Acceleration Gravitation and Origin of Centrifugal Force in Delta-c Mechanics and the basis of $E=mc^2$

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Introduction

Δc **Mechanics** is a particle based theory without the concept of fields, based on the effects of the density of Feynman photons, which are the probability of the existence of particles exterior to the Compton radius on action paths generated by photons in the interior of particles.

Δc **Mechanics** shows that inertial mass particles are formed by the self-binding of photons in circular motion. The Electron, muon and tauon are creations of mass particles with two bound photons. The more complex particles, mesons and protons are compositions of two and three of such particles. The effects of charge and gravitation are shown to be the action path interaction mechanisms of the of photon probability density in changing the index of refraction, and not the effect of a field [5].

Most of the previous work has focused on atomic and nuclear interactions, but the concept is general applying to the kinetics of mass velocity and acceleration and gravitation as well as the origin of the Lorentz transforms. This paper is to focus on the macroscopic aspects of the theory particularly acceleration, relative velocity, and Lorentz transforms.

The differences between what is defined as Feynman vs Ordinary phonons are the probability of its location.

All Photons and Feynman photons exist as Planck (10E-33 cm) particles that move at the velocity of light. Ordinary photons are rotating particles with their location probability density mostly inside the Compton radius. The same is true for self-bound photons. The energy of the photon is $\hbar\omega$ and the angular momentum is $\hbar$. The photons primary flow density is the movement of the particle inside the Compton radius, and the integral of the angular momentum of its probable flow density is the spin, $\hbar$.

A Feynman photon is the same particle but is distinguished by being on the action path outside the Compton radius and is not rotating. The integral of the angular momentum about the Compton radius of its flow density is the anomalous spin. The photon rotates about the central core, but can be very far from the particle and thus does not transfer the energy or momentum of the particle. Its cross section can scatter and change the direction of other Feynman photons. The effect is by way of a change in the index of refraction, directing the motion of other photons and thus the motion of other interacting particles, electric effects are created by differential rotational motion of internal particles and there is no electric field or electric charge [].

Feynman's theory of quantum electrodynamics is based on the probability of action paths existing throughout space, but Feynman and Wheeler missed the point that the probable presence of particles on these action paths could have effect on other particles. Δc Mechanics presumes that the presence of this interacting probability density is responsible for the effects attributed to fields, and no continuous energy fields exist.

For the proton the change in the velocity of light in its proximity due to the photon probability flows of photons inside the proton.

$$\frac{\Delta c}{c_0} = \left(\frac{\bar{\lambda}_{PL}}{\bar{\lambda}_P} \right)^2 \frac{2\bar{\lambda}_P}{r} \tag{1}$$

(See Appendix II and [8])

The Compton radius of the Planck particle is $\bar{\lambda}_{PL}$ and for the proton is $\bar{\lambda}_P$, the first term is the ratio of the ratio of the area of the Planck particle to the proton and the second term is the probable density of a Feynman photon being at a distance r from the particle. $\Delta c / c_0$ is the ratio of the change in the velocity of light to c_0 at that distance. Since protons are the primary constituents mass, this relation can be integrated over all the protons in the universe to get the background vacuum density of Feynman photons. This is about (1.6E+38 cm^{-2} sec^{-1}), and sets the speed of light in the universe.

Order of presentation

The issues dealt with in this paper are:

1 Δc Mechanics illustrates the origin of the Einstein relativistic mass relation and the cause of the constancy velocity of light in any rest or moving frame. It inherently gives the results of the Lorentz transform without the concept of frame change.

2 The origin of centripetal force and the relativistic mass of rotating particles.

3 The origin of gravitational attraction as a gradient in the velocity of light, or the vacuum photon flux. Energy carrying fields are not necessary for mass interaction.

Lorentz Transform

The Limit on the Speed of Light

The speed of light is limited by the intervening Feynman photons in its action path. The assumption of Δc Mechanics is that the speed of light is limited by the oncoming Feynman photon flux in the vacuum density; otherwise the velocity would be infinite. The vacuum density is generated by the action paths of the internal photons that makes up the particle mass. The product of the volume density n_d times c_0 is, the vacuum flow density in space in cm^2 sec, and is constant:

$$\frac{c_0 n_d}{cm^2 \sec} = 1.693E + 38 \tag{2}$$

The speed of light is the distance a group of photons can travel in one second, and arrive in sufficient numbers to trigger a an event. It is not measured by the emission and detecting of the arrival a single photon.

The intervening Feynman photons between the emission and the arrival point, determines the probability of a photon scattering out of the initial path, thus setting the mean free path and the number of photons available to trigger an event at a given distance. An increase in the intervening photon density increases the probability of the photon scattering out of the path, thus decreasing the detectable distance, the mean free path, and the velocity of light.

