Dimensional/Gravitational Symmetrical Model for Particles and Gravity in terms of Electrodynamics

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Analysis of radiometric data from the Pioneer 10 and 11 probes indicate that they are begin slowed by an anomalous constant acceleration with an average magnitude a_P $\sim 8 \times 10^{-8} cm/s^2$ oriented with respect to the sun. The acceleration can be described by the equation:

$$\langle a \rangle = h\nu \langle c \rangle$$

Combine this equation with Einstein's equation, $E = mc^2$ provides a complete relationship between gravity and electromagnetism not only in terms of electromagnetic waves, but matter as well. The final form takes the expressions:

$$\langle a \rangle = h\nu \langle c \rangle = mc^2 \langle c \rangle$$

$$a = \langle h \rangle \frac{c^2}{\lambda} = \left(\frac{\langle h \rangle}{\lambda c} \right) c^3$$

The acceleration is placed in brackets in the first equation to show that it is the expectation value or energy of the graviton derived from a quantized interaction. The second equation keeps acceleration with units of m/s^2, and has Planck's constant as a unit of proportionality between each expression.

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Introduction

Optimistically we have derived a quantized expression between electromagnetism and gravity, at least in terms of electromagnetic waves. We derived our hypothetical equation, $\langle a \rangle = h\nu\langle c \rangle$ as a possible solution [1], where we relate the acceleration to the frequency of the suns light. Our work rests on the data collected concerning the Pioneer probes [2] and the Lageos satellites [3], whose behavior are consistent with that of a quantized relationship between energy and gravity. It is also especially encouraging that our equation appears congruent with the result obtained by the Pound and Rebka experiment [4] that showed that light changes frequency in a gravity field. We would like to formulate a complete set of equations that satisfy a gravitational relation in terms of not only waves, but matter, or particles as well. This paper is the culmination of our attempt.

We have at least been able to draw an experimentally consistent picture from three different phenomena that appear gravitational in origin. The first of these of course it concerns the Pioneer probes. The second rests on the experimental evidence provided by the Pound and Rebka experiment in 1960 at Harvard. The third regards the Lageos satellite data which indicate an anomalous acceleration affecting the craft as they are eclipsed by the earth. We attribute the value of the acceleration associated with them as an indication of the reduction of electromagnetic gravitation for approaching photons.

Suppose we assume that our empirical equation

$$\langle a \rangle = h\nu c \tag{1}$$

is an accurate quantized relation between light and gravity. We might try to combine it with Einstein's equation $E = mc$ to form our complete formula:

$$a = h\nu c = mc^3 \tag{2}$$

We begin with acceleration or gravity on the left, energy in the middle and matter on the right. The formula is not consistent of course, because there needs to be a unit of proportionality for it to be balanced. However, there still exists the possibility of a relationship, and that the results of one do agree with the other if taken from the right perspective.

Symmetry

Let us consider nine particles, five of which we will focus our attention upon. It will be these five that we will attempt to show a gravitational relationship with.

$$\gamma, \quad e^{-}, \quad p^{+}, \quad n^{0}, \quad \bar{\nu}, \quad E, \quad B, \quad \bar{h}, \quad \bar{c}$$

The first five symbols represent the photon, electron, proton, neutron, and neutrino, respectively. The last four represent the electric and magnetic fields (specifically the virtual photons that mediate these fields), the graviton and the chronon.[1]

Our choice in beginning with a photon stems from the phenomena of *pair production*[2], where a photon materializes into an electron and positron:

...in a collision a photon can give and electron all of its energy (the photoelectric effect) or only part (the Compton effect). It is also possible for a photon to materialize into an electron and a positron. In this process, called ***pair production****, electromagnetic energy is converted into matter.*

