Time Dilation Is Caused by Changes in Specific Energy & The Theory of Electromagneticgravitism

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***Abstract*—The causal discovery presented in this paper is that special and general relativity time dilation are both caused by the same phenomena—changes in specific energy—as apposed to being caused by two very different unrelated phenomena, as previously understood. This is a newly induced generalization, and a significant portion of this paper is a study of this new generalization's implications. The implications studied includes: the mass-energy equation, the photon momentum equation, the mass of photons, red/blue shifts in photon frequency. It turns out, $E = mc^2$ is a special case of the total relativistic energy equation, which is derived in this paper. The total relativistic energy equation is such that $E \leq mc^2$. This change from the mass-energy equation to the total relativistic energy equation has many implications. Firstly, it implies that mass and energy are not the same things, as previously understood. Energy remains an inseparable aspect of an object with mass, as it did under Newtonian Physics, which in turn implies photons have mass. Secondly, it implies a change is required in the photon's momentum equation, because that equation was derived from $E = mc^2$. The last covered implication is that a simple experiment, leveraging a photon's red/blue shifts, can test for, and measure, a photon's mass. Finally, the paper indulges in some speculation where the implication study was unable to prove an implication. This speculation posits a potential path towards integrating quantum mechanics and relativity, and that perhaps only three fundamental forces exist, where the other supposed forces are only a special combination of one of the three. These three forces are electric forces, magnetic forces, and gravitational forces, and a photon is responsible for these forces and are coupled together under electromagneticgravitatism, where each force operates orthogonality, one force in each spacial dimension.**

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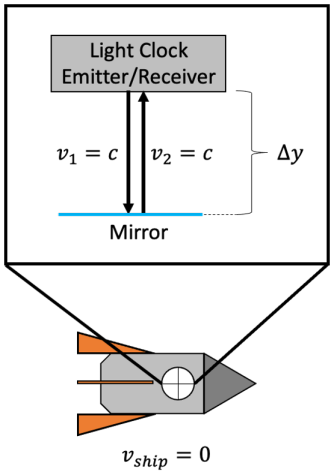
1. SPECIAL RELATIVITY TIME DILATION

The cause of time dilation, in special relativity, has been attributed to relative velocity. As we shall soon see, relative velocity is correlated to time dilation, but it is not the cause of time dilation. The reason relative velocity has been attributed as the cause of time dilation is derived from geometric laws when you assume the speed of light is constant. The original idea of the speed of light being constant stems from Maxwell's wave equations. In addition, the speed of light has been empirically measured to be constant from Michelson's experiments, who was actually attempting to prove it was not constant [2].

Deriving Special Relativity Time Dilation

A simple thought experiment sets up the problem to derive time dilation given constant speed of light. First imagine a light clock on a stationary ship that emits light from a known location, the light travels some distance, Δy, strikes a mirror and returns the same distance back to the clock's receiver, as shown in Figure 1.



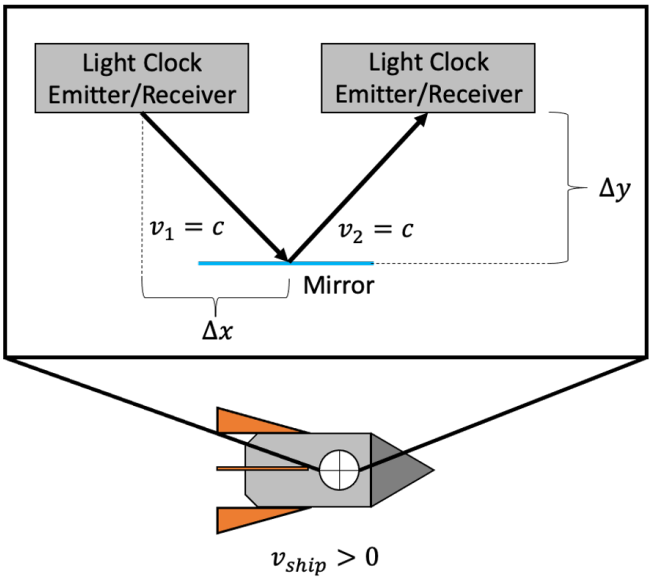
$$\Delta t_{clock} = \frac{2\Delta y}{c} [per\ cycle]$$

Figure 1. Light Clock At Rest.

Now imagine that the ship instead has some positive and constant velocity, v_{ship}, then the light clock can be observed to emit light at the source, bounce off the mirror and return to the receiver but the overall path was different. The light traveled the same vertical distance as before, but this time the light is traveling some non-zero horizontal distance, as show in Figure 2.

Traditional Newtonian physics would have v_1 and $v2$ be greater than c since the motion of the ship would contribute to the total velocity of the light. However, since the speed of light is constant in all references frames, then $v1$ and $v2$ remain c—the same speed the light was traveling when the ship was at rest.

