The Proper Light Speed (PLS)

(A unification of Gravity, Quantum Mechanics, and Light propagation)

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Abstract

General relativity is perhaps one of the most successful theories in all of physics. While it accurately predicts gravitational redshifting, gravitational lensing, black holes, and more, it fails to be compatible with quantum mechanics due to how each theory deals with scale and energy differences; space and time; singularities; and entanglement. Therefore, GTR and QM are not compatible at the most fundamental of levels. This article proposes a different structure than spacetime in which to apply the principles of QM where the aforementioned issues are resolved and experimental results in both GTR and QM are still accurately predicted. This model explains the results in QM, GTR, and the Michelson Morley experiment in terms of a variable speed of light by recognizing the difference between time and clock speed, and between what is real and what is observed. It is recommended that one read the "Theoretical Framework: Key Concepts" section with an open mind before deciding on the validity of this theory.

Theoretical Framework: Key Concepts

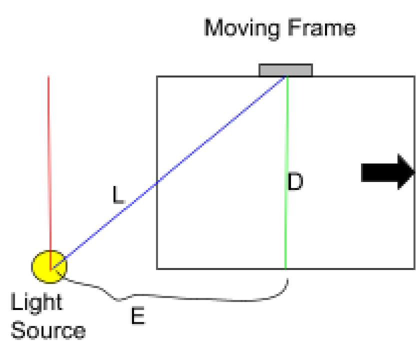


Figure 1: This is the typical setup for deriving the equations of time dilation in special relativity. The blue line represents the path of light from the stationary reference frame to the moving reference frame. At the moment that the moving frames mirror is directly over the light source, a flash occurs producing the red and blue photon paths. The moving reference frame travels just fast enough to ensure the blue line hits the mirror.

In Figure 1 there is the setup for the typical derivation of time dilation in special relativity. As the moving frame goes from left to right, at the moment that the center of the mirror in the moving frame is directly over the light source, a flash occurs. Two photons are emitted, one in the vertical direction (red) and one up and to the right (blue). In special relativity, the green line is treated as if it were the red line because the speed of light is the same in all reference frames. Thus:

$$\mathrm{L} = \mathrm{c}\ dt,\ \mathrm{D} = \mathrm{c}\ d\boldsymbol{\tau},\ \mathrm{E} = \mathrm{v}\ dt$$

$$\therefore L^2 = D^2 + E^2 \Rightarrow (c\ dt)^2 = (c\ d\boldsymbol{\tau})^2 + (v\ dt)^2$$

Simplifying yields:

$$d\boldsymbol{\tau} = dt * \sqrt{1 - (\frac{v}{c})^2} \quad (1)$$

Leading to the conclusion that time itself is malleable. Now consider the same setup with the following interpretation. The green line in Figure 1 is simply the vertical component of the blue line representing the vertical component of the photon's path. This means that the observer in the moving reference frame only sees the vertical component of the light and thus in the moving reference frame, the speed of light is slower. The equations are as follows:

$$\mathrm{L} = c\ dt,\ \mathrm{D} = c_0\ dt,\ \mathrm{E} = \mathrm{v}\ dt$$

$$\therefore L^2 = D^2 + E^2 \Rightarrow (c\ dt)^2 = (c_0 dt)^2 + (v\ dt)^2$$

Simplifying yields:

$$c_0 = c * \sqrt{1 - (\frac{v}{c})^2} \quad \text{(STR analog, 2)}$$

Where:

R_{zero}: This is the reference frame having zero-g (and no velocity).

R_0: This is the moving reference frame located anywhere.

R_s: This is a stationary reference frame located anywhere.

c: This is the speed of light in the R_{zero} RF. This is also the speed of light that is measured locally in any RF as all RF's measure the speed of light to be the same.

c_0: This is the proper speed of light in the R_0 RF. It is the real speed of light in the R_0 RF.

t: This is the clock speed in the R_{zero} RF. This is also the locally measured clock speed in the R_0 RF.

$\boldsymbol{\tau}$: This is the real clock speed in the R_0 RF.