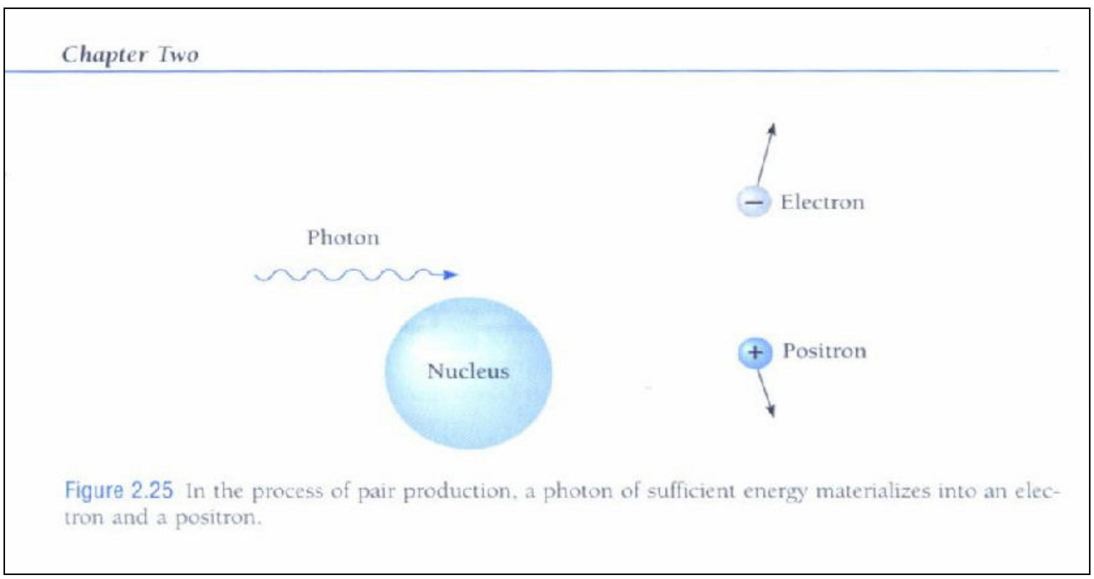

Figure 2.25 In the process of pair production, a photon of sufficient energy materializes into an electron and a positron.

Fig 1. Pair Production (Fig 2.25 from "Introduction to Quantum Mechanics)

No conservation principles are violated when an electron-positron pair is created near an atomic nucleus (Fig2.25). The sum of the charges of the electron (q= -e) and of the positron (q= +e) is zero, as is the charge of the photon; the total energy, including

[1] If the graviton background is 'composed' of gravitons, time may have a similar quantum counterpart, or chronon. Taken from *"Scientific American,"* 'That Mysterious Flow' by Paul Davies, Volume 15, Number 3, pg. 84, © 2005

[2] *"Concepts of Modern Physics,"* Sixth Edition: Authur Beiser, Chapter Two, pgs. 79-81, McGraw-Hill, © 2003

rest energy, of the electron and positron equals the photon energy; and linear momentum is conserved with the help of the nucleus, which carries away enough photon momentum for the process to occur. Because of its relatively enormous mass, the nucleus absorbs only a negligible fraction of the photon energy. (Energy and linear momentum could not both be conserved is pair production were to occur in empty space, so it does not occur there.)

The rest energy mc^2 *of an electron or positron is 0.51 MeV; hence pair production requires a*
photon energy of at least 1.02 MeV. Any additional photon energy becomes the kinetic energy of the electron and positron. The corresponding maximum wavelength is 1.2 pm. Electromagnetic waves with such wavelengths are called ***gamma rays****, symbol* γ *, and are found in nature as one of the emissions from radioactive nuclei and cosmic rays.*

We will assume some ground rules before we begin out hypothesis. Our first assumption is that the energy/gravity relation outlined in equation (1) carries into the quantum realm, meaning the acceleration due to mass is indeed proportional to a particles electric or magnetic wave frequency.

We will refer to space time as the continuum, and illustrate it by the equation:

$$\vec{\nabla}_{x,y,z} \tag{3}$$

The symbol represents the 'divergence' of the continuum:

$$\vec{\nabla}_{x,y,z} = \frac{\partial}{\partial x} + \frac{\partial}{\partial y} + \frac{\partial}{\partial z} \tag{4}$$

Of course divergence is used to refer to, among other things, the properties of a spherically symmetric electric field:

$$\vec{\nabla} E = \frac{\partial}{\partial x} + \frac{\partial}{\partial y} + \frac{\partial}{\partial z} \tag{5}$$

We merely choose it here as a symbolic representation for the continuum, and to refer the dimensional planes of waves and fields relative to it.

