Universal Specificity Investigation 9: The Theory of Everything... That is Light

Daniel Harris
Northrop Grumman
Morrisville, USA
daniel.harris2@ngc.com

Prior investigations into the theory of universal specificity (or specificity for short) found a proper conception of time missed in common practice; which led to the realization that a universally stationary frame (USF) must exist; which led to the discovery that for any inertial reference frame the average effective speed of light, c_0, is less than or equal to c, and equal in all directions; which led to discovering the cause of total time dilation; which led to a total specific energy model complete with specific internal energy, specific kinetic energy and specific potential energy terms; which led to a relationship between specific energy and energy, and updating the total energy model to incorporate potential energy; which finally led to a theoretical experiment capable of determining which frame is the USF.

The last remaining question to be invested in this series is: if spacetime is not a real thing, and therefore, cannot be responsible for kinetic or gravitational time dilation, as an environmental affect on objects, then what causes everything in the same reference frame to be effected by time dilation to the same degree? Addressing that question is the focus of this paper.

1. Everything is Light

What if light were the atom, i.e., the fundamental building block of matter, predicted in antiquity by Democritus [1]? What if matter as we know it, are simply entangled photons in differing structures and arrangements? That is the theory of everything that is light.

It was previously demonstrated that the average effective speed of light, c_0, is the metronome of the Universe. Recall that c_0 is caused by specific work done, as shown in Equation (1), and time dilation is governed by c_0 in Equation (2).

$$\frac{c_0}{c} = \sqrt{1 - \frac{w}{e_T}} = \sqrt{1 - \frac{\Delta e_t}{e_T}} \tag{1}$$

$$\frac{dt'}{dt} = \frac{c_0}{c} \tag{2}$$

The causal chain is thus: specific work done (in the USF), which is the prime cause, causes either an object's velocity in the USF to increase, the speed of light to decrease, or some combination of both; this causes a reduction in c_0 in the object's frame; and finally, a reduction in c_0 causes the interval over which all change occurs in the object's frame to increase. Specific work done can still properly be said to cause total time dilation, but only because of all the intermediary (and simultaneous) steps in between the primary cause and the final effect.

If everything were made of light, then it would explain why a reduction in c_0 causes everything that experiences that reduction in c_0 to also experience time dilation. The reason being, is that any duration of change would necessarily be dependent on the effective speed of light since all change involves light. Therefore, reducing the effective speed of light would increase the duration required for change to occur—all else being equal—which is the essence of time dilation (see investigation 3).

As an example of this idea, suppose it took an hour for your cup of coffee to reach room temperature in the USF (infinitely far from any gravitational source). This change in your coffee's temperature, being ultimately the response to the activity of entangled light (the stuff that makes up your coffee), occurs over the shortest duration in the USF (infinitely far from any gravitational source), being that $c_0 = c$ in that case. Now if an identical cup of coffee had a velocity with respect to the USF, then $c_0 < c$. This implies all activity happening inside the coffee that makes it cool takes more time as it takes more time for light to travel (being relatively slower) in that cup's reference frame. The resulting effect of this new situation, is that it takes longer than an hour for this cup of coffee to reach room temperature—all parts of the cup are effected by time dilation to the same degree. The same goes if the reduction in c_0 were caused by gravity instead—it makes no difference as to the cause of its reduction.

Additionally, if everything were light it could explain the increase in inertia as c_0 reduces, which is because it simply takes the quantity of matter longer to respond to a change in its motion—this is termed an object's *responsiveness*, R. The gamma term in relativistic momentum is inversely proportional to R, as shown in Equation (3).

$$p = m\gamma v = \frac{mv}{R} \tag{3}$$

An Obstacle to the Theory of Everything That is Light

The theory that everything is light is not conclusive. It lacks a method of agreement and method of difference experiment that makes inductive proof of this grand generalization possible [2]. It is based instead on an non-validated assumption, and only certain evidences are available to suggest that it might be true, not that it is true; however, the evidence is compelling enough to warrant the creation of a theory.