For convenience in this paper, one second time steps, thus the above is the number of photons encountered in a second of travel. The product is a constant and thus higher density represents a slower velocity of light. Flow density n_d (cm^{-2} sec^{-1}) is the number of photons in space with density of n_d cm^3 that would pass through an area of one cm in one second. (See Appendix I)

The velocity is seen to be inversely proportional to the oncoming density, and the product of the velocity of light times the oncoming flow density is a constant per time step (sec)

The product of the density times an altered velocity c' can be equally viewed as a change in the density because $n_d c' = n'_d c_0$.

Photon Mean free Path

The mean free path of a photon, S, encountering a density of $n_d / cm^2 sec$ Feynman photons having a intersecting radius between two particles of 1.5 times the Planck radius is:

$$\frac{n_d \; c}{cm^2 \; sec} \frac{\left(1.5\lambda\!\!\!^{-}_{PL}\right)^2 cm^2}{} \frac{S\,sec}{c} = \frac{1}{2} \quad \rightarrow \quad S = \frac{1}{2} \frac{1}{n_d\left(1.5\lambda\!\!\!^{-}_{PL}\right)^2} = 5.02E+26 \text{ cm} \tag{3}$$

Lorentz Equivalence of Δc Mechanics

Lorentz Postulates

The Lorentz transform is based on two assumptions put forth by Einstein. Those assumptions are true, but neither define the underlying mechanism for these assumptions or provide theoretical basis.

The first assumption defines the inertial mass relation between stationary and moving frames:

$$m' = \frac{m_0}{\sqrt{1 - v^2/c^2}} \rightarrow \quad m'^2 c_0^4 - m'^2 \mathbf{v}^2 c_0^2 = m_0^2 c_0^4 \quad \rightarrow \; \varepsilon^2 c_0^4 - \boldsymbol{p}^2 c_0^2 = m_0^2 c_0^4 \tag{4}$$

This can be written as: $\left[m'\left(\mathbf{c}_0 - \mathbf{v}\right)c_0\right] \cdot \left[m'\left(\mathbf{c}_0 + \mathbf{v}\right)c_0\right] = m_0{}^2 c_0^4$ (5)

Or more compactly in with Dirac matrix in Geometrical Algebra as:

$$\boldsymbol{p} = m'\left(\gamma^k c_0 + \gamma^0 v\right) \quad \rightarrow \quad \frac{\varepsilon^2}{c_0^2} = \; \boldsymbol{p}^2 = m_0^2 c_0^4 \tag{6}$$

Although this assumption is provably correct, it does not contain the physical underlying mechanics.

The second Lorentz postulate asserts constancy in the speed of light in any frame, moving or stationary:

$$c_1 = c_2 \tag{7}$$

The Lorentz transforms give the mathematical structure to this by transforming four Minkowski coordinates of an event in one inertial frame in terms of the coordinates of the same event in another inertial frame.

The coordinates (*x*,*y*,*z*,*t*) of an event in frame f_1 in terms of the coordinates (*x′*,*y′*,*z′*,*t′*) of the same event in frame f_2 , are:

$$t = \frac{t' + vx' / c^2}{\sqrt{1 - v^2 / c^2}}. \qquad x = \frac{x' + vt'}{\sqrt{1 - v^2 / c^2}} \tag{8}$$

The Lorentz transform presumes equivalents of inertial frames and the constancy of the velocity of light, to arrive at the transformation of the inertial properties for moving particles. This is also proven to be true experimentally, but also does not explain the underlying cause.

Equivalence of the Lorentz Transforms

Moving Point (Part 1)

In Δc Mechanics the velocity of light is set by the probable number density of Feynman photons confronting the photon as it passes, and the velocity of light, is inversely proportional to the density of oncoming vacuum Feynman photons $n_d c_0 = n'c'$, per cm^2 second. The concept of a frame change is not invoked, just the change in the density of the vacuum density as a result of the change in velocity.

Δc Mechanics starts with the presumption that mass is the local confinement of photons, primarily consisting of self-bound pairs. The total mass of a body is the sum of the energy of all the photons scaled by the square of the velocity of light.

$$m = \hbar(\omega_1 + \omega_2 + \cdots) / c_0^2 \qquad \boldsymbol{p} = m\mathbf{c} \qquad |\boldsymbol{p}| = \hbar(\omega_1 + \omega_2 + \cdots) / c_0 \tag{1.9}$$

For a stationary mass m the sum of the random momentum of all the internal photons of a mass in a given direction $\hat{\mathbf{u}}$ is equal to the sum of the momentum in the opposite direction, this is the necessary requirement for the mass to be stationary:

$$\mathbf{p}_1 = m\sum \hat{\mathbf{u}} \cdot \mathbf{c}_1 \quad = \quad \boldsymbol{p}_2 = m\sum -\hat{\mathbf{u}} \cdot \mathbf{c}_2 \tag{1.10}$$

