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On Gravitation, Spin, and Electromagnetism with a Correction to the Bending of Light

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Abstract: This last thought experiment, the one that one gets up in the middle of the night for, the one that we have been skirting along after, the one that we seek, shows that the two different representations of a particle cannot both be true. Particles are energy wave spheres. We consider an energy wave sphere with omnidirectional wave with velocity c and energy mc^2 to be the particle. The quantum-mechanical *representation* of spin as an operator, with no idea of what we have given as spin, *misses* what spin is. Recalling Ohanian's statement that "the mathematical formalism of the Dirac equation and of group theory demands the existence of the spin to achieve the conservation of angular momentum and to construct the generators of the rotation group, but fails to give us any understanding of the physical mechanism that produces the spin," Bohm's statement that "we shall therefore treat the nonrelativistic theory of spin in the form originally developed by Pauli, and we shall merely accept the spin as an empirically required addition to the angular momentum, without attempting to understand its origin a deeper way," and Feynman's statement that "these problems were solved classically in various ways, but none of the ways have been carried over successfully in quantum mechanics," we pass *for now* on considering further the quantum mechanical nature of spin since quantum mechanics has no idea what spin is and we have just given the nature of spin with a more realistic quantum approach. The portion of the energy wave sphere that the projection of which lies within the double horizontal cone has an angular momentum of $\frac{\hbar}{2}$, which is the spin of the energy wave sphere; similarly, the portion of the energy wave sphere that the projection of which lies within the double vertical cone has an angular momentum of $\frac{\hbar}{2}$, which is the magnetic moment of the energy wave sphere. The electric force between two energy wave spheres depends on the spin of the energy wave spheres. If the energy wave spheres are the same type, as in electron or proton, for two energy wave spheres separated by the distance r, the energy waves, on the sides closest together, oppose each other if the energy wave spheres have the same alignment, the spin of each being in the same direction. This would give rise to an attractive force between the energy wave spheres, but the spins are in the opposite direction since the magnetic force flips the direction of the waves so that waves are in the same direction on the sides of the energy wave spheres closest together, thus resulting in a repulsive force between the two energy wave spheres. For two energy wave sphere of different types, the flipping of the wave directions via the magnetic force results in an attractive force since the direction of the energy waves on the sides of the energy wave spheres closest together are opposite, resulting in an attractive force. An electron and a proton, with spins in the same direction via the magnetic force, attract each other since the momenta of the waves on the sides of the energy wave spheres closest together are in opposite directions, thus reducing the momenta of the energy waves on the sides of the energy wave spheres closest together. Without any magnetic force aligning the energy wave spheres so that the spins are opposite or the same, there is no electric force. With the radius of the proton smaller than the radius of the electron, the proton *burrows* into the electron. One can only view *what is going on* via *misinformation* obtained through the sealed off exit of the once upon a time bookstore at New Mexico Tech. There are no experiments measuring the velocity of light in the moving system. The result of such a

measurement is not c, which contradicts the lie. The nature of *spin* that we give here contradicts the lie that it must be unknown. If souls contain rational consciousness, the soul of a physicist does not. In the words of Bruce Springsteen, Big Wheels rolling through fields, Where sunlight streams, Meet me in a land of hope and dreams, This Train Dreams will not be thwarted

To give humanity a science, to give humans *their* science back, to give a simple view of the physical universe that is not that difficult to discover is the beginning and the end point of this work. This serves as a gift. The term *overlord*, "in the English feudal system was a lord of a manor who had subinfeudated a particular manor, estate or fee, to a tenant," [1] as a list, *tyrant*, as in *despot*, as in *dictator*, of synonyms suggests, has an overtone of *oppression,* which is what we have in mind.

The overlords of science, the ones who control the propaganda for the great false theories, which somehow *have to be true*, are organized enough to control nearly everything. The Center for Astrophysics, Harvard & Smithsonian has an elaborate website, which considers various fields including Einstein's Theory of Gravitation, for which the makers of the website state,

"Our modern understanding of gravity comes from Albert Einstein's theory of general relativity, which stands as one of the best-tested theories in science. General relativity predicted many phenomena years before they were observed, including black holes, gravitational waves, gravitational lensing, the expansion of the universe, and the different rates clocks run in a gravitational field. Today, researchers continue to test the theory's predictions for a better understanding of how gravity works."

Five different phenomena, the first four *hyperlinked*, are listed as predictions, among many, of General Relativity of phenomena years before the phenomena were observed. Even though *p implies q* is logically equivalent to *not p or q*, which is true whenever *p* is false, these supposed predictions are taken to be tests of general relativity, somehow having a bearing on whether general relativity is true.

How the Center for Astrophysics, Harvard & Smithsonian *became concerned at all* is best answered by considering the makers of the website to be overlords of science. The last of the phenomena mentioned, the different rates that clocks run in a gravitational field is Einstein's solution to the equation of the geodetic line for dx_4, where dx_4 and dX_4 are the *differentials* of the time coordinates x_4 and X_4 in the gravitational field and in the local system, respectively, along a radius in the case of a quasi-static, radially symmetric gravitational field about a point mass.

In *The Foundation of the General Theory of Relativity, The Principle of* Relativity, pages 158 and 159, Einstein claims to obtain Newton's theory from the general theory of relativity as an approximation. The case in which the $g_{\mu\nu}$ have the constant values (4) means the absence of any effects of gravitation. Einstein considers the case, "a closer approximation to reality," "where the $g_{\mu\nu}$ differ from the values of (4) by quantities which are small compared to 1, and neglecting small quantities of second and higher order. (First point of view of approximation.)" Einstein assumes further "that in the space-time territory under consideration the $g_{\mu\nu}$ at spatial infinity, with a suitable choice of co-ordinates, tend toward the values (4)."

Einstein assumes, as yet another approximation, that the velocity

$$v = \sqrt{\left(\frac{dx_1}{dx_4}\right)^2 + \left(\frac{dx_2}{dx_4}\right)^2 + \left(\frac{dx_3}{dx_4}\right)^2}$$

is small as compared with the velocity of light, i.e., the components

$$\frac{dx_1}{ds}, \frac{dx_2}{ds}, \frac{dx_3}{ds}$$

are small, "while *dx_4/ds*, to the second order of small quantities, is equal to one. (Second point of view of approximation.)"

Einstein remarks that from the first view of approximation, "the magnitudes $\Gamma_{\mu\nu}^{\tau}$ are all small magnitudes of at least the first order." By the second point of view of approximation, (46) becomes, considering only terms of lowest order,

$$\frac{d^2 x_\tau}{dt^2} = \Gamma_{44}^{\tau}$$

where we have set $ds = dx_4 = dt$. By the first point of view of approximation, this gives

$$\frac{d^2 x_\tau}{dt^2} = [44, \tau] \quad (\tau = 1, 2, 3)$$

$$\frac{d^2 x_4}{dt^2} = -[44,4].$$

Assuming the gravitational field to be quasi-static, Einstein neglects on the right-hand side differentiations with respect to time and obtains

$$\frac{d^2 x_\tau}{dt^2} = -\tfrac{1}{2}\frac{\partial g_{44}}{\partial x_\tau} \quad (\tau = 1, 2, 3)\ldots(67)$$

Einstein claims that "this is the equation of motion of the material point according to Newton's theory, in which $\frac{1}{2}g_{44}$ plays the part of the gravitational potential" and that "what is remarkable in this result is that the component g_{44} of the fundamental tensor alone defines, to a first approximation, the motion of the material point."

Since

$$-\frac{1}{2}\frac{d}{dr}\left(1 - \frac{\alpha}{r}\right) = -\frac{1}{2}\frac{\alpha}{r^2},$$

which is the gravitational acceleration according to Newton, Einstein obtains for g_{44},

$$1 - \frac{\alpha}{r}.$$

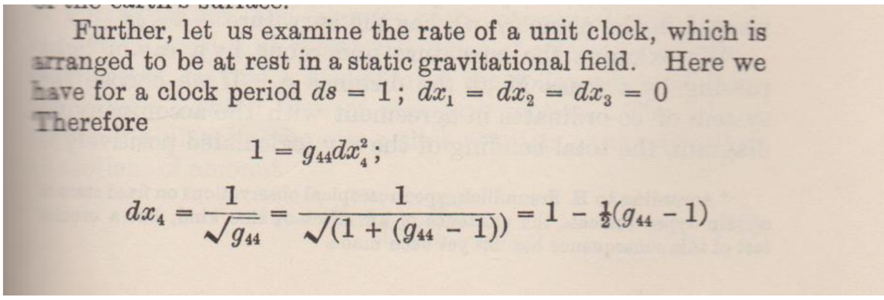
Thus

$$g_{44} dx_4^2 = \left(1 - \frac{\alpha}{r}\right) dx_4^2 = dX_4^2,$$

and

$$\frac{dx_4}{dX_4} = \left(1 - \frac{\alpha}{r}\right)^{-\frac{1}{2}},$$

which, according to Einstein, is the rate of a unit clock in a gravitational field.



Further, let us examine the rate of a unit clock, which is arranged to be at rest in a static gravitational field. Here we have for a clock period $ds = 1$; $dx_1 = dx_2 = dx_3 = 0$

Therefore

$$1 = g_{44}dx_4^2;$$

$$dx_4 = \frac{1}{\sqrt{g_{44}}} = \frac{1}{\sqrt{(1 + (g_{44} - 1))}} = 1 - \tfrac{1}{2}(g_{44} - 1)$$

Scanned image from *The Foundation of The General Theory of Relativity, The Principle of Relativity*, page 161.

Since

$$1 - \frac{\alpha}{r}$$

is less than 1, so is $\left(1 - \frac{\alpha}{r}\right)^{\frac{1}{2}}$, which implies that Einstein's rate of a unit clock, $\left(1 - \frac{\alpha}{r}\right)^{-\frac{1}{2}}$, is greater than 1, which implies that Einstein's clock rate is that of a faster clock, not the slower clock that Einstein claims.

Einstein obtains, as in the scanned image above,

$$dx_4 = \frac{1}{\sqrt{g_{44}}} = \frac{1}{\sqrt{1 + (g_{44} - 1)}} = 1 - \frac{1}{2}(g_{44} - 1),$$

or

$$dx_4 = 1 + \frac{\kappa}{8\pi}\int \rho \frac{d\tau}{r} \ldots (72).$$

"Thus the clock goes more slowly if set up in the neighborhood of ponderable masses."[3] *(The Foundation of The General Theory of Relativity, The Principle of Relativity*, page 162.)

Thus just after giving dx_4, obviously greater than 1 and in plain sight, Einstein claims that this is a slower clock. Einstein's dx_4 is greater than 1, increasing as r decreases, becoming arbitrarily large as $r \searrow \alpha$, and undefined at $r = \alpha$. With a time coordinate so that $dX_4 = 1$ in the local system and slower than that elsewhere in the gravitational field, clock rates dx_4 greater than 1 do not exist physically.

If $g_{44} < 1$, then ${g_{44}}^{-\frac{1}{2}} > 1$, which is the case for Einstein's $g_{44} = 1 - \frac{\alpha}{r}$, and $g_{44} = {g'_{44}}^{-1}$ for some $g'_{44} > 1$.

When Einstein, by setting *ds* = *dx₄* = *dt*, obtains

$$\frac{d^2x_\tau}{dt^2} = \Gamma_{44}^{\tau},$$

since dx_4 and dX_4 satisfy

$$g_{44}dx_4^2 = dX_4^2,$$

if $dX_\tau = 0, \tau = 1,2,3,$ dx_4 cannot be equal to $ds = dX_4$ if g_{44} is not equal to 1. But with Einstein's change in notation,

$$\frac{d^2x_\tau}{dt^2} = \frac{d^2x_\tau}{{dx_4}^2},$$

and

$$\frac{d^2x_\tau}{{dx_4}^2} = \frac{d^2x_\tau}{{dX_4}^2 g_{44}},$$

treating dx_4 as if it were in the local system.

Thus

$${dX_4}^2 = \frac{{dx_4}^2}{g_{44}},$$

or

$$\frac{{dx_4}^2}{{dX_4}^2} = g_{44},$$

or

$$\frac{{dX_4}^2}{{dx_4}^2} = {g_{44}}^{-1},$$

and

$$\frac{dX_4}{dx_4} = \left(1 - \frac{\alpha}{r}\right)^{-\frac{1}{2}},$$

which, keeping in mind that Einstein has *flipped* the roles of dX_4 and dx_4, gives Einstein's rate of a unit clock in a gravitational field.

Without Einstein's flipping variables, we have

$$\frac{dx_4}{dX_4} = \left(1 - \frac{\alpha}{r}\right)^{-\frac{1}{2}},$$

which gives Einstein's rate of a unit clock in a gravitational field with the usual roles of dX_4 and dx_4.

When Einstein solves equation (67) for g_{44}, the expression on the left side of the equation is not $\frac{d^2x_\tau}{{dx_4}^2}$, but $\frac{d^2x_\tau}{{dX_4}^2}$, despite the interchange of variables. We have

$$\frac{d^2x_\tau}{{dx_4}^2} = \frac{d^2x_\tau}{{dX_4}^2} g_{44}$$

$$= -\frac{1}{2}\frac{\partial g_{44}}{\partial r} g_{44}. \quad (1)$$

For $g_{44}dx_4^2 = dX_4^2$, we have

$$dx_4^2 = dX_4^2 \frac{1}{g_{44}}$$

so if $dx_4 < dX_4$, then $g_{44} > 1$, which is not the case for Einstein's g_{44}, which plays the role of ${g_{44}}^{-1}$ with $g_{44} = \left(1 - \frac{\alpha}{r}\right)^{-1}$. Thus equation (1) becomes

$$\frac{d^2x_\tau}{{dx_4}^2} = \frac{d^2x_\tau}{{dX_4}^2} g_{44} = -\frac{1}{2}\frac{\partial g_{44}}{\partial r} g_{44} = -\frac{1}{2}\frac{\alpha}{r^2}\left(1 + \frac{\alpha}{r} + \left(\frac{\alpha}{r}\right)^2 + \left(\frac{\alpha}{r}\right)^3 + \dots\right),$$

which is still close to $-\frac{1}{2}\frac{\alpha}{r^2}$ for $\frac{\alpha}{r}$ sufficiently small. Thus, of the two choices for g_{44}, Einstein chose the wrong one, the multiplicative inverse of $g_{44} = \left(1 - \frac{\alpha}{r}\right)^{-1}$, which is the correct value for g_{44}.

Since

$$g_{44} dx_4^2 = dX_4^2,$$

and, hence,

$$dx_4 = \frac{1}{{g_{44}}^{\frac{1}{2}}} dX_4,$$

$${g_{44}}^{\frac{1}{2}}$$

is a scale factor for the unit in the ${g_{44}}^{\frac{1}{2}}$ direction. If a material point moves in a geodetic line along the X_τ axis, aligned along a radius, with time coordinate X_4 such that

$$\frac{dX_\tau}{dX_4}$$

is constant, we can write the velocity of the material point along a radius in gravitational field as

$$\frac{dx_\tau}{dx_4} = \left(\frac{g_{44}}{g_{\tau\tau}}\right)^{\frac{1}{2}} \frac{dX_\tau}{dX_4}.$$

For Einstein's values of g_{44} and $g_{\tau\tau}$, we obtain

$$\frac{dx_\tau}{dx_4} = \left(\frac{1 - \frac{\alpha}{r}}{\frac{1}{1 - \frac{\alpha}{r}}}\right)^{\frac{1}{2}} \frac{dX_\tau}{dX_4}$$

$$= \left(1 - \frac{\alpha}{r}\right)\frac{dX_\tau}{dX_4},$$

which is decreasing in absolute value as r decreases. The acceleration $\frac{d^2x_\tau}{{dx_4}^2}$, the derivative of $\frac{dx_\tau}{dx_4}$ with respect to dx_4 is, using the chain rule,

$$\frac{\alpha}{r^2}\left(1 - \frac{\alpha}{r}\right)\left(\frac{dX_\tau}{dX_4}\right)^2,$$

which, considering the squared factor $\left(\frac{dX_\tau}{dX_4}\right)^2$, making it positive, is positive, which is the wrong sign. For the first term approximation of this acceleration to be $\frac{1}{2}\frac{\alpha}{r^2}$, the velocity $\frac{dX_\tau}{dX_4}$ must be $-\frac{1}{2^{\frac{1}{2}}} = -2^{-\frac{1}{2}}c$.

For the actual space-time coordinates with $g_{44} = \left(1 - \frac{\alpha}{r}\right)^{-1}$ and $g_{\tau\tau} = 1$,

$$\frac{dx_\tau}{dx_4} = \left(1 - \frac{\alpha}{r}\right)^{-\frac{1}{2}} \frac{dX_\tau}{dX_4},$$

and

$$\frac{d^2 x_\tau}{{dx_4}^2} = -\frac{1}{2}\left(1 - \frac{\alpha}{r}\right)^{-\frac{3}{2}} \frac{\alpha}{r^2}\left(1 - \frac{\alpha}{r}\right)^{-\frac{1}{2}} \left(\frac{dX_\tau}{dX_4}\right)^2$$

$$= -\frac{1}{2}\frac{\alpha}{r^2}\left(1 - \frac{\alpha}{r}\right)^{-2} \left(\frac{dX_\tau}{dX_4}\right)^2,$$

which has the right sign, but for the first term approximation of this acceleration to be $-\frac{1}{2}\frac{\alpha}{r^2}$, the velocity $\frac{dX_\tau}{dX_4}$ must be $-1 = -c$.

In *On the Nature of Being: Gravitation*, we considered, without calling it that, the electron energy wave sphere, or the electron de Broglie wave clock, of the Bohr model of the hydrogen atom. In the lowest energy state, the wavelength of the electron energy wave is equal to the circumference of the energy wave sphere, so the clock frequency is equal to the wave frequency. We assumed that the velocity of the energy wave is c in the local system of coordinates and that the radius of energy wave sphere is constant as a function of the distance from a mass M. In *The Material Point Universe Revisited*, we showed that the electron energy wave sphere in the Bohr hydrogen was like a miniature Michelson-Morley experiment, with the energy wave corresponding to the light wave in the experiment, the velocity of the energy wave equal to c to match the velocity of the light wave. With a unit clock frequency

$$\left(1 - \frac{\alpha}{r}\right)^{\frac{1}{2}},$$

which we have discussed as the multiplicative inverse of Einstein's unit clock rate from *Foundation* and which satisfies Einstein's equation (67) and the equation

$$\frac{\delta f}{f_0} = \frac{g\Delta h}{c^2},$$

which is experimentally verified in "Optical Clocks and Relativity," *Science* Vol 329 24 September 2010: 1630-1633, page 1632, we argued in *On the Nature of Being: Gravitation* that if the radius of the electron energy wave sphere decreased by the factor, corresponding to the multiplicative inverse of Einstein's ${g_{\tau\tau}}^{-\frac{1}{2}}$,

$$\left(1 - \frac{\alpha}{r}\right)^{\frac{1}{2}},$$

then the velocity of the energy wave would have to decrease by *two* factors of $\left(1-\frac{\alpha}{r}\right)^{\frac{1}{2}}$ for the frequency of the energy wave sphere to decrease by the factor

$$\left(1-\frac{\alpha}{r}\right)^{\frac{1}{2}}.$$

We opted for the case in the middle, where there is no change in the radius of the electron energy wave sphere.

In *On the Nature of Being: Gravitation*, page 69, RRJPAP | Volume 5 | Issue 4 | October - December, 2017, seeing that the energy *that the de Broglie wave clocks lose* becomes the energy of motion of the hydrogen atom so that energy is conserved and the need for nested de Broglie wave clocks, we wrote:

"The nested de Broglie wave clocks in the hydrogen atom move more slowly and, thus, lose energy by the factor

$$\left(1-\frac{\alpha}{r}\right)^{\frac{1}{2}}. \quad [6.49]$$

Thus, the energy of the hydrogen atom in the gravitational field is given by

$$\sum_i \left(1-\frac{\alpha}{r}\right)^{\frac{1}{2}} h\nu_i. \quad [6.50]$$

The mechanism for slowing these de Broglie wave clocks is not known, redundantly, the manner by which the de Broglie waves are slowed constituting another open question. This change in clock frequency is driven by the difference in clock rates along a radius passing through the atom; the outer clock rate slows, by decreasing the radius, in an endless attempt to equalize the wave frequency.