Let us return then to the issue of materialization. We propose that what occurs is a re-arrangement of the electric and magnetic wave of the photon as it splits into an electron-positron pair. Each photon obtains half the energy of the original photon, as stated above in our example. The dual nature of light shows us that it is both particle and wave. We propose that the magnetic wave part of the photon becomes an oscillating, standing magnetic wave and constitutes what is referred to as the electron's mass. The photon's electric wave constitutes the electron's negative charge or, in the case of the positron, its dimensional orientation gives it its positive charge, as in figure 2.

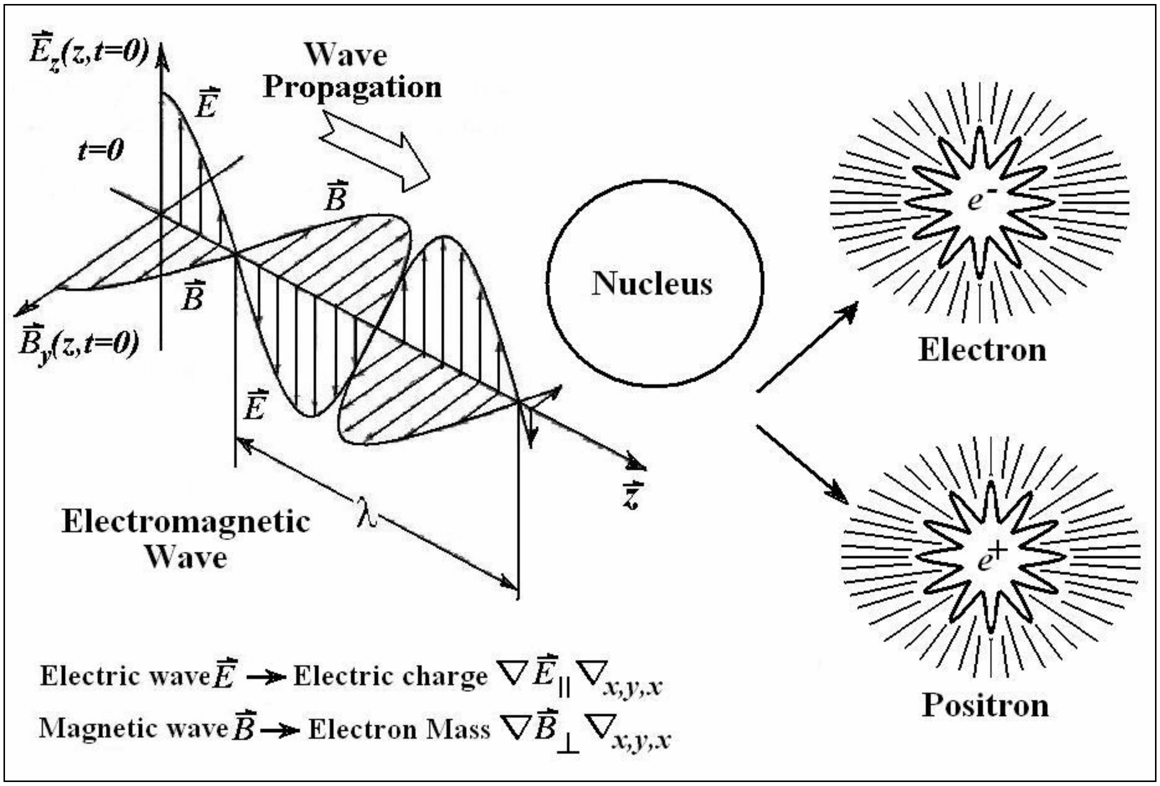

Fig 2. Hypothetical dimensional re-configuration as pair production

We will write the electron's mass as the 'divergence' of its standing magnetic wave being perpendicular to the continuum:

$$\vec{\nabla}B_{\perp}\vec{\nabla}_{x,y,z} = 0.511 Mev/c^2 \tag{6}$$

By perpendicular we mean that it interacts with the continuum, producing acceleration.[3] The electrons electric charge does not produce any gravitational contribution.[4] We write its relation to the continuum as:

$$\vec{\nabla}E_{||}\vec{\nabla}_{x,y,z} \tag{7}$$

Our last equation shows the relation of the electron's electric field and magnetic wave in relation to each other:

[3] We choose this arbitrarily by convention, in the same sense of the poles of a magnet are labeled, "North" and "South".
[4] The Reissner-Nordstrom metric suggests a curvature of the space-time continuum of charged black holes. Our hypothesis is consistent from a Quantum Mechanical perspective; electric and magnetic fields may be able to traverse the event horizon of a black hole because they do not lie in the same dimensional plane of gravity, thereby neither causing nor being susceptible to it. This does not refer to the phase of a *rotating* electric or magnetic field which may produce acceleration.

$$\vec{\nabla} B_{|\,|} \vec{\nabla} E \tag{8}$$

We indicate it here for reasons that will become clear further on.