This a constant in time and thus the product of these two sums is a time invariant

The magnitude of the product of these two momentum vectors of the internal photons is invariant and defines the scaler invariant energy of the mass.

$$\boldsymbol{p}_1 \cdot \boldsymbol{p}_2 = m\mathbf{c}_1 \cdot m\mathbf{c}_2 = \frac{\varepsilon^2}{c^2} \tag{1.11}$$

This is the foundation of the Einstein relation $\varepsilon = mc^2$

Product Viewed by External Moving Observer

An observer moving with respect to the mass will see a difference in the magnitude of the two momentum vectors in the forward and reverse direction along the velocity.

Change in Arriving Density

For an observer in a stationary point the number of particles moving thru one cm^2 in one second is $n_d c_0$. For a moving point the stationary observer sees a plus or minus increase in the density of photons arriving at the particle due to the velocity of the particle. (With no change of frame).

This is illustrated in Fig 1, as the particle moves with the photons from the left; there is a decrease in the photon density from the left arriving at the particle.

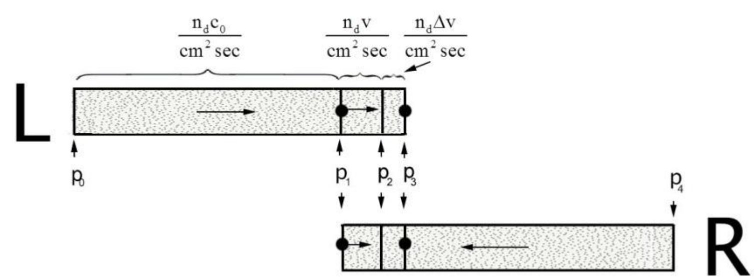


Fig. 1 **Feynman photon flux arriving at a moving mass viewed from a stationary observer**

The distance from p_1 to p_2 is the distance c_0 travels in one second thus the density of Feynman photons passing p_1 from the left is $n_d c_0$, and from the right is the same.

$$n_d c' = n_d c_0 - n_d v \tag{12}$$

If the particle is moving at v to the right, then when the particle arrives at p_2 The density passing the particle during this time from the left is reduced by, $n_d c_0 - n_d v$, and during this same time the number of photons passing from the right is increased by $n_d c_0 + n_d v$. The velocities coming from the left and right can be set as c_1', and c_2', thus:

$$c_1' = (c_0 + v) \;\rightarrow\; c_2' = (c_0 - v) \tag{13}$$

From Eq. (13), the velocity of light observed determined in the stationary frame gives different values for the momentum vector, thus at the moving point:

$$\boldsymbol{p}_1 = m(c_0 - v) \qquad \boldsymbol{p}_2 = m(c_0 + v) \tag{14}$$

Eq. (1.11) is then:

$$m^2\left(\left(\mathbf{c}_0 - \mathbf{v}\right)\cdot\left(\mathbf{c}_0 + \mathbf{v}\right)\right) \;=\; m_0^2\left(\mathbf{c}_0 \cdot \mathbf{c}_0\right), \tag{15}$$

This relation is the postulate of Einstein in Eq.(5), therefore the theory being proposed provides the physical cause for the Einstein postulate of the Lorentz transform.

Observation from the stationary position creates an asymmetry in vacuum density n_d for the moving particle that change the momentum vectors and value of the energy in the stationary frame, The basis of Δc Mechanics gives the same inertial relation as in Eq.(4), and Eq.(6), and yield the same relativistic mass in the observers position.

Writing this out shows the familiar relativistic velocity relation for a moving mass:

$$\varepsilon = m_0 c_0^2 = c_0\sqrt{m'^2\, c_0^2\left(1-\frac{v^2}{c_0^2}\right)} = m' c_0^2\left(1-\frac{1}{2}\frac{v^2}{c_0^2}\right) \tag{16}$$

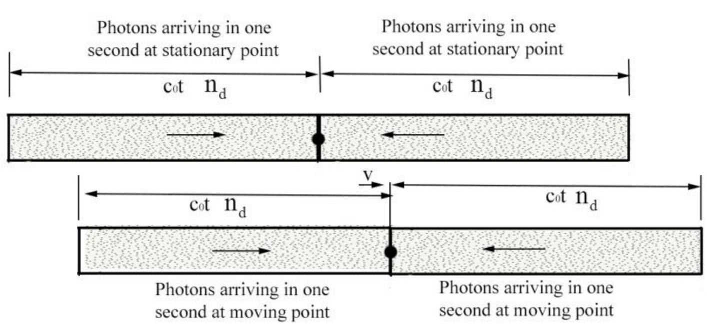
Changing the order shows the total energy of a moving mass to be the sum of the rest and the kinetic energy, where the kinetic mass is the relativistic mass

$$\varepsilon_T = m' c_0^2 = m_0 c_0^2 + m'\frac{1}{2}v^2 \tag{17}$$

Constancy of c in Relative Moving Points (Part 2)

In Δc Mechanics the velocity of Feynman photons at any point in space from all directions is equal and symmetric because the flow density is presumed to be in thermodynamic equilibrium.