Following geometric laws gives us a relationship between time experienced on the moving ship, Δt, and time experienced on the stationary ship, $\Delta t'$. A *differential* exists between how time passes between the two reference frames. Given the above relationship between Δt and $\Delta t'$, deriving



$$\Delta t'_{clock} = \frac{2\sqrt{\Delta x^2+\Delta y^2}}{c}[per\ cycle]$$

Figure 2. Light Clock In Motion.

time dilation is as follows:

$$\Delta x = v_{ship}\frac{\Delta t'}{2} \tag{1}$$

$$\Delta t' = \frac{2\sqrt{\Delta x^2 + \Delta y^2}}{c} \tag{2a}$$

$$\Delta t' = \frac{2\sqrt{\left(v_{ship}\frac{\Delta t'}{2}\right)^2 + \Delta y^2}}{c} \tag{2b}$$

$$c^2\Delta t'^2 = (v_{ship}\Delta t')^2 + 4\Delta y^2 \tag{2c}$$

$$(c^2 - v_{ship}^2)\Delta t'^2 = 4\Delta y^2 \tag{2d}$$

$$\Delta t'^2 = \frac{4\Delta y^2}{c^2 - v_{ship}^2} \tag{2e}$$

$$\Delta t' = \frac{2\Delta y}{\sqrt{c^2 - v_{ship}^2}} \tag{2f}$$

$$\Delta t' = \frac{c\Delta t}{\sqrt{c^2 - v_{ship}^2}} \tag{2g}$$

$$\Delta t' = \frac{\Delta t}{\sqrt{1 - \frac{v_{ship}^2}{c^2}}} \tag{2h}$$

$$\frac{\Delta t}{\Delta t'} = \sqrt{1 - \frac{v_{ship}^2}{c^2}} \tag{2i}$$

$$\frac{dt}{dt'} = \sqrt{1 - \frac{v_{ship}^2}{c^2}}\ \blacksquare \tag{2j}$$

From equation (2) it seems reasonable to conclude v_{ship} caused the time dilation because the speed of light is constant and the only variable is v_{ship}. As will be shown, via the method of difference and agreement, velocity cannot be the cause. Velocity is actually correlated to time dilation because velocity is an effect to the real cause of time dilation.

The Twins Paradox

Assuming that velocity is the cause of special relativity, then time dilation leads to what is termed *The Twins Paradox*, and the events of this paradox are illustrated in Figure 3. In this paradox, a twin takes off in a ship at some velocity towards Alpha Centauri, arrives, stops, turns around and upon returning home discovers that his twin aged more than himself.[2] This is a paradox because, according to special relativity's account for time dilation each twin fully expected that the other would have aged less. Why? Because on the flight out and back, each twin perceived that the other was moving, so the other's light clock would have looked like Figure 2. Both twins in fact observed the other's light clock looking like Figure 2.

Both clocks appeared to look like Figure 2, but only one aged. This tells us something very important because it reveals a contradiction in our assumptions. It was assumed that perceived velocity causes time dilation, because it creates a time clock that looks like Figure 2, which means time dilation occurs. And yet for one twin, time dilation did not occur. Invoking the method of difference, where each twin experienced a different effect than the other, while having the same relative velocity, proves that velocity cannot be the cause of time dilation. Then what is?

Velocity was not the only antecedent factor. Something else occurred, which was not common to both twins, and that factor was the accelerated twin had work done to himself. Work has a well known relationship to a change in kinetic energy, as defined in Equation (3) assuming initial velocity is zero. Equation (3d) is the relationship between specific work (left side) and change is specific energy (right side).

$$W = \Delta E_K \tag{3a}$$

$$Fd = \frac{1}{2}m(v_f - v_i)^2 \tag{3b}$$

$$mad = \frac{1}{2}m(v_f - 0)^2 \tag{3c}$$

$$\text{Let d} = x$$

$$ax = \frac{1}{2}v_f^2 \tag{3d}$$

We do not yet have enough information to determine the cause of time dilation. One more consideration is required. Does the same change in kinetic energy applied to two different objects with two different masses experience the same time dilation; or does it have more to do with specific work applied?

[2] Just to clarify, it is assumed the stationary twin is in uniform space, i.e., not in the vicinity of any source of gravity; that the distance being accelerated is so small of fraction of the total distance covered it can be ignored; and the relative velocity between the stationary twin and Alpha Centauri is zero.