The next particle we will consider is the proton, whose mass is much larger than that of an electron. Since the proton's charge is equal to that of an electron, we will use this charge itself as a 'control' from which we will derive the proton's characteristics. Specifically, we will tacitly treat the proton as if it is formed from a photon with the same energy as an electron in pair production.

We propose that the proton's mass is due to an interaction between its magnetic wave and electric field. This interaction produces a resulting frequency, also perpendicular to the continuum that we will refer to as the 'gravon' frequency, symbol $\vec{\nabla}\ddot{h}$.[5] We write the mass due to this secondary frequency as,

$$(\vec{\nabla} B_{p\perp} \vec{\nabla} E_p) = \vec{\nabla}\ddot{h}_{\perp} \vec{\nabla}_{x,y,z} = 937.761 MeV / c^2 \tag{9}$$

When added to the mass of the electron constitutes the protons full mass. Its electric field lies parallel to the continuum and its magnetic field as well, and we write them as:

$$\begin{gathered} \vec{\nabla} B_{\perp} \vec{\nabla}_{x,y,z} \\ \vec{\nabla} E_{|\,|} \vec{\nabla}_{x,y,z} \end{gathered} \tag{10}$$

For the neutron, we treat it as if it is a proton with its electric charge lying perpendicular to the continuum and that the difference in mass between a proton and neutron is due to it. The total effect of the gravon frequency, original electron magnetic frequency, and the electric wave frequency constitutes the neutrons mass.

$$\begin{gathered} \vec{\nabla} B_{\perp} \vec{\nabla}_{x,y,z} = 0.511 Mev / c^2 \\ (\vec{\nabla} B_{p\perp} \vec{\nabla} E_p) = \vec{\nabla}\ddot{h}_{\perp} \vec{\nabla}_{x,y,z} = 937.761 MeV / c^2 \\ \vec{\nabla} E_{n\perp} \vec{\nabla}_{x,y,z} = 1.293 MeV / c^2 \end{gathered} \tag{11}$$

The ratio of the 'strength' of the electric and magnetic waves are:

[5] It may also be possible to show that the strong force that nucleons respond to is due primarily to this interaction. For other short-lived particles that appear in particle interactions, we can attribute their mass to the amplitude of their magnetic waves. Indeed, we could simply treat the mass of any particle as being due to the amplitude of its magnetic wave, with its amplitude having a variable characteristic through its dimensional configuration as a standing wave. Both concepts show equal viability from an electromagnetic perspective.

$$\frac{\vec{\nabla}B_e}{\vec{\nabla}E_n} = 2.53 \quad (12)$$

The first issue of course is why the 'mass' of a standing electric wave is greater than that of a standing magnetic wave if we propose that they have the same frequency and dimensional configuration. We have not choice but to appeal to the possibility that certain intrinsic differences between the electric and magnetic wave carry through to their quantum states. In electrodynamics for example, there exists the following relationship between electric and magnetic waves:

$$E_{MAX} = cB_{MAX} \quad (13)$$

Or,

$$B = \varepsilon_0 \mu_0 cE\ . \quad (14)$$

Where,

$$\begin{aligned} \varepsilon_0 &= 8.85\times10^{-12}\, C^2 / N\cdot m^2 \\ \mu_0 &= 4\pi\times10^{-7}\, N / A^2 \end{aligned} \quad (15)$$

Our final particle, the neutrino, has a mass and we 'derive' it from the electron. We have introduced the gravon to account for the proton and neutron's mass, and the difference in the natures of permeability and permittivity to account for the discrepancy between the neutrons mass in our model. The neutrino forces us to make our final course correction in our attempt to maintain consistency and credibility.