Figure 2 is a sketch of an observer or particle at rest, and an observer moving with a velocity v



$$\frac{n_d}{cm^3} \times \frac{c_0\ cm}{sec} = \frac{n_d}{cm^2\ sec}$$

Fig. 2. Speed of light in two moving frames

The velocity of light at a point is set by the opposing density of Feynman photons, and since the background density moves in all direction at c_0 the number of photons per cm^3 is the same no matter what direction or velocity. All the photons coming from a distance of 29979245800.cm still arrive in one second, and photons coming from the opposite directions at a distance of 29979245800. cm come thru in one second. The space density of Feynman photon flow is observed to be homogeneous.

Thus from observation the theory in defining the velocity of light, assures <u>that the velocity of light in all moving frames is the same</u> . This gives cause to the the second Lorentz postulate.

Lorentz Summary

This section (part 1), observes the moving plane from a stationary frame yields the mechanism of the Einstein presumption causing the relativistic mass Eq.(4),

The section (part 2), shows the basis for the equivalence of the velocity $c_1 = c_2$ for observers in separate moving frames.

Thus Δc Mechanics provides an alternate to the Lorentz transforms and shows the physical cause underlying both base postulates.

Acceleration

The previous section discussed the change in velocity of light in a moving frame, but there is also a change due to a change in the velocity, or the acceleration shown in figure 1. The block from p_2 to p_3 is the change in velocity from the time photons at p_0 move to p_3, which is the integral of the acceleration for one time step or one second. This is the integral of the increase in velocity from the start at p_1 to the arrival at p_3 Eq.(12), thus becomes:

$$n_d c' = n_d c_0 + n_d v + \int_{v=o}^{v=1sec} n_d a \, dt \tag{18}$$

This change in the density of approaching photons is a change in the velocity of light experienced by the particle, and thus including the acceleration in Eq.(15), becomes:

$$m_0^2 \mathbf{c}_0 \cdot \mathbf{c}_0 \quad = \quad m^2 \left[\mathbf{c}_0 - \left(\mathbf{v} + \int_0^{1sec} \mathbf{a} dt \right) \right] \left[\mathbf{c}_0 + \left(\mathbf{v} + \int_0^{1sec} \mathbf{a} dt \right) \right] \tag{19}$$

The acceleration is a vector, and if in the same direction of the velocity is just the last second of acceleration, but it is not necessarily in the direction as the velocity.

The Origin of Centrifugal Force

The origin of centrifugal force has been a historic mystery since Newton developed the concept of force. Mach's view, that the origin centrifugal force is a result of the relative motion of the distant stars, was initially the presumption of Einstein in developing GR, and it still may be true, but locally this not the mechanism.

A deviation from a straight line does not necessarily change the magnitude of the velocity, but it does require energy to be applied $\Delta\varepsilon = f \cdot dr$. When a central force is applied to a rotating object, as the force is increased the force leads the velocity and changes the velocity of the mass. But when a purely lateral force, to the velocity, is applied, the velocity remains constant, but the force is still providing an increase in energy to the system, $\Delta\varepsilon = f \cdot dr$

The Energy of Circular Motion

The answer to the mystery of centrifugal force is that the relativistic energy of a mass moving in a circle is greater than that of the same mass moving in a straight line. The lateral acceleration of a particle requires energy that doesn't increase the velocity, but increases a hidden relativistic mass. When the acceleration stops the particle returns to a straight line and the centrifugal energy must be radiated away as gravitational radiation.

Thought Experiment

Consider a thought experiment in which a mass is rotating in a circle with velocity $v_m = v_i$ Figure 3:

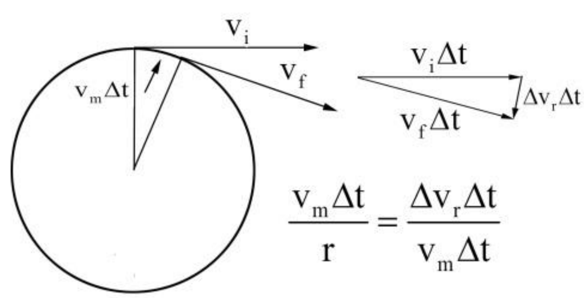


Fig.3. Rotating particle

After a short interval of time the angle between the radii positions and the velocity vector form similar isosceles triangles, and here is equality between the ratio of the base and one leg.

