Journal of High Energy Physics, Gravitation and Cosmology, 2025, 11(2), 554-566
https://www.scirp.org/journal/jhepgc
ISSN Online: 2380-4335
ISSN Print: 2380-4327

The Unification of Gravity with Electromagnetism in the Classical Newtonian Region, with an Explanation of the Crookes Radiometer, and a Model for "Dark Matter"

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How to cite this paper: Kennedy, S.J. (2025) The Unification of Gravity with Electromagnetism in the Classical Newtonian Region, with an Explanation of the Crookes Radiometer, and a Model for "Dark Matter". *Journal of High Energy Physics, Gravitation and Cosmology*, **11**, 554-566.
https://doi.org/10.4236/jhepgc.2025.112038

Received: February 8, 2025
Accepted: April 25, 2025
Published: April 28, 2025

Abstract

Maxwell wrote that he wanted to "leaven" his Treatise on Electromagnetism with Quaternions. Maxwell died before doing this. Silberstein and Conway accomplished this partially. This presentation claims the Lorenz condition field is proportional to the gravitational potential. This results in a gravitic-electromagnetic unification in the classical Newtonian region. An explanation of the Crookes radiometer is given and a model for dark matter is presented.

Keywords

Unified Field, Dark Matter, Gravity, Quaternion, Pauli Algebra, Crookes Radiometer, Photo-Graviton

1. Introduction

Michael Faraday met W.R. Hamilton in 1834, in Dublin [1]. It is speculated that Faraday told Hamilton of the weird electromagnetism experimental results he and others were getting. Electromagnetism needed some sort of geometric algebra to organize it. Hamilton, after much effort [2], in 1843, finally found, a generalization of complex numbers $\overleftrightarrow{Q} = w + x\hat{i} + y\hat{j} + z\hat{k} = w + \vec{r}$ ($\leftrightarrow$ double arrow denotes a quaternion, $\rightarrow$ right arrow denotes a vector, $\hat{}$ a caret denotes a unit vector, plain symbol denotes a scalar) that he called Quaternions, then in 1844 complex component quaternions calling them biquaternions. Complex quaternions can be represented as 2 × 2 matrices (Pauli matrices) [3] $\sigma_1 = i\hat{i}$ $\hat{\sigma}_2 = i\hat{j}$ $\hat{\sigma}_3 = i\hat{k}$ with all the properties of complex numbers except they are not commutative and division by a small class of quaternions that do not have an inverse, called zero divisors, are not allowed. Complex quaternions or Pauli quaternions can be represented by vector analysis notation, vector analysis being a truncated form of quaternions [4]. Hamilton's real quaternions have been used by computer scientists since the 1980's for 3 dimensional rotations.[1]

In 1854 Peter Guthrie Tait, a boyhood friend of Maxwell, went to Ireland from his native Scotland to study Quaternions. He informed Maxwell of quaternions in a series of letters [5]. Maxwell used the quaternion in his researches on how to make sense of the electromagnetism experiments of Faraday and others. In the 1870's Maxwell came up with 4 equations; 2 scalar equations and 2 vector equations now known as "Maxwell's Equations" that summarized the known electromagnetism experiments. He used quaternions to deduce that electromagnetic waves that traveled at the speed of light existed. This was later confirmed H. Hertz. Maxwell wrote to Tait [5] that he wanted to "leaven" his work on electromagnetism with quaternions. Maxwell's early death, due to cancer, prevented this from happening.

Quaternions fell out of favor in mainstream physics in the early 20th century. However, some quaternion research was still going on by some people such as, L. Silberstein and A. Conway. Conway [6] and Silberstein [7] [8] both apparently knew that all four Maxwell's equations could be written as one complex quaternion equation. However, when the equations were written in terms of Scalar and Vector Potentials, the equations had a troubling loose end. The quantity $\frac{\partial A_0}{c\partial t}+\vec{\nabla}\cdot\vec{A}\equiv G$, the scalar part of the field generated by the potentials, was not associated with anything in observed reality so that most treatments set $G=\frac{\partial A_0}{c\partial t}+\vec{\nabla}\cdot\vec{A}=0$, known as the "Lorenz condition"[2]. Both Silberstein and Conway seem to have followed this convention, with their quaternion electric field-Magnetic flux density fields being, the complex vector $-\vec{E}+i\vec{B}$. The quantity $\partial_0 A_0+\vec{\nabla}\cdot\vec{A}\equiv G$ with the short hand ($\frac{\partial}{c\partial t}\to\partial_0$) when left as the scalar part of the electromagnetic field denoted as, the quaternion $G-\vec{E}+i\vec{B}$ which will be called the classical quaternion electromagnetic field. Maxwell's equations are slightly modified but the effects after interpreting G as being proportional to the gravitational potential are so small as to be undetectable in terrestrial experiments. The full treatment below Equations (10) and (11) gives a one step derivation of the electromagnetic wave equation in which in the time independent angular independent case, the Laplacian operator on the G field being set equal to what is called the continuity Equation (12), which equals zero, with a static solution of $\frac{k}{r}$ equation, where r is a distance from an appropriate origin. When $k=0$ the standard Lorenz condition $\partial A_0+\vec{\nabla}\cdot\vec{A}\equiv G=0$ is obtained, however, if $k=-\kappa\mathcal{G}mM$ where $\mathcal{G}$ is Newton's gravitational constant with a proportionality constant κ then Newton's Law for