From equations 1 and 2, when the proper time $\boldsymbol{\tau}$ decreases, the speed of light is actually what decreases and therefore:

$$c_0 dt = \mathrm{c}d\boldsymbol{\tau} \quad (3)$$

It follows that $\boldsymbol{\tau} = \boldsymbol{\tau}(c_0)$ is a function of the proper speed of light. When the proper speed of light changes, the rate of propagation of all fundamental forces changes proportionally resulting in the clock speed changing. This clock speed change isn't noticed in the R_0 RF because everything, including all biological processes, utilize these same fundamental forces. To an observer in a different RF, with a different proper speed of light, the appearance of time dilation/contraction occurs. It turns out that the clock speed $\boldsymbol{\tau}(c_0)$ is the proper time of GTR. The proper time of GTR is simply a change in clock speed caused by a change in the rate of propagation of the force carriers, due to a change in the proper speed of light. It follows that since $\mathrm{c}d\boldsymbol{\tau} = \sqrt{g_{\mu\nu} dx^{\mu} dx^{\nu}}$ in GTR, from equation (3),

$c_0\, dt = \sqrt{g_{\mu\nu} dx^{\mu} dx^{\nu}}$, and therefore:

$$c_0 = \sqrt{g_{\mu\nu} \frac{dx^{\mu}}{dt} \frac{dx^{\nu}}{dt}} \quad \text{(GTR analog, 4)}$$

where $g_{\mu\nu}$ is the metric tensor. A clock moving at the local speed of light has a clock speed of zero, and so the proper speed of light from a photon's RF is always zero. Therefore:

$$[c_0 = 0] = \sqrt{g_{\mu\nu} \frac{dx^{\mu}}{dt} \frac{dx^{\nu}}{dt}} \quad \text{(Photon, 5)}$$

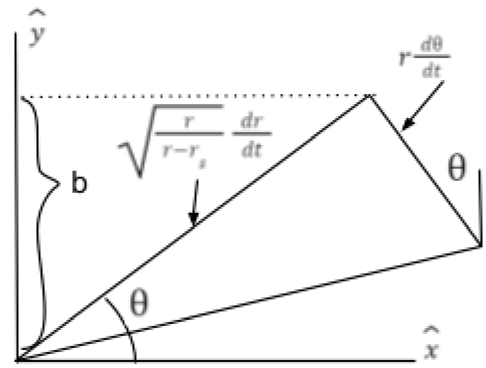
Using the Schwartzchild metric, with $\boldsymbol{\varphi} = 0$, yields:

$$c_0 = \sqrt{\frac{r - r_s}{r} c^2 - \frac{r}{r - r_s} v^2 - r^2 (\frac{d\theta}{dt})^2} \quad \text{(Schwarzschild } \boldsymbol{\varphi} = 0\text{, 6)}$$

Therefore the local speed of light in the R_s RF is (c_0= C):

$$\mathrm{C} = \sqrt{\frac{r - r_s}{r}}\, c \quad \text{(Schwartzchild - stationary, 7)}$$

Figure 2: This figure shows how the components of equation (6) fit geometrically. For a mass positioned at (0,0), a photon released in the x-direction from (x=0, y=b) will curve downwards.



When photons travel in a plane through the COM, equation (6) results in:

$$\frac{r-r_s}{r}c^2 - \frac{r}{r-r_s}\left(\frac{dr}{dt}\right)^2 - r^2\left(\frac{d\theta}{dt}\right)^2 = 0 \quad (8)$$

From Figure 2, we see that the components of equation (8) can be summed in each direction as:

$$C = \left|\left< \frac{dx}{d\boldsymbol{\tau}} = \sqrt{\frac{r}{r-r_s}}\frac{dr}{dt}cos(\theta) - r\frac{d\theta}{dt}sin(\theta),\ \frac{dy}{d\boldsymbol{\tau}} = \sqrt{\frac{r}{r-r_s}}\frac{dr}{dt}sin(\theta) + r\frac{d\theta}{dt}cos(\theta) \right>\right| \quad (9)$$

