \hat{\sigma}_1\frac{\partial}{\partial x} + \hat{\sigma}_2\frac{\partial}{\partial y} + \hat{\sigma}_3\frac{\partial}{\partial z}$

the quaternion differential operator

(Silberstein's Operator [5][6][7]) Pauli quaternion version is

$$\overleftrightarrow{D} = \frac{\partial}{c\partial \mathrm{t}} + \hat{\sigma}_1\frac{\partial}{\partial x} + \hat{\sigma}_2\frac{\partial}{\partial y} + \hat{\sigma}_3\frac{\partial}{\partial z} = (\partial_0 + \overrightarrow{\nabla}) \tag{1}$$

Its' parity conjugate is

$$\overleftrightarrow{D}^{\mathrm{p}} = \frac{\partial}{c\partial \mathrm{t}} - \hat{\sigma}_1\frac{\partial}{\partial x} - \hat{\sigma}_2\frac{\partial}{\partial y} - \hat{\sigma}_3\frac{\partial}{\partial z} = (\partial_0 - \overrightarrow{\nabla})$$

operation on the "real" part of a Pauli quaternion

$$\overleftrightarrow{D}(A_0+\overrightarrow{A}) = (\partial_0+\overrightarrow{\nabla})(A_0+\overrightarrow{A}) = (\partial_0 A_0+\overrightarrow{\nabla}\bullet\overrightarrow{A})+(\partial_0\overrightarrow{A}+\overrightarrow{\nabla}A_0+i\overrightarrow{\nabla}\times\overrightarrow{A}) \tag{2}$$

note

$$(\partial_0 - \overrightarrow{\nabla})(\partial_0 + \overrightarrow{\nabla}) = (\partial_0^2 - \nabla^2) \tag{3}$$

This is the d'Alembert operator also known as the d'Alembertian it is a scalar operator used in a number of Partial differential Equations.

[6]However, going back and forth between 2x2 matrix representation and scalar-plus-vector representation is allowable, and convenient, and the pedantic separation is only to remind one that the intuitive advantages of scalars and vectors over 2x2 matrices, should always be kept.

9 Pauli Algebra

Pauli algebra is basically Pauli quaternions with 2x2 matrices rather than unit vectors. When Mathematicians get a hold of it they get away from the actual physical applications. The standard Pauli matrix representations (although there are an infinite collection of the matrix representations) are:

$$I = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix} \ \sigma_1 = \begin{bmatrix} 0 & 1 \\ 1 & 0 \end{bmatrix} \ \sigma_2 = \begin{bmatrix} 0 & -i \\ i & 0 \end{bmatrix} \ \sigma_3 = \begin{bmatrix} 1 & 0 \\ 0 & -1 \end{bmatrix} \tag{4}$$

Part II

Pauli Quaternion Version of Standard Physics Equations, in vector analysis notation.

10 Maxwell's Equation(s)

Maxwell's four Equations can be written as one Pauli Quaternion Equation as follows:

$$(\partial_0 - \overrightarrow{\nabla})\left(G - \overrightarrow{E} + i\overrightarrow{B}\right) = 4\pi\left(\rho + \frac{\overrightarrow{J}}{c}\right) \tag{5}$$

$$G = (\partial_0 A_0 + \overrightarrow{\nabla} \bullet \overrightarrow{A}), \qquad \overrightarrow{E} = (-\partial_0 \overrightarrow{A} - \overrightarrow{\nabla} A_0) \qquad , i\overrightarrow{B} = (i\overrightarrow{\nabla} \times \overrightarrow{A})$$

$$G = Lorentz \quad condition \quad field, \overrightarrow{E} = Electric \quad field, \quad , \overrightarrow{B} = \quad Magnetic \quad Induction \quad field$$

$$A_0 = Electrostatic \quad Potential, \quad \overrightarrow{A} = Vector \quad Potential$$

Conversely all four Maxwell's equations can be extracted from eq (5).