[1]Quaternions are used by computer science for the navigation of aircraft, drones, and robots, also for 3D animation and gaming.

[2]Due to L. Lorenz, not to be confused with the more famous H.A. Lorentz as is done in all the editions of Jackson's "Classical Electrodynamics" book [9].

gravitational potential is essentially derived from Maxwell's equations. When time dependence is assumed, in Cartesian coordinates a standard wave equation with traveling gravitational waves that accompany the electromagnetic wave is obtained.

The final task of exploring quantum mechanics and gravity utilizes the idea of Alan Guth [10] that the gravitational field has negative mass and that a gravity wave accompanies the electromagnetic wave. Since a "photon" has an energy of hf it should have a mass of $\frac{hf}{c^2}$ the paradox of a massive object going the speed of light is resolved if the accompanying "graviton" has a mass of $\frac{-hf}{c^2}$ this also resolves the paradox of the Crookes Radiometer which is discussed below. Negative mass gravitons are presented before the Pauli (algebra) quaternion treatment of the Maxwell's equations with Newton's gravitational potential is presented so that the possibly unfamiliar math (see footnote 3), doesn't distract from the main point of this presentation, that **positive mass photons are escorted by negative mass gravitons!** Then a model for "dark matter" is also presented.

2. Negative Mass Gravitons and Photons Becoming "Photo-Gravitons"

2.1. Photo Graviton and Free Graviton

In the quaternion electromagnetism formulation, the electromagnetic field quaternion denoted $\vec{F} = G - \vec{E} + i\vec{B}$ has a scalar part G, which is usually set equal to 0 due to L. Lorenz (see footnote 2). In Equation (12) below a differential equation for G is derived. Although $G = 0$ is a trivial solution more physically suggestive solutions exist. It will be suggested below that at least in the Classical Newtonian domain the G could be proportional to the gravitational field. The time dependent "wave equation" for G Equation (12) below suggests in addition to the static solution there is a wave that travels along with electromagnetic wave (which is related to the quanta of light known as the "photon"). It is proposed that the companion G wave have a related quanta which should be called the "graviton". It is proposed that the graviton-photon couple be named the Photo-graviton. Note that the graviton in this model has a spin 1 so that the photo-graviton should have a spin 2. The graviton is proposed to have negative mass extrapolating on the idea in reference [10] and that this mass exactly cancels the companion photon mass.

Whenever mass is created, even a small amount, an appropriate amount of gravity must be created also (with the common assumption that mass and gravity are related). According to an idea by Alan Guth [10] a gravitational field should have negative mass, extending this 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 below. If a negative mass graviton rides along with a positive mass photon it explains how a massive photon with $m = \frac{E}{c^2}$ can go at the speed of light, while other objects of finite mass are restricted by relativity from ever attaining this supposed universal speed limit. 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.

Figure 1 shows photo graviton absorption, and the completed Maxwell's equation to the left, see subsection 6 below. It should be noted that the graviton wave has the "beat frequency" of the interference pattern of the two involved DeBroglie waves or Ψ functions. Figure 2 shows photo graviton spontaneous emission stimulated by graviton.

2.2. Gravitational Field's Involvement in Absorption, Spontaneous Emission, with Comment on Stimulated Emission

2.2.1. Absorption of Light

See Figure 1, the photo graviton excites the lower state electron, to a higher more energetic state. The extra energy causes an increase in mass of the atom (from Einstein's $E = mc^2$) that mass being; $\Delta m = \frac{hf}{c^2}$. With a corresponding decrease in the gravitational field mass of $\Delta m_{g-field} = \frac{-hf}{c^2}$. as shown by the emitted graviton.