The energy *that the de Broglie wave clocks lose* becomes the energy of motion of the hydrogen atom so that energy is conserved. We have

$$\sum_i \left(1-\frac{\alpha}{r}\right)^{\frac{1}{2}} h\nu_i - \sum_i h\nu_i$$

$$= \sum_i \left(\left(1-\frac{\alpha}{r}\right)^{\frac{1}{2}} - 1\right) h\nu_i$$

$$= \sum_i \left(-\frac{1}{2}\frac{\alpha}{r} - \frac{1}{8}\left(\frac{\alpha}{r}\right)^2 - \frac{1}{16}\left(\frac{\alpha}{r}\right)^3 - \frac{5}{128}\left(\frac{\alpha}{r}\right)^4 - \cdots\right) h\nu_i \quad [6.51]$$

since

$$(1-x) - 1 = -x."$$

We took the energy *that the de Broglie wave clocks lose* to be negative, since it was lost, but changed that to the *energy lost*, which is the same thing, and made that positive, since it was gained by the energy wave sphere as energy of motion. The rule of gravitation becomes that the energy lost by the wave in an energy wave sphere becomes the energy of motion of the energy wave sphere.

For any energy wave sphere, the energy of motion that it gains is

$$\left(\frac{1}{2}\frac{\alpha}{r}+\frac{1}{8}\left(\frac{\alpha}{r}\right)^2+\frac{1}{16}\left(\frac{\alpha}{r}\right)^3+\frac{5}{128}\left(\frac{\alpha}{r}\right)^4-\cdots\right)h\nu,$$

the first term

$$\frac{1}{2}\frac{\alpha}{r}\,h\nu$$

being the *kinetic energy* that the energy wave sphere gains in going from ∞ to the radius r, with $\frac{\alpha}{r}$ the ratio

$$\frac{v^2}{c^2}.$$

Since r is the same as in the local system, as r changes, so does the velocity v, which implies that the energy wave sphere does not move in a geodetic line.

Thus equipped, with a distance coordinate that does not vary and a time coordinate such that the frequency of the wave in an energy wave sphere is equal to

$$\left(1-\frac{\alpha}{r}\right)^{\frac{1}{2}}\nu,$$

so that the energy lost by the wave in the energy wave sphere becomes the energy of motion of the energy wave sphere, without ever giving the radius of an energy wave sphere except as an integral multiple of the wavelength of the wave in an energy wave sphere, with the need for nested energy wave spheres, and without any obvious way to go, we sat on the theory for years.

When we considered in *Quantum Gravity, Energy Wave Spheres and the Proton Radius* the electron energy wave sphere of the Bohr model of the hydrogen atom, we had the Bohr radius of the electron energy wave sphere as

$$r_e=\frac{\hbar}{\alpha m_e c},$$

with α the fine-structure or Sommerfield constant. As in the abstract of *Quantum Gravity, Energy Wave Spheres and the Proton Radius*,

“We argue, from present considerations and a previous analysis of the hydrogen atom as a miniature Michelson-Morley experiment in the Material Point Universe Revisited, that the electron wave velocity in the hydrogen atom is c and that the fine-structure constant α is the ratio of the remaining mass of the electron to the initial electron mass, not the ratio of velocities, as Sommerfield had it. We consider the proton energy wave sphere, with mass m_p and velocity c, so that the radius of the proton energy wave sphere contained in an electron energy wave sphere is

$$r_p=\frac{\hbar}{m_p c},$$

with m_p the remaining mass of the proton equal to one fourth of the initial proton mass so that

$$r_p=0.8411863173145236\times10^{-15}\,meters."$$

Thus, after considering the hydrogen atom in *Quantum Gravity, Energy Wave Spheres and the Proton Radius*, we found the proton energy wave sphere, which had to be there as one of the nested energy wave sphere de Broglie wave clocks. We took, considering the electron and proton masses were αm_e and $\frac{1}{4}m_p$, respectively, these masses to be the masses *shed* by the corresponding energy wave sphere.

In *Classical Quantum Hidden Variable Gravitation*, we introduced *imaginary energy wave spheres* as here in the Abstract:

"We extended the concept of energy wave spheres to imaginary energy wave spheres to explain the change in frequency of an energy wave sphere. The single expression,

$$\left(1-\frac{\alpha}{r}\right)^{\frac{1}{2}},$$

of which we remarked *this is what has to be this way*, gives us the relationship between the wave velocities of the two types of energy wave spheres. The 1 in this expression for the rate of a unit energy wave sphere clock gives the clock rate squared of a unit energy wave sphere in the local system and $-\frac{\alpha}{r}$ gives the imaginary energy wave velocity function, $d\mathcal{X}_4$, squared of the particle with mass M at radius r, $d\mathcal{X}_4$ being the imaginary energy wave velocity function of the wave in an imaginary energy wave sphere with radius r and wave velocity

$$ic\left(\frac{\alpha}{r}\right)^{\frac{1}{2}}.$$

For an energy wave sphere with mass m and radius

$$r_m = \frac{\hbar}{mc}$$

and imaginary energy wave sphere with mass m with radius

$$\alpha_m = \frac{\kappa m}{4\pi}$$

inside that, the velocity, which is i times the absolute velocity of the energy wave sphere, of the wave in the imaginary energy wave sphere starts at 0 for infinite r, and for any $r > \alpha_M$, is equal to

$$cd\mathcal{X}_4(r) = ic\left(\frac{\alpha_M}{r}\right)^{\frac{1}{2}},$$

and for $r = \alpha_M$, equals

$$d\mathcal{X}_4(\alpha_M) = i,$$

the imaginary energy wave velocity function $d\mathcal{X}_4(\alpha)$ of the wave of the imaginary energy wave sphere, at radius α of a mass M. It has the same velocity as the wave of the imaginary energy wave sphere, the kernel, at radius α of a mass M. The energy wave sphere is transformed into the imaginary energy wave sphere. For $r > \alpha_M$, we have

$$0 + d\mathcal{X}_4{}^2(r) = 0^2 - \frac{\alpha_M}{r} = -\frac{\alpha_M}{r},$$

which shows the effect of the imaginary energy wave velocity function of a mass M on an imaginary energy wave sphere with mass m. The 0 on the left side of the last equation is clock rate of the imaginary energy wave sphere with mass m for infinite r and the square of this clock rate since its value is 0. The fraction

$$\frac{\alpha_M}{r}$$

of the energy that the imaginary energy wave sphere with mass m loses in the sense that $d\mathcal{X}_4{}^2(r)$ is negative with increasing absolute value is the square $\left(\frac{v}{c}\right)^2$ of the ratio of its velocity $-v$ to c.

For $r > \alpha_M$, the absolute velocity, its absolute value, of the energy wave sphere with mass m increases to the velocity $c\left(\frac{\alpha}{r}\right)^{\frac{1}{2}} = v$ as $r \searrow \alpha$; at $r = \alpha$, the velocity of the wave in the energy wave sphere is 0 with no positive velocity to lose, thus making it the 0 energy wave sphere in that sense. This occurs just as, or nearly so, the velocity of the imaginary energy wave sphere, with wave velocity i and radius

$$\alpha_m = \frac{\kappa m}{4\pi},$$

its wave velocity matching that of the imaginary energy wave sphere, the kernel, at radius α of a mass M, equals $-1 = -c$.

The notion, as opposed to the idea of a black hole, of an imaginary energy wave sphere with radius

$$\alpha_M = \frac{\kappa M}{4\pi}$$

and wave velocity

$$cd\mathcal{X}_4(r) = ic\left(\frac{\alpha_M}{r}\right)^{\frac{1}{2}},$$

which for $r = \alpha_M$, equals

$$d\mathcal{X}_4(\alpha_M) = i,$$

gives the nature of the kernel with radius α of a mass M."

On pages 22, 23, our copy, of *Classical Quantum Hidden Variable Gravitation*, we stated,

"The expression

$$\left(1 - \frac{\alpha}{r}\right),$$

which is the square

$$dx_4{}^2$$

of the clock rate of a unit clock along a radius, is, once again,

$$\left(dX_4{}^2 - \frac{\alpha}{r}\right)$$

so that

$$d\mathcal{X}_4{}^2 = dx_4{}^2 - dX_4{}^2 = -\frac{\alpha}{r}$$

gives the imaginary energy wave velocity function squared of the particle with mass M at radius r, $d\mathcal{X}_4 \frac{c}{2\pi r}$ being the frequency of the wave in an *imaginary* energy wave sphere with radius r and wave velocity

$$ic\left(\frac{\alpha}{r}\right)^{\frac{1}{2}},$$

taking, once again,

$$\left(\frac{\alpha}{r}\right)^{\frac{1}{2}}$$

to be *positive*."

From pages 42-49, our copy, of *Classical Quantum Hidden Variable Gravitation*, since the content is what we need to state, we have:

"For an energy wave sphere of mass m at radius r in the quasi-static, radially symmetric gravitational field about a point mass M, the fraction of energy that the energy wave in the energy wave sphere has left

$$\left(1-\frac{\alpha}{r}\right)^{\frac{1}{2}},$$

which is also the ratio of the velocity of the energy wave to c, has the previously given Taylor series expansion about 1 of

$$\left(1-\frac{\alpha}{r}\right)^{\frac{1}{2}},$$

so that the velocity, upon multiplication by c, of the wave in the energy wave sphere in the local system of coordinates, is

$$1-\left(\frac{1}{2}\frac{\alpha}{r}+\frac{1}{8}\left(\frac{\alpha}{r}\right)^2+\frac{1}{16}\left(\frac{\alpha}{r}\right)^3+\frac{5}{128}\left(\frac{\alpha}{r}\right)^4+\cdots\right). \quad (4)$$

The first term $\frac{1}{2}\frac{\alpha}{r}$ in the series, which upon multiplication by $h\nu$ is the energy lost,

$$\left(1-\left(1-\frac{\alpha}{r}\right)^{\frac{1}{2}}\right) = 1-\left(1-\left(\frac{1}{2}\frac{\alpha}{r}+\frac{1}{8}\left(\frac{\alpha}{r}\right)^2+\frac{1}{16}\left(\frac{\alpha}{r}\right)^3+\frac{5}{128}\left(\frac{\alpha}{r}\right)^4+\cdots\right)\right)$$

$$=\left(\frac{1}{2}\frac{\alpha}{r}+\frac{1}{8}\left(\frac{\alpha}{r}\right)^2+\frac{1}{16}\left(\frac{\alpha}{r}\right)^3+\frac{5}{128}\left(\frac{\alpha}{r}\right)^4+\cdots\right), \quad (9)$$

is equal to

$$\frac{1}{2}\left(\frac{v}{c}\right)^2,$$

where v is the velocity

$$c\left(\frac{\alpha}{r}\right)^{\frac{1}{2}}.$$

For the constant of gravitation K, with

$$\frac{\mathrm{KM}}{c^2} = \frac{1}{2}\alpha_M,$$

we have

$$\frac{1}{c^2}\frac{KM}{r} = \frac{1}{2}\frac{\alpha_M}{r},$$

and

$$\frac{KM}{r} = \frac{1}{2}\frac{\alpha_M}{r}c^2 = \frac{KM}{r} = \frac{1}{2}v^2,$$

which upon multiplication by m is the kinetic energy

$$\frac{1}{2}mv^2.$$

Once again, if

$$\frac{\alpha}{r} = 1,$$

then the series (4) converges to 0 if and only if

$$1 = \left(\frac{1}{2} + \frac{1}{8} + \frac{1}{16} + \frac{5}{128} + \cdots\right).$$

As $r \searrow \alpha$, $\frac{\alpha}{r} \nearrow 1$, so that the kinetic energy of the energy wave sphere is arbitrarily close to one half of the energy lost, which cannot be greater than $h\nu$, or the energy lost is arbitrarily close to twice the kinetic energy.

For the mass M the mass of the Earth,

$$M = (5.9722)10^{24}\,kg = (5.9722)10^{27}gm,$$

for $2\mathrm{K}M$, with the unit of time being such that the velocity of light $c = (2.99792458) \times 10^{10}\,\frac{cm}{sec}$, we have

$$2\mathrm{K}M = 2(6.6743\ \times\ 10^{\ -11}10^6 cm^3 10^{-3}\ gm^{-1}\ sec^{-2})(5.9722)10^{27}gm$$

$$= 7.972050892 \times 10^{20}cm^3sec^{-2},$$

or

$$\mathrm{K}M = 3.986025446 \times 10^{20}cm^3sec^{-2}.$$

For the radius $r = (6.378)10^8cm$ of the Earth, we have

$$r^2 = \left((6.378)10^8cm\right)^2$$

$$= 4.0678884 \times 10^{17}cm^2$$

and

$$\frac{\mathrm{K}M}{r^2} = \frac{3.986025446}{4.0678884} \times 10^3 cmsec^{-2}$$

$$= 0.9798758112439859 \times 10^3 cmsec^{-2},$$

which is the familiar *acceleration*, calculated using only the first term of the energy lost, due to gravity at the Earth' surface since

$$\frac{d}{dr}\frac{KM}{r} = -\frac{KM}{r^2}.$$

The second term of the series (9), which is the energy lost after multiplication by $h\nu$, still with the unit of time being such that the velocity of light $c = (2.99792458) \times 10^{10}\frac{cm}{sec}$, is

$$\frac{1}{8}\left(\frac{\alpha}{r}\right)^2 = \frac{1}{8}\left(\frac{2KM}{r}\right)^2 = \frac{1}{2}\mathrm{KM}\frac{\mathrm{K}M}{r^2}$$

$$= 1.95290495876921 \times 10^{23} cm^4 sec^{-4},$$

which, if expected to be small, as in negligible or unnoticeable, seems quite large. With these units,

$$\frac{2KM}{r} > 1.$$

If we use equation (8),

$$2\mathrm{KM} = \frac{8\pi KM}{4\pi} = 1.485232053823733 \times 10^{-28}\frac{cm}{gm}\left(\frac{cm}{sec'}\right)^2 M = \alpha_M(cm)\left(\frac{cm}{sec'}\right)^2, \quad (8)$$

with

$$1.485232053823733 \times 10^{-28}\frac{cm}{gm}M = \alpha_M(cm),$$

so that $\frac{2\mathrm{K}M}{c^2} = \alpha_M$ with unit of time such that the velocity of light is 1, for the mass M the mass of the Earth with

$$M = (5.9722)10^{24}\ kg = (5.9722)10^{27} gm,$$

we have

$$\alpha_M(cm) = 0.8870102871846098(cm).$$

For the radius $r = (6.378)10^8 cm$ of the Earth,

$$\frac{\alpha_M(cm)}{r} = \frac{0.8870102871846098(cm)}{(6.378)10^8 cm} = 1.390734222616196 \times 10^{-9}.$$

For this value of $\frac{\alpha}{r}$, its powers in the series (9) become arbitrarily small. For $\frac{\alpha}{r} = 1$, however, the terms in the series (9) are not negligible. At the radius of the Earth, the second term

$$\frac{1}{8}\left(\frac{\alpha}{r}\right)^2 = 2.417677097444844 \times 10^{-19}$$

and the succeeding terms are arguably small enough that

$$\frac{1}{2}\frac{\alpha}{r}\mathrm{h}\nu$$

is a good approximation to the energy lost. More generally, for $\frac{\alpha}{r}$ sufficiently small,

$$\frac{1}{2}\frac{\alpha}{r}\mathrm{h\nu}$$

is close to the energy lost.

For a quasi-energy conserving gravitation in which an energy wave sphere with mass m has lost the energy

$$mc^2$$

when the energy wave sphere reaches the radius α_M, the first term in the series (9) accounts for half of that. The sum of the remaining terms gives the other half. The velocity of the energy wave sphere at this point is

$$-c\left(\frac{\alpha_M}{\alpha_M}\right)^{\frac{1}{2}} = -c,$$

and the velocity of the wave in the energy wave sphere is 0. Nearly simultaneously with this, the velocity of the wave in the imaginary energy wave sphere, also with velocity $-c$, inside the energy wave sphere is ic, the same as the velocity of the imaginary energy wave of the kernel of the mass M with radius α_M.

What happens to an energy wave sphere, with wave velocity 0 and velocity $-c$, inside the kernel depends on factors *only the unknown effects of which* can be seen. If imaginary energy wave spheres are not present inside the imaginary energy wave sphere, the kernel of a mass M at radius α_M, then the velocity of the energy wave sphere remains $-c$. The existence of an energy wave sphere, the *real* kernel, with mass M and radius

$$r_M = \frac{\hbar}{Mc},$$

assuming this equation still holds, would give the energy wave sphere and any light ray a place *past the imaginary kernel*, where the imaginary energy wave sphere inside the energy wave sphere or light ray was left, to go.

For the mass of the Sun

$$M_S = 1.989 \times 10^{33} gm,$$

we have

$$\alpha_{M_S} = \frac{\kappa M_S}{4\pi}$$

$$= \frac{(1.866396067265298)10^{-27} cmgm^{-1}}{12.5663706144}(1.989) \times 10^{33} gm$$

$$= 2.95412405992287 \times 10^5 cm,$$

which is $2.95412405992287 km$. For the mass $M = 10^{10} M_S = 1.989 \times 10^{43} gm,$

we have

$$\alpha_M = 10^{10}\frac{\kappa M_S}{4\pi} = 2.95412405992287 \times 10^{15} cm$$

$$= 1.83451104121204 \times 10^{10} miles.$$

The time for light to travel this last distance is

$$\frac{2.95412405992287 \times 10^{15} cm}{2.99792458 \times 10^{10} \frac{cm}{sec}} = 0.9853897191512636 \times 10^{5} sec.$$

The radius of the real kernel for this mass M is

$$r_M = \frac{\hbar}{Mc}$$

$$= \frac{6.62607015 \times 10^{-27} \frac{gmcm^2}{sec}}{(6.283185307)(1.989 \times 10^{43} gm)\left(2.99792458 \times 10^{10} \frac{cm}{sec}\right)}$$

$$= 1.768563570561413 \times 10^{-81} cm.$$

The density of the real kernel, if it exists, with mass M and radius

$$r_M = \frac{\hbar}{Mc},$$

is

$$\frac{M}{\frac{4}{3}\pi\left(\frac{\hbar}{Mc}\right)^3} = \frac{3}{4}\frac{M^4 c^3}{\pi\hbar^3}\frac{gm^4\left(\frac{cm}{sec}\right)^3}{\left(\frac{gmcm^2}{sec}\right)^3} = \frac{3}{4}\frac{M^4 c^3}{\pi\hbar^3}\frac{gm}{cm^3}.$$

For any energy wave sphere with mass m and radius

$$r = \frac{\hbar}{mc},$$

we have

$$(2\pi r)mc = h,$$

where $2\pi r = \lambda$. Similarly,

$$h\nu\frac{1}{\nu} = h.$$

The failure of an energy wave sphere or light ray to escape the imaginary kernel may be due to the existence of a place, such as the real kernel, to go. For an energy wave sphere with wave velocity 0 or a light ray with no imaginary energy wave sphere inside, gravitation may not work on it anyway.

For the sake of argument, we assume, as a starting point, that inside the imaginary kernel of a mass M, imaginary wave spheres with wave velocity

$$ic\left(\frac{\alpha_M}{r}\right)^{\frac{1}{2}}$$

exist for each r. If a real kernel for the mass M exists for some radius $r \leq \alpha_M$, then we can deal with that. We can cope with energy wave spheres, imaginary or real, making it past the imaginary kernel for the mass M.

The situation at $r = 0$, where the imaginary wave velocity is undefined, is no more bizarre than the existence of a real kernel with radius

$$r_M = \frac{\hbar}{Mc}$$

and gives us yet another place for the energy wave spheres to go.

We may as well regard *the imaginary energy wave sphere inside an energy wave sphere* as the *source* of the gravitational force that holds the wave of the energy wave sphere together. If the imaginary energy wave sphere inside an energy wave sphere does not get past the imaginary kernel of a mass M, then there is nothing to hold the wave, the velocity of which is 0 at α_M, of the energy wave sphere together. There is, however, seemingly nothing to prevent an imaginary energy wave sphere from starting up inside an energy wave sphere inside the imaginary kernel of a mass M, but once the imaginary energy wave sphere is gone, there is nothing to hold the energy wave sphere together.