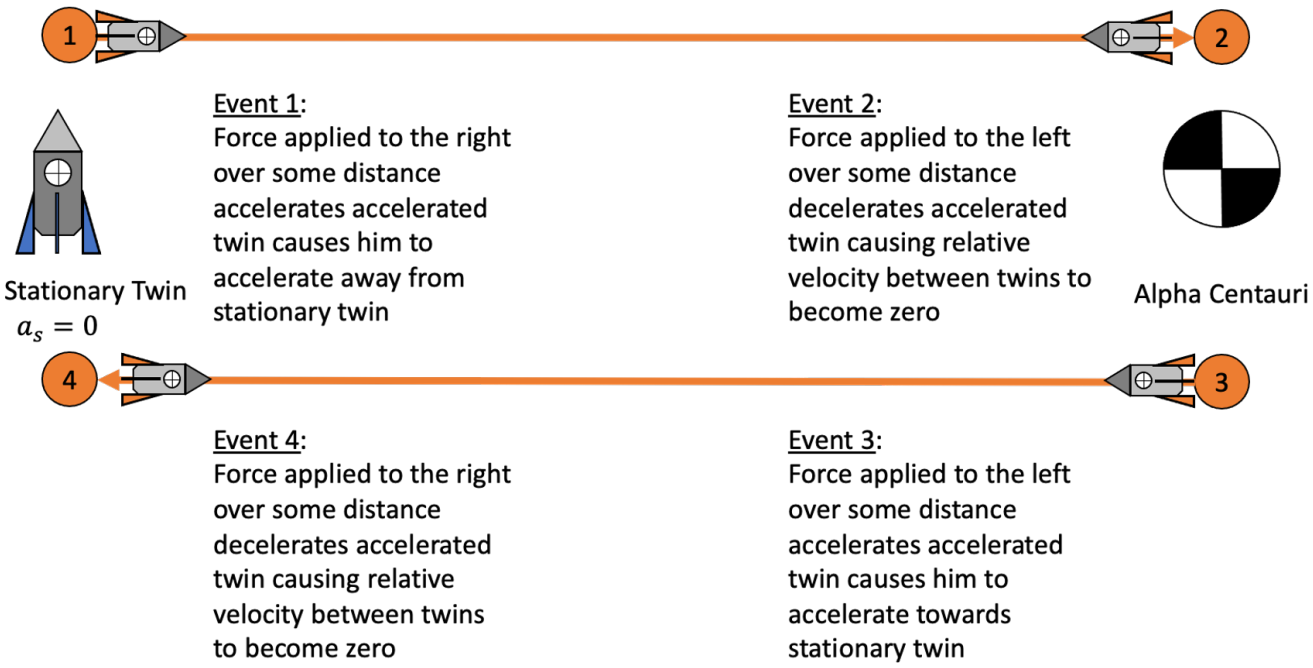


Figure 3. Events Leading to The Twins Paradox.

Two simple thought experiments tells us that a change in specific work is the cause. Proof:

First, let us evaluate change in kinetic energy.

Case 1: Consider a planet that barley moves when some work is done to it versus the same work done to a tiny marble, which causes that marble zoom to a much higher velocity. Observing both of their light clocks reveals that the marble experiences more time dilation than the planet; therefore, invoking the method of difference, where each object experienced a different effect than the other, while having the same change in kinetic energy, proves that change in kinetic energy cannot be the cause of time dilation.

Now, let us evaluate change in specific kinetic energy.

Case 2: Consider the same two objects as before, but now they have the same change in specific energy applied to them. By definition, their light clocks show the same time dilation; therefore, invoking the method of agreement, where each object experienced the same effect, while having the same change in specific kinetic energy, proves that change in specific kinetic energy is the cause of time dilation ■.

Returning out thoughts back to The Twins Paradox, the accelerated twin's change in specific kinetic energy also caused the change in their relative velocity. As we can now see, relative velocity is only correlated to time dilation, not the cause of it. Updating Equation (2), but substituting out correlated terms for causal terms gives us Equation (4).

$$\frac{dt}{dt'} = \sqrt{1 - \frac{2a'd'}{c^2}} \tag{4}$$

Where :

dt' is the time derivative before time dilation

dt is the time derivative after time dilation

a' is the accelerated twin′s acceleration in initial inertial frame

x' is the accelerated twin′s distance accelerated in initial inertial frame

It is important to note some differences between the meaning of Equation (4) and Equation (2). In Equation (2), v caused time dilation for as long as there was a velocity different—it applied it over time. In Equation (10), on the other hand, creates a time differential between the two reference frames up front during acceleration, and once the acceleration is done the differential remains until the object is acted upon by an outside force.

As an analogy for interpreting Equation (4), imagine a system of cogs turned by a hand crank attached to the time differential cog, which drives the others. For this analogy, the original inertial reference frame time drives that hand crank at the same revolutions per minute (RPM) regardless of time dilation. When time dilation occurs, then that original time dilation cog is swapped out for a smaller cog. From then on the hand crank spins the system of cogs at a slower RPM than before time dilation, and will continue to do so until that cog is swapped out again (by another change in specific kinetic energy). Figure 4 illustrates this analogy.

Applying Equation (4) to The Twins Paradox example's four events as shown in Figure 3, and assuming the same magnitude of acceleration was applied over the same magnitude of

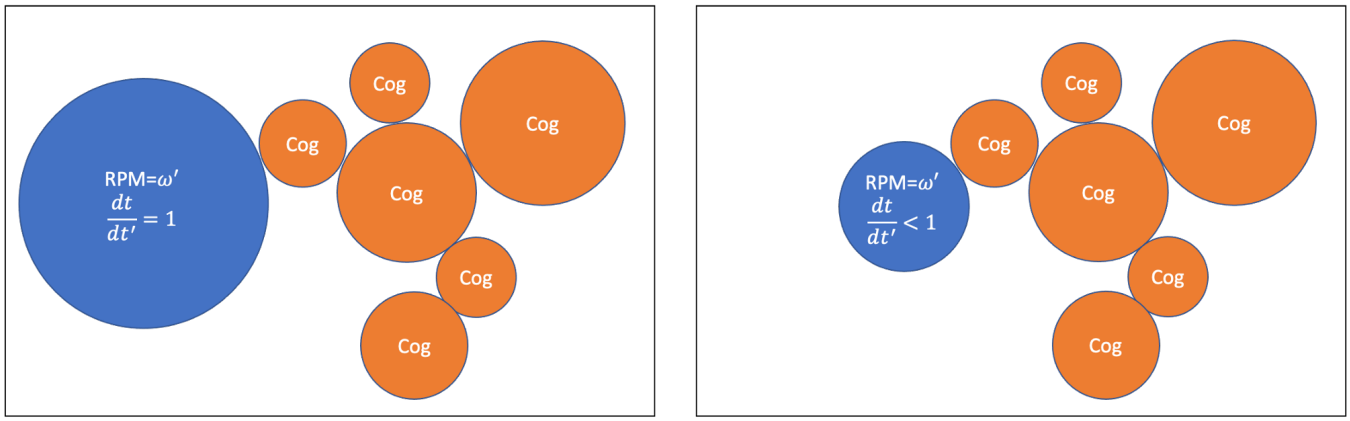


Figure 4. Left: system of cogs without time dilation. Right: system of cogs with time dilation.