An electron has intrinsic spin, and behaves as though it were a magnet. As a classic university text explains: [6]

A spinning charged particle constitutes a magnetic dipole. Its ***magnetic dipole moment****, μ, is proportional to its angular momentum,* ***S****.*

$$\mu = \gamma S; \quad (16)$$

the proportionality constant, is called the ***gyromagnetic ratio****.[30] When a magnetic dipole is paced in a magnetic field* ***B****, it experiences a torque, $\mu\times B$, which tends to line it up parallel to the field (just like a compass needle). The energy associated with this torque is[31]*

[6] "Introduction to Quantum Mechanics", Second Edition, David J. Griffiths, Chapter 4, pgs. 178 and 179, ©2005

$$H = -\mu \cdot B \tag{17}$$

So the Hamiltonian of a spinning charged particle, at rest[32] *in a magnetic field B, is*

$$H = -\gamma B \cdot S. \tag{18}$$

In Quantum mechanics, the mass of a neutrino is obtained from deriving an equation rather than experimentally. Due to the small mass of the neutrinos themselves, on the order of ~0.05-0.3 *eV*, we propose that it is a result of the oscillation of its magnetic dipole moment. Thus for the neutrino, we arrive at the following:

$$\vec{\nabla} B_{||} \vec{\nabla}_{x,y,z}$$
$$\vec{\nabla} E_{||} \vec{\nabla}_{x,y,z}$$
$$\vec{\nabla} \mu_{||} \vec{\nabla}_{x,y,z}$$
$$\vec{\nabla} B \ \ and \ \ \vec{\nabla} E_{||} \vec{\nabla} B_{EXT} \ \ and \ \ \vec{\nabla} E_{EXT} \tag{19}$$
$$\vec{\nabla} \mu_{\perp} (e^{-}, n^{0}, p^{+}) \tag{20}$$

Equation (16) represents the concept that the neutrino's magnetic and electric fields are parallel to external magnetic and electric fields. Equation (17) indicates that the neutrino's dipole moment 'field' does interact with individual particles themselves.[7]

[7] Up to this point our model has used the dimensional configuration of the particles fields relative to the continuum and their other aspects to derive their properties. While it is plausible, within the framework of our model, that the neutrino's mass can be formulated according to these postulates, we admit that, outside of the masses derived by those who study neutrinos, we cannot actually account for what constitutes a neutrino's mass. In our attempt to remain congruent with the logic we have presented thus far, we treat it as if it were a particle whose mass is a result of the dimensional configuration of its magnetic dipole due to its spin.

Dimensions

A hypothetical exercise to justify pair production and the other particles needs a corresponding explanation for proper units for mass.

The binding energy gained in the formation of a deuteron can provide the necessary framework to begin our hypothesis.

The hydrogen isotope deuterium, ${}_1^2H$, has a neutron as well as a proton in its nucleus. This we would expect the mass of the deuterium atom to be equal to that of an ordinary atom plus the mass of a neutron:

Mass of ${}_1^1H$ atom	*1.007825 u*
+ mass of neutron	*+1.0086765 u*
Expected mass of ${}_1^2H$ atom	*2.016490 u*

However, the measured mass of the ${}_1^2H$ atom is only 2.014102 u, which is 0.002388 u less than the combined massed of a ${}_1^1H$ atom and a neutron (Fig. 11.10).