One glaring obstacle stand in the way of this theory seeming plausible. Light, we are told from relativity, only travels at a constant speed, c—the same c for any reference frame. This is a problem because massed objects, normally not considered to be entangled photons, are clearly not traveling at c; therefore, it presents a paradox of how could stationary objects be made up of things that move at a constant c. The solution may be as simple as they do move at c, but constantly change directions making the velocity of the overall system zero. This may be the case sometimes; however, I suspect this is not the whole solution.

Given this obstacle, this theory seems ridiculous from the perspective of relativity, but let us see what specificity has to say. Specificity gains access to two key pieces of evidences, which relativity is blocked from, that shows light does not always travel at c in the USF. Not to mention there are other observations that support the notion that everything is light.

Light Slower Than c

The two key pieces of evidence that light can travel slower than c in the USF are in the case where it is moving through a gravitational potential, and moving through a medium, which turns out to likely be the same thing.

Relativity explains gravity with the bending of spacetime which allows the light to travel at a constant c, because this bending creates more distance for the light to travel to counteract the fact that it takes more time for light to travel through a gravitational field. If one measured the radius, r, of a gravitational field some arbitrary distance away from its center, and if one measured the circumference, C, at that distance, one would find that $\frac{C}{2r} \neq \pi$. According to relativity, it is possible for light to take longer traveling through a gravitational field than around it.

Specificity does not accept spacetime as a thing that actually exists; it is only a useful model in making predictions, like using Ptolemy's model to predict celestial motion, or a flat earth model to predict short range trajectories. According to specificity, therefore, nothing is actually bending. What is happening is the base units (or units for short) being measured are changing giving the appearance of a bend. In the case of the circumference example, $\frac{C}{2r} \neq \pi$ is the result of using miscalibrated instruments. pi is unit-less so $\frac{C}{2r} = \pi$ being true, depends on the same units for distance being used for C and r. $\frac{C}{2r} \neq \pi$ implies different units were used, and a conversion is required, which specificity confirms. In this case, relativity assumed that the speed of light in a gravitational field is constant, when it really is not, which causes estimates of r based on that faulty assumption to be inflated.

A prior investigation integrated the total energy equation with changes in gravitational potential energy, and it was discovered that the velocity of objects (including light) slow down in a gravitational field by a factor of $\gamma_P^{-1} = \sqrt{1 - \frac{\Delta e_P}{e_T}}$ (see investigation 6). Light traveling slower than c is the reason why light takes longer to travel through a gravitational field. With this calibrated speed of light, c_0, used to measure r, one finds that $\frac{C}{2r} = \pi$, as expected if spacetime were not really anything. Specificity also holds that it is possible for light to take longer traveling through a gravitational field than around it, but for different reasons. This is akin to Kepler's model making the same predictions as Ptolemy's model, but for different reasons. One reason has a better causal basis than the other.

As far as refraction and the speed of light goes, a common explanation for why light slows down inside of a medium is because it bounces back and forth between atoms, essentially taking the scenic route (or taking the rabbit's approach to the tortoise and the hare's race), which is just wrong [3]. Another common, and more plausible, explanation is that electromagnetic interference to the original wave caused by a wave generated by moving electrons (moved by the original wave), makes the effective wave appear slower [3]. Thus it is said light only appears to move slower due to interference, but it really does not. This last explanation tacitly assumes that the effective wave being slower means the light passing through is also slower. If the effective wave is only a linear combination of its constituents, then if its constituents slowed down, the effective wave would go even slower, making its constituents go slower still, ad infinitum until all momentum stops. The effective wave moving slower might be a neat model to predict observation, but it does not explain why the effective wave's constituents (particularly the original wave of interest) move slower.