distance, gives us Equation (5):

Event 1 :

$$\frac{dt_1}{dt'} = \sqrt{1 - \frac{2a'x'}{c^2}} \tag{5a}$$

Event 2 :

$$\frac{dt_2}{dt'} = \sqrt{1 - \frac{2(a'x' + (-a')x')}{c^2}} = 1 \tag{5b}$$

Event 3 :

$$\frac{dt_3}{dt'} = \sqrt{1 - \frac{2(a'x' + (-a')x' + (-a')(-x'))}{c^2}} \tag{5c}$$

Event 4 :

$$0 = a'x' + (-a')x' + (-a')(-x') + a'(-x) \tag{5d}$$

$$\frac{dt_4}{dt'} = \sqrt{1 - \frac{2(0)}{c^2}} = 1 \tag{5e}$$

Where :

dt' is the time derivative before time dilation
dt_1 is the time derivative for the accelerating twin after event 1
dt_2 is the time derivative for the accelerating twin after event 2
dt_3 is the time derivative for the accelerating twin after event 3
dt_4 is the time derivative for the accelerating twin after event 4
a' is the accelerated twin's acceleration in initial inertial frame for each event
x' is the accelerated twin's distance accelerated in initial inertial frame

As might be expected, time differential is unity after event 2 and event 4.

Although the cause for why the accelerated twin was the twin that experienced time dilation, one last question remains to be answer before the paradox is resolved. Why would both twins perceive the other twin's light clocks behaving exactly the same way? The answer lies in length contraction, which is defined by Equation (6).

$$\frac{dx}{dx'} = \sqrt{1 - \frac{2a'x'}{c^2}} \tag{6}$$

Where :

dx' is the space derivative before time dilation
dx is the space derivative after time dilation
a' is the accelerated twin's acceleration in initial inertial frame
x' is the accelerated twin's distance accelerated in initial inertial frame

Two steps are taken to prove length contraction only affects the accelerated twin, as proved by Equation (7), which causes both clocks to look the same regardless of perspective.

Proof :

$$v' = v \tag{7a}$$

$$\frac{dx'}{dt'} = \frac{dx}{dt} \tag{7b}$$

$$\frac{dx'}{dt'} = \frac{dx}{dt'\sqrt{1 - \frac{2a'x'}{c^2}}} \tag{7c}$$

$$\frac{dx}{dx'} = \sqrt{1 - \frac{2a'x'}{c^2}} \blacksquare \tag{7d}$$

(7e)

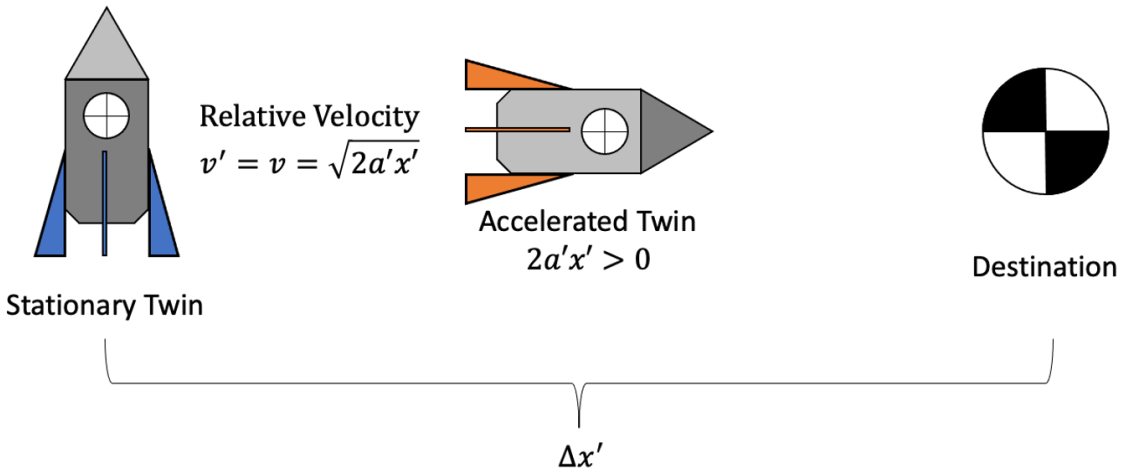


Figure 5. **Example Used In Proof for Cause of Length Contraction.**

Where :

v' is relative velocity before time dilation
v is relative velocity after time dilation
dx' is space derivative before time dilation
dx is space derivative after time dilation
dt' is time derivative before time dilation
dt is time derivative after time dilation
a' is the accelerated twin′s acceleration in initial inertial frame
x' is the accelerated twin′s distance accelerated in initial inertial frame

An interpretation of Equation (7) is considered in the following thought experiment, which is aided by Figure 5. Consider an accelerated twin headed towards some destination at velocity, v'. Suppose the effect of time dilation is that the time differential cog makes the system of cogs under time dilation rotate at half their original RPM. This means the accelerated twin arrived at their destination in half the time the stationary twin measured. Since the velocities are measured the same, this means that the distance traveled was also half as less.