$$\frac{v_m\Delta t}{r} = \frac{\Delta v_r\Delta t}{v_i\Delta t} \qquad v_i = v_m \tag{20}$$

The centripetal acceleration is $a = v_m^2 / r$, and with some manipulations Eq.(20), becomes:

$$\begin{gathered} v_m^2 \Delta t^2 \quad = \quad r\,\Delta v_r \;=\; r\left(a_r \Delta t\right) \;=\; r\frac{v_r^2}{r}\Delta t = v_r^2 \Delta t \\ v_m^2 \Delta t^2 \quad = \quad v_r^2 \Delta t \end{gathered} \tag{21}$$

From the section on acceleration, the time interval for the density flow is one second thus integrating over one second gives the radical change in the density of photons in that second is equal to the radial velocity change due to the acceleration.

$$n_d \int_{t=0}^{t=1} v_m^2 \Delta t^2 \;=\; n_d \int_{t=0}^{t=1} v_r^2 \Delta t \;\to\; n_d v_m = n_d v_r \tag{22}$$

The number density of photons approaching the mass along the radius is reduced the same as from the lateral direction. Eq.(5), becomes:

$$m_0 c_0^2 = \; mc_0^2\left[1 - \frac{1}{2c^2}\left(\mathbf{v}_m + \mathbf{v}_r\right)\cdot\left(\mathbf{v}_m - \mathbf{v}_r\right)\right] \tag{23}$$

The vector velocities of $\mathbf{v}_m$, and $\mathbf{v}_r$ are perpendicular, and thus their dot product vanishes, leaving.

$$mc_0^2 = m'c_0^2\left[1 - \left(\frac{1}{2}\frac{v_m^2}{c_0^2} + \frac{1}{2}\frac{v_r^2}{c_0^2}\right)\right] \tag{24}$$

And the total relativistic energy is:

$$\varepsilon = m'c_0^2 = \left(mc_0^2 + \frac{1}{2}m'v_m^2\right) + m'\frac{1}{2}v_r^2 \tag{25}$$

The relativistic energy is the rest energy plus twice the kinetic energy. The term in parenthesis is the relativistic energy of the moving particle, Eq.(17). The second term is the additional relativistic mass created by circular acceleration. When the acceleration ceases (i.e. cutting the string) the energy vanishes and thus must be radiated by the change in acceleration or jerk, presumed to be by gravitational radiation.

Summary

This change in the relativistic mass in Eq.(25), due to circular motion shows up in Δc Mechanics, but **not in the Lorentz transforms,** because of the Einstein presumption of Eq.(4), does not include the change in the relativistic mass due to an acceleration, and is not present in a four-space coordinate transform.

It has been shown that centripetal force is more a local phenomenon related to travel in straight line, than the motion of the distance stars, and is found that there is energy hidden in the relativistic mass.

Since this circular centrifugal energy does not contribute to a change in the magnitude of the velocity, it is a hidden contribution to the relativistic mass, and whether it can be detected by experiment, is an interesting question.

Gravitation

Gravitation is a particle generated phenomenon, caused by the change in c induced by the Feynman photons on action paths exterior to the Compton radius. The self-bound photons revolving in the proton generate most of the probability density of Feynman photons creating the gradient in c that is the source of gravitation. Gravitation is not generated by a mass density of space.

Except for the low mass electron there is no particular orientation of the rotating photons in the proton, thus the probable exterior action flow density of the Feynman photons have no particular direction. The flow density exterior to the proton Compton radius exists as a random directed density of probability flow.

The acceleration by mechanical or electric interaction take place in an environment of a constant of vacuum density Feynman photons, but the acceleration due to gravity is from a gradient in the vacuum density, locally producing a gradient in the velocity of light.

Specifics

The change in the velocity of light for a proton was arrived at in [8] based on the intersecting probability density of Feynman photons from the proton intersecting with the vacuum density of space. As expressed here the change in the velocity of light in the proximity of a proton is:

$$\frac{\Delta c}{c_0} = \left(\frac{\lambda\!\!\!^{-}_{PL}}{\lambda\!\!\!^{-}_{P}}\right)^2 \frac{2\lambda\!\!\!^{-}_{P}}{r} \tag{26}$$

(See Appendix II)

The radius of the Planck particle is $\lambda\!\!\!^{-}_{PL}$ and the Compton radius of the proton is $\lambda\!\!\!^{-}_{P}$. The term in parenthesis is the probability of hitting a Planck particle within the Compton radius of a proton, and the last term is the probability of a Planck particle from the proton being at a distance r from its center constituting the Feynman photon density.