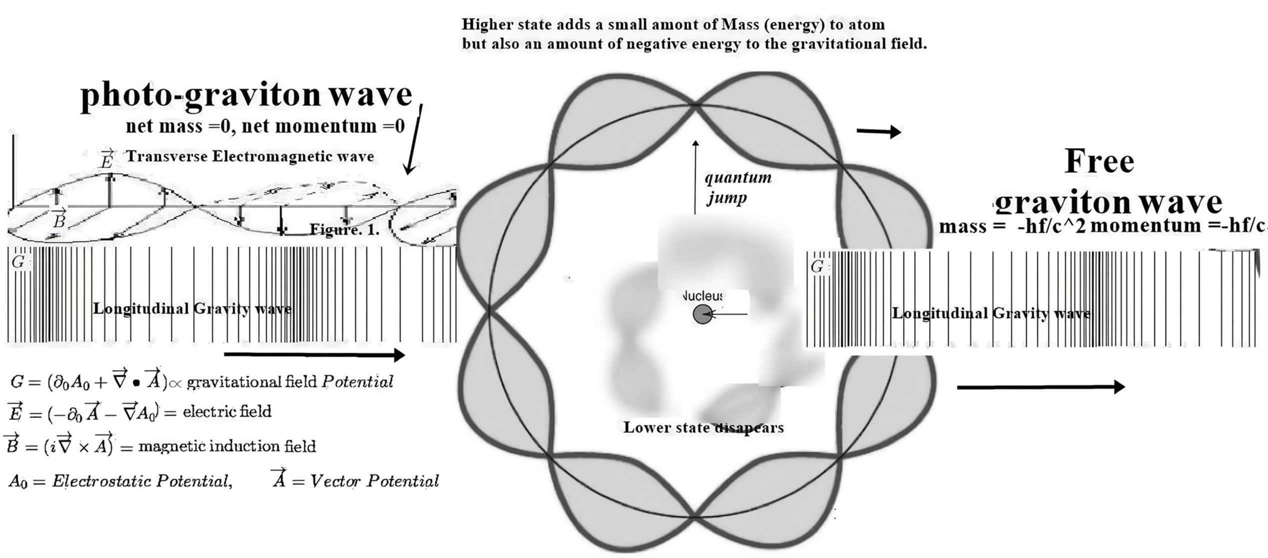

Figure 1. The above is a model that depicts an electromagnetic wave associated with a photon having energy $E = hf$ coupled to a graviton wave and posited graviton with Energy $E = -hf$ together they have a zero mass, solving the paradox of how an energetic and therefore massive photon can travel at 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.

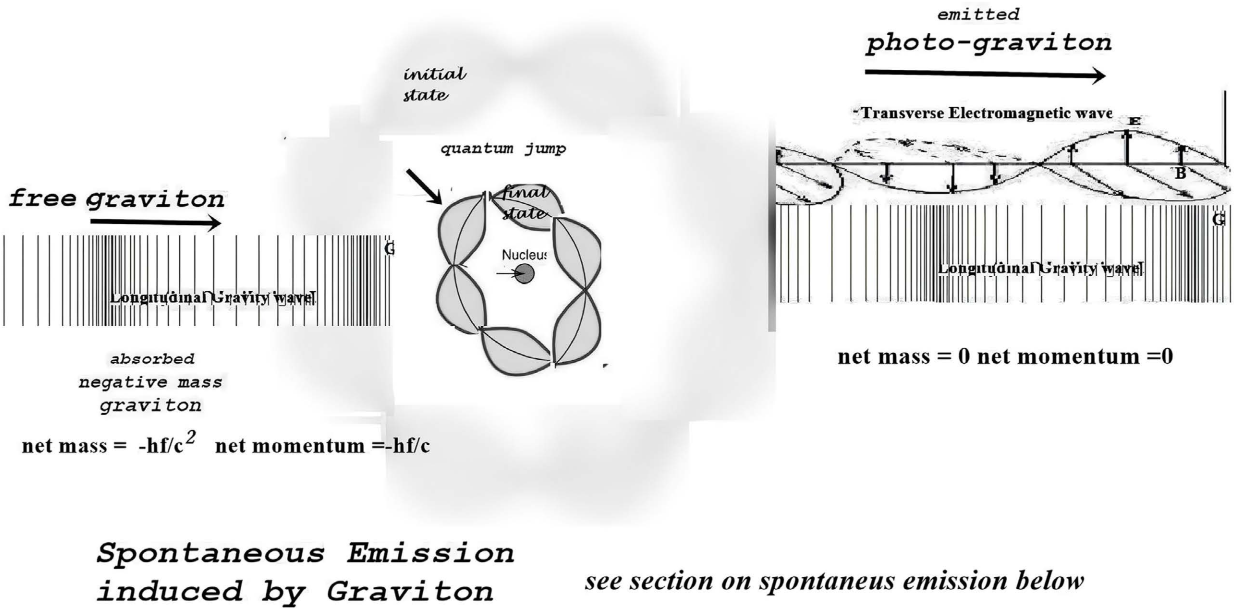

Figure 2. This depicts the reverse effect of photo-graviton absorption depicted in **Figure 1**. An excited Atom (or in general any quantum state) emits a photo-graviton after interacting with a free graviton. See section on spontaneous emission below.