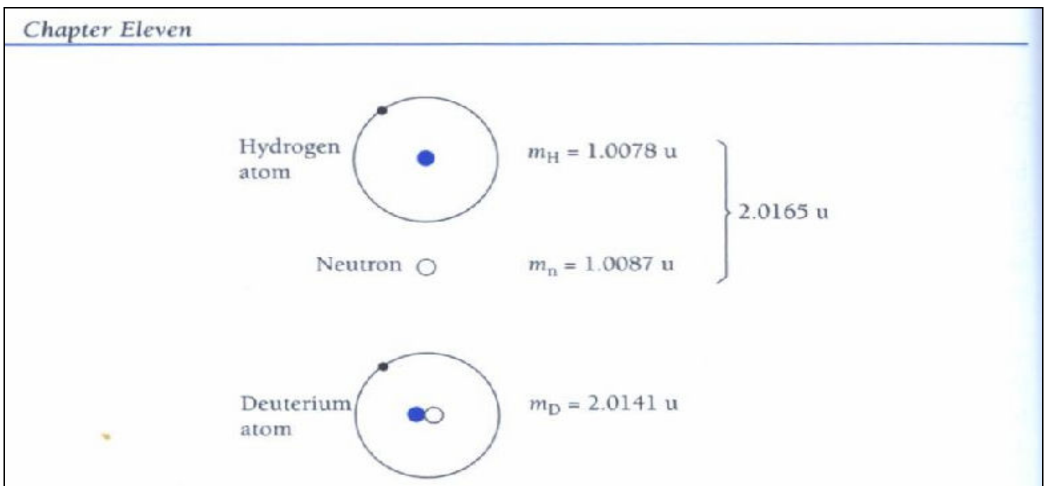

Figure 11.10 The mass of a deuterium atom (${}_1^2H$) is less than the sum of the masses of a hydrogen atom (${}_1^1H$) and a neutron. The energy equivalent of the missing mass is called the binding energy of the nucleus.

Fig. 3 Binding Energy (Fig. 11.10, Concepts of Modern Physics)

What comes to mind is that the "missing" mass might correspond to energy given off when a ${}_1^2H$ nucleus is formed from a free proton and neutron. The energy equivalent of the missing mass is

$$\Delta E = (0.002388\ u)(931.49\ MeV/u) = 2.224\ MeV$$

To test this interpretation of the missing mass, we can perform experiments to see how much energy is needed to break apart a deuterium nucleus into a separate neutron and proton. The required energy indeed turns out to be 2.224 MeV (Fig. 11.11). When less energy than 2.224 MeV is given to a ${}_{1}^{2}H$ *nucleus, the nucleus stays together. When the added energy is more than 2.224 MeV, the extra energy goes into kinetic energy of the neutron and proton as they fly apart.*[8]

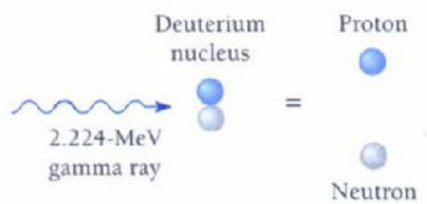

Figure 11.11 The binding energy of the deuterium nucleus is 2.224 MeV. A gamma ray whose energy is 2.224 MeV or more can split a deuterium nucleus into a proton and neutron. A gamma ray whose energy is less than 2.224 MeV cannot do this.

Fig. 4 (Figure 11.11, Concepts of Modern Physics)

From here we will use Compton's equation for particle scattering as a substitute for mass into Einstein's equation to show, at the bare minimum, a dimensional quantum correspondence between Einstein's equation and our own (1).

From Bohr's equation for the energy of a photon emitted by an electron transitioning between atomic energy levels,

$$h\nu = h\nu_i - h\nu_f \tag{21}$$

We can show that the difference in mass that produces the emission of photons associated with nuclear transformations can be derived from Einstein's equation,

$$E = mc^2 \tag{22}$$

Expanding

$$\begin{gathered} h\nu = mc^2 \\ h\nu = m\nu\lambda\nu\lambda \\ h\nu = \frac{h}{c\lambda}\nu\lambda\nu\lambda \\ m = \frac{h}{c\lambda} \end{gathered}$$

[8] *"Concepts of Modern Physics,"* Sixth Edition: Authur Beiser, Chapter Two, pgs. 399, 400, McGraw-Hill, © 2003

From Compton Scattering,

$$\lambda_c = \frac{h}{mc} \tag{23}$$

Substituting,

$$h\nu = \left(\frac{h}{c\lambda} - \frac{h}{c\lambda}\right)\nu\lambda\nu\lambda$$

$$\lambda = \frac{c}{\nu}$$

$$h\nu = \left(\frac{h\nu}{c^2} - \frac{h\nu}{c^2}\right)\nu\lambda\nu\lambda$$

$$h\nu = (h\nu - h\nu)\frac{\nu\lambda\nu\lambda}{c^2}$$

$$h\nu = h\nu_i - h\nu_f$$

Next we obtain the total 'wavelength' of the masses before and after the reaction using Compton's equation,

$$\lambda_i = \frac{(6.626\times 10^{-34}\,J\cdot s)}{(3.3476\times 10^{-27}\,kg)(2.9979\times 10^{8}\,m/s)} = 6.6023\times 10^{-16}\,m$$

$$\lambda_f = \frac{(6.626\times 10^{-34}\,J\cdot s)}{(3.3436\times 10^{-27}\,kg)(2.9979\times 10^{8}\,m/s)} = 6.6101\times 10^{-16}\,m$$