Specificity, however, addresses light speed inside a medium by integrating the effect of a time dilation gradient with the bending of light in refraction. The index of refraction, n, relates to gravitational inertial time differential, $\frac{dt'}{dt} = \gamma_P^{-1}$, and to $\nabla\tau^2$ as follows:

$$\text{Recall: } v' = \gamma_P v \tag{4a}$$

$$n = \frac{c}{v} = \frac{v'}{v} \tag{4b}$$

$$\therefore\ n = \gamma_P = \frac{dt}{dt'} \blacksquare \tag{4c}$$

$$\text{Recall: } g(r) = \lim_{\Delta r' \to 0} -e_T \nabla\tau^2 \tag{4d}$$

$$\text{Where: } \nabla\tau^2 = \frac{\tau^2}{\Delta r} = \frac{\left(1 - \left(\frac{dt'}{dt}\right)^2\right)}{\Delta r} \tag{4e}$$

$$\therefore \nabla\tau^2 = \frac{\left(1 - \frac{1}{n^2}\right)}{\Delta r} \blacksquare \tag{4f}$$

What this tells us is that at the threshold, from one medium to another, there is a time differential gradient (TDG)which causes the light to refract and slow down, due to specific work done, just like with gravity. This would explain why material density is correlated to refraction index, because denser objects exhibit a higher specific potential energy within the material, making the TDG more extreme.

Now, the values of τ in the gravitation examples from previous investigations were extremely small (see investigation 5). For example, in the studied case on earth's surface $\tau = 4.67 \times 10^{-5}$, which means $n \approx 1$. In contrast, consider the material with highest discovered index of refraction, which is $n = 38.6$ [4], which would mean $\tau = 0.9997$, or five orders of magnitude higher than the earth's gravity case.

Not to mention in our gravitation examples the distance measuring the TDG were on the order of kilometers, meaning the grade of the TDG was quite shallow. Whereas the TDG at the threshold of two mediums is practically a step function, implying the TDG is close to a step function. This would explain the "kink" (apparent infinite acceleration) in the light path during refraction, and the arc of the light path for gravitation. This would also explain why light only bends at the threshold (i.e., Snell's Law)—the TDG is zero everywhere else inside the medium.

The similarities between refracted light and light in gravity continue. The wavelength decreases (blue shift) as light passes into a gravitational field, just as it does when it passes into a medium, while maintaining its frequency. In fact, it is the same shift. The relationship between the wavelength in a medium, λ', the wavelength in empty space, λ, and the index of refraction, n, is given by Equation (5).

$$\frac{\lambda}{\lambda'} = n \tag{5}$$

Which means the relationship between the wavelength near a gravity source, λ', the wavelength in empty space, λ, and changes in specific potential energy, Δe_P, is given by Equation (6), which matches observation.

$$\frac{\lambda'}{\lambda} = \sqrt{1 - \frac{\Delta e_P}{e_T}} \tag{6}$$

Additionally, certain works [6] in general relativity relate equations of motion via refraction and general relativity and found that they were the same equations of motion stating, "the equations of motion for [refracted] light are formally identical to those predicted by general relativity." However, they do not attempt to integrate the two as the same phenomenon as I did for probably obvious reasons—refraction is clearly not caused by spacetime bending, while gravity is believed to be.

Much would be explained about refraction if everything were light. What remains unexplained, however, is why different frequencies of light bend different amounts during refraction, while they appear to bend the same amount with gravity. It actually may mean that light of differing frequencies do bend differently for gravity too, but the effect is so small that it goes unnoticed, or perhaps there is some other reasonable explanation. As to why the refractive index is different for different frequencies, which causes dispersion, I do not know for certain, and this will have to remain a question to be answered by future work.

Thus, gravitation and refraction, which were once considered separate phenomena, are now one step away from being united under a common cause—specific work done.

Given the observations of light's speed change in a gravitational field and in cases of refraction we know that light can, and does, travel at slower speeds than c in the USF; therefore, specificity hurtles over that obstacle with ease. Things made of light travel slower than c because light travels slower than c.

Other Observations

Other observations, serving as evidence supporting the notion that everything is light, will be quickly listed and described.

- All objects emit and absorb light constantly
- The food chain begins with light emitted from a process of fusion
- The speed of light limits all things.
- $e_T = \frac{1}{2}c^2$

It seems reasonable that when dissecting an object to determine what it is made of, that the conclusion ought to be based on what is found. All physical objects in the universe absorb and emit light in accordions with Planck's Law and their spectral emissivity. Does it not seem reasonable to conclude based on this observation that all things could be made up of light?