An energy wave sphere with mass m *that makes it past the radius* α_M has

$$c\left(1 - \frac{\alpha_M}{r}\right)^{\frac{1}{2}},$$

which is imaginary, for wave velocity, making it impossible to match the real wave velocity of the real kernel for a mass M. The only conceivable place to match the wave velocity of the real kernel of a mass M, where the wave velocity of the kernel is c and the velocity of the energy wave sphere, not its wave velocity, is $-c$, is at the radius α_M. The other remaining place for the energy wave sphere to go is to a discontinuity at radius 0, where its velocity and wave velocity are no longer defined.

A light ray with constant velocity $-c$ moving toward the imaginary kernel of a mass M along a radius has a real energy wave sphere with wave velocity 0 always. In the face of imaginary energy wave spheres with wave velocity

$$ic\left(\frac{\alpha_M}{r}\right)^{\frac{1}{2}}$$

along its path, the wave velocity of the energy wave sphere never becomes imaginary assuming any energy lost by the wave goes into the velocity of the energy wave sphere. This is the only clue that we have and the rule on *only clues* is to take them.

Taking the non-imaginary wave velocity clue amounts to assuming it holds for all real energy wave spheres and, as a consequence, that the absolute velocity of a real energy wave sphere cannot exceed c. Knowing that the source of this velocity is the energy wave sphere itself, we should have already concluded this anyway.

Thus a real energy wave sphere always has a finite velocity and the singularity at $r = 0$ does not apply since the velocity is well-defined. Any imaginary energy wave sphere becomes part of the imaginary kernel at radius α_M, so the absolute velocity of an imaginary energy wave sphere is well defined and never exceeds c. As for a real kernel for the mass M for some radius $r < \alpha_M$, no real energy wave sphere has an imaginary energy wave sphere to hold it together for such a radius."

In *The Dying of a Principle*, pages 24, 25, our copy, we noted,

"Along the way in the development, we saw that the velocity of the wave in an energy wave sphere decreased from $c = 1$ for infinite r to 0 at $r = \alpha$ with the possibility of imaginary values for this velocity for $r < \alpha$. The transformation of an energy wave sphere into an imaginary energy wave sphere with wave velocity *matching* that of the kernel of a mass M at radius α_M was not possible, so we placed an imaginary energy wave sphere, the kernel for the mass m of the energy wave sphere with radius α_m, inside the energy wave sphere, only later realizing that this imaginary energy wave sphere was what provided the force that held the energy wave sphere together. Without a place inside the kernel of a mass M at radius α_M for an energy wave sphere to go, an energy wave sphere should emerge from the other side of the kernel. Since the imaginary energy wave sphere inside an energy wave sphere, its kernel, with wave velocity matching that of the kernel of a mass M at radius α_M, becomes part of the kernel of a mass M at radius α_M, an energy wave sphere is no longer an energy wave sphere unless the energy wave sphere, its velocity $-c = -1$, becomes part of, with matching absolute velocity, the real kernel of the mass M at radius α_M."

For the bending of light in a gravitational field, in *The Dying of a Principle*, pages 20, 21, our copy, we wrote,

"For a light ray perpendicular to a radius, the component of the velocity in the radial direction of the resulting *bent* light ray is

$$d\mathcal{X}_4(r) = -c\left(\frac{\alpha_M}{r}\right)^{\frac{1}{2}} = -v$$

with

$$cd\mathcal{X}_4(r) = ic\left(\frac{\alpha_M}{r}\right)^{\frac{1}{2}}$$

the velocity of the wave in the imaginary energy wave sphere. Since the resulting light ray would have a velocity of

$$(v^2 + c^2)^{\frac{1}{2}},$$

we must divide both of these velocities, the radial component and the perpendicular one, by

$$(v^2 + c^2)^{\frac{1}{2}}.$$

This is a sufficient condition for the resulting light ray to have velocity $c = 1$.

Apparently, the perpendicular light ray coming in, pre-bending, is different from the perpendicular component of the bent light ray coming out, which has a radial component, whereas the perpendicular light ray coming in has no radial component.

What we want, of course, is a description of physical reality, but we also want the incoming perpendicular light ray to not lose energy via an energy wave sphere *that it does not have* losing energy.

Going in, we have a perpendicular light ray with velocity $c = 1$ and frequency ν. The velocity of the wave in the imaginary energy wave sphere

$$cd\mathcal{X}_4(r) = ic\left(\frac{\alpha_M}{r}\right)^{\frac{1}{2}},$$

which amounts to a loss of energy from its 0 energy state at infinite r, results in a velocity of

$$-c\left(\frac{\alpha_M}{r}\right)^{\frac{1}{2}}$$

for the imaginary energy wave sphere, which is inside the photon.

Without any redshift, the square of the velocity of the resulting light ray is

$$c^2 + c^2\frac{\alpha_M}{r} = c^2\left(1+\frac{\alpha_M}{r}\right),$$

So, the resulting light ray must be red shifted by the factor

$$\left(1+\frac{\alpha_M}{r}\right)^{\frac{1}{2}}$$

for its velocity to be $c = 1$. Once again, both the radial component and the perpendicular one of the resulting light ray are

$$(v^2 + c^2)^{-\frac{1}{2}}$$

times the corresponding component of the non-red shifted light ray. For $\tan\theta$, we have

$$\tan\theta = \left(\frac{\alpha}{r}\right)^{\frac{1}{2}}."$$

We took the velocity of the component of light perpendicular to a radius as

$$d\mathcal{X}_4(r) = -c\left(\frac{\alpha_M}{r}\right)^{\frac{1}{2}} = -v,$$

but since this is the component of the velocity of light and not the velocity of an energy wave sphere, we should have taken perhaps the velocity of the component of the velocity of light to be proportional to the frequency corresponding to the energy

$$\left(\frac{\alpha_M}{r}\right)h\nu.$$

Since the frequency ν corresponds to the velocity c, the frequency

$$\left(\frac{\alpha_M}{r}\right)\nu$$

corresponds to the velocity

$$\left(\frac{\alpha_M}{r}\right)c$$

of the component of the velocity of light in the radial direction, corresponds to a deflection given by

$$\sin\theta = \left(\frac{\alpha_M}{r}\right).$$

This puts the component of velocity of light in the perpendicular direction as

$$\left(1-\left(\frac{\alpha_M}{r}\right)^2\right)^{\frac{1}{2}} c.$$

As long as the velocities satisfy

$${v_{rad}}^2 + {v_{perp}}^2 = c^2,$$

the corresponding distances will satisfy

$${v_{rad}}^2 t^2 + {v_{perp}}^2 t^2 = c^2 t^2.$$

If the perpendicular light ray loses the energy

$$\left(\frac{\alpha_M}{r}\right) h\nu.$$

and, conserving energy, has the energy

$$h\nu - \left(\frac{\alpha_M}{r}\right) h\nu = h\nu \left(1 - \left(\frac{\alpha_M}{r}\right)\right)$$

remaining, the corresponding velocity

$$\left(1 - \left(\frac{\alpha_M}{r}\right)\right) c,$$

is not enough, being less than

$$\left(1-\left(\frac{\alpha_M}{r}\right)^2\right)^{\frac{1}{2}} c,$$

to give the velocity

$${v_{rad}}^2 + {v_{perp}}^2 = c^2.$$

In the case where

$$\tan\theta = \left(\frac{\alpha}{r}\right)^{\frac{1}{2}},$$

the square of the velocity of the resulting light ray is

$$c^2 + c^2 \frac{\alpha_M}{r} = c^2\left(1 + \frac{\alpha_M}{r}\right),$$

So, the resulting light ray must be red shifted by the factor

$$\left(1 + \frac{\alpha_M}{r}\right)^{\frac{1}{2}}.$$

In the case where

$$\sin\theta = \left(\frac{\alpha_M}{r}\right),$$

the energies of the components, if energy is conserved, are not enough to give c for the velocity of the resultant light ray.

If we consider the energy of the component in the radial direction to be provided by the energy lost by the imaginary energy wave sphere inside the photon, then the perpendicular component of the resultant light ray is c and the radial component is

$$\left(\frac{\alpha_M}{r}\right)c,$$

putting the velocity of the resultant light ray as

$$c\left(1+\left(\frac{\alpha_M}{r}\right)^{\mathbf{2}}\right)^{\frac{1}{2}},$$

So, both the radial component and the perpendicular one of the resulting light ray are

$$\left(1+\left(\frac{\alpha_M}{r}\right)^{\mathbf{2}}\right)^{-\frac{1}{2}}$$

times the corresponding component of the non-red shifted light ray. For $\tan\theta$, we have

$$\tan\theta=\left(\frac{\alpha}{r}\right).$$

The total deflection is twice this, or

$$\tan\theta=2\left(\frac{\alpha}{r}\right).$$

In *On the Nature of Being: Gravitation*, page 84, our copy, we wrote:

The mechanism for slowing these de Broglie wave clocks is not known, redundantly, the manner by which the de Broglie waves are slowed constituting another open question. This change in clock frequency is driven by the difference in clock rates along a radius passing through the atom; the outer clock rate slows, by decreasing the radius, in an endless attempt to equalize the wave frequency.

Similarly, in *Quantum Gravity, Energy Wave Spheres, and the Proton Radius*, page 54, our copy, we wrote:

In the gravitational case, the energy wave spheres are in an environment where the clock rate function of a mass is less on the side of the wave sphere that is closer to the mass so that the far side of the wave has to slow down to match up with the near side of the wave, which is endlessly pushed closer to the mass. In a sense, the energy wave sphere has to move, giving up energy that goes into the energy of motion of the wave sphere so that the wave frequency is the same in any direction.

We have *the imaginary energy wave sphere inside an energy wave sphere* as the *source* of the gravitational force that holds the wave of the energy wave sphere together. The energy remaining, with the energy lost corresponding to, upon division by m, the imaginary energy wave velocity function squared of a mass m, at radius r of the wave in imaginary energy wave sphere of mass m is

$$-mc^2(1-\frac{\alpha_m}{r}),$$

where we have placed the − sign to emphasize that this energy is *negative*. The energy lost by the wave in a real energy wave sphere *containing* an imaginary energy wave sphere at radius r is

$$-mc^2\frac{\alpha_m}{r},$$

the absolute value of which is the energy required to *hold* the wave of the energy wave sphere in orbit at radius r from the imaginary energy wave sphere. This energy is arbitrarily small for r arbitrarily large, but for r=α_m, the energy is equal to $-mc^2$.

The *imaginary* electron energy wave sphere, the energy of which holds the electron energy wave sphere together, when placed inside a proton energy wave sphere as in the hydrogen atom, exerts, at the Compton wavelength radii, the same force on the proton energy wave sphere as it does on the electron energy wave sphere because the radius of the proton energy wave sphere is smaller by the factor m_e/m_p. *The force exerted on the proton energy wave sphere is the same as the force exerted on the electron energy wave sphere*. This explains why the forces are the same, as with two electric charges, one from the proton and one from the electron, even though the masses are different. In turn this allows us to explain why in the hydrogen atom the electron sheds the mass *(alpha)*m_e and the proton sheds the mass *(1/4)*m_p. This explanation, which is profound, is the result that we needed.

For a proton inside an electron in a hydrogen atom, the electron energy wave in the electron energy wave sphere, which was held in position by the force of the imaginary electron energy wave sphere via the imaginary energy wave velocity function, has the additional force of the imaginary proton energy wave sphere *pulling* it inward, but no such orbital radius less than the *Compton wavelength radius* $\frac{\lambda}{2\pi}$, with $\lambda = h/m_e c$, is possible. The electron energy wave sphere sheds the electron energy wave sphere with radius $\frac{1}{\alpha}\frac{\lambda}{2\pi}$, which is the Bohr radius a_0, with the electron energy wave sphere with radius $\frac{1}{1-\alpha}\frac{\lambda}{2\pi}$ remaining. The total energy of the waves in these two wave spheres is equal to $\big(\alpha + (1-\alpha)\big)h\nu = h\nu$ with $h\nu = m_e c^2$. The fine-structure Sommerfield constant is determined by the equation

$$a_0 = \frac{4\pi\varepsilon_0\hbar^2}{e^2 m_e} = \frac{\varepsilon_0 h^2}{\pi e^2 m_e} = \frac{\hbar}{m_e c\alpha},$$

so that

$$\frac{e^2}{4\pi\varepsilon_0} = \hbar c\alpha,$$

and

$$\alpha = \frac{e^2}{4\pi\varepsilon_0\hbar c}.$$

The Compton radius is the radius r_0 such that the electrostatic potential energy is

$$\frac{e^2}{4\pi\varepsilon_0 r_0} = m_e c^2,$$

but there is another radius, the Compton wavelength radius $\frac{\lambda}{2\pi}$, such that

$$\frac{e^2}{4\pi\varepsilon_0 \frac{\lambda}{2\pi}} = \frac{e^2}{2\varepsilon_0 \lambda} = m_e c^2.$$

We shall see that the Compton wavelength radius is the smallest possible radius, equal to $\frac{1}{\alpha}$ times the Compton radius, so this last equation should have $\alpha m_e c^2$ on the right side.

Since

$$\lambda = h/m_e c$$

and

$$a_0 = \frac{\hbar}{m_e c \alpha},$$

we have

$$a_0 = \frac{\lambda}{2\pi\alpha}.$$

Thus, the Bohr radius wavelength is

$$2\pi a_0 = \frac{\lambda}{\alpha}.$$

If the Bohr radius electron wave velocity is αc, then the frequency of the Bohr radius electron wave is

$$\frac{\alpha c}{\frac{h}{m_e c \alpha}} = \frac{m_e \alpha^2 c^2}{h},$$

so that the energy of the Bohr radius electron wave is

$$h \frac{m_e \alpha^2 c^2}{h} = m_e \alpha^2 c^2.$$

This puts the electrostatic energy, assuming that this energy is equal to the energy of the electron energy wave, at the Compton wavelength radius at

$$m_e \alpha c^2,$$

but this energy is by definition, according to the values of the terms involved,

$$m_e c^2.$$

This contradiction puts the velocity of the Bohr radius electron wave at c and the mass of the Bohr radius electron energy wave at

$$m_{e_0} = \alpha m_e.$$

Just as in the electron energy wave case in the hydrogen atom, the proton energy wave sheds the mass

$$\frac{1}{4} m_p,$$

leaving the proton energy wave with mass

$$\frac{3}{4}m_p$$

and proton energy wave sphere with radius

$$\frac{4}{3}\frac{\hbar}{m_p c}.$$

Once again, the energy lost by the wave in a real energy wave sphere *containing* an imaginary energy wave sphere at radius r is

$$-mc^2\frac{\alpha_m}{r},$$

the absolute value of which is the energy required to *hold* the wave of the energy wave sphere in orbit at radius r from the imaginary energy wave sphere.

For the constant of gravitation K, with

$$\frac{2\mathrm{KM}}{c^2} = \alpha_M,$$

we have

$$\frac{\alpha_m}{r} = \alpha_m\frac{1}{r},$$

the distance α_m is the radius of the imaginary energy wave sphere with mass m. The distance r to a real energy wave sphere cannot be less than α_m since the wave in the real energy wave sphere has lost all of its energy at the radius r.

As noted previously, the *imaginary* electron energy wave sphere, the energy of which holds the electron energy wave sphere together, when placed inside a proton energy wave sphere as in the hydrogen atom, exerts, at the Compton wavelength radii, the same force on the proton energy wave sphere as it does on the electron energy wave sphere because the radius of the proton energy wave sphere is smaller by the factor m_e/m_p. *The force exerted on the proton energy wave sphere is the same as the force exerted on the electron energy wave sphere.* This explains why the forces are the same, as with two electric charges, one from the proton and one from the electron, even though the masses are different. In turn this allows us to explain why in the hydrogen atom the electron sheds the mass *(alpha)*m_e and the proton sheds the mass *(1/4)*m_p.

The gravitational energy provided by the imaginary electron energy wave sphere that holds the electron energy wave in place at the Compton radius is

$$m_e c^2\frac{\alpha_{m_e}}{r}.$$

The electrostatic potential energy

$$\frac{e^2}{4\pi\varepsilon_0 r_0} = m_e c^2$$

at the Compton radius r_0, when compared to the gravitational energy

$$mc^2\frac{\alpha_m}{r} = mc^2\alpha_m\frac{1}{r},$$

has the same form

$$\frac{e^2}{4\pi\varepsilon_0 r_0} = \frac{e^2}{4\pi\varepsilon_0}\frac{1}{r_0} = m_e c^2 r_0 \frac{1}{r_0}.$$

We have already shown, however, that there is another radius, the Compton wavelength radius $\frac{\lambda}{2\pi}$, such that

$$\frac{e^2}{4\pi\varepsilon_0 \frac{\lambda}{2\pi}} = \frac{e^2}{2\varepsilon_0 \lambda} = \alpha m_e c^2.$$

Since

$$\lambda = h/m_e c$$

and

$$a_0 = \frac{\hbar}{m_e c\alpha},$$

we have

$$a_0 = \frac{\lambda}{2\pi\alpha}.$$

The above equation for the Compton radius holds for the Compton wavelength radius by replacing r_0 with $\frac{\lambda}{2\pi}$ and placing the factor α on the right side.

We can obtain the corresponding result for the Compton radius of the proton, the radius r_{p_0} such that the electrostatic potential energy at that radius is equal to $m_p c^2$, that is, such that

$$\frac{e^2}{4\pi\varepsilon_0 r_{p_0}} = m_p c^2.$$

The radius r_{p_0} is such that

$$r_{p_0} = \frac{m_e}{m_p} r_0.$$

We have

$$\frac{e^2}{4\pi\varepsilon_0 r_{p_0}} = \frac{e^2}{4\pi\varepsilon_0}\frac{1}{r_{p_0}} = m_p c^2 r_{p_0} \frac{1}{r_{p_0}}.$$

For the electron energy wave, the radius derived by setting the electrostatic energy equal to mc^2 has the form $\frac{k}{r_0} = mc^2$ and the radius obtained by setting $r_0 = \frac{\hbar}{mc}$ has the form $\frac{\hbar}{r_0} = mc$, thus if the radii are equal, $\frac{k}{\hbar} = c$. If $k = \frac{e^2}{4\pi\varepsilon_0}$, by definition, $\alpha = \frac{e^2}{4\pi\varepsilon_0 \hbar c}$, but this implies that $\alpha c = \frac{e^2}{4\pi\varepsilon_0 \hbar}$, which contradicts $\frac{k}{\hbar} = c$.

We are talking about two representations of the same radius of the electron orbit, one according to energy and the other according to momentum. These radii are not the same. The energy and momentum are mc^2 and mc, respectively, so the energy divided by the momentum is c, but anytime one equates the energy with the electrostatic energy using the radius for the energy representation, one gets αc for the energy divided by the momentum. This inherent contradiction results from equating the energy with the electrostatic energy using the radius for the energy representation.

The Compton radius and the Compton wavelength radius are *not* two representations of the same radius of the electron orbit, the Compton radius being the energy representation and the Compton wavelength radius being the momentum representation.

An electrostatically free electron with electron wave velocity c at radius *r* in a gravitational field only requires the gravitational energy to hold it place. Now take the same electron wave and let it circle *with velocity c* the gravitational source of energy at radius r. Classically, the view of the electron in a hydrogen atom is that of a particle at radius r in an electrostatic field. The notion that a Compton wavelength orbit is involved, the Compton wavelength radius being $\frac{1}{2\pi}$ times that circumference, changes that view.

The function $1/r$ is the derivative of $ln(r)$. At $r = 1$, the slope of the tangent line is -1 since $d(1/r)/dr = -1/r^2$. For a_0 the Bohr radius of the hydrogen atom, the function a_0/r has slope, meaning slope of the tangent line, $-a_0{}^{-1}$ at a_0 and the absolute value of the slope never gets bigger than $a_0{}^{-1}$. We call a_0 the *swing point* of the function a_0/r since a_0 is the minimum value for r and the absolute value of the slope at a_0 is a maximum since r is never less than a_0.

Assuming that the two representations,

$$\frac{e^2}{4\pi\varepsilon_0 r} = mc^2 \quad (2)$$

and

$$\frac{\hbar}{r} = mc, \quad (3)$$

are for the same radius, the m on the right side of the equations is the same whether it is m_e or not. Dividing the left side of the first equation by the left side of the second equation, we get

$$\frac{e^2}{4\pi\varepsilon_0 \hbar} = c.$$

Dividing both side of this last equation by c, we get

$$\alpha = 1,$$

which is a contradiction.