This vacuum density is the basis of the electron creation radius $\Re_0$, and the mass of the electron, thus providing the connection between gravitation and quantum effects [5,8].

Combining Relativistic Mass Effects

Gravitation changes the Feynman photon density n_d and the velocity of light. The operable relations in Δc Mechanics Eq.(27), below are; (a),The change in c due to the probability density in the presence of a single proton Eq.(1); (b) the Blandford, Thorne, velocity of light vs gravitation arrived at Solar delays and solar bending, in a Minkowski space, [15, 17], and; (c), The estimated number of proton equivalent mass particles in the universe [16].

$$(a)\frac{\Delta c}{c_0}=\left(\frac{ƛ_{PL}}{ƛ_P}\right)^2\frac{2ƛ_P}{r} \qquad (b)\ \frac{c}{c_0}=\left(1-\frac{2\mu}{r}\right) \qquad (c)\ \ n_P=\frac{R}{2\mu_P} \qquad (27)$$

In Eq.(27), μ is the gravitational radius, and R is the radius of the universe and n_p is the number of proton equivalent mass in the universe.

The Combined Relativistic, Velocity and Gravitation, Mass

A test particle placed in a proximity to a mass particle has a change in its relativistic mass, due to the decrease in the velocity of light, Eq. (27) (b), and the moving particle has a change in its relativistic mass due to the flow of the vacuum photon density Eq.(17):

$$m_0c_0^2=m'_v\left(c_0^2-\frac{1}{2}v^2\right) \quad (28) \qquad m_0c_0^2=m'_gc_0^2\left(1-\frac{2\mu_P}{r}\right) \quad (29)$$

This is the same test particle, thus the mass of expression, (29), m'_g is the zero velocity mass of expression (28), $m'_g \rightarrow (m_0)_V$ and the expressions can be combined to be:

$$m_0c_0^2=m'\frac{\left(c_0^2-\frac{1}{2}v^2\right)}{\left(1-\frac{2Gm_P}{c_0^2r}\right)}=m'c_0^2\left(1-\frac{1}{2}\frac{v^2}{c_0^2}+\frac{2\mu_P}{r}\right) \qquad (30)$$

This is a relativistic Lagrangian for a moving mass particle in a in a gravitational field:

$$m_0c_0^2=m'c_0^2\left(1-\frac{1}{2}v^2+\frac{2Gm_P}{r}\right) \qquad m_P=\sum(n\,\text{proton masses}) \qquad (31)$$

Note that the gravitational term is not a negative field potential.

Observations

The constancy of the velocity of light in moving frames has been shown.

The effect of gravitation is caused by a change in the speed of light induced by the individual particles in a mass; there is no charge, no electric field, and no potential energy generated by gravitation.

From Eq.(31), if a test particle arrives from a great distance entering the presence of a mass having a kinetic energy equal to the gravitational energy, $\frac{1}{2}v^2 = \frac{2Gm_P}{r}$, shows the relativistic mass does not change, and the velocity is constantly equal to the escape velocity. Should a particle in a gravitational presence, loses its kinetic energy, the relativistic rest mass is then less than m_0, and it cannot escape without the addition of an escape velocity. If two equal mass particles come together and radiate the kinetic energy away, they are trapped with energy less than their free mass values.

In Gravitational motion the energy components of velocity and mass are being exchanged by a gradient in the density of Feynman particles. There is no negative energy supplied by a ubiquitous negative Gravitational field of unknown origin or location. There is in fact, no field at all.

Conclusion

The purpose of this paper is to illustrate the macro mechanics and utility of Δc Mechanics in physical phenomena that needed some clarification. Mass is nothing more than localized or self-trapped photons. $m = \hbar(\omega_1 + \omega_2 +) / c_0^2$, and the gravitational and electric effects, are the result of the probability density of the Feynman action paths outside the confines of the Compton radius,

The speed of light is limited, and set by the probability density of oncoming Feynman photons of the vacuum density generated by the internal photon action paths of mass particles. Gravitation is the gradient in the Feynman vacuum probability density, generated primarily by a collection of protons.

Δc Mechanics illustrates the physical mechanism of the Lorentz transformation, acceleration, the centrifugal forces, electric, and gravitational interaction. There are no un-locatable field energy content or excluded energy infinities, of the standard view of QED.

Δc Mechanics is the genesis of a new formulation for physics, and this paper has been to present the theory in a more familiar context, for those familiar with general physics, but it is unlikely to create much notice or be accepted in the foreseeable future.

The Feynman action path formulation of QED yields an understanding of the underlying mechanisms of physics. Adding the particle view of the action paths, rather than a field concept, removes infinities and allows a physical understanding of the process. The processes shown here include; the velocity of light, particle-particle interaction, gravitation, and the velocity transforms.