Notice that $\boldsymbol{\tau}$ is used instead of t. Dividing the x-component in equation (9) by dx, squaring both sides, and multiplying by $\partial^2 E_x$ yields:

$$\left[\sqrt{\frac{r}{r-r_s}}\frac{dr}{dt}cos(\theta) - r\frac{d\theta}{dt}sin(\theta)\right]^2 \frac{\partial^2 E_x}{\partial x^2} = \frac{\partial^2 E_x}{\partial \boldsymbol{\tau}^2} \quad (10)$$

Repeating the same process for the y-component yields:

$$\left[\sqrt{\frac{r}{r-r_s}}\frac{dr}{dt}sin(\theta) + r\frac{d\theta}{dt}cos(\theta)\right]^2 \frac{\partial^2 E_y}{\partial y^2} = \frac{\partial^2 E_y}{\partial \boldsymbol{\tau}^2} \quad (11)$$

Equations (10) and (11) are equations for light propagation in a gravitational field where the light is traveling through some plane going through the COM. Notice that when r_s = θ = 0 equation (10) yields:

$$c^2\frac{\partial^2 E_x}{\partial x^2} = \frac{\partial^2 E_x}{\partial t^2} \quad \text{(Wave eq for light in zero-g, } \hat{x} \text{ - direction)}$$

Likewise, when r_s = 0, and θ = $\frac{\pi}{2}$, equation (11) yields:

$$c^2\frac{\partial^2 E_y}{\partial y^2} = \frac{\partial^2 E_y}{\partial t^2} \quad \text{(Wave eq for light in zero-g, } \hat{y} \text{ - direction)}$$

Using equation (11) with θ = $\frac{\pi}{2}$, and y = r yields:

$$\left[\sqrt{\frac{r}{r-r_s}}\frac{dr}{dt}\right]^2 \frac{\partial^2 E}{\partial r^2} = \frac{\partial^2 E}{\partial \boldsymbol{\tau}^2} \quad (12)$$

Since there aren't any rotational velocities, equation (8) tells us that $\frac{r-r_s}{r}c^2 = \frac{r}{r-r_s}\left(\frac{dr}{dt}\right)^2$. Thus, equation (12) becomes:

$$\frac{r-r_s}{r}c^2\frac{\partial^2 E}{\partial r^2} = \frac{\partial^2 E}{\partial \boldsymbol{\tau}^2} \quad (13)$$

Setting E = ᚱ(r)$\mathbf{T}(\boldsymbol{\tau})$, the differential equation for ᚱ(r) is:

$$\frac{d^2\Re(r)}{dr^2} = -\,[k^2\frac{r}{r-r_s}]\Re(r) \quad (14)$$

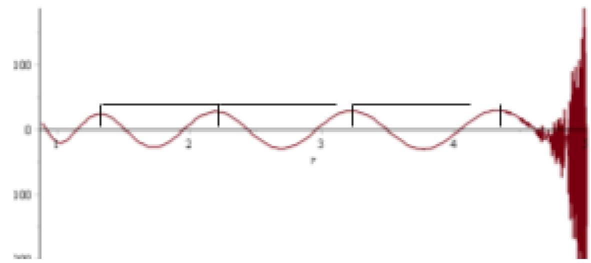


Figure 3: The black strips are the same length, thus, this figure shows a gravitational redshift as the light gets further from the event horizon on the left. The noise on the right-side is believed to be attributed to the complexity of the Whittaker functions, and is not believed to be accurate.

The solutions for equation (14) are Whittaker functions shown in figure 3 for arbitrary values simply to show the shape. As you can see from the red and blue stripes, gravitational redshifting occurs as the photon gets further and further from the event horizon (EH). From equation (14), $k\sqrt{\frac{r}{r-r_s}} = \frac{2\pi}{\lambda}$. Thus:

$$\lambda = \frac{2\pi}{k}\sqrt{\frac{r-r_s}{r}} = \lambda_\infty\sqrt{\frac{r-r_s}{r}} \quad (15)$$

Where equation (15) is the exact relationship between λ and λ_∞ predicted in GTR. Notice that equation (13) can be written as:

$$[c_0]^2\frac{\partial^2 E}{\partial r^2} = \frac{\partial^2 E}{\partial \boldsymbol{\tau}^2} \quad (16\ )$$

Where $C = c_0$ is not from the photons perspective ($c_0 = 0$), it is from the R_s RF where the photon passes. This is important because when equations of physics are written in terms of c_0 and $\boldsymbol{\tau}$, the physics holds everywhere.