Wrapping up The Twins Paradox, The accelerated twin experiences time dilation and length contraction, which are effects that cancel out when the accelerated twin is observing the velocity of the light in the stationary twin's time clock. As we can see from this, the twins paradox is resolved.

To sum up what has been proven thus far, now it ought to be well established that a change is specific kinetic energy causes time dilation and length contraction—or space-time dilation. In addition, changes in specific kinetic energy also causes a change in velocity, thus, making velocity necessarily correlated to time dilation, but not its cause.

2. General Relativity Time Dilation

General relativity also has its own time dilation, as defined in Equation (9).

$$\frac{dt}{dt'} = \sqrt{1 - \frac{2MG}{rc^2}} \tag{9}$$

Where :

dt' is time derivative before time dilation
dt is time derivative after time dilation
M is the mass creating the gravity potential
r is the distance to center of gravity potential
G is the gravitational constant

Equation (9) can also be rearranged into Equation (10), which is also in terms of acceleration applied over some distance:

Relating $\frac{\text{2MG}}{\text{r}}$ to 2gr :

$$F = \frac{GMm}{r^2} = gm$$

$$\frac{2MG}{rc^2} = \frac{2MG}{rc^2}\frac{r}{r} = \frac{2gr}{c^2}$$

Updating Equation (9) :

$$\frac{dt}{dt'} = \sqrt{1 - \frac{2gr}{c^2}} \tag{10}$$

Where :

dt' is time derivative before time dilation
dt is time derivative after time dilation
g is gravitational acceleration
r is the distance to center mass

3. TIME DILATION'S COMMON CAUSE

It is no coincidence that both special and general relativity time dilation are both in terms of acceleration applied over some distance, which is a change in specific energy. A change is specific energy is what what is common to both special and general relatively time dilation.

Special relativity time dilation are due to changes in specific kinetic energy, and changes in general relativity time dilation are due to changes in specific potential energy. Below is a proof that time dilation is caused by changes in specific energy.

The approach this proof takes is that it assumes:

1. An object is at rest some distance, r, away from some gravity potential causing local gravitational acceleration to be, g.
2. All the specific potential energy is transferred to specific kinetic energy

If time dilation is caused by changes in specific energy, then the time dilation for a non-accelerating object with specific potential energy ought to be the same when all the specific potential energy is transferred to specific kinetic energy.

Proof :

$$\text{Let } \gamma = \frac{\Delta t}{\Delta t'} \tag{12a}$$

$$\gamma_P^2 = \gamma_K^2 \tag{12b}$$

$$1 - \frac{2gr}{c^2} = 1 - \frac{ax}{c^2} \tag{12c}$$

$$\frac{2gr}{c^2} = \frac{ax}{c^2} \tag{12d}$$

$$gr = \frac{1}{2}ax \tag{12e}$$

$$gr = \frac{1}{2}v^2 \blacksquare \tag{12f}$$

This proves that time dilation is the same before and after the energy transformation, because assuming otherwise would contradict a basic specific potential-kinetic energy identify in Equation (12f). gr from Equation (12f) is the max possible potential energy that could be transfer to kinetic, which assumes the source of gravity is a point source (a dot without dimension). If the object under the influence of gravity fell r, then it would reach the center of mass, and then would have no more potential left to transfer. If all the potential transferred to kinetic, then the result would be a velocity that equals: $(2gr)^{\frac{1}{2}}$.

Invoking the method of agreement, since the same change in the amount of specific energy caused the same time dilation, proves that time dilation is caused by a change in specific energy.

4. IMPLICATIONS

This discovery has many implications, to include: updates to the mass-energy equation, photons have mass and can be easily measured, and updates to the photon momentum equation. These are the only discovered and proved implications so far, and many more are probably not too far of a leap, as we'll see in the next section.

Total Relativistic Energy Equation

We will see from this next proof that the famous $E = mc^2$ is actually not the whole story—its a special case. This proof begins by taking specific potential energy and specific kinetic energy's relationship to γ^2 and solving for total energy, E_T.