$$\overrightarrow{\nabla} \bullet \overrightarrow{E} = 4\pi\rho - \partial_0 G \quad is \ the \ real \ scalar \ part \quad Coulomb's \quad Law \quad (almost) \qquad (5A)$$

$$\overrightarrow{\nabla} \bullet \overrightarrow{B} = 0 \quad is \ the \ imaginary \ scalar \ part \quad No \quad Magnetic \quad monopoles \qquad (5B)$$

$$\overrightarrow{\nabla} \times \overrightarrow{E} + \partial_0 \overrightarrow{B} - \overrightarrow{\nabla} G = 0 \quad is \ the \ real \ vector \ part \quad Faraday's \quad Law \quad (almost) \qquad (5C)$$

$$\overrightarrow{\nabla} \times \overrightarrow{B} - \partial_0 \overrightarrow{E} = 4\pi\frac{\overrightarrow{J}}{c} \quad is \ the \ imaginary \ vector \ part \quad Ampere's \quad Law \qquad (5D)$$

$\overrightarrow{E}$ is the electric field and $\overrightarrow{B}$ is the magnetic flux density or magnetic induction ρ is the charge density and $\overrightarrow{j}$ is the current density.

G is the Lorentz condition field, typically it is set equal to zero (for actually, no good reason) however if $\partial_0 G << 1$ *and* $\overrightarrow{\nabla} G << 1$ then the standard Maxwell's equations are obtained. The physical interpretation for G which is more satisfying than the "gauge" idea is that G is the Newtonian gravitational potential) this will be demonstrated in the following:

10.0.1 One step derivation of the electromagnetic wave equation

$$(\partial_0 + \overrightarrow{\nabla})(\partial_0 - \overrightarrow{\nabla})\left(G - \overrightarrow{E} + i\overrightarrow{B}\right) = 4\pi(\partial_0 + \overrightarrow{\nabla})\left(\rho + \frac{\overrightarrow{J}}{c}\right) \qquad (6A)$$

$$(\partial_0^2 - \nabla^2)\left(G - \overrightarrow{E} + i\overrightarrow{B}\right) = 4\pi[(\partial_0\rho + \overrightarrow{\nabla}\bullet\frac{\overrightarrow{J}}{c}) + (\overrightarrow{\nabla\rho} + \partial_0\frac{\overrightarrow{J}}{c}) + (i\overrightarrow{\nabla}\times\frac{\overrightarrow{J}}{c})] \qquad (6B)$$

from the continuity equation

$$(\partial_0^2 - \nabla^2)G = 4\pi(\partial_0\rho + \overrightarrow{\nabla}\bullet\frac{\overrightarrow{J}}{c}) = 0 \qquad (6)$$

A static solution to the partial differential equation is the standard

$$G = \frac{K}{r}$$

Choosing the K $\propto G'_{Newton}Mm$ yields Newton's Gravity potential equation.

$$G = \frac{G'_{Newton}Mm}{r}$$

where G'_{Newton} is Newton's gravitational constant

Getting Newton's gravitational potential equation out of Maxwell's equations is a major accomplishment, but everyone keeps ignoring this, preferring the Heavyside inspired,Yang-Mills "gauge theory[17] path, which leads to "mass"confusion!!

A Gravitational Traveling wave solution is

.

$$G = G_0 e^{i(Kx - wt)})$$

10.0.2 Maxwell's Equations Potential Form

Maxwell's Equations in terms of Potentials are:

$$(\partial_0^2 - \nabla^2)\left(A_0 + \overrightarrow{A}\right) = (\partial_0 - \overrightarrow{\nabla})\left((\partial_0 A_0 + \overrightarrow{\nabla} \bullet \overrightarrow{A}) + (\partial_0 \overrightarrow{A} + \overrightarrow{\nabla}\Phi) + (i\overrightarrow{\nabla} \times \overrightarrow{A})\right) = (\partial_0 - \overrightarrow{\nabla})\left(G - \overrightarrow{E} + i\overrightarrow{B}\right) = 4\pi\left(\rho + \frac{\overrightarrow{J}}{c}\right) \tag{7}$$