2.2.2. Spontaneous Emission

The claim of **Figure 2** is that spontaneous emission is triggered by free gravitons, the quanta of the field $G = \partial_0 A_0 + \vec{\nabla} \cdot \vec{A}$. This claim is actually reinforced by standard physics graduate school text books such as reference [11] which give a simplified and not completely rigorous treatments of spontaneous emission.

Texts give an interaction Hamiltonian for the simplest spontaneous emission of $H_I = \vec{j} \cdot \vec{A} = -\frac{e\vec{p} \cdot \vec{A}}{mc}$ where $\vec{j}$ is the current of electron in upper state this is a gives transition matrix element $\langle \beta | H_I | \alpha \rangle$ going from the excited state $\langle \beta |$ to the lower state $| \alpha \rangle$ note that $\vec{p}$ is the electron momentum $\vec{A}$ is the vector potential. In quantum mechanics $\vec{p}$ is an operator $\vec{p} \to -ih\vec{\nabla}$ substituting this into $H_I = -\frac{e\vec{p} \cdot \vec{A}}{mc}$ yields $H_I = \frac{-ieh\left(\vec{\nabla} \cdot \vec{A}\right)}{mc}$ note that the interaction Hamiltonian for spontaneous emission contains ($\vec{\nabla} \cdot \vec{A}$), which is the vector potential part of what is claimed to be proportional to the gravitational potential $G = \left(\partial_0 A_0 + \vec{\nabla} \cdot \vec{A}\right)$ therefore bolstering the claim that gravitational fluctuations or gravitons cause spontaneous emission!

2.2.3. Stimulated Emission of Light

Devices such as lasers depend on the stimulated emission of light. It should involve a dragging ambient graviton into the process of light amplification however, this topic deserves a better treatment than can be presented here.

3. Methods

Pauli representation quaternions are used here because they are more familiar to

Physicists[3] while Hamilton quaternions, since the 1980's, are used by computer scientists. "Pauli Algebra" has been used by a number of researchers see [3] for references, however the vector analysis notation rather than the matrix notation will be used for the most part, however, they are equivalent so that Pauli quaternion is a better and more accurate name.

3.1. Pauli Quaternion Multiplication Rule

3.1.1. "Real" Pauli Quaternion

For two "real" Pauli quaternions $\vec{A} = w_A + x_A\hat{\sigma}_1 + y_A\hat{\sigma}_2 + z_A\hat{\sigma}_3 = (w_A + \vec{r}_A)$ and $\vec{B} = w_B + x_B\hat{\sigma}_1 + y_B\hat{\sigma}_2 + z_B\hat{\sigma}_3 = (w_B + \vec{r}_B)$

$$\vec{A} * \vec{B} = (w_A + \vec{r}_A)(w_B + \vec{r}_B) = \left(w_A w_B + (\vec{r}_A \cdot \vec{r}_B) + w_A\vec{r}_B + w_B\vec{r}_A + i(\vec{r}_A \times \vec{r}_B)\right) \quad (1)$$

Note that the dot product has a positive sign instead of the negative sign of real quaternions and the cross product becomes imaginary and has the opposite parity of the Hamilton representation (*i.e.* right-hand rule vs left hand rule).

3.1.2. Full Pauli Quaternion

A "Complex" Pauli quaternion takes the form;

$$\begin{aligned}\vec{P}_C &= (w_R + x_R\hat{\sigma}_1 + y_R\hat{\sigma}_2 + z_R\hat{\sigma}_3) + i(w_I + x_I\hat{\sigma}_1 + y_I\hat{\sigma}_2 + z_I\hat{\sigma}_3) \\ &= (w_R + \vec{r}_R) + i(w_I + \vec{r}_I)\end{aligned} \quad (2)$$

the Pauli quaternion has a quasi real (on the left denoted with subscript *R*) and quasi imaginary part (on the right denoted with subscript *I*).

This quaternion in terms of the Pauli matrices, is actually more convenient for the way that human physics has evolved; being usable for Maxwell's equations, relativity and relativistic quantum mechanics. Although they could be presented in Hamilton Biquaternion form. For now rather than rewrite Physics text books of the last hundred years it is convenient to go along with the Pauli quaternion version of Physics or even the more awkward Pauli Algebra version where matrices are used instead of scalars and vectors.