Proof :

$$\gamma_P^2 = 1 - \frac{2gr}{c^2} \tag{13a}$$

$$\gamma_P^2 = 1 - \frac{2gr}{c^2}\frac{E_P}{E_P} \tag{13b}$$

$$\gamma_P^2 = 1 - \frac{2gr}{c^2}\frac{E_P}{mgh} \tag{13c}$$

$$\text{Let r} = h$$

$$\gamma_P^2 = 1 - \frac{2}{c^2}\frac{E_P}{m} \tag{13d}$$

$$\frac{2}{c^2}\frac{E_P}{m} = 1 - \gamma_P^2 \tag{13e}$$

$$\text{Let } \tau_\text{P}^2 = 1 - \gamma_P^2$$

$$E_P = \tau_P^2 \frac{1}{2}mc^2 \tag{13f}$$

$$\gamma_K^2 = 1 - \frac{2ax}{c^2} \tag{14a}$$

$$\gamma_K^2 = 1 - \frac{2ax}{c^2}\frac{E_K}{E_K} \tag{14b}$$

$$\gamma_K^2 = 1 - \frac{v^2}{c^2}\frac{E_K}{\frac{1}{2}mv^2} \tag{14c}$$

$$\gamma_K^2 = 1 - \frac{2}{c^2}\frac{E_K}{m} \tag{14d}$$

$$\frac{2}{c^2}\frac{E_K}{m} = 1 - \gamma_K^2 \tag{14e}$$

$$\text{Let } \tau_\text{K}^2 = 1 - \gamma_K^2$$

$$E_K = \tau_K^2 \frac{1}{2}mc^2 \tag{14f}$$

$$E_T = E_P + E_K \tag{15a}$$

$$E_T = \tau_P^2 \frac{1}{2}mc^2 + \tau_K^2 \frac{1}{2}mc^2 \tag{15b}$$

$$E_T = (\tau_P^2 + \tau_K^2)\frac{1}{2}mc^2 \blacksquare \tag{15c}$$

Qualities of τ ranges from $[0, 1]$ for both specific potential and kinetic energy contributions to time dilation. If either are 1, then that form of specific energy is contributing the maximum amount it can to time dilation. For example, when $\tau_K = 1$ it is because $2ax = c^2$; or, when $\tau_P = 1$ it is because $2gr = c^2$. It is apparent from Equation (15c) that $E \leq mc^2$. Equally apparent. When both $\tau_P$and τ_K are less than unity, then Equation (15c) simplifies to Equation (16).

$$E_T = E_P + E_K = mgh + \tfrac{1}{2}mv^2 \tag{16}$$

This implies that energy is not some separate entity from mass, but rather energy is an inseparable aspect of an object, which has mass. Therefore, mass cannot be converted into energy, as theorized before, in the sense that mass disappears and pure energy without mass appears.

Lets consider a case involving a photon, a particle commonly believed to have no mass. Let's assume that a non-accelerating object with some mass, m, is not in vicinity of any gravity potential. If this object were to disintegrate into nothing but photons, What would the total energy be of all the released photons (considered in the reference from from which the object started)? If we assume that mass is conserved, then the total mass of the photons is m, and its speed is c by definition. Therefore, $\tau_P^2 = 0$ and $\tau_K^2 = 1$ and plugging these values into the total relativistic energy equation we get: $E_T = \frac{1}{2}mc^2$.

Now, if instead this same object started near a gravity potential, such that $\tau_P^2 = 1$, then the total energy of all the disintegrated photons would be $E = mc^2$ instead because in addition of the specific kinetic energy there is also the specific potential energy. Figure 6 helps visualize this situation.

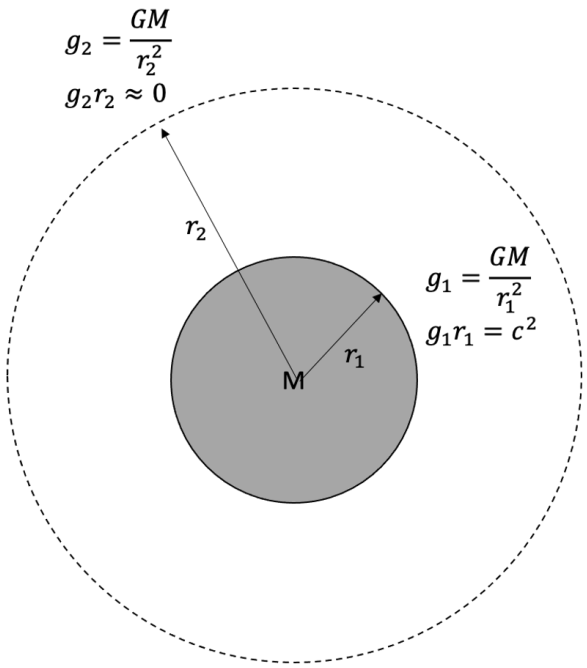


Figure 6. **Comparing $\tau_P^2 = 1$ to $\tau_P^2 = 0$.**

If a photon is not massless, like many formerly supposed, then what is its mass? We now have the tools to measure this.

Reinterpreting Red/Blue Shift Reveals Photon Mass

We know from electromagnetism that the energy of a photon particle is defined by Equation (17).

$$E = \frac{hc}{\lambda} = hf \tag{17}$$

Now that we have the total relativistic specific energy equation from Equation (15c), we can use that with Equation (17) to estimate the mass of a photon using red/blue-shift measurements as proven below:

Proof :

$$\Delta E = \frac{hc}{\Delta\lambda} = h\Delta f = (\Delta\tau_P^2 + \Delta\tau_K^2)\frac{1}{2}mc^2 \tag{18a}$$

$$\frac{hc}{\Delta\lambda} = (\Delta\tau_P^2 + 0)\frac{1}{2}mc^2 \tag{18b}$$

$$m = \frac{2h}{\Delta\tau_P^2 \Delta\lambda c} = \frac{2h\Delta f}{\Delta\tau_P^2 c^2} \tag{18c}$$

Therefore, measuring the change in specific potential energy and the measured shift in wavelength (or frequency) can yield the mass of a photon. This seems like a relatively (pun intended) easy experiment to set up. What is required most likely already exists. With an emitter at a location on earth, with a known gravity potential, emitting light at a known wavelength (can be constant emission), and with a receiver in orbit, with a known gravity potential, you can collect all the required measurements to estimate the mass of a photon.