Given that the Bohr radius a_0 is equal to

$$\frac{1}{\alpha m_e}\frac{\hbar}{c},$$

we can keep the second equation

$$\frac{\hbar}{a_0} = \alpha m_e c,$$

since it is empirically true, and blame the contradiction on the first equation. The first equation with a_0 for r and αm_e for m is

$$\frac{e^2}{4\pi\varepsilon_0 a_0} = \alpha m_e c^2,$$

which implies

$$\frac{e^2}{4\pi\varepsilon_0 a_0 \alpha m_e} = c^2,$$

or

$$\frac{e^2}{4\pi\varepsilon_0 \hbar} = c,$$

which is what we had before, so the contradiction $\alpha = 1$ still holds.

If

$$\frac{e^2}{4\pi\varepsilon_0 r} = kmc^2,$$

then with a_0 for r and αm_e for m we have

$$\frac{e^2}{4\pi\varepsilon_0 \hbar} = kc,$$

or

$$\alpha = k.$$

This gives

$$\frac{e^2}{4\pi\varepsilon_0 a_0} = \alpha^2 m_e c^2,$$

or

$$\frac{e^2}{4\pi\varepsilon_0 \hbar} = \alpha c.$$

The problem with this is that $\frac{e^2}{4\pi\varepsilon_0 \hbar}$ is not equal to c, which is the value that it must have by dividing the left side of

$$\frac{e^2}{4\pi\varepsilon_0 r} = mc^2$$

by the left side of

$$\frac{\hbar}{r} = mc,$$

since by definition, $\alpha = \frac{e^2}{4\pi\varepsilon_0 \hbar c}$.

In *Quantum Gravity, Energy Waves Spheres, and the Proton Radius*, we questioned whether the m_e in the expression

$$\frac{\hbar}{a_0} = \alpha m_e c$$

is $m_e$or αm_e, which is the mass corresponding to Bohr radius of the electron energy wave at that radius. This would introduce the factor α^2 on the right side of the last equation, but regardless of how we determined in *Quantum Gravity, Energy Waves Spheres, and the Proton Radius* that the m_e in the expression

$$\frac{\hbar}{a_0} = \alpha m_e c$$

is not αm_e, the value of $\frac{\hbar}{a_0}$ is $\alpha m_e c$.

We considered, as part of the process, that the Coulomb electrostatic energy is some constant k times mc^2, that is, kmc^2, in which case we discovered by analysis that $k = \alpha$. In other words, for any radius r, with the possible radii being the Bohr radius, the Compton wavelength radius, and the Compton radius, the Coulomb electrostatic energy is αmc^2, where m is the mass corresponding to that radius. One has to go to the next smaller radius, by a factor of α to get the energy mc^2. Incredibly, the electrostatic energy at any radius is *too small by a factor of* α to be equal to mc^2. The conclusion is that the energy necessary to hold the energy waves together is less than *mc*^{2} since the Coulomb electrostatic energy is too small to give the energy mc^2.

The expression

$$\frac{e^2}{4\pi\varepsilon_0\hbar} = c,$$

which we obtained by dividing the corresponding sides of equation (2) by equation (3), is independent of r. When we set

$$\frac{e^2}{4\pi\varepsilon_0\hbar} = \alpha c,$$

which follows directly from the definition of α, we corrected the expression for the electrostatic energy as a function of r to

$$\frac{e^2}{4\pi\varepsilon_0 r} = \alpha mc^2 \quad (2c),$$

so that there is no longer a contradiction. At the Bohr radius, this gives

$$\frac{e^2}{4\pi\varepsilon_0 a_0} = \alpha^2 m_e c^2, \quad (4)$$

or

$$\frac{e^2}{4\pi\varepsilon_0\hbar} = \alpha c.$$

One would have to go to the Compton radius $\alpha^2 a_0$, which is smaller than that allowed by

$$\frac{\hbar}{r} = m_e c$$

to get

$$\frac{e^2}{4\pi\varepsilon_0 r} = m_e c^2.$$

As is, we have the mass of the Bohr radius electron wave as αm_e and the Bohr radius as

$$a_0 = \frac{\hbar}{\alpha m_e c}.$$

At the Compton wavelength radius $\alpha a_0 = \frac{\hbar}{m_e c}$, the energy of the electron energy wave is $m_e c^2$, but according to equation (4), the Coulomb electrostatic energy at this radius is

$$\frac{e^2}{4\pi\varepsilon_0 a_0 \alpha} = \alpha m_e c^2.$$

At the Bohr radius, once again,

$$\frac{e^2}{4\pi\varepsilon_0 a_0} = \alpha^2 m_e c^2,$$

So, the expression on the right of this equation is α times $\alpha m_e c^2$. The Rydberg constant for hydrogen in energy units is given by

$$R_y = hcR_\infty = \frac{1}{2}\alpha^2 m_e c^2,$$

which is only $\frac{1}{2}$ of the electrostatic energy given by equation (4).

The electrostatic energy at the Bohr radius is equal to the magnetic energy at the Bohr radius. These energies are each equal to $\frac{1}{2}\alpha^2 m_e c^2$. The electrostatic and magnetic forces at the Bohr radius are equal and opposite, thus cancelling each other. The force holding the electron and proton energy waves together is the gravitational force provided by the imaginary electron and proton energy wave spheres. Any net inward electrostatic and magnetic force at the Bohr radius creates an *imbalance*, so these forces must be equal and opposite. Without those imaginary energy wave spheres inside the *free* real energy wave spheres, the proton and electron energy wave spheres, there is nothing to hold the electron and proton energy waves together.

One deception that is created with the assumption that the electron energy wave velocity is αc at the Bohr radius is that the Coulomb electrostatic energy is equal to the energy of the electron energy wave. The energy of the electron energy wave at the Bohr radius is the mass αm_e times the velocity c squared or $\alpha m_e c^2$, which is not $\alpha^2 m_e c^2$ or $\frac{1}{2}\alpha^2 m_e c^2$ either. The Coulomb electrostatic energy at the Bohr radius is α times the energy $\alpha m_e c^2$ of the electron energy wave and the Coulomb electrostatic energy at the Compton wavelength radius is the same α times the energy $m_e c^2$ of the electron energy wave. The propaganda is that the energy of the electron energy wave at the Bohr radius is equal to the Coulomb electrostatic energy at that radius.

Thus, without any attempt to give a more definite analysis of the nature of *electromagnetism* and of anything beyond the nature of the electron and proton that we have given, we have made conclusions about the forces on the electron energy wave. When we later consider the nature of *spin*, we give a more complete description of the nature of the electron and of any other spin $\frac{1}{2}$ particle. We discover *there* that energy of light emitted as a result of a change of the electron energy level in a hydrogen atom is $\frac{1}{2}$ of the change in energy because the other $\frac{1}{2}$ of the change in energy lies in the *recoil* of the hydrogen atom.

This last discovery stands until we consider spin further and view the magnetic force as holding the proton and the electron in the hydrogen atom, with the proton inside the electron, in place, with no electric force exerted by the proton on the electron. Gravitationally, the loss of energy by the energy wave spheres becomes their energy of motion. This energy of motion corresponds to the emission of the photon in the electromagnetic case of the magnetic moment portion of the electromagnetic electron wave in the hydrogen atom losing energy and the recoil of the electron, which contains the proton, in the electromagnetic case of the spin portion of electromagnetic electron wave in the hydrogen atom losing energy.

Regarding the nature of α, we have shown that if

$$a_0 = \frac{\hbar}{\alpha m_e c},$$

with αm_e equal to the fraction of the electron mass at the Bohr radius, and the Coulomb electrostatic energy is equal to some constant k times mc^2, that is, kmc^2, in which case we discovered by analysis that $k = \alpha$, then α is completely determined and is equal to

$$\frac{e^2}{4\pi\varepsilon_0 \hbar c} = \alpha.$$

In On proton charge radius definition, EPL, 128 (2019) 21001, Ole L. Trinhammer and Henrik G. Bohr conclude,

“We have defined a proton charge radius from a conception of the proton structure based on a Hamiltonian on the intrinsic configuration space, the Lie group $U(3)$. The compactness of the intrinsic space manifests itself in parameter space as periodic potentials. The periodic potentials open for Bloch phase factors allowing period doublings with topological consequences in the wave function of the proton relative to that of the neutron thereby lowering the nucleon ground state. Our result relates the proton charge radius to its Compton wavelength and the result is in excellent agreement with experimental results using spectroscopy on muonic hydrogen. Further confirmation of our result would stress the connection between the period doublings and the Higgs mechanism which opens the necessary degrees of freedom. We look forward to results from simultaneous electron and muon scattering on protons.”

Since the radius is a scale parameter for a mapping analogous to the one in (28) and the mapping of the intrinsic protonic state has to take into account the period doubling from the Bloch phase factors $e^{i\theta/2}$ in (17), Trinhammer and Bohr take the Compton wavelength λ_p to be the projected extension in laboratory space relating to the charge of the proton:

"After the neutron decay the emerging proton lives in laboratory space as an extended charge-scarred object. Being a quantum object, it will have "fuzzy edges, with an extension conventionally described by its Compton wavelength

$$\lambda_p = \frac{h}{m_p c}. \quad (30)$$

This wavelength is an experimentally observable quantity, *e.g.*, in Compton scattering. For a lucid description of Compton scattering of photons off electrons cf. p. 6 in [48]. The photon, in its role of being the $U(1)$ gauge field of electromagnetism, interacts with the electric charge. We therefore take the Compton wavelength λ_p to be the projected extension in laboratory space relating to the charge of the proton. We are aware that the Compton wavelength is defined also for neutral particles and is determined by the mass of the particle. We come to this more general conception in the next section. The length scale to be used in the mapping of the *intrinsic* charge scar we will identify as the proton charge radius r_p. We do not want to imply that it would mean that the proton as a space object has a sharp, well-defined radius. Rather as stated, the radius is a scale parameter for a mapping analogous to the one in (28). Now, as the mapping of the intrinsic protonic state has to take into account the period doubling from the Bloch phase factors $e^{i\theta/2}$ in (17), the projectional relation analogous to (28) reads

$$x_j = r_p \frac{\theta_j}{2} \quad (31)$$

or, for a full extension projection,

$$\lambda_p = r_p \frac{\pi}{2}, \quad (32)$$

as shown in fig. 1 and equivalent to eq. (1),

$$\pi r_p = 2\lambda_p.$$

The result for r_p is

$$r_p = 0.841235641(10) fm \quad (33)$$

in agreement with the root-mean-square value of the proton charge distribution [8]

$$r_p^{\mu} = \langle r^2 \rangle^{\frac{1}{2}}$$

as observed by spectroscopy on muonic hydrogen [1,3,4]."

Prior to this last quote from On proton charge radius definition, Trinhammer and Bohr state,

"**Higgs potential and electroweak scale.** - We fitted the Higgs potential to the periodic potential (4) as seen in fig. 2 and found [23]

$$V_H(\phi) = \frac{1}{2}\delta^2\varphi_0^2 - \frac{1}{2}\mu^2\left(\phi^\dagger\phi\right) + \frac{1}{4}\lambda^2\left(\phi^\dagger\phi\right)^2, \quad (23)$$

$$\delta^2 = \frac{1}{4}\varphi_0^2, \quad \mu^2 = \frac{1}{2}\varphi_0^2, \quad \lambda^2 = \frac{1}{2}, \quad \varphi_0 = \frac{2\pi}{\alpha}\Lambda.$$

From this there follows $m_H c^{\,2} = \frac{1}{\sqrt{2}}\,\varphi_0$. The 2π shift sets the electroweak energy scale v to

$$\frac{v}{\sqrt{2}} = \varphi_0 = \frac{2\pi}{\alpha}\Lambda. \quad (24)$$

Note that the standard model value v_{SM} is related to our

v by the u and d quark mixing matrix element V_{ud}, thus

$v_{SM} = v\sqrt{|V_{ud}|}$ [23,44]. From the Higgs potential and the scale (24) we got an accurate expression for the Higgs mass [23,38] the value of which we update here:

$$m_H c^2 = \frac{1}{\sqrt{2}}\frac{2\pi}{\alpha(m_W)}\frac{\pi}{\alpha_e}c^2 = 125.095 \pm 0.014\,\mathrm{GeV}. \quad (25)$$

The fine-structure couplings are $\alpha(m_W) = 1/127.989(14)$ (see footnote [4]) at the W boson scale [38] and $\alpha_e = 1/137.035999139(31)$ at the electron scale [8], respectively. The electron mass enters from our use of the classical electron radius, cf. [46] and p. 97 in [47],

$$r_e = \frac{e^2}{4\pi\varepsilon_0 m_e c^2} \quad (26)$$

to set the length scale a in (2) by the projection relation, cf. fig. 3 [24],

$$\pi a = r_e. \quad (27)$$

This projection rests on the existence of a map from the intrinsic torus to space coordinates, thus

$$x_j = a\theta_j. \quad (28)$$

The choice of r_e in (27) to set the exterior scale in mapping the intrinsic scale is heuristically motivated by the fact that the electron with its rest mass m_e is created simultaneously with the topological change giving p its charge in the transformation from the neutral neutron n to the charged p. We have called the electron a “peel-off”[24] and we have described the proton as “charge scarred”. The scale introduced in (26) led to an accurate value for the electron-to-neutron mass ratio [24]

$$\frac{m_e}{m_n} = \frac{\alpha(m_n)}{\pi}\frac{1}{E_n} = \frac{1}{1839(1)}, \quad (29)$$

where the fine structure coupling is to be taken at nucleonic energies. The same scale is to be used for the baryon spectra. Cf. [23,32] for approximate solutions for charged states. The result in (29) is calculated with $\alpha^{-1}(m_n) = 133.61$ obtained by sliding with radiative corrections from $\alpha^{-1}(m_\tau) = 133.476(7)$ [8] and with $E_n = \mathcal{E}_n/\Lambda = 4.382(2)$ where $\mathcal{E}_n$ is the neutron ground-state eigenvalue found in a Rayleigh-Ritz solution [38] of (15) with 3078 base functions [23]. With $r_e = \frac{e^2}{4\pi\varepsilon_0 m_e c^2}$ eq. (27) gives $a = 0.92\ldots fm$ for the length scale used in the space projection (28) of the toroidal angles in the neutronic state.

Finally, Trinhammer and Bohr state:

“Mass as intrinsic energy-momentum. - We here connect our relation (32) to semi-classical considerations. We start out by the differential geometry underlying the treatment of (2). From the compactness of the intrinsic configuration space $U(3)$ and the exchange of energy-momentum through the exterior derivatives (momentum forms) dR and $d\Phi$ operating on the intrinsic wave function we get an intuitive conception of baryonic massiveness as *introtangled* energy-momentum. The exterior derivatives act on the momentum generators and rotation generators in laboratory space and thereby map the intrinsic wave function to laboratory space. In particular, by the projection of the toroidal degrees of freedom [24] on the spatial degrees of freedom (28), we imagine the extension of a baryon as a compromise on the impossibility of point-like localization and mutual, definite "curled up" momentum [49]. We take the general relation

$$\mathcal{E}^2 = p^2c^2 + m^2c^4 \quad (35)$$

among energy $\mathcal{E}$, momentum *p* and mass *m* as defined in space-time where c is the velocity of pure energy configurations and assume formally that intrinsic dynamics is that of pure energy (zero mass and no gravity in intrinsic space). Then from an intrinsic point of view

$$\mathcal{E}^2 = p_{int}^2c^2. \quad (36)$$

In the complementary real-space configuration, the state is a particle at rest (zero momentum), so we have

$$\mathcal{E}^2 = m^2c^4. \quad (37)$$

The right-hand sides of (36) and (37) are squares of corresponding eigenvalues for the same baryonic entity in (2) only seen from complementary spaces. Thus,

$$p_{int}c = mc^2. \quad (38)$$

With the quantization inherent in the concept of the de Broglie wavelength and the Bohr-Sommerfeld quantization condition for the action integral $\oint p\,\mathrm{d}q = nh, n \in \mathrm{Z}^+$(cf. p. 36 in [50]) we infer for *n* = 1

$$p_{int}\lambda_0 = h \rightarrow \lambda_0 = \frac{h}{mc} = 2\pi\frac{hc}{E\Lambda} = \frac{2\pi a}{E}. \quad (39)$$

The fourth expression is the Compton wavelength of the particle as conceived in real space. The last expression opens for relating the proton charge radius in (1) to the classical electron radius by using $\pi a = r_e$ from (27) in (39) to yield

$$r_p = \frac{4}{\pi E}\frac{\alpha(m_n)}{\alpha_e}r_e = 0.8398(4)\mathrm{fm}. \quad (40)$$

Here the main uncertainties lie in $E = 4.382(2)$ determined from (15) and in the necessary sliding from the fine-structure coupling $\alpha^{-1}(m_\tau) = 133.476(7)$ at tauonic energies [8] to nucleonic energies in the neutron-to-proton transformation where $\alpha^{-1}(m_n) = 133.61(1)$. This has only been done for radiative corrections and not for fermionic corrections since here we are outside the perturbative regime of QCD. We may insert the classical electron radius (26) in (40) to get

$$r_p = \frac{4}{\pi E}\frac{\alpha(m_n)}{\alpha_e}\frac{e^2}{4\pi\varepsilon_0 m_e c^2} = \frac{4\alpha(m_n)}{\pi E}\frac{\hbar c}{m_e c^2}, \quad (41)$$

where the last expression involves the proton charge in the fine-structure coupling at nucleonic energies."

One can solve equation (29) for $\alpha(m_n)$, obtaining

$$\alpha(m_n) = \frac{m_e}{m_n}\pi E_n,$$

which is not the fine-structure constant α. If we look in On the electron to proton mass ratio and the proton structure, EPL (Europhysics Letters) · June 2013, Ole L. Trinhammer , we find,

"The ratio we get between the electron mass m_e and the proton mass m_p *is*

$$\frac{m_e}{m_n} = \frac{\alpha}{\pi}\frac{1}{E}, \quad (1)$$

where $\alpha = \frac{e^2}{4\pi\varepsilon_0\hbar c}$ is the fine-structure constant [1] and $\mathrm{E} = E/\Lambda$ is the dimensionless ground state eigenvalue of a reinterpreted lattice gauge theory Kogut-Susskind Hamiltonian [2]

$$\frac{\hbar c}{a}\left[-\frac{1}{2}\Delta + \frac{1}{2}\mathrm{Tr}\chi^2\right]\Psi(u) = E\Psi(u). \quad (2)$$

with Manton's action [3] used now as a potential for a configuration variable $u = e^{i\chi}$ in the Lie group $u(3)$ instead of a link variable U in the $\mathrm{SU}(3)$ algebra [4]. The energy scale $\Lambda \equiv \hbar c/a$ corresponds to a fundamental length scale a, which we shall relate to the classical electron radius R_0 by

$$a\pi = R_0, \quad (3)$$

where R_0 is determined by the electron self-potential energy [5]

$$\frac{1}{4\pi\varepsilon_0}\frac{e^2}{R_0} = m_e c^2. \quad (4)$$

We assume (2) to describe the baryon spectrum and identify the ground state with the proton. With $E = m_p c^2 = \mathrm{E}\Lambda = \mathrm{E}\,\hbar c/a$ and (4) applied in (3), eq. (1) follows directly. Our configuration space is "orthogonal" to the laboratory space wherefore (2) describes a truly interior dynamics which may be projected on laboratory space parameters through the eigenangles θ_j parameterizing the eigenvalues $e^{i\theta_j}$ of u. The projection introduces the dimensionful scale a, thus

$$x_j = a\theta_j \quad (5)"$$

In The Higgs mass derived from the U(3) Lie group, Ole L. Trinhammer*, Henrik G. Bohr, Mogens Stibius Jensen, arXiv:1503.00620v2, the authors state:

"The standard model contains quite a few unexplained parameters such as the six quark mass parameters, the three angles and one phase of the Cabibbo-Kobayashi- Maskawa (CKM) mixing matrix10, the several coefficients and exponents of each parton distribution function and a similar wealth for the six leptons. The strong and electroweak interactions are described by seemingly independent gauge groups $SU(3)$ and $U(2) \cong SU(2) \times U(1)$[11]. Baryons feel both interactions wherefore we seek a description from a common Lie group background. The simplest choice is $U(3)$ which contains $SU(3)$; $SU(2)$ and$U(1)$ as exemplar subgroups. With this choice we can reduce considerably the number of parameters needed to describe baryon mass spectra and the Higgs mass. We stress that the group $U(3)$ is generated from three parametric momentum operators, three parametric angular momentum operators and three remaining Runge-Lenzlike operator components to connect the algebra. The six latter can be seen as intrinsic editions of the generators of the Lorentz algebra[12]. With three dimensions in laboratory space $\mathbb{R}^3$, the group manifold $U(3)$ therefore becomes the natural choice for intrinsic degrees of freedom that can be kinematically excited from laboratory space. The dynamics of the intrinsic degrees of freedom is projected back to laboratory space in the shape of quantum fields of various structures depending on the projection base chosen. A mixing between such projections becomes natural when one considers that the related subgroups are intermingled in the common $U(3)$ configuration. This conception may open for a derivation of CKM-matrix elements although that is far beyond the scope of the present work. We shall, however, make a first step to correlate the strong and electroweak interactions of baryons, namely in a derivation of the Higgs mass."