The full Pauli quaternion product is given by;

$$\vec{P}_A\vec{P}_B' = (\vec{P}_R + i\vec{P}_I)(\vec{P}_R' + i\vec{P}_I') = (\vec{P}_R\vec{P}_R' - \vec{P}_I\vec{P}_I') + i(\vec{P}_R\vec{P}_I' + \vec{P}_I\vec{P}_R') \quad (3)$$

Pauli quaternions can be used for Maxwell's Equations, Relativity and Relativistic quantum mechanics.

3.2. Pauli Quaternion Differential Operator

The del operator in Pauli quaternion form is

$$\vec{\nabla} \equiv \hat{\sigma}_1\frac{\partial}{\partial x} + \hat{\sigma}_2\frac{\partial}{\partial y} + \hat{\sigma}_3\frac{\partial}{\partial z} \quad (4)$$

[3]In June of 1990, in my quest to learn more about quaternions, I went over to MIT and was told to ask Viki Weisskopf, I went to his office, the door was open I introduced myself, it turns out he didn't know much about quaternions or that complex quaternions (biquaternions) were the same as Pauli matrices if each matrix was the same as a unit vector. In a way this was discouraging, because Viki knew Pauli and had even co-authored a paper [12] with him.

the quaternion differential operator.

(Silberstein's Operator [7] [8]) Pauli quaternion version is

$$\vec{D} = \frac{\partial}{c\partial t} + \hat{\sigma}_1 \frac{\partial}{\partial x} + \hat{\sigma}_2 \frac{\partial}{\partial y} + \hat{\sigma}_3 \frac{\partial}{\partial z} = \left(\partial_0 + \vec{\nabla}\right) \quad (5)$$

Its parity conjugate is

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

operation on the "real" part of a Pauli quaternion

$$\vec{D}\left(A_0 + \vec{A}\right) = \left(\partial_0 + \vec{\nabla}\right)\left(A_0 + \vec{A}\right) = \left(\partial_0 A_0 + \vec{\nabla}\cdot\vec{A}\right) + \left(\partial_0 \vec{A} + \vec{\nabla}A_0 + i\vec{\nabla}\times\vec{A}\right) \quad (6)$$

note

$$\left(\partial_0 - \vec{\nabla}\right)\left(\partial_0 + \vec{\nabla}\right) = \left(\partial_0^2 - \nabla^2\right) \quad (7)$$

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.

3.3. Pauli Algebra

Pauli algebra is basically Pauli quaternions with 2 × 2 matrices rather than unit vectors. The standard Pauli matrix representations (although there are an infinite collection of the matrix representations) are:

$$I = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix} \quad \sigma_1 = \begin{bmatrix} 0 & 1 \\ 1 & 0 \end{bmatrix} \quad \sigma_2 = \begin{bmatrix} 0 & -i \\ i & 0 \end{bmatrix} \quad \sigma_3 = \begin{bmatrix} 1 & 0 \\ 0 & -1 \end{bmatrix} \quad (8)$$

4. Pauli Quaternion Versions of Standard Physics Equations

4.1. Maxwell's Equation(s)

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

$$\left(\partial_0 - \vec{\nabla}\right)\left(G - \vec{E} + i\vec{B}\right) = 4\pi\left(\rho + \frac{\vec{J}}{c}\right) \quad (9)$$

$$G = \left(\partial_0 A_0 + \vec{\nabla}\cdot\vec{A}\right), \quad \vec{E} = \left(-\partial_0 \vec{A} - \vec{\nabla}A_0\right), \quad i\vec{B} = \left(i\vec{\nabla}\times\vec{A}\right)$$

G = Lorenz condition field, $\vec{E}$ = Electric field, $\vec{B}$ = Magnetic Induction field.

A_0 = Scalar Potential, $\vec{A}$ = Vector Potential.

Conversely all four Maxwell's equations can be extracted from Eq. (9).

$\vec{\nabla}\cdot\vec{E} = 4\pi\rho - \partial_0 G$ is the real scalar part Coulomb's Law (modified) (9A)

$\vec{\nabla}\cdot\vec{B} = 0$ is the imaginary scalar part No Magnetic monopoles (9B)

$\vec{\nabla}\times\vec{E} + \partial_0\vec{B} - \vec{\nabla}G = 0$ is the real vector part Faraday's Law (modified) (9C)

$\vec{\nabla}\times\vec{B} - \partial_0\vec{E} = 4\pi\frac{\vec{J}}{c}$ is the imaginary vector part Ampere's Law (9D)

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

G is the Lorenz condition field, typically it is set equal to zero however if $\partial_0 G \ll 1$ and $\vec{\nabla}G \ll 1$ then the standard Maxwell's equations are obtained. The physical interpretation for G which is more satisfying than the "gauge ambiguity" is that G is proportional to the Newtonian gravitational potential this will be demonstrated in the following:

4.1.1. One Step Derivation of the Electromagnetic Wave Equation

$$\left(\partial_0+\vec{\nabla}\right)\left(\partial_0-\vec{\nabla}\right)\left(G-\vec{E}+i\vec{B}\right)=4\pi\left(\partial_0+\vec{\nabla}\right)\left(\rho+\frac{\vec{J}}{c}\right) \tag{10}$$

$$\left(\partial_0^2-\nabla^2\right)\left(G-\vec{E}+i\vec{B}\right)=4\pi\left[\left(\partial_0\rho+\vec{\nabla}\cdot\frac{\vec{J}}{c}\right)+\left(\nabla\rho+\partial_0\frac{\vec{J}}{c}\right)+\left(i\vec{\nabla}\times\frac{\vec{J}}{c}\right)\right] \tag{11}$$

from the continuity equation, the scalar part of the "Electromagnetic quaternion" wave equation is:

$$\left(\partial_0^2-\nabla^2\right)G=4\pi\left(\partial_0\rho+\vec{\nabla}\cdot\frac{\vec{J}}{c}\right)=0 \tag{12}$$

The following is to demonstrate the plausibility of claiming that the scalar part of the electromagnetic field quaternion could be associated with the gravitational potential.

4.1.2. Time Independent Angular Independent Solution to Laplace Equation for *G*

There are a number of Solutions to Equation (12) the simplest is $G=0$ which the Lorenz condition "gauge" assuming the continuity equation $\partial_0\rho+\vec{\nabla}\cdot\frac{\vec{J}}{c}=0$ is true, while time dependence and angular dependence are not present, Equation (12) becomes Laplace's equation, $\nabla^2 G=0$, so that the simplest non-zero solution (ignoring added integration constants) for the static case in spherical coordinates for the Laplace equation is:

$$G=\frac{K}{r} \tag{13}$$

where K is an unspecified integration constant. Choosing $K=-\kappa G'_{Newton}Mm$ $\kappa=\frac{1}{q'd}$ so that κ is an inverse dipole moment from dimensional analysis which yields a form of Newton's Gravity potential equation.

$$G=\frac{1}{q'd}\frac{-G'_{Newton}Mm}{r} \tag{14}$$

where G'_{Newton} is Newton's gravitational constant. In the typical model with the charge q on a mass m, since the model is so simple, a charge $-q$ should appear on M and $q'd\to -qr$.

4.1.3. Traveling Wave Solution for *G*

A Gravitational Traveling wave solution for Equation (12) in rectangular coordinates is

$$G=G_0\mathrm{e}^{i\left(\vec{k}\cdot\vec{r}-wt+\phi\right)} \tag{15}$$

4.1.4. Maxwell's Equations Potential Form

Maxwell's Equations in terms of Potentials are:

$$\begin{aligned}\left(\partial_0^2-\nabla^2\right)\left(A_0+\vec{A}\right)&=\left(\partial_0-\vec{\nabla}\right)\left(\left(\partial_0 A_0+\vec{\nabla}\cdot\vec{A}\right)+\left(\partial_0\vec{A}+\vec{\nabla}\Phi\right)+\left(i\vec{\nabla}\times\vec{A}\right)\right)\\&=\left(\partial_0-\vec{\nabla}\right)\left(G-\vec{E}+i\vec{B}\right)=4\pi\left(\rho+\frac{\vec{J}}{c}\right)\end{aligned} \tag{16}$$

4.2. Relativity

Relativity is an obvious application for quaternions. In addition to discovering the equivalent of Equation (9) without the G, the Lorentz Transformation in quaternion form was discovered by both Ludwik Silberstein [7] [8] [13] and Arthur Conway [6] [14] independently, a minor dispute followed. See **Figure 3**.

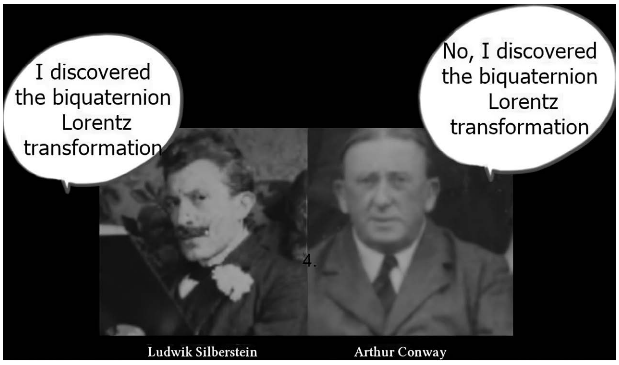

Figure 3. Silberstein and Conway applied complex quaternions (biquaternions) to Einstein's 1905 special relativity independently. The choice of Grassmann's tensor analysis by Minkowski and his friend Hilbert to generalize relativity followed by Einstein, caused the more natural biquaternions to be ignored. 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.