I would not assume that the photons at various wavelengths to have the same mass. In fact, it stands to reason, that they would not have the same mass given certain other observations.

Reinterpreting Photon Momentum

Because it was formerly assumed that $E = mc^2$, it was also assumed that the momentum of a photon was defined as Equation (19) below:

$$p = \frac{E}{c} \tag{19}$$

But with our new understanding of total relativistic specific energy we get Equation (20) below instead:

$$p = \frac{2E}{(\tau_P^2 + \tau_K^2)c} \tag{20}$$

This suggests that momentum changes as total specific energy changes—this much makes sense. But, since changes in specific energy induce a color shift, then it seems there is a relationship between a photon's mass and its wavelength (and frequency), assuming constant velocity. I am uncertain how to reconcile this implication with conservation of mass, because the same photon might shift its color and these relationships suggests that its mass also changes. Experimental evidence shows that a photon's momentum is a function of its wavelength, and its energy is also a function of its wavelength. If the masses are different for photons of different wavelength, then we need to revisit what mass means. I speculate in the next section that the measurement of matter (quantity of particles) is subject to dilation too.

Solving for a photon's mass as a function of wavelength or frequency yields:

$$m = \frac{2h}{(\tau_P^2 + \tau_K^2)\lambda c} \tag{21a}$$

$$m = \frac{2hf}{(\tau_P^2 + \tau_K^2)c^2} \tag{21b}$$

This reconciliation will have to wait on future work and additional experimental evidence making use of the progress contained in this work. I will now indulge in speculation in what this reconciliation may be, and therefore, what it might mean; and take the implications of this speculation much farther.

5. SPECULATIONS

It is important to delineate what scientific work is based on causal proofs and what is speculation. Unfortunately today, this delineation is obscured far too often largely due to a general ignorance on a valid method of induction. I do not like the popular approach of picking an arbitrary hypothesis and treating as if it were true until proven otherwise—it is a regression to a prescience era in my opinion.

Do not misunderstand me, I am no Einstein; if I were ignorant of the valid method of induction, this paper would likely not exist. If this work has merit, it is only because I know what contradictions mean when I see them, I know how to conduct the causal discovery process[3], and I know how to integrate and find implications of newly discovered generalizations to material I am familiar with [3][4][5]—anyone could have done what I did using those same powerful cognitive tools and methods.

The causal discovery in this paper was that special and general relativity time dilation are both caused by the same phenomena—changes in specific energy—as apposed to being caused by two very different unrelated phenomena, as previously understood. This is a newly induced generalization, and the rest of the paper, up to this point, has been a study of the implications via deductive reasoning. I have taken the deductions as far as I can, and now I a will begin to speculate.

Theory of How Photons Create Gravity and Gravitational Relativity

I acknowledge up front that there is a possible issue with conservation of mass if the mass of a photon were related to its wavelength, because its mass could change simply because its color shifts. A photon would weigh more inside a gravity well. I do not think the amount of matter (measured as mass) is actually changing, but our measure for it might change depending on our reference frame. We understand that our measure for time, and space change in relativistic sense termed dilation. Is it so unrealistic to assume that our measure for the amount of matter might change as well, that it too might be susceptible to dilation?

Why might our measure for the amount of matter change? What could cause this to happen? One plausible reason is that photons with the same intensity (amplitude), but different frequency, interacts with different amounts of space over the same time period, as shown in Figure 7. This gives the appearance, in how its modeled anyway, that one frequency is "more dense" than the other.

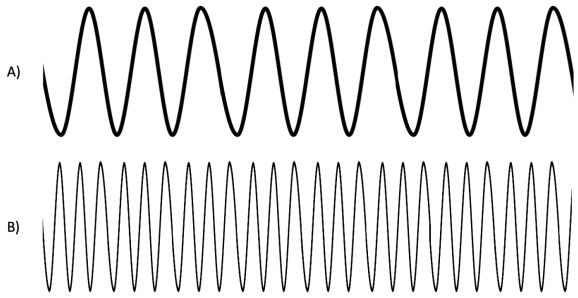


Figure 7. (A) being a smaller frequency seems "less dense" than (B).

This concept—increasing frequency increases the photon's "density"—is consistent with what is found in Equation (21b), $m \propto \frac{f}{(\tau_P^2+\tau_K^2)}$, but I acknowledge that it could be a coincidence.

What could this mean if it were the true reason? Perhaps every photon is exactly the same frequency, and the only difference that gives the appearance of a frequency change is difference in time dilation causing a shrinking of the space between wave peaks.

What if they do not all go the same speed? Maybe each photon goes so fast, a limit approaching c, that they only appear to all go the same speed. Perhaps changes in specific energy causes imperceptible difference in speed, which then causes their frequency to shift, and therefore, the space between peaks of the wave would shrink or grow accordingly.