Heaviside and Lorentz didn't know what to do with $G = (\partial_0 A_0 + \overrightarrow{\nabla} \bullet \overrightarrow{A})$ so they said it didn't matter, you could make some adjustments to it. Lorentz wanted it to be zero. and it was called the Lorentz condition. They claimed that the vector potential, $\overrightarrow{A}$ could have added components and only differences in the scalar potential,A_0 mattered. Earlier Faraday believed that the "vector potential" which he called the "electrotonic state" was a real thing, and Maxwell elaborated treating it as a potential momentum and that it had existence, even when no magnetic field was present. This was shown to be true in the Aronof-Bohm effect . If $G = (\partial_0 A_0 + \overrightarrow{\nabla} \bullet \overrightarrow{A})$ is interpenetrated as the gravitational potential, for the Newtonian case It could be generalized for Einstein's gravity theory.

Equations (6) and (7) therefore clarify gauge invariance.

10.1 Relativity

Relativity is an obvious application for quaternions the Lorentz Transformation in quaternion form was discovered by Ludwik Silberstein [5, 6, 7]and Arthur Conway[8, 9] independently see figure 2.

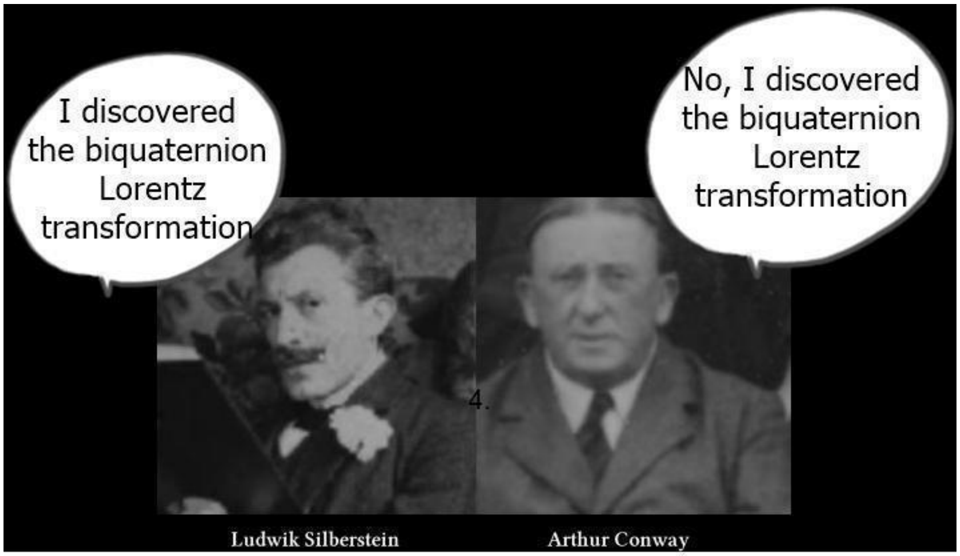


Figure 2 Silberstein and Conway applied complex quaternions (biquaternions) to Einstein's1905 special relativity independently. The choice of Grassmann's /Rieman tensor analysis by Minkowski and his friend Hilbert to generalizes relativity, followed by Einstein, caused the more natural biquaternions to be ignored. Silberstein went on to learn general relativity in both "Tensor" and quaternion form, claiming errors, in the standard general relativity, which he pointed out to Einstein, and others, but was dismissed by the mainstream. Interestingly, in May of 2021, Silberstein's heirs (he died in 1948) sold a response letter from Einstein for 1.2 million U.S. dollars.