"One of us has previously introduced the Lie group $U(3)$ as configuration space[17,18]. It contains the usual gauge groups $SU(3)$ of strong interactions and $SU(2) \times U(1)$ of electroweak interactions. The essential frame to be adopted here complies with local gauge symmetry when the intrinsic Lie group dynamics is projected to laboratory space. Each point $P(x;\ y;\ z)$ in space is equipped with an intrinsic $U(3)$ configuration space in which the fundamental dynamics is formulated with $u = e^{i\chi} \in U(3)$ as configuration variable. Thus, our configuration space is orthogonal to the space-time manifold of the laboratory space. The closest analogue we can think of is that of intrinsic spin. In the present case the intrinsic space contains both color, spin, isospin and hypercharge degrees of freedom. We thus can capture both the strong and electroweak sections of baryon phenomena. A major motivation is to reduce the number of ad hoc mass parameters in baryon phenomena relative to the standard model. As a benefit of intermingling the gauge groups of the standard model in a common intrinsic space, the parameters in the Higgs potential and the electroweak energy scale are determined from the relation to the intrinsic baryon potential - and the missing resonance problem in baryon spectroscopy vanishes. We do not expect to capture the meson sector since mesons are interaction quanta, i.e. field constructions in laboratory space."

"Our basic frame is a Hamiltonian structure on the Lie group $U(3)$ as a configuration space for baryons. We consider baryons as stationary states with masses $mc^2 = E$ determined as eigenvalues of [17,19-21]

$$\frac{\hbar c}{a}\left[-\frac{1}{2}\Delta + \frac{1}{2}\mathrm{Tr}\chi^2\right]\Psi(u) = E\Psi(u). \quad (1)$$

where $\Lambda \equiv \hbar c/a \approx 214{:}\,27\ \mathrm{MeV}$ is our energy scale factor corresponding to a length scale a. Note that Λ corresponds to the QCD energy scale factor [22], e.g. $\Lambda_{\overline{MS}}^{(5)} = 213 \pm 8\ \mathrm{MeV}$ and is of the order of the pion decay constant [23] $F_\pi = 184\ MeV$. The latter is common for setting the scale in different phenomenological models [24,25]. For our Λ the length scale a was explicitly related [17] to the classical electron radius [26-28] $r_e = e^2/4\pi\varepsilon_0 m_e c^2 = \alpha\hbar c/m_e c^2$ by a mapping $\pi a = r_e$ between real parameter space and toroidal angles in the Lie group, see Fig. 2. The Λ above is calculated from a fine structure constant taken at nucleonic energies [29] $\alpha^{-1}(m_\tau) = \alpha^{-1}(1.77\ \mathrm{GeV}) = 133.471$."

Aside from the description,

"The essential frame to be adopted here complies with local gauge symmetry when the intrinsic Lie group dynamics is projected to laboratory space. Each point $P(x;\ y;\ z)$ in space is equipped with an intrinsic $U(3)$ configuration space in which the fundamental dynamics is formulated with $u = e^{i\chi} \in U(3)$ as configuration variable. Thus, our configuration space is orthogonal to the space-time manifold of the laboratory space,"

and perhaps a few others, how the configuration space corresponds to physical reality is bothersome. The classical electron radius, given as

$$r_e = e^2\, /4\pi\varepsilon_0 m_e c^2 = \alpha\hbar c/m_e c^2,$$

becomes

$$r_e = \frac{\alpha\hbar}{m_e c}$$

after the rightmost expression in the previous equation is reduced to the right side of the last equation.

We had hoped, from equation (1) in "On the electron to proton mass ratio and the proton structure," to give αm_e the fine-structure constant α times m_e, as the fraction of the electron mass at the Bohr radius. In the first paper quoted, On proton charge radius definition, Trinhammer and Bohr give the Compton wavelength of the proton as

$$\lambda_p = \frac{h}{m_p c}. \quad (30)$$

We could have immediately given from this the Compton wavelength radius of the proton as

$$r_p = \frac{1}{2\pi}\lambda_p$$

without considering, since "the mapping of the intrinsic protonic state has to take into account the period doubling from the Bloch phase factors $e^{i\theta/2}$ in (17), the projectional relation analogous to (28)

$$x_j = r_p\frac{\theta_j}{2}. \quad (31)"$$

Whether the consideration of the intrinsic $U(3)$ configuration space at each point $P(x;\, y;\, z)$ in space gives a view of reality or a better view of reality is not clear, but when Trinhammer and Bohr give the classical electron radius as

$$r_e = e^2\, /4\pi\varepsilon_0 m_e c^2 = \alpha\hbar c/m_e c^2,$$

we find, by noting that this would make the electron mass at the classical electron radius

$$m_{e_c} = \frac{m_e}{\alpha},$$

that there is no such radius. We did not find any mention in the three Trinhammer, Bohr, et al, papers any mention of whether they consider α to be the ratio of masses

$$\frac{m_e(a_0)}{m_e}$$

with $m_e(a_0)$ being the shed mass corresponding to the Bohr radius electron wave orbit or the ratio of velocities

$$\frac{v_1}{c},$$

as Sommerfield had it, where v_1 is the velocity of the electron at the Bohr radius.

Nor do we find any mention of what holds the Compton wavelength energy wave spheres together, the nature of the various radii in the hydrogen atom, space-time coordinates, and the nature of the gravitational force as the energy lost by the energy wave spheres.

In response to, "*the kinetic energy is only half of the energy of the wave*," on ResearchGate, Andre Michaud wrote,

“Yes. What you name "the wave" and that de Broglie named "the pilot wave" is named "the electron carrier-photon" in electromagnetic mechanics, and this kinetic energy amount is the momentum energy of the electron at Bohr radius distance from the proton vectorially oriented towards the proton, that maintains the electron captive in resonance state at approximate Bohr radius distance from the proton, captive between the inward pressure exerted by this momentum energy against the outward pressure of the mutually repelling magnetic fields of the electron on one hand, and the compound magnetic fields of the 3 inner charged subcomponents of the proton on the other hand, that are in permanent default repelling parallel magnetic spin alignment with respect to the magnetic field of the electron, as discovered as an outcome of the 1998 experiment: On The Magnetostatic Inverse Cube Law and Magnetic Monopoles...”

In this paper, On the Magnetostatic Inverse Cube Law and Magnetic Monopoles, Michaud, page 64, states

“Since all components of the proton are translating on closed orbits, their individual magnetic moments will by definition be more intense than if the same particles were travelling in a straight line due to the mandatory magnetic drift of the oscillating half of their carrying energy towards magnetostatic space as a function of their respective gyroradii, as clarified in ([14]).”

Michaud gives in Table II, Absolute amplitudes of the proton constituting scatterable particles as follows:

Absolute Amplitudes of the Proton Constituting Particles			
Particle	Energy (E)	Amplitude $\left(A = \frac{hc}{2\pi E}\right)$	Space concerned
Up Quark	1.842098431E-13 J	1.716263397E-13 m	Magneto-static
Down Quark	7.368393804E-13 J	4.290658445E-14 m	
Carrier-photon of each quark	4.974082389E-11 J	6.35599868E-16 m	
Proton Radius in Normal space		1.252776701E-15 m	Normal
Coplanar Rotation Diameter		3.344237326E-13 m	Electrostatic

The energy of the up quark is one fourth the energy of the down quark and the radii, here given as the amplitude, being

$$r = \frac{hc}{2\pi E},$$

are inversely proportional to the energy E, just as for any energy wave sphere. Both quarks have radii that exceed the radius of the proton, which is to say that they stick out, as is the case for any such energy wave sphere with wave energy less than that of the proton.

In On quarks and the origin of QCD: Partons and baryons from intrinsic states, EPL, 133 (2021) 31001, Trinhammer, page 4, states,

"From the constituent quark model, we have an expression for the proton magnetic moment [23]

$$\mu_p = \frac{4}{3}\mu_u - \frac{1}{3}\mu_d, \qquad \mu_q = \frac{\frac{e_q\hbar}{2}}{4\pi\varepsilon_0 m_q}. \quad (25)$$

We use [19]

$$m_p \ = \ 2m_u + m_d, \quad \frac{m_u}{m_d} = \frac{\int_0^1 x f_u(x)dx}{\int_0^1 x f_d(x)dx} = \frac{0.2722}{0.1432} \quad (26)$$

and get $m_u c^2 = \ 371MeV, m_d c^2 = 195\text{MeV}$ from which

$$\mu_p = 2.779\ldots\mu_N, \qquad \mu_N = \frac{\frac{e_q\hbar}{2}}{4\pi\varepsilon_0 m_p}, \quad (27)$$

to compare with experiment $2.7928473446(8)\mu_N$ [1]."

In Review of Particle Physics, K.A. Olive 2014 *Chinese Phys. C* 38 090001, the mass of the up quark is given as

$$m_u = 2.3^{+0.7}_{-0.5}MeV$$

and the mass of the down quark is given as

$$m_u = 4.8^{+0.5}_{-0.3}MeV.$$

Since $1\,joule = (6.2415)10^{18}\ electron\ volts$, Michaud's value for the energy of the up quark is

$$(1.842098431)10^{-13}(6.2415)10^{18}$$
$$= 1.14974573570865MeV,$$

which is *half* of the energy m_u of the up quark given by Olive, and the Michaud's value for the energy of the down quark is *four* times his value for the energy of the up quark.

For the energy equivalent of the mass of the electron we have

$$m_e = 0.5109989 \text{ MeV}.$$

In Steinberger, J. M.. "Experiments with High-Energy Neutrino Beams." *Science* 245 (1989): 1202 – 1208, Steinberger notes,

"In 1969, at the newly created 2-mile linear electron accelerator at SLAC, it was discovered that in electron-proton collisions, at high momentum transfer, the form factors were independent of Q^2. This so-called 'scaling' behavior is characteristic of 'point', or structureless, particles. The interpretation in terms of the composite structure of the protons—that is, protons composed of point-like quarks—was given by Bjorken and Feynman."

5.2 Quark structure of the nucleon

In 1969, at the newly completed 2-mile linear electron accelerator at SLAC, it was discovered[7] that in electron–proton collisions, at high momentum transfer, the form factors were independent of Q^2. This so-called 'scaling' behaviour is characteristic of 'point', or structureless, particles. The interpretation in terms of a composite structure of the protons — that is, protons composed of point-like quarks — was given by Bjorken[8] and Feynman[9].

Neutrinos are projectiles *par excellence* for investigating this structure, in part because of the heavy mass of the intermediate boson, and in part because quarks and antiquarks are scattered differently by neutrinos owing to the V–A character of the weak currents; they can therefore be distinguished in neutrino scattering, whereas in charged-lepton scattering this is not possible. The quark model makes definite predictions for neutrino–hadron scattering, which are beautifully confirmed experimentally. Many of the predictions rest on the fact that now the kinematical variable x takes on a physical meaning: it can be interpreted as the fraction of the nucleon momentum or mass carried by the quark on which the scattering takes place. The neutrino experiments we review here have primarily used iron as the target material. Iron has roughly equal numbers of protons and neutrons. For such nuclei, the cross-sections can be expressed in terms of the total quark and total antiquark distributions in the proton. Let $u(x)$, $d(x)$, $s(x)$, $c(x)$, etc., be the up, down, strange, charm, etc., quark distributions in the proton. The proton contains three 'valence' quarks: two up-quarks and one down-quark. In addition, it contains a 'sea' of virtual quark–antiquark pairs. The up valence-quark distribution is $u(x) - \bar{u}(x)$, and the down valence-quark distribution is $d(x) - \bar{d}(x)$. The sea quarks and antiquarks have necessarily identical distributions, so that $s(x) = \bar{s}(x)$, $c(x) = \bar{c}(x)$, etc. For the neutron, u and d change roles, but s and c are the same. Let

$$q(x) = u(x) + d(x) + s(x) + c(x) + \ldots \qquad \text{and} \qquad \bar{q}(x) = \bar{u}(x) + \bar{d}(x) + \bar{s}(x) + \bar{c}(x) + \ldots$$

be the total quark and antiquark distributions of the proton, respectively. For spin-½ quarks interacting according to the Standard Model, for a target with equal numbers of protons and neutrons, and for $Q^2 \ll m_W^2$ and $m_p \ll E$:

$$\frac{d^2\sigma^{\nu}}{dxdy} = \frac{G_F^2 E m_p}{\pi} x[q(x) + (1 - y)^2 \bar{q}(x)]$$

9

and

$$\frac{d^2\sigma^{\bar{\nu}}}{dxdy} = \frac{G_F^2 E m_p}{\pi} x[\bar{q}(x) + (1 - y)^2 q(x)] \ .$$

Comparison with the expression for the cross-section in terms of structure functions then gives these functions in terms of quark distributions:

$F_2(x, Q^2) = x[q(x) + \bar{q}(x)]$: $q(x) + \bar{q}(x)$ is the total quark + antiquark distribution;

$xF_3(x, Q^2) = x[q(x) - \bar{q}(x)]$: $q(x) - \bar{q}(x)$ is the 'valence'-quark distribution;

$F_L(x, Q^2) = 0$: this is a consequence of the spin-½ nature of the quarks.

From these simple expressions for the cross-sections, in terms of quark structure, several tests of the quark model are derived. For the experimental comparisons, we take the CDHS experiments[10]. It should be noted that the measurements in the detector, i.e. the hadron energy and the muon momentum, are just sufficient to define the inclusive process.

1) Scaling. The independence of the differential cross-sections with respect to Q^2 is evident everywhere, over a large domain in Q^2. As one example, Fig. 12 shows the linearity of the total cross-sections with neutrino energy; as another, Fig. 13 shows the uniformity of the average of y with respect to neutrino energy; both examples are consequences of scaling. Small deviations from scaling are observed in the structure functions, as we will see later, but these have their explanation in the strong interactions of the quarks.

Image from Steinberger, J. M.. "Experiments with High-Energy Neutrino Beams." *Science* 245 (1989): 1202 – 1208.

The work of Feynman to which Steinberger refers in the assertion that protons are composed of point-like quarks, *Photon-hadron interactions*, Benjamin, New York, 1972, followed Feynman's book, *The Theory of Fundamental Processes*, Addison-Wesley, 1961, in Chapter 4, Rules of Composition of Angular Momentum, of which, Feynman states,

"A spin $1/2$ state is characterized by two amplitudes. In general, $a = a_+(1/2) + a_-(-1/2)$ where $(1/2)$ stands for $\binom{1}{0}$, $(-1/2)$ stands for $\binom{0}{1}$, and a for $\binom{a_+}{a_-}$."

In *Quantum Theory*, Dover Publications, New York, 1951, Chapter 17, Spin and Angular Momentum, pages 387-388, David Bohm writes,

"In Chap. 14 we studied the quantum properties of the angular momentum of single particle systems. We wish now to extend this treatment to take into account the angular momentum of a system of particles. We shall also discuss the treatment of the additional angular momentum arising from the fact that the electron has an intrinsic spin.

1. Electron Spin. Although the Schrödinger wave equation gives excellent general agreement with experiment in predicting the frequencies of spectral lines, small discrepancies are found, which can be explained in terms of the postulate that the electron has, besides its usual orbital angular momentum, an additional intrinsic angular momentum that acts as if it came from a spinning solid body.* It was found that agreement with experiment could be obtained by means of the assumption that the magnitude of this additional angular momentum was $\hbar/2$. The magnetic moment needed to obtain agreement with the Zeeman effect was, however, $\mu = e\hbar/2mc$, which is exactly the same as that arising from an orbital angular momentum of $\hbar$. The gyromagnetic ratio, i.e., the ratio of magnetic moment to angular momentum is therefore twice as great for electron spin as it is for orbital motion.

Many efforts were made to connect this intrinsic angular momentum to an actual spin of the electron, considered as a rigid body. In fact, the gyromagnetic ratio needed is exactly that which would be obtained if the electron consisted of a uniform spherical shell spinning about a definite axis. The systematic development of such a theory met, however with such great difficulties that no one was able to carry it through to a definite conclusion. Somewhat later, Dirac developed a relativistic wave equation for the electron, in which the spin and the charge were shown to be bound up in a way that can be understood only in connection with the requirements of relativistic invariance. In the nonrelativistic limit, however, the electron still acts as if it had an intrinsic angular momentum of $\hbar/2$. In this chapter, we shall therefore treat the nonrelativistic theory of spin in the form originally developed by Pauli, and we shall merely accept the spin as an empirically required addition to the angular momentum, without attempting to understand its origin a deeper way."

Thus, without any deeper understanding, as in without any attempt at deeper understanding, Bohm proceeds with the nonrelativistic theory of spin in the form originally developed by Pauli. In the abstract of "What is spin?," Am. J. Phys. 54 (6), June 1886, Hans C. Ohanian states,

"According to the prevailing belief, the spin of the electron or of some other particle is a mysterious internal angular momentum for which no concrete physical picture is available, and for which there is no classical analog. However, on the basis of an old calculation by Belinfante [Physica 6, 887 (1939)], it can be shown that the spin may be regarded as an angular momentum generated by a circulating flow of energy in the wave field of the electron. Likewise, the magnetic moment may be regarded as generated by a circulating flow of charge in the wave field. This provides an intuitively appealing picture and establishes that neither the spin nor the magnetic moment are "internal"—they are not associated with the internal structure of the electron, but rather with the structure of its wave field. Furthermore, a comparison between calculations in the Dirac and electromagnetic fields shows that the spin of the electron is entirely analogous to the angular momentum carried by a classical circularly polarized wave."

In the Introduction that follows, Ohanian states,

"When Goudsmit and Uhlenbeck proposed the hypothesis of the spin of the electron, they had in mind a mechanical picture of a small rigid body rotating about its axis. Such a picture had earlier been considered by Kronig and discarded on the advice of Pauli, Kramers, and Heisenberg, who deemed it a fatal flaw of this picture that the speed of rotation—calculated from the magnitude of the spin and a plausible estimate of the radius of the electron— was in excess of the speed of light. However, the great success of the spin hypothesis in explaining the Zeeman effect and the doublet structure of the spectral lines quickly led to its acceptance. Since the naïve mechanical picture of spin proved untenable, physicists were left with the concept of spin without its physical basis, like the grin of the Cheshire cat. Pauli pontificated that spin is “an essentially quantum-mechanical property,…a classically not describable two-valuedness” and he insisted that the lack of a concrete picture was a satisfactory state of affairs:

After a brief period of spiritual and human confusion, caused by a provisional restriction to 'Anschaulichkeit', a general agreement was reached following the substitution of abstract mathematical symbols, as for instance psi, for concrete pictures. Especially the concrete picture of rotation has been replaced by mathematical characteristics of the representations of rotations in three-dimensional space.

Thus, physicists gradually came to regard the spin as an abstruse quantum property of the electron, a property not amenable to physical explanation.