In the R_s RF, C = $f\boldsymbol{\lambda}$, and using equations (7) and (15), this results in:

$$f_{real} = \frac{\sqrt{\frac{r-r_s}{r}}\,c}{\lambda_\infty\sqrt{\frac{r-r_s}{r}}}$$
$$= \frac{c}{\lambda_\infty}$$
$$= const$$

However, every RF measures the local speed of light to be c due to clock speed dilation, and therefore what is measured is c = $f\boldsymbol{\lambda}$. Using equations (7) and (15) again, this results in:

$$f_{meas} = \frac{c}{\lambda_\infty\sqrt{\frac{r-r_s}{r}}}$$
$$= \frac{c}{\lambda_\infty}\sqrt{\frac{r}{r-r_s}}$$
$$= f_i\sqrt{\frac{r}{r-r_s}}$$

It follows that what is really happening in the R_s RF is described by C = $f_{real}\boldsymbol{\lambda}$, and what is measured from the R_s RF is described by $c = f_{meas}\boldsymbol{\lambda}$. The real energy of the photon is therefore $E_{real} = \frac{c}{\lambda_\infty}h$ which does not change, and the energy that is measured is $E_{meas} = [\frac{c}{\lambda_\infty}h]\sqrt{\frac{r}{r-r_s}}$. E_{real} is constant because even though the wavelength decreases with r, the actual speed of light C slows down as well and those differences exactly cancel. It follows that:

$$E_{meas} = E_{real}\sqrt{\frac{r}{r-r_s}} \quad \text{(photon viewed from the } R_s \text{ RF, 17)}$$

What this means is that the energy that is really involved (E_{real}) is quantized by h, and the energy that is measured (E_{meas}) is not since h$\sqrt{\frac{r}{r-r_s}}$ is continuous for all r > r_s. So quantum mechanics says that everything is quantized, and the PLS theory says that that quantization is real but the measurement of it can be as if it is continuous due to light speed dilation. This is the key to uniting QM with experimental results of GTR: the difference between what is real and what is measured.

PROPERTY VALUES OF A **PHOTON** AS r DECREASES (AS VIEWED FROM THE R_s RF)					
	Speed of light	Clock Speed	λ	f	Energy
Real (R_s RF)	Decrease C = $\sqrt{\frac{r-r_s}{r}}\, c$	Decrease d$\boldsymbol{\tau}$ = $\sqrt{\frac{r-r_s}{r}}\, dt$	Decrease $\lambda = \lambda_\infty\sqrt{\frac{r-r_s}{r}}$	Constant $f_{real} = \frac{c}{\lambda_\infty}$	Constant $E_{real} = [\frac{c}{\lambda_\infty}h]$
Measured (R_s RF)	Constant c	Constant Change t	Decrease $\lambda = \lambda_\infty\sqrt{\frac{r-r_s}{r}}$	Increase $f_{meas} = \frac{c}{\lambda_\infty}\sqrt{\frac{r}{r-r_s}}$	Increase $E_{meas} = [\frac{c}{\lambda_\infty}h]\sqrt{\frac{r}{r-r_s}}$
Table 1: Shows the relationship between the given quantities as r decreases, when viewed from the R_s RF. Notice that both the speed of light and the proper time scale the same.					