10.2 Lorentz Transformation, Pauli quaternion form, equivalent reformulation of Silberstein's version.

$$(ct' + \overrightarrow{r'}) = \gamma\sqrt{1 + \frac{\overrightarrow{v}}{c}}(ct + \overrightarrow{r})\sqrt{1 + \frac{\overrightarrow{v}}{c}} \tag{8}$$

$$where\ \gamma = \frac{1}{\sqrt{1 - \frac{v^2}{c^2}}}$$

10.3 General Relativistic Quaternion Lorentz Transformation.

In standard tensor[7] based general relativity it is claimed that "mass curves space and space tells mass how to move". The quaternion (Pauli representation) Lorentz transformation in terms of Energy (mass)-Momentum in a more instructive, ready-to-be-generalized form,(in terms of Energy=E, and momentum $=\overrightarrow{P}$ and rest mass, m_0) is:

$$(ct' + \overrightarrow{r'}) = \sqrt{\frac{E}{m_0c^2} + \frac{\overrightarrow{P}}{m_0c}}(ct + \overrightarrow{r'})\sqrt{\frac{E}{m_0c^2} + \frac{\overrightarrow{P}}{m_0c}} \qquad (9)$$

To Generalized for electric and magnetic effects, let

$$E \rightarrow E_{mechanical} + qA_0 \qquad \overrightarrow{P} \rightarrow \overrightarrow{P}_{mechanical} + q\overrightarrow{A} \qquad (9A)$$

This completes the Classical unification of gravity and electromagnetism. When gravitons are included quantum gravity appears.

Part III
Artificial gravity "graviton gas" model

Equations (5C) the modified Faraday's Law equation can be rearranged as

$$\partial_0 G = 4\pi\rho - \overrightarrow{\nabla} \bullet \overrightarrow{E} \qquad (5A')$$

$$\overrightarrow{\nabla} G = \overrightarrow{\nabla} \times \overrightarrow{E} + \partial_0 \overrightarrow{B} \qquad (5C')$$

combining yields the Pauli quaternion equation

$$(\partial_0 + \overrightarrow{\nabla})G = (4\pi\rho - \overrightarrow{\nabla} \bullet \overrightarrow{E}) + (\overrightarrow{\nabla} \times \overrightarrow{E} + \partial_0 \overrightarrow{B}) \qquad (5AC)'$$

This claims that the gravitational force is proportional to the curl of the electric field plus the time derivative of the magnetic induction field divided by the speed of light. This is believed to be zero in classical physics, however, in the non-Euclidean space caused by "graviton bubbles in the vacuum" a finite non zero number can be gotten.

[7] The "Father" of tensor analysis, Herman Gunther Grassman, had a difficult time getting his ideas paid attention to. After submitting the second edition of his book to the publisher, he got a response that his first edition was "un-sellable" and that he still had 600 copies that were now being used as scrap paper (meaning toilet paper)