Judging from statements found in modem textbooks on atomic physics and quantum theory, one would think our understanding of spin (or the lack thereof) has not made any progress since the early years of quantum mechanics. The spin is usually said to be a nonorbital, "internal," "intrinsic," or "inherent" angular momentum (the words are often used interchangeably, although they should not be), and it is often treated as an irreducible entity that cannot be explained further. Sometimes the (unsubstantiated) suggestion is made that the spin is due to an (unspecified) internal structure of the electron. And sometimes the consolation is offered that the spin arises in a natural way from Dirac's equation5 or from the analysis of the representa-tions of the Lorentz group. It is true that the Dirac equation contains a wealth of information about spin: The equation tells us that the spinor wavefunctions are indeed endowed with a spin angular momentum of $\hbar/2$, it supplies the mathematical description of the kinematics of a free-electron or other particle of spin one-half, and—in conjunction with the principle of minimal coupling—it supplies the equations governing the dynamics of a charged particle immersed in a electromagnetic field, equations which directly yield the correct value of the gyromagnetic ratio for the electron. It is also true that the analysis of the representations of the Lorentz group is very informative: The analysis tells us that the quantum-mechanical wavefunctions must be certain types of tensors or spinors characterized by a value of the mass and (if the mass is not negative) an integer or half-integer value of the spin. But in all of this the spin merely plays the role of an extra, nonorbital angular momentum of unknown etiology. Thus the mathematical formalism of the Dirac equation and of group theory demands the existence of the spin to achieve the conservation of angular momentum and to construct the generators of the rotation group, but fails to give us any understanding of the physical mechanism that produces the spin.

The lack of a concrete picture of the spin leaves a grievous gap in our understanding of quantum mechanics. The prevailing acquiescence to this unsatisfactory situation becomes all the more puzzling when one realizes that the means for filling this gap have been at hand since 1939, when Belinfante established that the spin could be regarded as due to a circulating flow of energy, or a momentum density, in the electron wave field. He established that this picture of the spin is valid not only for electrons, but also for photons, vector mesons, and gravitons—in all cases the spin angular momentum is due to a circulating energy flow in the fields. Thus, contrary to the common prejudice, the spin of the electron bas a close classical analog: It is an angular momentum of exactly the same kind as carried by the fields of a circularly polarized electromagnetic wave. Furthermore, according to a result established by Gordon in 1928, the magnetic moment of the electron is due to the circulating flow of charge in the electron wave field. This means that neither the spin nor the magnetic moment are internal properties of the electron—they have nothing to do with the internal structure of the electron, but only with the structure of its wave field.

Unfortunately, this clear picture of the physical origin of the spin and of the magnetic moment has not received the wide recognition it deserves, perhaps because neither Belinfante nor Gordon loudly proclaimed that their calculations provided a new physical explanation of the spin and of the magnetic moment. These calculations are sometimes reproduced in texts on quantum field theory, but usually without any commentary on their physical interpretation. In the present paper, it is my objective to revive these forgotten explanations of the spin and the magnetic moment in the hope that the intuitive picture of circulating energy and charge will become part of the lore learned by all students of physics. I want to emphasize that, in contrast to some other attempts at explaining the spin, the present explanation is completely consistent with the standard interpretation of quantum mechanics."

Despite Ohanian's statement that "the mathematical formalism of the Dirac equation and of group theory demands the existence of the spin to achieve the conservation of angular momentum and to construct the generators of the rotation group, but fails to give us any understanding of the physical mechanism that produces the spin," he somehow cares that "the present explanation is completely consistent with the standard interpretation of quantum mechanics."

Passing over, for now, Section II. Spin in the Electromagnetic Field, Section III. Spin in the Dirac Field, and Section IV. The Magnetic Moment of the Electron of the Ohanian paper, we quote from Section V. Conclusions:

"The calculations in the preceding sections should lay to rest the common misconception that spin is an essentially quantum-mechanical property. What these calculations show is that spin is essentially a wave property, but whether the wave is classical or quantum mechanical is of secondary importance. The only fundamental difference between the spins of a classical wave and a quantum-mechanical wave is that the spin of the former is a continuous macroscopic parameter, whereas the spin of the latter is quantized and is represented by a quantum-mechanical operator. The argument is often made that since the spin of a quantum-mechanical particle—such as a photon—has a fixed magnitude, it is not possible to proceed to the classical limit of large quantum numbers, and consequently the spin must be regarded as a quantum property without classical analog. But this argument is flawed. Although we cannot proceed to the limit of large quantum numbers for a single particle, we can proceed to the limit of large occupation numbers for a system of many particles. A circularly polarized light wave is an example of a system in which the classical macroscopic spin angular momentum arises from the addition of a large number of quantum spins. Such a classical limit is also possible for electrons, but we must take the precaution of placing electrons in different orbital states whenever we place them in the same spin state. The Einstein-de Haas effect and the magnetization found in permanent magnets involve classical limits brought about by a large number of electron spins and magnetic moments.

The physical picture of spin presented in the preceding sections has great intuitive appeal because it confirms our deep prejudice that angular momentum ought to be due to some kind of rotational motion. But the rotational motion consists of a circulation of energy in the wave fields, rather than a rotation of some kind of rigid body. The spin is *intrinsic* or *inherent*, i.e., it is a fixed feature of the wave field that does not depend on environmental circumstances. But it is not *internal*, i.e., it is not within the internal structure of the electron or photon (of course, the structure of the wave field is crucial to the spin, but this is not what is usually meant by internal structure).

A conspicuous feature of the above physical picture is the close kinship of spin and orbital angular momentum: Both are due to energy flow in the wave fields, and the distinction between them hinges on the mathematical separation of the angular momentum associated with the flow into two independent portions. Since this physical picture treats the spin and orbital angular momentum in the same way, it gives us as good an understanding of spin as of orbital angular momentum. We no longer need to regard the spin as a mysterious entity."

For both the electron and the proton, the radius is equal to the radius of the corresponding energy wave sphere. Far from the spin and magnetic moment having nothing to do with the internal structure of an electron, they *are* the electron. The electron and proton, with different masses and radius in each case inversely proportional to the mass and equal to

$$\frac{\hbar}{mc},$$

with the same spin and angular momentum, with the same absolute charge, its absolute value, and with the same magnetic moment, *exemplify* two objects with *certain* properties equal. One may wonder if some of these properties are the same thing—that the electric force between two particles with charge is a function of the charge, which a function of the spin, which is a function of the angular momentum. We make clear the *impotence* of quantum mechanics in giving any description of physical reality in this regard.

With no consideration of Einstein's theories, an energy wave sphere with mass m has, at rest, the energy mc^2 since its energy is the mass times the velocity squared of the wave, the velocity of the wave being omnidirectional and equal to c in all directions. This makes the energy of the wave and, as well, the momentum, which is

$$mc = \frac{h\nu}{c} = \frac{\hbar}{r},$$

an average, or so we thought. With the spin of an energy wave sphere equal to $\frac{\hbar}{2}$, which is only half of the angular momentum,

$$mcr = \hbar,$$

of the wave, we at first took the spin to be an average angular momentum, obtained by integration, of the various planar orbits, which lie in some plane passing through the center of the sphere at some angle θ to the plane of the maximal spin orbit, perpendicular to the direction of the angular momentum, of the wave.

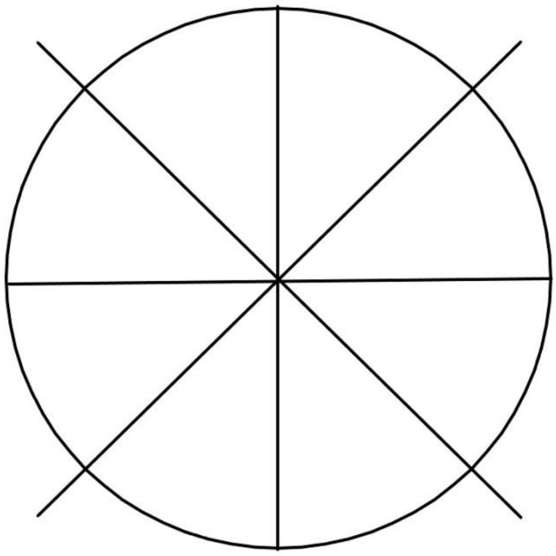


Figure 1

Figure 1 shows the projection of the energy wave sphere, and the horizontal line corresponds to the projection of the maximal spin orbit. The counterclockwise rotations by some angle θ about a line through the center and perpendicular to the plane shown give the possible orbits of the energy wave.

We have

$$m = \frac{h\nu}{c^2} = \nu \frac{h}{c^2},$$

or

$$mc = \nu \frac{h}{c}.$$

If we consider the circle in Figure 1 to be the maximal spin orbit, perpendicular to the direction of the angular momentum, of the wave, then the rotation of this orbit is counterclockwise about the vertical line that runs through the center of the circle. The movement of the wave in the maximal spin orbit is either counterclockwise or clockwise when viewed from a perpendicular direction. Viewing the motion from the opposite direction perpendicular to the spin reverses the motion from counterclockwise to clockwise or from clockwise to counterclockwise.

The portion of the energy wave sphere that the projection of which lies within the double horizontal cone has an angular momentum of $\frac{\hbar}{2}$, which is the spin of the energy wave sphere; similarly, the portion of the energy wave sphere that the projection of which lies within the double vertical cone has an angular momentum of $\frac{\hbar}{2}$, which is the magnetic moment of the energy wave sphere.

The electric force between two energy wave spheres depends on the spin of the energy wave spheres. If the energy wave spheres are the same type, as in electron or proton, for two energy wave spheres separated by the distance r, the energy waves, on the sides closest together, oppose each other if the energy wave spheres have the same alignment, the spin of each being in the same direction. This would give rise to an attractive force between the energy wave spheres, but the spins are in the opposite direction since the magnetic force flips the direction of the waves so that waves are in the same direction on the sides of the energy wave spheres closest together, thus resulting in a repulsive force between the two energy wave spheres.

For two energy wave sphere of different types, the flipping of the wave directions via the magnetic force results in an attractive force since the direction of the energy waves on the sides of the energy wave spheres closest together are opposite, resulting in an attractive force. An electron and a proton, with spins in the same direction via the magnetic force, attract each other since the momenta of the waves on the sides of the energy wave spheres closest together are in opposite directions, thus reducing the momenta of the energy waves on the sides of the energy wave spheres closest together. Without any magnetic force aligning the energy wave spheres so that the spins are opposite or the same, there is no electric force. With the radius of the proton smaller than the radius of the electron, the proton *burrows* into the electron.

Inside the electron energy wave sphere, we see the magnetic moment of the proton still being opposite the magnetic moment of the electron so that the energy wave spheres are held in place by the attraction of the opposite magnetic moments. For a proton energy wave sphere inside an electron energy wave sphere, the spins are still the same, but any electric force on the electron by the proton would result in an imbalance, the electron energy wave already held in place as an energy wave sphere by the force exerted by the imaginary energy wave spheres, and there is no place for the electron energy wave sphere to go.

As noted previously, the energy of motion, analogous to the gravitational case, corresponds to the emission of the photon in the electromagnetic case of the magnetic moment portion of the electromagnetic electron wave in the hydrogen atom losing energy and the recoil of the electron, which contains the proton, in the electromagnetic case of the spin portion of electromagnetic electron wave in the hydrogen atom losing energy.

We first considered the hydrogen atom as a miniature Michelson-Morley experiment in *The Material Point Universe Revisited*, which was never published. Although we considered Michelson-Morley experiment in *Fast Clocks in the Moving System* in 2017, we did not publish the material on the hydrogen atom as a miniature Michelson-Morley experiment until 2024, some twenty years after the treatment in *The Material Point Universe Revisited*, in *Quantum Gravity, Energy Wave Spheres, and the Proton Radius*.

We bring up *when a result was obtained* to compare the elapsed time until now with the elapsed time from Einstein's relativity theories and quantum theories until now and to point out that these supposedly great theories never get exposed for being false. As we were leaving the New Mexico Tech bookstore from the back door in the late 1960s, someone remarked to us about the discovery of new fundamental particles called *quarks*, which we had never heard of. The time, of course, was figuratively halfway between the time of the relativity and quantum theories and now.

In 1958, Richard Feynman gave a special series of lectures during a visit to Cornell University with notes, from which *The Theory of Fundamental Processes* came, taken by P. A. Carruthers and M. Nauenberg. In Chapter 28, Self-Energy of the Electron, which Feynman discusses as follows:

"The self-energy of the electron is an old problem; it appeared in classical physics. If you assume that an electron is a ball of radius a with all of its charge on the surface, then the total electrostatic energy $E_0 = e^2/2a$. Maybe the mass m of the electron corresponds to this energy. However, if you compute the momentum P carried by the field when the electron is moving with velocity V (including the Lorentz contraction of the ball) you find $P = (4/3)E_0 V/(1 - V^2)^{1/2}$. This corresponds to a particle of mass $m = (2/3) \times e^2/a$. Poincaré suggested that there must be something to hold the ball together and that the forces would contribute an additional amount of stored energy. But there is no reliable theory for these forces.

This self-energy comes from the energy needed to "assemble" the charge. From one view it is the energy of interaction of one part of the charge with another. One way out might at first seem to be to deny that an electron can act on itself—to suppose that electrons only act on each other. (Then the electron could be a point charge.) Yet the action of an electron on itself is required to explain a real phenomena, that of radiation resistance. An accelerating charge radiates, losing energy, so the accelerating force must do work. Against what? Against a force generated by action of one part of the charge on another, according to classical physics.

You can calculate the force F on a moving charge ball due to the interaction of the electromagnetic field of one part of the ball on another. This force is

$$F = (2/3) \times (e^2/a)\ddot{\chi} + (2/3) \times (e^2/c^3)\dddot{\chi} + O(a).$$

The first term agrees with the mass computed from the momentum of the field. The second term is the reaction force due to the radiation emitted by the electron and does not depend on a. However, it is not consistent to let $a \to 0$. A spread-out charge has never been thoroughly analyzed. Problems about internal motions, etc., arise. Actually, these problems were solved classically in various ways, but none of the ways have been carried over successfully in quantum mechanics."

The quantum-mechanical *representation* of spin as an operator, with no idea of what we have given as spin, *misses* what spin is. Recalling Ohanian's statement that "the mathematical formalism of the Dirac equation and of group theory demands the existence of the spin to achieve the conservation of angular momentum and to construct the generators of the rotation group, but fails to give us any understanding of the physical mechanism that produces the spin," Bohm's statement that "we shall therefore treat the nonrelativistic theory of spin in the form originally developed by Pauli, and we shall merely accept the spin as an empirically required addition to the angular momentum, without attempting to understand its origin a deeper way," and Feynman's statement that "these problems were solved classically in various ways, but none of the ways have been carried over successfully in quantum mechanics," we pass *for now* on considering further the quantum mechanical nature of spin since quantum mechanics has no idea what spin is and we have just given the nature of spin with a more realistic quantum approach.

Before we considered the velocity of light as the measured velocity of light in the system moving with constant velocity v and showed, as in proved, that what one gets is not c contradicting Einstein's second principle, which had to be true, we thought about Einstein's space-time coordinates in the vicinity of a quasi-static, radially symmetric gravitational field about a point mass and found that these coordinates give a faster clock, not the slower clock claimed by Einstein. We showed that the frequency of the wave in an energy wave sphere had to be the same in the parallel and perpendicular directions to the motion with a constant velocity v and argued that this applied to the frequency of the wave in any direction, the omni-directionality being necessary for an extension of the result to any direction.

In *Quantum Gravity, Energy Wave Spheres, and the Proton Radius*, pages 30-35, our copy, we stated,

“Now that this is set up, we consider in The Material Point Universe, Part 4, pages 10-11, our copy, the Lorentz contraction:

“The apparatus in the Michelson-Morley experiment consists of a clock, or really, two clocks and a way of comparing the periods of those two clocks. At rest each arm has a period of

$$T_0 = \frac{2l}{c}.$$

If the apparatus has a velocity *v*, the parallel arm has a period, in the rest system, if there is no change in *l* with respect to the rest system, of

$$T_{v,parallel} = \frac{2l}{c}\frac{1}{1-\frac{v^2}{c^2}}.$$

Similarly, if the apparatus has a velocity *v*, the perpendicular arm has a period, in the rest system, if there is no change in *l* with respect to the rest system, of

$$T_{v,perpendicular} = \frac{2l}{c}\frac{1}{\sqrt{1-\frac{v^2}{c^2}}}.$$

Thus, in the parallel direction, the moving clock unavoidably slows down by a factor of

$$1-\frac{v^2}{c^2};$$

in the perpendicular direction, by a factor of

$$\sqrt{1-\frac{v^2}{c^2}}.$$

The result of the Michelson-Morley experiment is that these times are equal. So, the only way to get both clocks to slow down, the experimental result, by a factor of $\sqrt{1-\frac{v^2}{c^2}}$ is for the parallel length to get shorter by this factor, thus speeding the parallel clock up by the inverse of this factor, and the perpendicular length not to change at all. One could have the perpendicular length get longer by $\frac{1}{\sqrt{1-\frac{v^2}{c^2}}}$ and the parallel length not change at all and obtain equal times, but this would increase the period of the perpendicular clock to make it equal to that of the parallel clock. One could have any other change in the two lengths that would give equal times, yet it is the Lorentz-contraction that implies and is implied by the experimental result of a slower clock by a factor of $\sqrt{1-\frac{v^2}{c^2}}$."

Since without the Lorentz contraction, the parallel clock slows down *too much*, by two factors of $\sqrt{1-\frac{v^2}{c^2}}$, the effect of the shortening of the parallel length by $\sqrt{1-\frac{v^2}{c^2}}$ is to speed the parallel clock up by the inverse of this factor so that the parallel clock and the perpendicular clock have the same period.

The shortening of the parallel length by $\sqrt{1-\frac{v^2}{c^2}}$ does not give an explanation for this shortening other than it being equivalent to the experimental result. We have more than just the equivalency and *worrying about possible criticism* of an original elucidation does not make sense considering the lack of relevance given by Einstein's false principle of relativity, incredibly taken to be a sign of Einstein's genius, and the false equation for the time coordinate provided by the Lorentz transformation.

In The Material Point Universe Revisited, Part 1, pages 8-9, we noted:

"In Einstein's 1905 paper, *On the Electrodynamics of Moving Bodies*, his two postulates were that (1) ("Principle of Relativity") that "… the same laws of electrodynamics and optics will be valid for all frames of reference for which the equations of mechanics hold good," and (2) "that light is always propagated in empty space with a definite velocity *c* which is independent of the state of motion of the emitting body." According to Hawking, as quoted earlier, the first postulate is "that the laws of science should appear the same to all freely moving observers," from which follows the second, that "observers should all measure the same speed for light, no matter how they were moving.""

In Fast Clocks in the Moving System, showing that the Lorentz transformation for the time coordinate is false, we gave the following argument in the abstract:

"*Suppose in what follows* that $\tau = 0$ when $t = 0$ and that $t = 0$ when $x' = 0$ and $\xi = 0$ coincide.

The final discovery, which we knew all along or should have known all along, following from the constancy of the velocity of light c in the moving system, is that, for a light ray emitted from the origin of the system *k* and arriving at ξ at time τ,

$$\xi = c\tau. \quad [i]$$

For the time coordinate τ, this gives

$$\tau = \beta(1 - v/c)t, \quad [ii]$$

which is equivalent to the Lorentz transformation for the time coordinate τ.

In the final blow to Einstein's theory, for the rod moving to the left, with velocity $-v$, and x positive, we have

$$\tau = \beta(1 + v/c)t. \quad [iii]$$

Clearly

$$\tau > \beta t > t, \quad [iv]$$

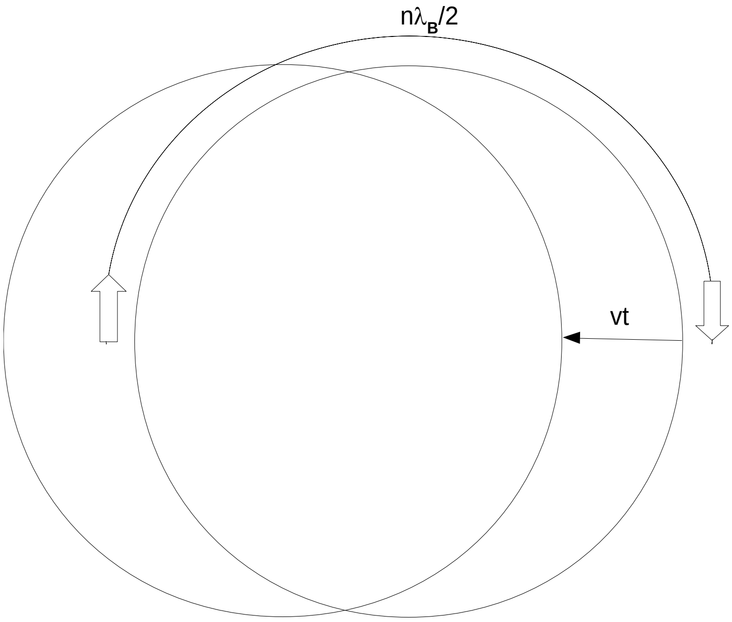
contradicting the experimentally verified slower clock in the moving system."