In table 1 above, a presentation of how the real and measured quantities change with a decrease in r-value. Notice that the real energy remains constant, while the measured energy increases. The real energy is quantized; and the measured energy is quantized for a given r-value but it is continuous with r. As a particle approaches an EH: 1) the measured energy in that RF approaches infinity; 2) the measured clock speed in that RF is t; 3) the real energy in that RF remains constant; 4) and the real clock speed becomes zero. Equations () and () can then be used to write $E_{meas} = \frac{c}{C}E_{real}$ which can be rewritten for the R_0 RF as:

$$E_{meas} = \frac{c}{c_0}E_{real} \quad \text{(photon traveling in and viewed from the } R_0 \text{ RF, 18)}$$

Without length contraction, velocity scales with c_0. Therefore:

$$v_{real} = v_{meas}\frac{c_0}{c} \quad (19)$$

Starting with $E = \sqrt{p^2c^2 + m^2c^4}$:

$$E_{meas} = \sqrt{m^2v_{meas}^2c^2 + m^2c^4}$$

$$= cm\sqrt{v_{meas}^2 + c^2} \quad (20)$$

And

$$E_{real} = \sqrt{m^2v_{real}^2c_0^2 + m^2c_0^4}$$

$$= \sqrt{m^2(v_{meas}\frac{c_0}{c})^2c_0^2 + m^2c_0^4}$$

$$= mc_0\sqrt{(v_{meas}\frac{c_0}{c})^2 + c_0^2}$$

$$= mc_0^2\sqrt{(v_{meas}\frac{1}{c})^2 + 1}$$

$$= m\frac{c_0^2}{c}\sqrt{v_{meas}^{\ \ 2} + c^2} \quad (21)$$

Therefore:

$$E_{meas} = (c^2/c_0^2)E_{real}$$ (particle with mass, in and viewed from the R_0 RF, 22)

The Schrodinger Equation represents an observable (measured), and the Hamiltonian is the energy term. Therefore:

$$i\hbar\frac{\partial\Psi}{\partial t} = [-\frac{\hbar^2}{2m}\nabla^2 + V(..., t, c)]\Psi$$ (measured-particle in and viewed from the R_0 RF: Ψ(t,c), 23)

$$i\hbar\frac{\partial Y}{\partial \boldsymbol{\tau}} = [-\frac{\hbar^2}{2m}\nabla^2 + V(..., \boldsymbol{\tau}, c_0)]Y(\frac{c_0}{c})^2$$ (real-particle in and viewed from the R_0 RF: Y($\boldsymbol{\tau}$,c_0), 24)

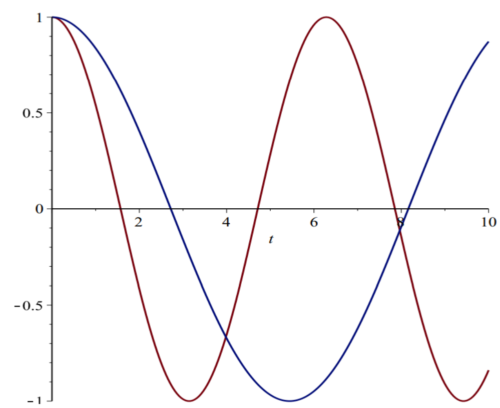
Equation (23) is written in terms of (t, c) to represent that the speed of light is always locally observed as c, and time is always locally observed as t. Equation (24) changes c to c_0, and t to $\boldsymbol{\tau}$ as those are the real values locally, and the $(\frac{c_0}{c})^2$ term is added to the energy term as required by equation (22). As an example, set V = 0, and Ψ = Ψ(r) for a particle in and measured from the R_s RF:

Measured: Ψ = R(r)T(t), $T(t) = Ae^{-ik^2t}$, $R(r) = A_1 sin(\sqrt{\frac{2m}{\hbar}}kr) + A_2 cos(\sqrt{\frac{2m}{\hbar}}kr)$:

Real: Y =$\underline{R}$(r)T($\boldsymbol{\tau}$), $T(\boldsymbol{\tau}) = Ae^{-ik^2\boldsymbol{\tau}}$, $\frac{d^2}{dr^2}(\underline{R}(r)\frac{r-r_s}{r}) = \frac{-2mk^2}{\hbar}\underline{R}(r)$: With the following solution:

$$\underline{R}(r) = B_1 e^{-ikr\sqrt{2m/\hbar}} * r * KummerU(1 + i\sqrt{\frac{m}{2\hbar}}kr_s, 2, 2i\sqrt{\frac{2m}{\hbar}}k(r - r_s)) +$$
$$B_2 e^{-ikr\sqrt{2m/\hbar}} * r * KummerM(1 + i\sqrt{\frac{m}{2\hbar}}kr_s, 2, 2i\sqrt{\frac{2m}{\hbar}}k(r - r_s))$$