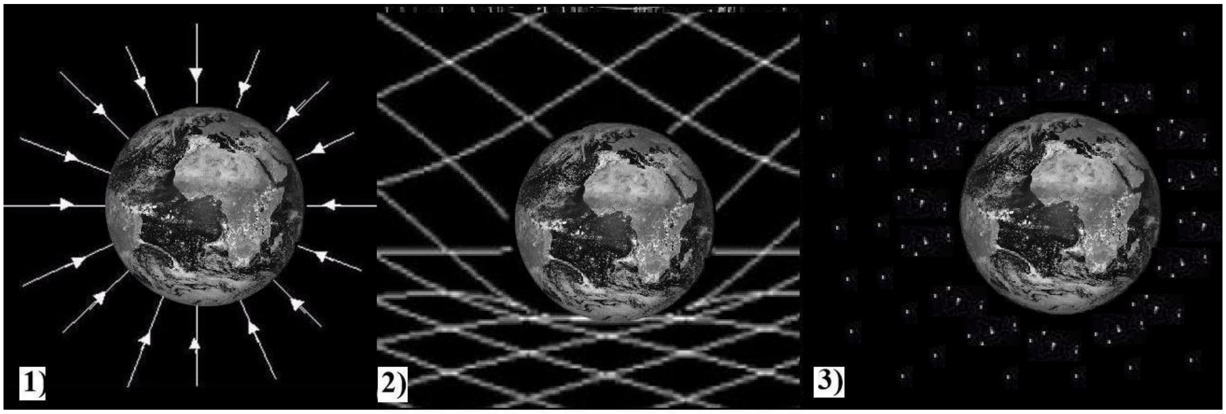


Figure 3 The above depicts 3 different conceptual models for the gravitational field 1) The lines of force model gives the classical force and direction of the gravitational force. 2) The non euclidean geometry model of Rieman used by Hilbert to complete the work of his deceased friend Minkowski, with Einstein claiming he thought of it first 3) The graviton gas model , a quantum model that completes Maxwell's quaternion equation while being a quantum gravity model with the gravitons being negative energy "bubbles" in what we would considered to be vacuum, which would seem to curve space.

Part IV

The acceleration of spacecraft by graviton gas; enabling high free-fall acceleration in any chosen direction without killing the passengers.

People have photographed advanced crafts commonly called UFOs for a long time. There is credible photographic evidence from videos released by the US Navy see figure 4 and many others by civilians that have been observed for a long time see figure 5.

They have also been observed to have what would be lethal accelerations were they achieved by standard rocket propulsion, however a free-fall acceleration by artificial gravity created by a graviton gas would be harmless to passengers.

Figure 4. from Official U.S. Navy video of a 2015 UFO encounter, taken aboard a Navy fighter jet from the nuclear aircraft carrier USS Theodore Roosevelt, off the eastern seaboard, near the Florida coast.

Figure 5 UFO 1966 over Hillsdale County Michigan, USA

Appendix

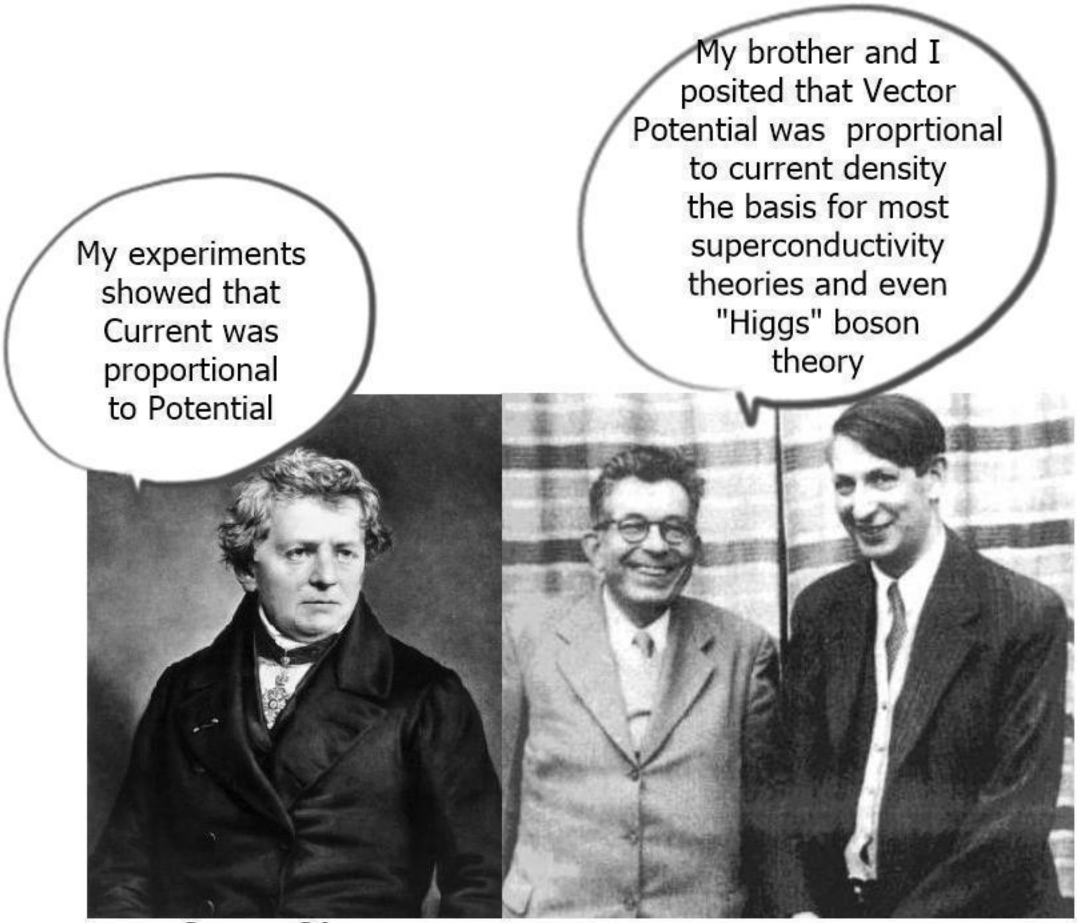
11 Electromagnetic-Gravitic-Weak Unification