In The Material Point Universe Revisited, Part 4, pages 14-17, we considered the parallel and perpendicular electron de Broglie wave clocks in a hydrogen atom moving with velocity *v* follows:

"Thus, at rest, the radius of a hydrogen atom is determined by the de Broglie electron wavelength. In the moving hydrogen atom, one might expect that this is the case as well. For a de Broglie electron wave circling the nucleus in the parallel direction, we have, for a hydrogen atom moving with velocity *v*, the period

$$T_{parallel,rest} = \frac{n\lambda_B}{c}\frac{1}{1-\frac{v^2}{c^2}},$$

where we have assumed that the velocity of the de Broglie wave is *c*. This follows from a consideration akin to that of Feynman in the treatment of the Michelson-Morley experiment in Part 1.



Primitive Figure

For the case of the de Broglie wave moving in the opposite direction to the velocity of the atom, we have

$$ct_2 = n\lambda_B/2 - vt_2.$$

For the de Broglie wave moving in the same direction as the velocity of the atom, we have

$$ct_1 = n\lambda_B/2 + vt_1.$$

The above expression for $T_{parallel,rest}$ holds since it is the sum $t_1 + t_2$.

For the de Broglie wave moving in the perpendicular direction to the velocity of the atom, one might consider, in the above primitive figure, the circle on the right with the velocity *v* pointing out the face of the page. The path of the de Broglie wave is an elongated half-circle, the projection of which is a half-circle of length $n\lambda_B/2$. Since at each point of the path of the de Broglie wave, the projected velocity is $c\sqrt{1-\frac{v^2}{c^2}}$, the right triangle with sides of length $n\lambda_B/2$, vt, and hypotenuse of length $\frac{n\lambda_B}{2}\frac{1}{\sqrt{1-\frac{v^2}{c^2}}}$ is identical to the right triangle with sides of length $n\lambda_B/2$, vt, and hypotenuse of length ct. The latter right triangle has, for the length of the hypotenuse, the length of the path of the de Broglie wave; for the cosine of the angle θ, which the side of length vt makes with the hypotenuse, it has v/c, the same ratio as that of the length of the path of the atom to the length of the path of the de Broglie wave in its orbit. Thus

$$ct_3 = \frac{n\lambda_B}{2}\frac{1}{\sqrt{1-\frac{v^2}{c^2}}},$$

so that

$$T_{perpendicular,rest} = \frac{n\lambda_B}{c}\frac{1}{\sqrt{1-\frac{v^2}{c^2}}}.$$

Thus, we have shown that the moving hydrogen atom "is like a miniature Michelson-Morley experiment."

For the electron in the hydrogen atom, the de Broglie wave must have the property that it does not interfere with itself. Requoting Marmet, once more, "For any of these quantum numbers, we observe that the de Broglie electron wave is always in phase, after each complete rotation." Since the de Broglie electron wave is not just a *linear* wave moving around a circle, the period of the wave in any direction must be the same. This is necessary and sufficient for the wave to stay together.

In the perpendicular direction, since the period, in the rest system of the de Broglie electron wave in the hydrogen atom moving with velocity v, increases by a factor of $\frac{1}{\sqrt{1-\frac{v^2}{c^2}}}$, the path length of the de Broglie wave must increase by the same factor. This holds since the velocity, in the rest system, of the de Broglie wave along its path is the constant c. Since length of the path of the de Broglie wave is the wavelength of the wave or an integral multiple of that wavelength, it is necessary and sufficient that the wavelength increases by a factor of $\frac{1}{\sqrt{1-\frac{v^2}{c^2}}}$. Once more, since the period of the wave in any direction must be constant, this automatically fixes the period, path length, and wavelength in any direction to the period, path length, and wavelength in the perpendicular direction.

In the perpendicular direction, the diameter of the hydrogen atom moving with a velocity v is just the diameter of the projection of the path of the de Broglie wave and that diameter does not change. In the parallel direction, the period in the rest system of the de Broglie wave never gets any bigger than $\frac{n\lambda_B}{c}\frac{1}{\sqrt{1-\frac{v^2}{c^2}}}$ and certainly not as large as $\frac{n\lambda_B}{c}\frac{1}{1-\frac{v^2}{c^2}}$, the period of the moving parallel clock in the rest system if there is no change in the Bohr radius in the parallel direction, which would require an increase in the wavelength by a factor of

$\frac{1}{1-\frac{v^2}{c^2}}$. Thus, in the parallel direction, the equation $T_{parallel,rest} = \frac{n\lambda_B}{c}\frac{1}{1-\frac{v^2}{c^2}}$ holds, but for a smaller $n\lambda_B$, with

$$n\lambda_B = n\lambda_{B_0}\sqrt{1-\frac{v^2}{c^2}}.$$

This is the Lorentz contraction.

We have

$$T_{parallel,rest} = \frac{n\lambda_B}{c}\frac{1}{1-\frac{v^2}{c^2}} = \frac{n\lambda_{B_0}}{c}\frac{1}{\sqrt{1-\frac{v^2}{c^2}}}.$$

In the parallel direction, this is the period in the rest system of the de Broglie electron wave in the moving hydrogen atom with velocity *v*.

In this ontology for the Michelson-Morley experiment, we assumed that the velocity of the de Broglie electron wave is *c*. We use the principle that *there must be a rational explanation for physical reality*. As we have shown with respect to Einstein's postulates and his premise that clocks in the moving system are synchronous, they may seem "nice," but they are false. In this ontology, we know enough to look at the wavelength of the de Broglie electron waves since that wavelength determines the period and radius of the atom. If this ontology is not the case, then we have exhausted our only "choice." If this were not obvious or explicitly stated, clocks moving with a velocity *v* slow down because the de Broglie electron waves must travel farther.""

We knew, some twenty five years before we wrote *Quantum Gravity, Energy Wave Spheres, and the Proton Radius*, that the velocity of the electron energy wave in the hydrogen atom must be c; otherwise, there is no Lorentz contraction. We also knew that there had to be nested energy wave spheres in the hydrogen atom. When we considered the hydrogen atom in *Quantum Gravity, Energy Wave Spheres, and the Proton Radius*, we knew that that the electron wave velocity in the hydrogen atom is c and that the fine-structure constant α is the ratio of the remaining mass of the electron to the initial electron mass, not the ratio of velocities, as Sommerfield had it.

The advantage goes to the one who knows more, the one who does thought experiments that were unknown to his predecessors. An energy wave with velocity αc has energy $h\nu$ with $\nu = \alpha\nu_0$ if the wavelength $\frac{c}{\nu_0}$ remains constant and the energy is $h\nu$. The corresponding particle, the one supposedly circling the center of the sphere, has energy $mv^2 = \alpha^2mc^2$ since $v = \alpha c$.

This last thought experiment, the one that one gets up in the middle of the night for, the one that we have been skirting along after, the one that we seek, shows that the two different representations of a particle cannot both be true. Particles are energy wave spheres.

What Einstein, as well as the others, including Dirac, Pauli, Bohm, Bohr, and Feynman, did not know *haunts* their work because their *bumbling* arguments are perpetuated. For any measurement, which Einstein defines as *the light path divided by the time interval*, of the velocity of light c, if the distance travelled, the light path, is the same as in the rest system, then the time interval must be the same as in the rest system to get c for the velocity of light. The Lorentz transformation for the distance coordinate gives the same distance as the one in the rest system, but the Lorentz transformation for the time coordinate gives a greater value than the clock in the rest system; yet the distance divided by the time is c.

For a particle with spin $\frac{\hbar}{2}$ and mass m, we have

$$mc = \frac{h\nu}{c} = \frac{\hbar}{r},$$

with the spin of an energy wave sphere equal to $\frac{\hbar}{2}$, which is only half of the angular momentum, which is

$$mcr = \hbar.$$

For a proton, we have for the circumference

$$2\pi r = \frac{h}{mc}.$$

For the velocity of the proton energy wave equal to c, the period of the proton energy wave is

$$\frac{2\pi r}{c} = \frac{h}{mc^2} = \frac{h}{h\nu} = \frac{1}{\nu}.$$

For $h = 6.62607015 \times 10^{-34}\,Joule - seconds$, the mass of the proton $m_p = 1.6726 \times 10^{-27}\,kilograms$, and $c = 2.99792458 \times 10^8\,meters\ per\ second$, we have

$$\frac{h}{mc^2} = \frac{h}{h\nu} = \frac{1}{\nu} = \frac{6.62607015 \times 10^{-34}}{1.6726 \times 10^{-27} \times (2.99792458)^2 \times 10^{16}} seconds$$

$$= \frac{3.961539011120411}{8.987551787368176} \times 10^{-23} seconds$$

$$= 0.4407806602781722 \times 10^{-23} seconds.$$

Any quark, up or down, that lies inside the proton has spin $\frac{\hbar}{2}$ and, since the radius of the quark $r_q = \frac{\hbar}{m_q c}$ with $m_q < m_p$, the quark does not lie inside the proton, which is a contradiction.

In “The Inner Life of Quarks, *Scientific American*,” May 2013 Special Edition, p. 12, the author states,

“The Standard Model is one of the most strikingly successful theories ever devised. In essence, it postulates that two classes of indivisible matter particles exist: quarks and leptons. Quarks of various kinds compose protons and neutrons, and the most familiar lepton is the electron. The right mix of quarks and leptons can make up any atom and, by extension, any of the different types of matter in the universe. These constituents of matter are bound together by four forces—two familiar ones, gravity and electromagnetism, and the less familiar strong and weak nuclear forces. The exchange of one or more particles known as bosons mediates the latter three forces, but all attempts to treat gravity in the microrealm have failed.”

These quarks, the same ones that we have shown cannot lie inside a proton, somehow elude this result in the Standard Model. We are at the level in physics, where false theories are billed individually as *one of* the most strikingly successful theories ever devised, that logical arguments to the contrary do not matter. Repeatedly getting away with this, building lie upon lie extending seemingly forever, the stack of *absurdities* is such that one can only return the first, the most basic lie—Einstein's principle that the velocity of light is the constant c.

Einstein's second principle, "that light is always propagated in empty space with a definite velocity *c* which is independent of the state of motion of the emitting body," *taken as a law* implies, together with principle of relativity, that "observers should all measure the same speed for light, no matter how they were moving," as Hawking stated.

From *The Dying of a Principle: The Bending of Light, the Oppenheimer-Snyder Gravitational Contraction, and the Postulate of Relativity*, pages 34-39, our copy, we state,

"The first time one discovers by thinking about it that some great postulate is false because of a contradiction, an alarm bell rings, yet the propaganda that the postulate is true pervades in the face of obvious evidence that contradicts it. As far as figuring this out, most will just consider the postulate to be true. When the process involves every significant postulate at which one looks with corresponding propaganda too, the entities that control this are considered to be evil when the dumbing of the crowd is at hand.

Years ago, when we first considered the measured velocity of light in the moving system, we were aware that this matter had already been resolved beforehand by Einstein's principles or postulates *thinking that postulates in plain sight had to be true*. We analyzed the case that follows and blamed the problem that what we obtained for the velocity of light was not c on the Lorentz contraction since the postulated value for this velocity had to be c.

Given a length l moving with velocity v parallel to the length and a light ray moving in the opposite direction from one end of the length to the other, the time in the rest system for the light ray to traverse the length l is $l/(v+c)$. In the moving system, where the clocks move more slowly by the factor $1/\beta$, this time is $(1/\beta)(l/(v+c))$. If the length *l* is Lorentz contracted by the factor $1/\beta$, then the time in the rest system for the light ray to traverse the length, which is now $\frac{l}{\beta}$, is shortened by an additional factor of $1/\beta$ so that the time in the moving system is now $(1/\beta)^2(l/(v+c))$. This last value for the time in the moving system gives for the measured value of the velocity of the light ray in the moving system $\beta^2(v+c)$, which is not c or $v+c$ either. The only way to get $v+c$ is for the length l to get bigger by the factor β.

Like it or not, the length l is Lorentz contracted by the factor $1/\beta$, so the measured velocity of light in the moving system is $\beta^2(v+c)$, contradicting Einstein's second postulate and, hence, the first.

To consider a similar situation using Einstein's equations of the Lorentz transformation, we note in *Fast Clocks in the Moving System*, pages 8-9, our copy, that the Lorentz transformation for the distance coordinate is set up as follows:

"Further consideration of the equations of the Lorentz transformation is not necessary, but the equations cannot *by our analysis* be true: something must be wrong with the equations. In the case of the distance coordinate along the direction of motion, the equation is

$$\xi = \beta(x - vt), \quad [32]$$

where ξ is the distance coordinate in the moving system. In Einstein's derivation of the equation's of the Lorentz transformation, the distance coordinate x' of a point at rest in the moving system k *along the direction of motion* is given by

$$x' = x - vt, \quad [33]$$

where x is the coordinate of the moving point in the rest system:

". . . it is clear that a point at rest in the system *k* must have a system of values *x*', *y, z* independent of time." He sets out to define τ as a function of *x*', *y*, *z*, and *t*, noting that "we have to express in equations that τ is nothing else than the summary of data of clocks at rest in system *k*, which have been synchronized according to the rule given in § 1.""

"Since lengths in the moving system are Lorentz contracted by a factor of $1/\beta$, the coordinate x' is, assuming the origin of the distance coordinates of the rest system and the moving system coincide when $t = 0$, $1/\beta$ times the length x'' of the measuring rod, *which when placed in the moving system the right endpoint of which is* x' *and the left endpoint of which is* 0, in the rest system. Thus

$$\begin{aligned} \xi &= \beta(x - vt) \\ &= \beta x' \\ &= \beta \frac{1}{\beta} x'' \\ &= x'', \quad [36] \end{aligned}$$

and the length of the moving measuring rod in the distance coordinate of the moving system is just the length of the measuring rod at rest in the rest system."

Continuing with the development on page 12 of *Fast Clocks*, we note.

"*Suppose in what follows* that $\tau = 0$ when $t = 0$ and that $t = 0$ when $x' = 0$ and $\xi = 0$ coincide.

The final discovery, which we knew all along or should have known all along, following from the constancy of the velocity of light c in the moving system, is that, for a light ray emitted from the origin of the system k and arriving at ξ at time τ,

$$\xi = c\tau. \quad [44]$$

We have

$$\begin{aligned} \xi = \beta(x - vt) &= \beta(ct - vx/c) \\ &= c\beta(t - vx/c^2) \\ &= c\tau. \quad [45] \end{aligned}$$

Thus, working backwards,

$$\begin{aligned} c\tau &= \beta(ct - vx/c) \\ &= \beta(c - v)t \end{aligned}$$

$$= c\beta(1 - v/c)t. \quad [46]$$

This gives

$$\tau = \beta(1 - v/c)t." \quad [47]$$

The distance in the rest system that the light travels, since the length of the moving measuring rod is Lorentz contracted, is

$$ct = \frac{1}{\beta}x'' + vt,$$

so that

$$t = \frac{1}{\beta}\frac{x''}{c - v}$$

and

$$\tau = \left(\frac{1}{\beta}\right)^2 \frac{x''}{c - v}.$$

Thus, the velocity of the light ray in the moving system is

$$\beta^2(c - v).$$

Since x is the coordinate in the rest system of a point at rest in the moving system k and

$$x' = x - vt, \quad [33]$$

we have

$$x' = x$$

when $t = 0$, but since

$$x = x'' + vt$$

for some x'', we must have when $t = 0$,

$$x' = x''.$$

Thus

$$x' = x'' + vt - vt = x''$$

for all t. Thus, the Lorentz transformation for the distance coordinate is

$$\xi = \beta x''$$

and the Lorentz transformation for the time coordinate is

$$\tau = \frac{\xi}{c} = \beta\frac{x''}{c} = \beta t,$$

which is a faster clock since

$$\beta = \frac{1}{\sqrt{1 - \frac{v^2}{c^2}}} > 1.$$

By expressing the Lorentz transformation for the distance coordinate as

$$\xi = \beta(x - vt),$$

Einstein obtains

$$\tau = \frac{\xi}{c} = \frac{\beta(x - vt)}{c} = \beta\left(t - \frac{vx}{c^2}\right)$$

for the Lorentz transformation of time coordinate. Setting $x = vt$, which is equivalent to $x'' = 0$, Einstein gets

$$\tau = \beta\left(1 - \frac{v^2}{c^2}\right)t = \sqrt{1 - \frac{v^2}{c^2}}\,t,$$

which supposedly, according to Einstein, implies that the moving clock is slower than the rest clock by the factor

$$\sqrt{1 - \frac{v^2}{c^2}};$$

but since $x'' = 0$, we have

$$t = \frac{x''}{c} = 0$$

and, hence,

$$\tau = 0.$$

Since, by postulate, the ratio of the distance coordinate to the time coordinate is the velocity of light c, any change by some factor k in the unit of distance is accompanied by a corresponding change by the same factor k in the unit of time so that the ratio of the coordinates is c. If the unit of distance gets smaller, then the unit of time gets smaller by the same factor so that the ratio of the two coordinates is c. On the other hand, since the velocity of light in the postulate is the *measured* velocity of light and the measured unit of distance, the result of Einstein's operation (a), in the moving system is the same, by Einstein's argument, as in the rest system by the principle of relativity, the measured unit, the period of a light clock, in the moving system of a parallel light clock at rest in the moving system cannot change from its value in the rest system. In reality, contrary to postulate, a light clock with velocity v parallel to its length has a period, its unit of time, that gets bigger by the factor

$$\beta^2 = \frac{1}{1 - \frac{v^2}{c^2}},$$

so that it is slower by two factors of $\sqrt{1 - \frac{v^2}{c^2}}$. The contraction of the length of the parallel light clock by the factor $\sqrt{1 - \frac{v^2}{c^2}}$, the Lorentz contraction, decreases its period by the factor $\sqrt{1 - \frac{v^2}{c^2}}$, resulting in a period that gets bigger by only the single factor

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

so that the parallel light clock is slower by the factor $\sqrt{1-\frac{v^2}{c^2}}$, the same rate as the perpendicular light clock. On an atomic level, the perpendicular and parallel energy wave sphere clocks have the same period.

One can only wonder what evil force dictates those in control, from universities, books, scientific journals, media propaganda, the supposedly great minds, and any poisonous entity that we may have missed, to promote their obscenely false theories when they obscure and turn in to darkness any reasonable view of what is going on. The evil lies within them.

If, for a physicist, heaven lies in ones grasp exceeding ones reach, to rephrase Robert Browning, then, literally, physics has gone to hell."

As noted previously, Einstein obtains

$$\tau = \frac{\xi}{c} = \frac{\beta(x-vt)}{c} = \beta\left(t - \frac{vx}{c^2}\right)$$

for the Lorentz transformation of time coordinate. This requires that

$$t = \frac{x}{c},$$

but

$$x = x' + vt,$$

so

$$t = \frac{x'}{c} + \frac{v}{c}t.$$

Thus

$$t\frac{c-v}{c} = \frac{x'}{c},$$

or

$$c - v = \frac{x'}{t}.$$

Being at rest in the moving system does not make the system that is at rest in the moving system the rest system. In *The Material Point Universe Revisited*, pages 16, 17, we wrote,

"In § 3, Theory of the Transformation of Co-ordinates and Times from a Stationary System to another System in Uniform Motion of Translation Relatively to the Former, which contains the cruxes of Einstein's arguments, for which Hawking credits Einstein with "cut(ting) through the ether and solv(ing) the speed-of-light problem once and for all," Einstein considers in "stationary" space "two systems of coordinates, i.e. two systems, each of three rigid material lines, perpendicular to one another, and issuing from a point." Einstein assumes that the axes of X of the two systems coincide and those of Y and Z, respectively, to be parallel. He assumes each system to be provided with a measuring-rod and numerous clocks, the rods and clocks alike in all respects.