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Appendix I

The flow density of Feynman photons

The Local volume density of Feynman photons at a point is constant and the flow density of photons from any two opposite directions Integrated over all directions are Equal, thus the integral of flow density for any point in any direction is the same.

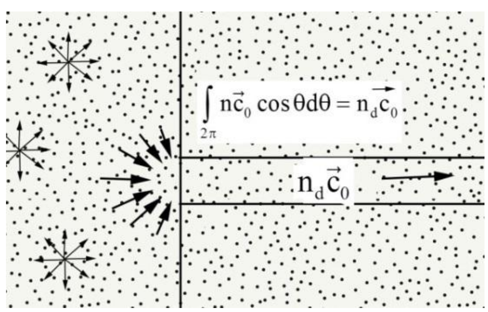


Figure 4 is a sketch of space with a volume density of Feynman photons integrated over the 2 pi solid angle
The Flow density n_d ($cm^{-2} sec^{-1}$) is the integral of the number of photons in space with density of n_d cm^3 moving at c that would pass through an area of one cm in one second. (Appendix I)

A photon moving in space encounters an opposite flow of Feynman photons of about 1.6932057E+38 photons per second per square cm. With that opposing density the photon can travel about 2.9979245800E+10 cm in one second. The integral of photons going in a particular direction over a given area is the same, and each photon experiences the same oncoming density. The number and flow density are homogeneous.

Appendix II

The Electron as Two Orbiting Photons

Excerpts with corrections from:

Electron Mass and State Energy Levels Resulting from Photon-Photon Interaction [18]

Mechanics of the Electron

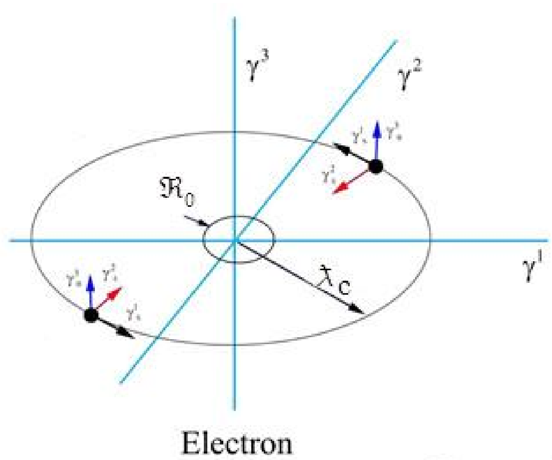


Fig.1. The vector orientation of the probability of location of two radially polarized photons rotating in the electron at the first most probable $L=\hbar$, orbit with r equal to the electron Compton radius. Red is the electric vector Blue is the magnetic vector and Black is the Poynting vector.

The electron is a composition particle composed of two photons, each with half the energy of the electron, revolving around the center of mass at a probable distance of the Compton radius. A photon passes or engages the probability of the other photon twice per revolution thus the frequency of photons passing the other photon is twice the rotation frequency. For a fixed point, there are two photon passing per revolution that provides the proper Compton frequency of the electron. The Compton frequency is twice the rotation frequency of the photons.

From earlier papers, [2-9], the change in the velocity of light of a passing photon as the result of the probability of another photon passing at a perpendicular distance r is:

$$\frac{\Delta c}{c_0} = \frac{ƛ_{PL}^2}{ƛ_{ph}^2}\left(\frac{ƛ_{ph}}{r}\right) = \left(\frac{ƛ_{PL}^2}{ƛ_{ph}^2}\right)\left(\frac{\hbar}{m_{ph} c r}\right) \tag{32}$$

$$(\text{cross-section ratio}) \times \text{Feynman photon probability density}$$

The first term in brackets is change in the density of Feynman photons as the result of encountering the "ph" photon, and the second is the probability of the "ph" photon passing at a perpendicular distance r from the observed point. The momentum of the photon is $m_P c_0$, the Planck particle radius is $ƛ_{PL}$, and the Compton radius of the photon is $ƛ_{Ph}$.

If a photon is bound in orbit, at a frequency per revolution of ν_1 , an interloping photon encounters the universal background density of Feynman photons per second, [2-4], plus the density of rotating photon. This slows the velocity of light proportional to the frequency.

$$\frac{\Delta c}{c_0} = \frac{ƛ_{PL}^2}{ƛ_1^2}\left(\frac{ƛ_1}{r}\nu_{ph}\right) \tag{33}$$

The other photon in the electron is not an interloping photon, but participating. The velocity of the photons is proportional to the density of Feynman photons in the universe, plus the density of encountering the other photon. The change is proportional to the probability of encountering the other photon, thus the "coincidence: of the probable encounter of the photons in an orbit.