Figure 4: In this plot, T(t) is plotted in red, and since $T(\boldsymbol{\tau})$ is the same function with a different parameter, it is not graphed here. Instead, $T(\boldsymbol{\tau} \rightarrow \sqrt{1 - \frac{r_s}{r}}t)$ is plotted as a function of t to model what an observer in the R_{zero} RF would observe. From the R_{zero} RF, the time component of the R_s RF would appear "drug out" as if everything were slowing down. At r = r_s, $T(\sqrt{1 - \frac{r_s}{r}}t)$ = A. The EH is at $r_s = \frac{1}{2}$.



In Figure 4, T(t) (red) represents what is measured in the R_s RF. Since all reference frames measure the same speed for light locally due to clock speed dilation, the measured time component T(t) is the same function as the real time component T($\boldsymbol{\tau}$) just with a different parameter. The blue wave is a plot of $T(\boldsymbol{\tau} \rightarrow \sqrt{1 - \frac{r_s}{r}}t)$, representing what an observer in the R_{zero}RF would see occurring in the R_s RF. Those events appear slowed down. It is important to note that the r in $\boldsymbol{\tau} = \sqrt{1 - \frac{r_s}{r}}t$ is the r-value of the R_s RF.

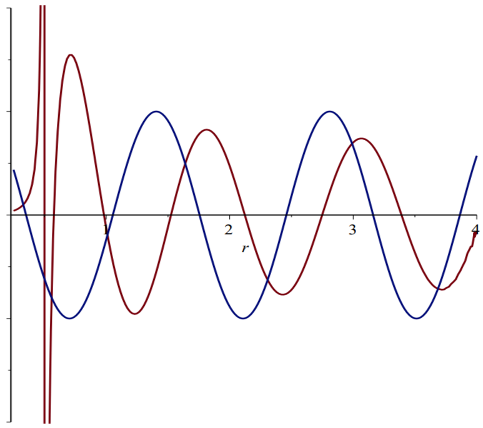


Figure 5: R(r) (blue) represents the measured value in the R_s RF, and $\underline{R}(r)$ (red) represents what is really happening in the R_s RF. The real wavelength decreases, while the measured wavelength remains constant. The EH is at $r_s = \frac{1}{2}$.

In figure 5, $\underline{R}(r)$ (red) represents the real wave function in the R_s RF, and $R(r)$ is the observed wave function in the R_s RF. The real wavelength decreases as the particle approaches the EH, while the measured wave function remains constant.

PROPERTY VALUES OF A **PARTICLE** AS r DECREASES (AS VIEWED FROM THE R_s RF)			
	λ	f	Energy
Real (R_s RF)	Decrease	Unknown $f = \frac{c_0}{\lambda}$	Decrease $E_{real} = m\frac{c_0^2}{c}\sqrt{v_{meas}^2 + c^2}$
Measured (R_s RF)	Constant $\lambda = \frac{pi}{k}\sqrt{\frac{2\hbar}{m}}$	Constant $f = \frac{c}{\lambda}$	Constant $E_{meas} = cm\sqrt{v_{meas}^2 + c^2}$
Table 2: Shows the relationship between the given quantities as r decreases, when viewed from the R_s RF.			

Notice that a particle in the R_{zero} RF has a given energy, and as the particle moves towards an EH, the measured energy remains the same locally, but the real energy goes to zero. Therefore a particle with mass has no energy at the EH.