4.3. Lorentz Transformation, Pauli Quaternion Form, Equivalent Reformulation of Silberstein's Version

$$\left(ct'+\vec{r}'\right)=\gamma\sqrt{1+\frac{\vec{v}}{c}}\left(ct+\vec{r}\right)\sqrt{1+\frac{\vec{v}}{c}} \tag{17}$$

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

5. Gravitons, Negative Mass

5.1. Negative Mass

Recent experiments [15] have shown that antimatter *i.e.* anti-Hydrogen reacted to gravity the same as "normal" matter *i.e.* Hydrogen. That is, contrary to some speculation**, antimatter doesn't fall up**! Alan Guth had previously suggested [10] that the gravitational field has negative mass. Agreeing with Guth, this presentation suggests that the gravitational potential field which is claimed to be proportional to the Lorenz condition field, has negative mass! This report also goes a step further, to say that gravitons exist, have negative mass, and curve space, which is not observed in the classical Newtonian region.

5.2. Photo-Gravitons

Since the full Maxwell's equations yield a wave equation for $G - \vec{E} + \vec{B}$ the electromagnetic-gravitational fields, assigning a composite quanta, a "photo-graviton" to it seems appropriate. The photo graviton should have a net mass of zero and a spin of 2.

5.3. 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[4] The model presented in Figure 4 and Figure 5. 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. There have been some experiments that have changed the geometry of the Crookes radiometer, but the side that absorbs the most light still is pushed more, an experiment with an extreme vacuum should settle the question of the "radiometer" only working in a "partial vacuum". So called reflective solar sails in miniature made to fit into a Crookes radiometer might clarify the issue, since they supposedly work by reflection, pitted against the absorbing "dark" side of the radiometer should get the same results that the radiometer gives now.

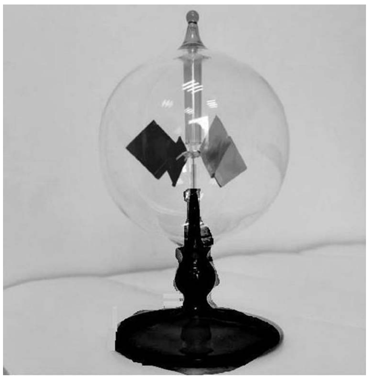

Figure 4. Crookes Radiometer, this was initially thought to measure radiation pressure. The mirrored side would hypothetically reflect back light in an elastic collision type of interaction achieving double the impulse (momentum change) of the dark absorbing side which would be like an inelastic collision. 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 Figure 1 and Figure 2, suggests a simple resolution of the paradox.

[4]See Wikipedia article on "Crookes Radiometer".

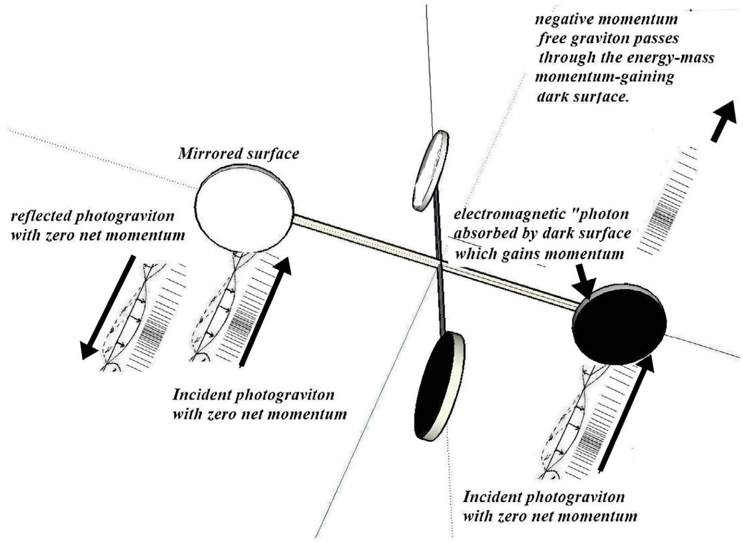

Figure 5. The above depicts a simplified version of the Crookes radiometer. The circular white drawing represents the mirrored side of the Crookes radiometer vanes, while the darken circle represents the absorbing side of the vane. If "photons" have energy of *hf* then according to Einstein they have mass $\frac{hf}{c^2}$ momentum $\frac{hf}{c}$. The standard physics explanation says that the mirrored side should be pushed twice as hard as the dark absorbing side but the vanes spin in the wrong direction! If a negative mass-momentum graviton rides along with the "photon" as the completed Maxwell's equation suggests. Then the paradox is resolved.