The product of the probability of the photon densities, thus the "coincident" probability of collision is:

$$P_1 P_2 = \frac{ƛ_1}{r}\nu_{ph}\frac{ƛ_2}{r}\nu_{ph} = \nu_{ph}^2 \frac{ƛ_1}{r}\frac{ƛ_2}{r} \tag{34}$$

The probability densities expressed here are for the Feynman photons of photons passing at a distance. The square of the frequencies v_{ph}^2 is the coincident collision frequency of the photons

The frequency of rotation is v_e thus the distance the photon travels at this distance in one second at the core of the electron c_e is $S = 2\pi\left(ƛ_{PL} 2v_{ph}\right)v_e$. The ratio of this distance to the distance light moves, in one second is:

$$\frac{c}{c_0} = \frac{\left(ƛ_{PL} v_e\right) \times 2\pi\nu_e}{c_0 t} = \frac{\Re\,\omega_e}{c_0 t} \tag{35}$$

The radial value $\Re$ is designated as the "Electron Creation Radius" since it represents the radius at which the potential energy of the two rotating photons is equal to the total energy The maximum of the potential energy can only be half the total energy at the point at which it is equal to the kinetic energy, thus we will define:

$$\Re_0^2 = 2ƛ_{PL}^2 v_e^2 \tag{36}$$

This is the core radius of the electron it is an invariant quantity that defines the invariant mass. Two photons cannot actually be closer than this is because the kinetic energy of the photons p would be less than the invariant energy.

$$\frac{\Delta c}{c_0} = \frac{ƛ_{PL}^2}{ƛ_1^2}\left(\frac{ƛ_1}{r} v_{ph}\right) \tag{37}$$

The other photon in the electron is not an interloping photon, but participating. The velocity of the photons is proportional to the density of Feynman photons in the universe, plus the density of encountering the other photon. The change is proportional to the probability of encountering the other photon, thus the "coincidence: of the probable encounter of the photons in an orbit.

Appendix III

The nature of the force between these particles

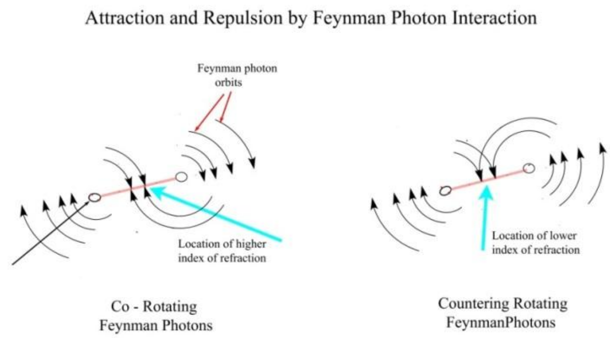
Excerpts from:

The Feynman Photon-Photon Electric Attraction, Repulsion and the Chirality of the Electron [19]

Opposite Charges

For a simple atomic system, Positronium, there are two opposite, rotating particles. Each particle is surrounded by a circulating probability of the core photons being in a planar rotating path. As shown in Fig. [2], the photons from both particles rotate, and engage the photons from the other particle.

Attraction or repulsion between the particles depends on direction of the interacting photons. This is the result of the Lorentz condition that photons in the same direction cannot interact, whereas opposite going photons have a probability of collision, and reduce each other's relative speed of light, or index of refraction



Fig, 2. Interacting rotating particles

The collision probability in Eq.(34), and the magnitude of the change in c Eq.(37), as the result of a charged particle at a, distance r,

$$\frac{\Delta c}{c} = \frac{1}{2}\frac{1}{m_e c^2}\frac{\alpha c \hbar}{r} \qquad (38)$$

Δc is the change in the velocity of light or the index of refraction .

Appendix IV

Issues regarding Δc Mechanics

Planck vs Ordinary phonons

Ordinary photons are rotating Planck particles with their probability of location on a rotating line inside the Compton radius from the perimeter thru the center and back. The energy of the photon is $\varepsilon = \hbar\omega = h\nu$ and the angular momentum is $\hbar$. The photons flow density is the movement of the particle inside the Compton radius, and the integral of the angular momentum of its flow density is the spin.

A Feynman photon is the probability of the particles location on action paths outside the Compton radius, and the integral of the angular momentum of its flow density is the anomalous spin. The Feynman photon can be miles away from the particle and thus it cannot transfer energy or momentum, but its cross section and velocity can scatter and change the direction of other Feynman photons.

Feynman's theory of quantum electrodynamics is based on the probability of these paths being out there. Feynman did not presume that the probable presence of particles on these action paths had any effect on other particles, but Δc Mechanics presumes it is the interaction mechanism between mass particles rather than that of continuous fields. Changing the index of refraction experienced by the Feynman photons of another particle changes its direction and thus can attract or repel other particles.