Not to mention, according to current orthodoxy, "annihilated" matter results in energy (a.k.a., gamma rays, a.k.a. light). Matter completely decomposed produces light. We were not that far from concluding that light was there all along. $E = \gamma m_0 c^2$ is considered the mass-energy equivalence formula; therefore, perhaps, E is the energy of the light, c is the speed of the light, and γm_0 is the inertia of entangled light.

To take it another step, all living organisms require food for energy, which fundamentally can be traced back to the sun as its source via plants and photosynthesis. It has been said that we are all made of stardust [5]. Well, starlight is the source of our energy, so maybe we are ultimately made of starlight.

This next point basically repeats a previous point, but now it is used explicitly as evidence. Why would the speed of light be a limit to all things unless everything were light? In contrast, the speed of sound does not limit everything because not everything is sound.

Total specific energy is $e_T = \frac{1}{2}c^2$. This is interesting, because it suggests that all objects have the potential to achieve a motion of c when $e_I = \Delta e_P = 0$—it would not violate any known laws of physics (all else being equal). If everything were all light, and all the entangled light of an object were released via radiation, then all of its matter would have achieved c.

More evidence exists, but these were the most interesting to consider.

2. Transforming Light Into Matter

The only way for light to transform into matter appears to be for light to be within sufficiently close proximity to other light causing each to slow down sufficiently via mutual gravitational time dilation. That way both become entangled by each others gravitational fields. The light is now part of a larger system governed by the system's specific internal, specific kinetic and specific potential energy. This occurs on a galactic scale all the time, when light is absorbed by objects, and during stray opportunities where light meets in the vastness of space.

The reverse of this process appears to be whenever light breaks its entanglement and radiates outward. The light stops being a part of the larger system by removing its contribution to that system's mass and its energy becomes fully kinetic. This too occurs all the time via thermal radiation.

The total specific energy equation fully describes the process by which light is captured (e.g., kinetic$\rightarrow$internal), and emitted (e.g., internal$\rightarrow$kinetic). In fact anything in thermal equilibrium is doing both in equal amounts of energy.

3. Conclusion

In conclusion, a compelling theory (based on a non-validated assumption) for why all objects in the same reference frame are affected by time dilation to the same degree is because everything is light. That way, when the effective speed of light reduces, it creates an increase in the duration for any change to take place, thus causing time dilation to everything to the same degree. Observational evidence supports this theory because according to specificity, light can move slower than c; therefore, it avoids paradoxes that would otherwise arise on the basis of relativistic assumptions.

Additionally, under specificity, it was found that gravitation and refraction are one step away from being integrated under a common cause—specific work done. All that remains is to discover why indexes of refraction is a function of frequency.

This concludes this series of investigations into the theory of universal specificity.

References

[1] S. Berryman, *Democritus*, Stanford Encyclopedia of Philosophy, 07-Jan-2023. [Online]. Available: https://plato.stanford.edu/entries/democritus/. [Accessed: 22-Feb-2023].

[2] D. Harriman, *The Logical Leap: Induction in Physics*, NYC: Berkley, 2010.

[3] fermilab, *Why does light slow down in water?*, YouTube, 20-Feb-2019. [Online]. Available: https://www.youtube.com/watch?v=CUjt36SD3h8. [Accessed: 16-Feb-2023].

[4] *Metamaterial breaks refraction record*, Physics World, 29-Aug-2017. [Online]. Available: https://physicsworld.com/a/metamaterial-breaks-refraction-record/. [Accessed: 16-Feb-2023].

[5] *Are we really made of stardust?*, Natural History Museum. [Online]. Available: https://www.nhm.ac.uk/discover/are-we-really-made-of-stardust.html. [Accessed: 23-Feb-2023].

[6] K. BROWN, *Refractions on Relativity*, in Reflections on relativity, LULU COM, 2018.