6. Graviton Gas-Gravity Breaking Away from Matter

It was discovered in the 1970's that gravity waves exist [16] this has been confirmed by a number of other experiments. These gravity waves, break off from the masses that they are associated with and become free. If gravity waves are associated with the quanta known as gravitons then the gravitons are free from the masses that they were associated with. In quantum statistical mechanics there exist photon gas. It is conjectured that there should also be "graviton gas", the gradient of the gas should be a force even if there is no mass present. This suggests a new model for gravity depicted in Figure 6.

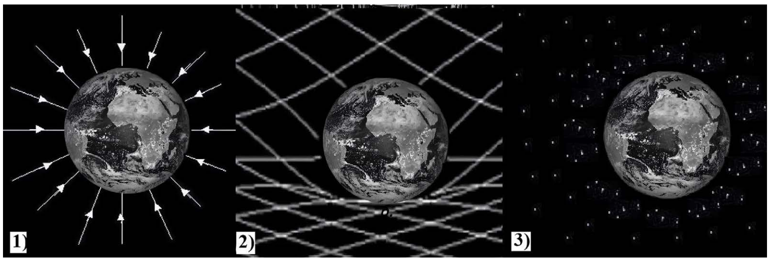

Figure 6. The above depicts 3 different conceptual models for the gravitational field 1) The lines of force model give the classical force and direction of the gravitational force. 2) The non Euclidean geometry model of Riemann used by Hilbert to complete the work of his deceased friend Minkowski, Einstein claimed he thought of it first and Hilbert yielded credit. 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 consider to be a vacuum, which would seem to curve space.

7. Model for "Dark Matter"

Observations of frequency shifted light from the outer stars from our neighboring spiral galaxy, Andromeda, [17] reveal that the stars are moving way too fast to be explained by Newton's and Einstein's laws of gravity. Furthermore, similar observations from both Andromeda and the other neighboring spiral galaxy, Triangulum indicate that all three local group spiral galaxies are accelerating towards each other far too strongly for a standard gravity explanation [18]. Even more, the local group seems to be pulled toward the Virgo super cluster, again not explained with standard gravity. A standard hypothesis has been something called "dark matter". A different hypothesis is presented here. To explain this, it is proposed that extra gravitons are created by the absorption of the electromagnetic part of photo gravitons by galactic interstellar dust in the inner parts of galaxies and the intergalactic dust between galaxies. It is proposed that the same thing that causes the Crookes radiometer motion also causes the dark matter "gravity" by flooding the outer reaches with free gravitons (**Figure 7**).

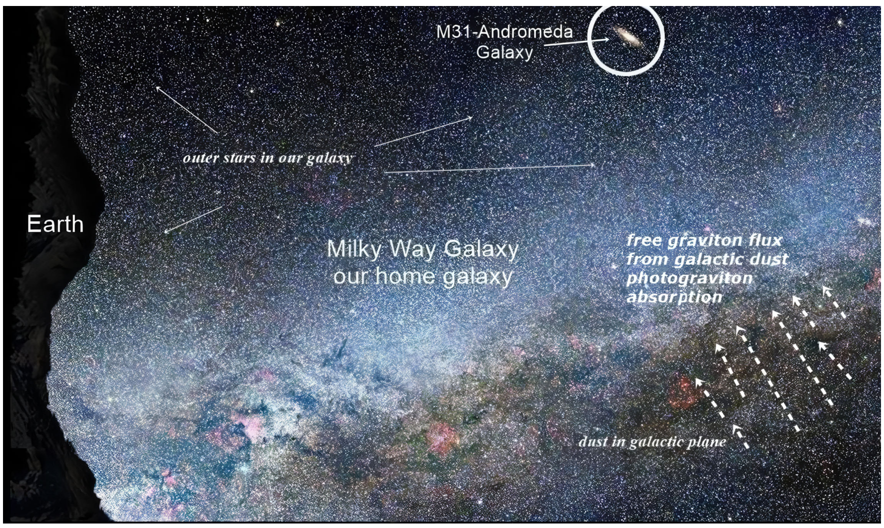

Figure 7. The above is an image of a portion of the Milky Way galaxy. It was taken over the horizon and rotated 90 degrees. It shows the stars in the outer milky way galaxy and the vast dust formations in the inner galaxy. It also shows our neighbor galaxy; Andromeda. Vera Rubin and Kent Ford observed that outer stars in Andromeda were moving way too fast for either Newton's or Einstein's laws of gravity. If the graviton gas model is correct then the inner galactic dust should absorb electromagnetic radiation and flood the outer galaxy with free gravitons. (The inner galaxy dust acts like the absorbing sides in the Crookes Radiometer. This may explain dark matter.)

Conflicts of Interest

The author declares no conflicts of interest regarding the publication of this paper.

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