Einstein gives the origin of one of the systems (*k*) a constant velocity *v* in the direction of increasing *x* of the other stationary system (K), the velocity applying to the coordinate axes, measuring-rod, and clocks of the moving system. For any time of the stationary system K, the axes of the moving system have a definite position and, by symmetry, Einstein assumes the motion of *k* to be such that the axes of *k* remain parallel to the axes of the stationary system.

Einstein assumes space in the stationary system K and the moving system *k*, to be measured by the corresponding measuring-rod, stationary or moving, respectively, obtaining coordinates *x, y, z* and ξ, η, ζ respectively. Einstein assumes the time *t* of the stationary system to be determined for all points at which there are clocks by the means of light signals as in § 1 and the time τ of the moving system to be determined for all points at which there are clocks at rest relatively to that system by, once again, the means of light signals as in § 1.

For any coordinates *x, y, z, t*, which completely define the place and time of an event in the stationary system, there correspond coordinates ξ, η, ζ, τ that determine that event relatively to the system *k*. Einstein seeks the system of equations, which, because of the properties of homogeneity he attributes to space and time, must, clearly to him, be *linear*, that connect these quantities.

Despite claiming to give in § 2 an example of clocks that synchronize in the stationary system, but do not synchronize in the moving system, Einstein assumes that "the time τ of the moving system to be determined for all points at which there are clocks at rest relatively to that system by applying the method, given in § 1, of light signals between the points at which the latter clocks are located." That is to say Einstein assumes what he just claimed to show was false. The times $t_B - t_A$ and $t'_A - t_B$, which correspond to t_1 and t_2, respectively, in the Michelson-Morley experiment, and which have values that are determined by the Doppler effect, for clocks at the ends of a length moving *away from* and *toward* a light signal are not equal, which implies that clocks at the ends of a moving rod are not synchronous."

As noted above,

"Thus the Lorentz transformation for the distance coordinate is

$$\xi = \beta x''$$

and the Lorentz transformation for the time coordinate is

$$\tau = \frac{\xi}{c} = \beta \frac{x''}{c} = \beta t."$$

Since

$$x = x' + vt,$$

$$x' = x - vt = x'' + vt - vt = x'',$$

so we have both

$$c - v = \frac{x'}{t}$$

and

$$c = \frac{x'}{t},$$

which, defying Einstein's principles, is impossible. Einstein's false assumptions of the synchronicity of clocks in the moving system and the constancy of the measured velocity of light lead to contradictions; the Lorentz transformation for the time coordinate in particular is false.

When we showed on ResearchGate along the lines given here that the Lorentz transformation for the time coordinate gives a faster clock since $\beta > 1$for non-zero v, Wolfgang Konle stated that we had the time coordinates reversed, that τ is the time in the rest system for the clock in the moving system to *show* t seconds. In the same forum, Carmen Wrede, the proponent of segmented space-time, echoed the same assertion together with the claim that we did know what we were talking about. Since we have *exactly* quoted Einstein on this matter, Carmen Wrede is both dishonest and ignorant without taking the time to give any arguments beyond *argument by lying*.

Carmen Wrede states,

"Instead you invoke Bell's inequality only to brush it off, treating it as a misunderstanding or semantic trick. That is not how physics works. Bell's theorem is one of the most rigorously tested results in quantum foundations."

We showed that Bell's inequality was derived under certain conditions, which were not met in Bell's supposed counterexample:

"Considering that $\vec{a} = \vec{b} = \vec{c}$ does not hold, recalling Bell's equation (13) for which the assumption $\vec{a} = \vec{b}$ was made *and* that Bell uses equation (13) here in the right side of the inequality (13), and that Bell's equation (1) does not hold, there is no reason to expect Bell's inequality to hold in the first place."

Any experiment that supposedly tests Bell's inequality by using conditions *that violate the ones under which the equality is derived* does not contradict the inequality.

When we showed that the moving hydrogen atom "is like a miniature Michelson-Morley experiment," the part of the hydrogen atom *analogous* to the light in the Michelson-Morley experiment is electron energy wave; yet Carmen Wrede, missing the analogy completely, stated that "there is no hydrogen light source in the Michelson-Morley experiment."

Carmen Wrede is in the backyard. At the universities, no one ever concedes, no matter how trivially the supposedly great theories of physics get refuted. We must finish this work, and we leave the following trivial example:

Even without the equations of the Lorentz transformation, clocks in the moving system are slower experimentally. Such a clock has a bigger unit of time and reads less than an identical clock in the stationary system. This makes the time interval in the moving system less than the time interval in the stationary system. One divides the distance measured in the moving system, which is the same as in the rest system, by the smaller time interval and obtains a value greater than c for the velocity of light.

In *The Material Point Universe Revisited*, Part 1, we noted,

“If, as one little person put it, restated somewhat, physicists judge theories according to the arguments contained therein, one can only wonder if the scientific community, the ones who completely accept relativity, even looked at it.”

The back door to the bookstore at New Mexico Tech has been sealed off, but not without being replaced by a bookstore with no back door. No one measures the velocity of light or thinks about doing so. No one considers what is false. Albert Einstein played a role, receiving in return a notoriety that is the only thing that lasts. In *The Quantum Theory of the Electron*, Paul Dirac states, “Our problem is to obtain a wave equation of the form (2) which shall be invariant under a Lorentz transformation and shall be equivalent to (1) in the limit of large quantum numbers.” Thus, whatever Dirac gets *contains* the false Lorentz transformation for the time coordinate *together with* the three Pauli spin angular momentum matrices, which supposedly describe spin angular momentum, with no idea of what *spin* is: “We must extend the σ’s in a diagonal manner to bring in two more rows and columns, so that we can introduce three more matrices ρ_1, ρ_2, ρ_3 of the same form as σ_1, σ_2, σ_3, but referring to different rows and columns, thus :—

$$\sigma_1=\begin{Bmatrix}0&1&0&0\\1&0&0&0\\0&0&0&1\\0&0&1&0\end{Bmatrix} \quad \sigma_2=\begin{Bmatrix}0&-i&0&0\\i&0&0&0\\0&0&0&-i\\0&0&i&0\end{Bmatrix} \quad \sigma_3=\begin{Bmatrix}1&0&0&0\\0&-1&0&0\\0&0&1&0\\0&0&0&-1\end{Bmatrix},$$

$$\rho_1=\begin{Bmatrix}0&0&1&0\\0&0&0&1\\1&0&0&0\\0&1&0&0\end{Bmatrix} \quad \rho_2=\begin{Bmatrix}0&0&-i&0\\0&0&0&-i\\i&0&0&0\\0&i&0&0\end{Bmatrix} \quad \rho_3=\begin{Bmatrix}1&0&0&0\\0&1&0&0\\0&0&-1&0\\0&0&0&-1\end{Bmatrix}.$$ ”

Dave Thomas, the one from New Mexicans for Science and Reason, lurking in the sealed off exit to the New Mexico Tech bookstore, tried to stare us down at Mandeville’s funeral, called us pompous and deluded for thinking of what we had done, which has come a long way since then, never looked at it, and played ripples at Mandeville’s funeral.

Richard Sonnenfeld, the one who stated that Einstein’s theory on special relativity had been proven, of New Mexico Tech, the one who claimed that he could find the error in what we had done, which has come long way since then, in fifteen minutes, never looked at it.

Elsewhere at Oxford, James Binney claimed that contradictions were to be expected since we had stepped outside Einstein’s framework of special relativity, which was subtle. Binney never looked at it. Binney, stuck in the sealed off back exit of the New Mexico Tech bookstore, can only use “the correct formulae for transforming between frames,” which are the equations of the Lorentz transformation. In “Bender Goes to Oxford,” we wrote,

“On 31/05/2012, in a rush to leave, we write up the following example for the first time and send it to James Binney, Professor of Physics and Head of the Peierls Centre for Theoretical Physics, Oxford University:

“Consider two rigid rods, each of length *l*, with identical clocks moving at the same rate at the ends of each rod. At a certain time t the rods coincide. One rod moves to the left with velocity v; one rod moves to the right with velocity v. At the time t, all clocks are set to zero and a ray of light is emitted to the right from the common left endpoint of the two rods. According to Einstein's special theory of relativity, the velocity of light as measured in each moving system is c; so that when the light ray reaches the right endpoint of the rod moving to the left, the right endpoint of the rod moving to the right must be in the same place. This is clearly impossible. This proves that the velocity of light as measured in the moving systems is not c and that clocks in the moving system are not synchronous.”

Now, in the papers, there are scores of simple arguments which prove that special relativity is false; yet, evidently, neither Binney nor anyone else reads papers that contradict relativity since they do not have open minds. Binney, in spite of his closed mind, features himself as gifted even though he has no gifts, and he must protect his image. This passes for gifted.

Bender did not work ten to fifteen years to send these papers to Binney in order to get Binney’s worthless opinion. One could argue with Binney, yet Binney does not accept valid arguments. Binney begins by asserting that we presume an absoluteness of time, which, of course, we do not:

“Your fallacy lies in the statement "at a certain time t" an event happens. This presumes the absoluteness of time. Actually, different observers assign different times to the same event. If you step outside of Einstein's framework in setting up the problem, it is to be expected that you arrive at a contradi(c)tion.

Really, there's nothing in the least puzzling about special relativity. Physics is full of puzzles, but special relativity isn't a good hunting ground for them once you grasp that every situation has to be broken down into a number of events, and that space-time coordinates need to be assigned to these events using the correct formulae for transforming between frames.”

What Binney means by “stepping outside of Einstein’s framework in setting up the problem” is that any other logical arguments, not considering a “situation (that) has to be broken down into a number of events,” and not considering a situation in which space-time coordinates are “to be assigned to these events using the correct formulae for transforming between frames,” based on Einstein’s own premises, give, as expected, a contradiction.

So, the only way one can obtain the “correct” answer, according to Binney, is to use Einstein’s equations of coordinate transformation to endlessly calculate the velocity of light and get *c*. We have shown, in Part 1 of *The Material Point Universe Revisited*, that Einstein’s equations of coordinate transformation are *phony*. We show here that these equations are *extremely* phony.

We reply, in part, to Binney as follows:

“In the rest system, synchronous clocks, synchronized via light signals, give, in effect, an absolute time. Clocks are corrected, via synchronization, to read the same thing. Suppose a light signal leaves a point A and the clock at A is simultaneously set to zero; when the light reaches the point B, the clock at B is set to d/c, where d is the distance between A and B.

In the rest system, there a common time, that given by the synchronous clocks, for the endpoints and the entire rods to coincide. When the rods coincide in the rest system, the clocks in the moving system will read something. The clocks, at the ends of each rod, might be zeroed in the moving systems or via a signal from the rest system. They need not be zeroed at all. When the light ray reaches the right endpoint of the rod moving to the left, the difference in the reading of the clock on the left endpoint from the reading of the clock on the right endpoint is, according to Einstein, l/c. When the light ray reaches the right endpoint of the rod moving to the right, the difference in the reading of the clock on the left endpoint from the reading of the clock on the right endpoint is, once again, according to Einstein, l/c. This contradicts the clocks moving at the same rate.

We have spent more than a few hours on this. In effect, we claim (that) there is no fallacy and that we need reasonable room to argue. The existence of the Doppler effect proves that clocks in the moving system are not synchronous. This also proves that, in the moving system, one cannot divide the length of the apparent path by the time and get c. So, there are other ways to arrive at contradiction than the example given this morning.""

The *calculation* of the velocity of light in the moving system is straightforward. In *The Dying of a Principle*, we wrote at the end,

"The first time one discovers by thinking about it that some great postulate is false because of a contradiction, an alarm bell rings, yet the propaganda that the postulate is true pervades in the face of obvious evidence that contradicts it. As far as figuring this out, most will just consider the postulate to be true. When the process involves every significant postulate at which one looks with corresponding propaganda too, the entities that control this are considered to be evil when the dumbing of the crowd is at hand.

Years ago, when we first considered the measured velocity of light in the moving system, we were aware that this matter had already been resolved beforehand by Einstein's principles or postulates *thinking that postulates in plain sight had to be true*. We analyzed the case that follows and blamed the problem that what we obtained for the velocity of light was not c on the Lorentz contraction since the postulated value for this velocity had to be c.

Given a length l moving with velocity v parallel to the length and a light ray moving in the opposite direction from one end of the length to the other, the time in the rest system for the light ray to traverse the length l is $l/(v+c)$. In the moving system, where the clocks move more slowly by the factor $1/\beta$, this time is $(1/\beta)(l/(v+c))$. If the length l is Lorentz contracted by the factor $1/\beta$, then the time in the rest system for the light ray to traverse the length, which is now $\frac{l}{\beta}$, is shortened by an additional factor of $1/\beta$ so that the time in the moving system is now $(1/\beta)^2(l/(v+c))$. This last value for the time in the moving system gives for the measured value of the velocity of the light ray in the moving system $\beta^2(v+c)$, which is not c or $v+c$ either. The only way to get $v+c$ is for the length l to get bigger by the factor β.

Of course, the problem was not the Lorentz contraction, but Einstein's principles, which were never true. The dying of Einstein's principles, the one about the same laws of physics holding in systems that are in uniform translatory motion and the other, taken to be a law, about the velocity of light being the constant c, gives one access to the light of free thought, which was always suppressed. To quote Dylan Thomas, "Do not go gentle into that good night.

Rage, rage against the dying of the light.""

With the same setup, given a length l moving with velocity v parallel to the length and a light ray moving in the opposite direction from one end of the length to the other, the wavelength of the light, taken to be l in the rest system, is βl as measured in the moving system. The frequency of the light as measured in the moving system is $\beta(c/l)\,(v+c)/c$ so that the wavelength of light multiplied by the frequency of light, both in the moving system, gives the velocity of light as measured in the moving system, which is $\beta^2(v+c)$ as before.

One can only view *what is going on* via *misinformation* obtained through the sealed off exit of the once upon a time bookstore at New Mexico Tech. There are no experiments measuring the velocity of light in the moving system. The result of such a measurement is not c, which contradicts the lie. The nature of *spin* that we give here contradicts the lie that it must be unknown. If souls contain rational consciousness, the soul of a physicist does not. In the words of Bruce Springsteen,

Big Wheels rolling through fields

Where sunlight streams

Meet me in a land of hope and dreams

This Train

Dreams will not be thwarted

REFERENCES

Apostle, Tom M., Mathematical Analysis, Palo Alto: Addison-Wesley Publishing Company, Inc., 1957.

Bartels, Meghan, "Oppenheimer Almost Discovered Black Holes Before He Became 'Destroyer of Worlds'," Scientific American, July 21, 2023

Bell, J.S., On the Einstein Podolsky Rosen Paradox, Physics Vol. 1, No. 3, pp. 195-290, 1964.

Beyer, Axel et al, In The Rydberg constant and proton size from atomic hydrogen, 6 October 2017, Science, Vol 358, Issue 6359.

Bender, Darrell, "Bender Goes to Oxford."

Bender, D. (2024). Classical Quantum Hidden Variable Gravitation. European Journal of Applied Sciences, 12(6), 635–679.

Bender, Darrell, "Fast Clocks in the Moving System," Research & Reviews: Journal of Pure and Applied Physics, Volume 5, Issue 3, April - June, 2017.

Bender, D. (2024). Mystery's End: Analysis of Bell's Theorem. European Journal of Applied Sciences, 12(3), 521–542. https://doi.org/10.14738/aivp.123.17174

Bender, D. (2024), Quantum Gravity, Energy Wave Spheres, and the Proton Radius. European Journal of Applied Sciences, 12(1), 99–165

Bender, D. (2025). The Dying of a Principle: The Bending of Light, the Oppenheimer-Snyder Gravitational Contraction, and the Postulate of Relativity. European Journal of Applied Sciences, 13(02), 505–546.

Bender, Darrell, The Material Point Universe.

Bender, Darrell, The Material Point Universe Revisited.

Bender, Darrell, On the Nature of Being: Gravitation, Research & Reviews: Journal of Pure and Applied Physics, Volume 5, Issue 4, October - December, 2017.

Bohm, David, Quantum Theory, Dover Publications, Inc., 1989.

Bohm, D., B. J. Hiley, The Undivided Universe, Routledge, 1993.

Chou, C. W., D. B. Hume, T. Rosenband, D. J. Wineland, “Optical Clocks and Relativity,” Science Vol 329 24 September 2010: 1630-1633.

Dirac, P. A. M., The Quantum Theory of the Electron, St. John’s College, Cambridge, 1928.

Einstein, A., “On the Electrodynamics of Moving Bodies,” Annalen der Physik, 17, 1905.

Einstein, A., “On the Influence of Gravitation on the Propagation of Light,” Annalen der Physik, 35, 1911.

Einstein, A., “The Foundation of the General Theory of Relativity,” Annalen der Physik, 49, 1916.

Feynman, Richard P., Quantum Electrodynamics, Addison-Wesley Publishing Company, Inc., 1961.

Feynman, Richard P., Fernando B. Morinigo, William G. Wagner, Feynman Lectures on Gravitation, Addison-Wesley Publishing Company, 1995.

Feynman, Richard P., Photon-hadron interactions, Benjamin, New York, 1972.

Feynman, Richard P., Robert B. Leighton, Mathew Sands, The Feynman Lectures on Physics, Menlo Park: Addison-Wesley Publishing Company, 1963.

Feynman, R. P., The Theory of Fundamental Processes, Addison-Wesley Publishing Company, Inc., 1961.

Harrison, David M., Bell’s Theorem, Physics Virtual Bookshelf, Department of Physics, University of Toronto, 2006.

Hewitt, Edwin, Karl Stromberg, Real and Abstract Analysis, Springer-Verlag, 1965

Lorentz, H. A., A. Einstein, H. Minkowski, and H. Weyl, The Principle of Relativity, New York: Dover Publications, Inc., 1952, including: Einstein, A. entries.

Kiefer, Claus, Conceptual Problems in Quantum Gravity and Quantum Cosmology, International Scholarly Research Notices, 2013.

Messiah, Albert, Quantum Mechanics, John Wiley & Sons, 1976.

Michaud, Andre, On the Magnetostatic Inverse Cube Law and Magnetic Monopoles, International Journal of Engineering Research and Development e-ISSN: 2278-067X, p-ISSN: 2278-800X, www.ijerd.com Volume 7, Issue 5 (June 2013), PP.50-66.

Misner, Charles W., Thorne, Kip S., Wheeler, John Archibald, Gravitation, W. H. Freeman and Company, 1973.

Myrvold, Wayne, Marco Genovese, and Abner Shimony, "Bell’s Theorem", The Stanford Encyclopedia of Philosophy (Spring 2024 Edition), Edward N. Zalta & Uri Nodelman (eds.), URL = <https://plato.stanford.edu/archives/spr2024/entries/bell-theorem/>.

Ohanian, Hans C., “What is spin?,” Am. J. Phys. 54 (6), June 1886.

Oppenheimer, J.R., Snyder, H., “On Continued Gravitational Contraction,” Phys. Rev. 56, 455–Published 1 September, 1939

Pais, Abraham, ‘Subtle is the Lord…’ The Science and the Life of Albert Einstein, Oxford University Press, 1982.

Siegal, Ethan, Scientific Proof Is A Myth, Forbes, 22 Nov, 2017

Singham, Mano, The Idea That a Scientific Theory Can Be ‘Falsified’ Is a Myth, Scientific American, 7 September, 2020.

Sommerfeld, A. (1921). Atombau und Spektrallinien (in German) pp. 241–242.

Steinberger, J. M.. “Experiments with High-Energy Neutrino Beams.” Science 245 (1989): 1202 – 1208.

Trinhammer, Ole L. and Henrik G. Bohr, On proton charge radius definition, EPL, 128 (2019) 21001.

Trinhammer, Ole L., On quarks and the origin of QCD: Partons and baryons from intrinsic states, EPL, 133 (2021) 31001.

Trinhammer, Ole L., On the electron to proton mass ratio and the proton structure, EPL (Europhysics Letters) · June 2013.

Trinhammer, Ole L., Henrik G. Bohr, Mogens Stibius Jensen, The Higgs mass derived from the U(3) Lie group, arXiv:1503.00620v2.

Wald, Robert M., General Relativity, Chicago: The University of Chicago Press, 1984.