Dividing c by each wavelength gives us the frequencies,

$$\nu_i = \frac{c}{\lambda_i} = 4.5407\times 10^{23}\,hz \text{ , and } \nu_f = \frac{c}{\lambda_f} = 4.5353\times 10^{23}\,hz\,.$$

Substituting into Bohr's equation, $h\nu = h\nu_i - h\nu_f$ gives:

$$= ((4.136\times 10^{-15}\,eV\cdot s)(4.5407\times 10^{23}\,hz)_i - (4.136\times 10^{-15}\,eV\cdot s)(4.5353\times 10^{23}\,hz)_f)$$
$$= 2225161.225eV = 2.225\,MeV\,.$$

Except for the units, the Compton equation works well as a 'substitute' for mass into Einstein's equation in our goal of relating it to our empirical equation. Addressing the issue of units, we rewrite equation (2) as two equations:

$$\langle a \rangle = h\nu \langle c \rangle = mc^2 \langle c \rangle \qquad (24)$$

$$a = \langle h \rangle \frac{c^2}{\lambda} = \left(\frac{\langle h \rangle}{\lambda c} \right) c^3 \qquad (25)$$

In equation (24) the acceleration is placed in brackets to show that it is the expectation value or energy of the graviton derived from a quantized interaction. Equation (25) keeps the acceleration as a 'real and classical' value with units of m/s^2. Planck's constant is placed in brackets, indicating that it is considered as a dimensionless constant, and acts as the unit of proportionality between the three expressions.[9] For equation (25) it would be:

$$\langle h \rangle = 6.626068 \times 10^{-34} \qquad (26)$$

In the case of equation (24), we must appeal to the essence of quantum mechanics in reasoning it units. Treating the magnitude of $\langle a \rangle$ as an expectation value, we can view it as a number that pertains to an observable. The value of the number itself would change depending on the value of units we chose for Planck's constant, as either $J \cdot s$ or $m^2 kg / s$.

[9] Equation (22) adds one *c*, forming c^3, to keep the dimensional units consistent, and uses mass in terms of equation (20).

Dimensions

The idea of treating neutrinos transparent to gravitons stems chiefly from the notion that they travel near the speed of light and yet have mass. In a bubble chamber, charged particles interact with the chambers magnetic field, which slows their flight paths. Although the chamber is too small to show the effect of gravity to be seen in the particles' path, several light years would suffice.

Gravity cannot cause a particle to travel faster than the speed of light, even if it acts in the same direction as the object. The following example shows the relativistic relationship for a particle and a gravity field.[10]

Example 1.5

Find the acceleration of a particle of mass m and velocity ***v*** *when it is acted upon by the constant force* ***F****, where* ***F*** *is parallel to* ***v****.*

Solution

From Eq. (1.19), since $a = dv/dt$

$$F = \frac{d}{dt}(\gamma m v) = m\frac{d}{dt}\left(\frac{v}{\sqrt{1-v^2/c^2}}\right)$$

$$= m\left[\frac{1}{\sqrt{1-v^2/c^2}} + \frac{v^2/c^2}{\left(1-v^2/c^2\right)^{3/2}}\right]\frac{dv}{dt}$$

$$= \frac{ma}{\left(1-v^2/c^2\right)^{3/2}}$$

We note that F *is equal to* $\gamma^3 ma$, ***not*** *to* γma. *Merely replacing* m *by* γm *in classical formulas does not necessarily yield a relativistically correct result.*

The acceleration of the particle is therefore:

$$a = \frac{F}{m} = \left(1-v^2/c^2\right)^{3/2}$$

Even though the force is constant, the acceleration of the particle decreases as its velocity increases. As $v \to c,\ \ a \to 0$, *so the particle can never reach the speed of light, a conclusion we expect.*

[10] "Concepts of Modern Physics," Sixth Edition: Authur Beiser, Chapter One, pg 26, McGraw-Hill, © 2003

This only shows the effect of gravity acting in the same direction as the particles velocity. It is surely not zero in the opposite direction; in fact it should experience a *retarding* force. Even if a neutrino is able to penetrate many light years of lead, if it interacts with gravity, it cannot travel at c indefinitely, but would slow.