I am not sure of the exact reason and I cannot prove these speculations, but perhaps how me measure mass has to do with the space between peaks, so how we measure their mass changes —the existing standards of measurement dilates— as the frequency changes; however, the quantity of matter remains unchanged.

If distance between peaks affects how we measure mass, then perhaps it also affects what we perceive as gravity. Maybe what we are observing with differences in frequency are differences in space-time density. Reconciling this issue satisfactorily might lead to the integration between quantum mechanics and gravity.

Some experimental observations lending to the plausibility of this theory include, refraction observations, and the energy of a photon is known to be related to its frequency and if its speed is the same, then how we measure mass might dilate (or perhaps its speed changes imperceptibly). Also, it is well established that blue light refracts more than red when changing mediums (e.g., light travels in from a vacuum and passes through something more dense like earth's atmosphere). If blue photons have a greater gravitational force, but they have the same amount of matter as red photons, it might explain why blue bends more than red.

Theory of Electromagneticgravitism

If photons are responsible for gravity, then photons are responsible for three forces: electrical forces, magnetic forces, and gravitational forces. Electromagnetism would be a special case of *electromagneticgravitism*, where each force

[3] And that this process is the only known valid method of induction.

operates orthogonality to the others, and gravitational force operates longitudinally (along the light path) as a function of the frequency of electromagnetism, which makes gravity's coupling with electromagnetism fundamentally different from the electromagnetic coupling.

It would be an interesting coincidence if photons were responsible for three forces, one force in each spatial dimension. Maybe those are the only three forces because there are only three dimensions, and the nuclear forces are actually a special case of *electromagneticgravitism*—each being a different combination of two of the three fundamental forces. These combinations are most likely electrogravitism and magneticgravitism since electromagnetism is well understood.

Matter is Comprised of Photons

If atomic particles (electron, neutron, photon, positron, etc.) were simply many structured photons then the total relativistic energy of all the photons might be $E = mc^2$. This would occur if the structure of the photons were so tightly packed that the distance between photons caused $\tau_P^2 = 1$ (we already know $\tau_K^2 = 1$ for photons).

There is compelling evidence that conventional matter (found on the periodic table) are nothing but light: every massed object emits and absorbs photon radiation constantly, and split atoms releases a significant amount of photons. It might explain why Planck's Law operates as it does, since higher energy implies higher temperature, which implies more kinetic energy for the atomic particles and more kinetic energy is related to blue shifts in photons.

If this were the case, it might lead to the discovery of certain photon structures that combine electromagnetic waves in such a manner that it causes charged patterns or magnetic patters. For example, the structure of photons comprising an electron, could be a photon structure that causes a net negative electric charge while the magnetic part cancels out completely in destructive interference. A difference structure of the same photons might create a positron, which has a positive electric charge, and no magnetic field. As another example, a certain structure of structures (structure of photons, neutrons and electrons) might disrupt the destructive interference of the magnetic part of a photon such that a magnetic field is created. Or when you consider the dynamics of electric or magnetic particles as simply moving light structures, then this might explain how electricity generates magnetism and vice versa.

Perhaps all there is is light in the universe, and the seeming variety of matter found in the periodic table of elements, and their various states, are each simply a unique structure of photons. If so, then the energy of all the photons comprising traditional matter could be $E = mc^2$. However, the released energy can only be $E = \frac{1}{2}mc^2$ because the released photons are no longer in close proximity to each other, and $\tau_P = 0$. The original object still lost mc^2 energy, because that much mass dissipated as released photons, so where did half the energy go? Half the energy was used to achieve escape velocity—i.e., to escape from neighboring photons.

If structured photons comprise matter, there may be a sense in which gravity my be caused by length contraction. First observe that change in specific kinetic energy, which causes a blue shift when moving towards something and red when moving away. A change in potential kinetic energy, which causes a blue shift when moving towards something and red when moving away. This may not be a coincidence.

Perhaps gravity is what we experience with length contraction when a photon experiences changes in its kinetic energy. If this be the case, then perhaps structured photons are constant changing direction, which by definition has to occur since the massed objects move slower than, c; otherwise, the photons would escape, and some do. Perhaps like changes in electrical flux causes a magnetic field and changes in magnetic flux causes an electrical field, the perhaps changes in electromagnetic flux causes a gravitation field via length contraction. If the center of mass had the most length contraction and it reduced as $\frac{1}{r^2}$, then this could explain what causes gravity—length contraction. Since length contraction occurred for changes in kinetic energy, then is it so hard to believe it also occurs for changes in potential energy.

Perhaps Velocity Is Just a Useful Construct

Perhaps the only states in terms of motion is a non-accelerating and an accelerating state. Perhaps velocity only serves to measure the different between the states of motion. As in, what we call velocity is only a relational measurement between two states, which is useful because it tells us how much acceleration is required to transition from on state to another.

6. CONCLUSION

In conclusion, it was proved that the common cause uniting all known forms of time dilation is changes in specific energy: specific potential energy for general relativity and specific kinetic energy for special relativity. This had significant implications causing us to update our understanding of the mass-energy equation, photon momentum, and photon mass. In addition, speculations about the nature of a photon's mass lead to a concept of mass dilation, a potential path towards integrating quantum physics and relativity, and finally to the coupling of electromagnetism with gravity, termed *electromagneticgravatism*.

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