Since the Lorentz condition field is used as the gravitational field potential not a "gauge" an alternative treatment is offered to replace the Weinberg-Salam model. Borrowing the $Z^0 and \pm W$ masses from their model. This results in an electromagnetic-gravitational-Weak unification equation in the spirit of the Glashow[22]-Schwinger weak model.

Majernik Nagy Equation

Majernik and Nagy[18] generalized Maxwell's Equations to include imaginary charge and potentials. The interpretation could be magnetic monopoles or Weak potentials for a stronger electro-weak unification.

$$(\partial_0^2 - \nabla^2)\left(A_0 + iW_0 + \overrightarrow{A} + i\overrightarrow{W}\right) = 4\pi\left(\rho + i\rho_w + \frac{\overrightarrow{J}}{c} + i\frac{\overrightarrow{J_w}}{c}\right) \tag{10}$$



Georg Ohm **Fritz and Heinz London**

Figure 6 Ohm's Law could almost be combined with the London vector potential equation to form a Minkowski quarternion or a Pauli quaternion consistent with relativity. It is however easier to postulate at least an approximate four dimensional current proportional to to a scalar plus vector potential quaternion and with various approximations extract Ohm's Law and the London vector potential equation. Scalar and vector potentials are proportional to wave functions in in some QED treatments suggesting the following: $\left(W_0 + \overrightarrow{W}\right) = \frac{4\pi}{kM^2_{Z^0\pm W}}\left(\rho_{w} + \frac{\overrightarrow{J_w}}{c}\right)$ **The constant term includes the square of the** $Z^0 \pm W$ **mass for convenience.**

Inserting into right side of eq(10) yields a replacement for Yang-Mills[17] type "standard Model" electro-weak unification.,

The modified Majernick-Nagy equation[18], with the extended London brother's [19]addition is:

$$(\partial_0^2 - \nabla^2)\left(A_0 + iW_0 + \overrightarrow{A} + i\overrightarrow{W}\right) = 4\pi\left(\rho + \frac{\overrightarrow{J}}{c} + +kM^2_{\pm W or Z^0}\left(iW_0 + +i\overrightarrow{W}\right)\right) \tag{11}$$

Where the$M_{\pm W or Z^0}$are the masses of the weak force bosons.

This would be an electroweak gravitic unification replacing the Weinberg Salam theory but keeping the Glashow-Schwinger[22] idea. The left handedness is handled by the Lanzcos -Weyl -Sakutai Equation[25]

There is a second Lorentz condition field possibly predicting new physical effects an imaginary short ranged gravity field. Feynman in his space time approach to Physics [23, 24] said that there should be 2 transverse "photons" associated with electromagnetic waves and a longitudinal "photon" (which a graviton is claimed to be here) and a "time-like photon which could be an imaginary "graviton" associated with the short ranged weak interaction.