The other concept is that they may not see gravity because they represent a gravitational/dimensional symmetry between the continuum and themselves, in a relative sense as in the case of a photon. Photons do not have mass, but they are susceptible to and produce gravity. Neutrinos may be the 'dimensionally anti-symmetric' equivalent to photons, having mass, but not interacting with gravity.

This does not violate the philosophy in which neutrinos were proposed by Wolfgang Pauli. It is possible that not only do neutrinos satisfy the conservation of momentum in β–decay, but that this responsibility need not hinge on whether or not they interact with gravity.

Summary

Our goal was three-fold: to show a gravitational relation between our equation and Einstein's; the possibility of a dimensional/ gravitational symmetry between the neutrino and the photon; to formulate a general gravitational and dimensional frame of reference for our five particles.

The first relation of course stems from our need to unify the relation between electromagnetic waves and mass, which led us to formulate our model for mass according to Compton's equation.

The second case that deals with the neutrino is posed to provide a resolution between conservation of momentum that the neutrino was theorized to satisfy, and to propose that its behavior suggests this relationship. It is not our goal to justify a new gravitational model based on its (the neutrino) apparent behavior. We mention its non gravitational interaction to remain consistent within the framework of our hypothesis.

The third case rests entirely on the phenomenon of pair production. Although one may be comfortable with our first premise when we derived the electrons mass, since it proceeds directly from pair production, the others (for the proton, neutron and neutrino) may not. Any number of models could be derived from an initial electromagnetic frame of reference of a photon materializing into an electron/positron pair. Once again it is only our aim to suggest one, and show that it is consistent. At least in the case of the biding energy example we give on page 10, we can at least arrive at the same result.

In some ways we have attempted to reconcile Planck's constant as a dimension-less constant of proportionality by appealing to the possibility of dimensional re-configuration of the photon in equation [25]. In essence, we do not extricate a specific proportionality constant between each entity (photon, electron, and neutrino) without reference to dimensional constraints of the continuum, and treating each entity as a kind of state between dimensional transitions (analogous to an electron's transition between energy levels in an atom).

Conclusion

A good comment regarding dimensional constraints, in the sense that we aim to explain them can be expressed in light of the following comment with regard to the text "Gravitation":

The physical explanations are just brilliant and what is more important general relativity is introduced in the manner Einstein itself viewed it: as a geometric representation of gravity! Other books on this subject formulate general relativity only algebraically (like quantum theory) but this hides the importance of the idea that all gravitational effects can be extracted from the geometry of spacetime. The algebraic formulation may be regarded as more modern by some authors, it must be said however that no algebraic formulation managed to give more physical insight. The algebraic treatment tries to unify the view of general relativity and quantum field theory, but the physical discrepancies between the two theories remain unsolved.[11]

In the case of the hypothesis presented in this paper, we give what is essentially an *algebraic description* of a multi-dimensional/gravitational interaction/relationship between particles and space-time. A deeper mathematical description is needed; however this paper, for the time being, serves as a basic outline of the philosophy of our approach in accounting for dimensional/gravitational relationships between particles and space-time.

The other issue as well is that we have two equations: one "quantum" [21] and the other "classical" [22]. This implication is that the nature of the effect is dualistic, or depends on how an observer chooses to measure/interpret the effect. The closest correlation that we can associate as a bridge between the two is that they indicate the correspondence effect noted by Bohr, and that one is really an approximation of the other.

Finally, what one regards as 'units' or 'dimensions' for a 'classically observed phenomenon' may not hold in the quantum realm, where it may not be possible to associate units or dimensions with a quantum interaction. Perhaps the situation of a graviton is the best possible relation that we can associate with our case. The magnitude of acceleration (energy of the graviton(s)) measured by a gravimeter could be associated as the 'observable' in the quantum sense. The units or dimensions we associated with the acceleration could then be thought of as the corresponding dimensional framework within which we measure the observable.

[11] Amazon.com search for "Gravitation," by Kip S. Thorne, Charles W. Misner, John Archibald Wheeler. Comment by Dr. Alexander Mircescu (Muenchen Germany)

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