References

[1] Maxwell,]. C. 1870 letter to P.G. Tait November 14 reprinted in Crowe, M,]. 1967. A History of Vector Analysis University of Notre Dame Press, South Bend IN pp. 131-132.

[2] Maxwell, j. C. 1871 letter to P.G. Tait November, 2 reprinted in Crowe, M.]. 1967. A History of Vector Analysis University of Notre Dame Press, South Bend IN pp. 131-132.

[3] Maxwell,]. C. 1871 letter to P.G. Tait December 21 reprinted in Crowe, M.]. 1967. A History of Vector Analysis. University of Notre Dame Press, South Bend IN pp. 132-133.

[4] Maxwell,]. C. 1954 ,Treatise on Electricity and Magnetism. Quaternion expressions for the Electromagnetic Equations, Dover New York. vol 2, sec 618, pp2S7-258

[5] Silberstein, L. 1912 Quaternionic form of relativity Phil. Mag. 2 3:790-809.

[6] Silberstein, L. 1913 Second memoir on Quatemjonic relativity Phil. Mag. 24:135-144.

[7] Silberstein L. 1924 Theory of Relativity 2nd Ed London: Macmillan.

[8] Conway A.W. 1911 "On the application of quaternions to some recent developements of electrical theory" Proc.Roy.Irish Academy A 29 1

[9] Conway A.W. 1912 "The quaternionic form of Relativity" Phil. Mag. 24 p208

[10] Guth A. 1997 "the Inflationary Universe" Persius press, Cambridge MA pp289-293].

[11] Hulse, Russell Alan, "A High Sensitivity Pulsar Search." (1975). Doctoral Dissertations University of Massachusetts Amherst. Proquest. AAI7605345. https://scholarworks.umass.edu/dissertations/AAI7605345

[12] Abbott BP, et al. (LIGO Scientific Collaboration and Virgo Collaboration) (2016). "Observation of Gravitational Waves from a Binary Black Hole Merger". Physical Review Letters. 116 (6):

[13] Whitaker, E.T. 1945 The Sequence of Ideas in the Discovery of Quaternions. Proc. Roy Irish Acad. SOA:93-98.

[14] Whitaker, E.T. 1940 The Hamiltonian Revival. Math. Gazz 24:153-158.

[15] Hankins, Thomas L., l981Wi1liam Rowan Hamilton, john Hopkins U. Press, Baltimore.

[16] Graves R.P. 1889 “Life of William Rowan Hamilton” Dublin University press p.90

[17] Yang, C.N.; Mills, R. 1954. "Conservation of isotopic spin and isotopic gauge invariance". Physical Review. 96 (1): 191–195.

[18] Majernik, V., and Nagy, M. 1976. Quaternionic form of Maxwell’s equations with sources. Lett. Nuovo Cimento. 16:265—268.

[19] London, F.; London, H. 1935. "The Electromagnetic Equations of the Superconductor". Proceedings of the Royal Society A: Mathematical, Physical and Engineering Sciences. 149 (866): 71.

[20] E.K. Anderson et al (2023) "Observation of the effect of gravity on the motion of Antimatter" Nature 621 p716-72

[21] Synge J.L. 1972 “Quaternions Lorentz Transformations and the Conway-Dirac-Eddington Matrices” Com. Dublin Inst . Adv. Std Series A No.2

[22] Glashow S.L.1988 "Interactions" Warner New York p116

[23] Feynman R.P. 1948 Space-time Approach to Non-relativistic Quanum Mechanics Reviews of Modern Physics , Vol. 20 p679

[24] Feynman R.P. 1949 Space-time Approach to Quantum electrodynamics Physical Review , Vol. 76 p267

[25] Sakurai, j.j. (1967) “Advanced Quantum Mechanics”. Addison-Wesley. Reading , MA. pp.75-85 ,Weyl, H. 1950 Group Theory and Quantum Mechanics Dover, New York p.212 .