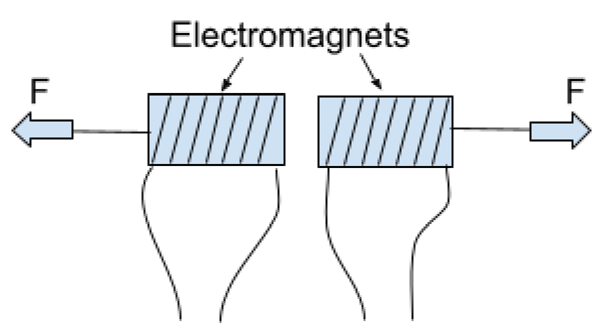


Figure 6: Two electromagnets are each connected to a rope that is used to apply a force F. The electromagnets are then connected to then disconnected from a battery with a frequency f. The slower the frequency, the longer the off state resulting in less force needed to separate them. This is analogous to the speed of light slowing down resulting in the slowing down of the force carriers.

Now consider the following analogy: Two electromagnets as depicted in Figure 6, are pulled in opposite directions with a force F. The electromagnets are then turned off and then on at a frequency of f. The slower the frequency, the longer the off state, therefore the smaller the force needed to separate them. This is analogous to the propagation speed of the force carriers (photons) slowing down. The slower the force carriers, the weaker the force needed to pull the magnets completely apart. This suggests that the gravitational forces are:

$$F_{real} = \frac{GmM}{r^2}\frac{(r-r_s)}{r} \quad (25)$$

$$F_{meas} = \frac{GmM}{r^2} \quad (26)$$

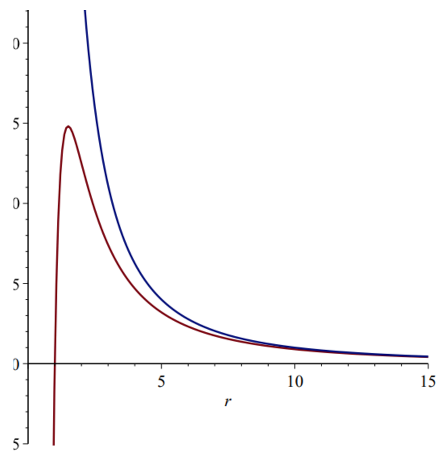


Figure 7: In this figure, F_{real} is depicted in red, and F_{meas} in blue. The two forces are nearly identical until just before the EH, where F_{meas} continues to increase, while F_{real} drops to 0. Inside the EH, F_{real} is negative indicating that a particle found inside is forced outwards.

From figure 7, F_{real} (red) and F_{meas} remain very similar up until right before the EH. F_{meas} gets very large, and F_{real} drops to 0. A particle headed towards the EH feels a tremendous force that tapers off and then drops to 0. F_{real} is negative inside of the EH implying that a particle trapped inside during the black hole's formation is pushed outwards to the EH and therefore a black hole doesn't have any singularities.

The index of refraction of space can conveniently be written as:

$$n = \frac{c}{c_0} = c\left[\sqrt{g_{\mu\nu}\frac{dx^{\mu}}{dt}\frac{dx^{\nu}}{dt}}\,\right]^{-1} \quad (27)$$

The PLS theory allows for the derivation of Maxwell's Eqs in a gravitational field, and it unifies quantum mechanics with experimental results of GTR. It turns out that time is not relative, but the speed of light is.

Fine-Tuning the Model: A Metaphysical Argument Of Key Concepts

Suppose that y exists and x = 0. Then k components of $\frac{y}{k}$ must also exist for each k $\in$ N. Since $[\lim_{k\to\infty} k(\frac{y}{k}) = y] \neq [\infty(x) = x]$, $(\frac{y}{k}) \nLeftrightarrow$ (x) proving that y cannot be produced from even an infinite amount of nothing. This can be summed up with the following diagram where an infinite number of 0’s still results in 0.

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.
.
______________________________ 0 ______________________________……
_______________0______________ + ______________ 0 ______________ ……

$$\frac{0}{(0+0)+(0+0)} + \frac{0}{(0+0)+(0+0)} + \frac{0}{(0+0)+(0+0)} + \frac{0}{(0+0)+(0+0)} \ldots\ldots$$

One could argue that x is not required to follow laws of physics or logical principles and therefore anything is possible to occur, but x doesn't exist for it to matter. It is therefore an existence problem, not a logical one. This is explained in more detail in P_2. It follows that since existence exists, existence has always existed. A less philosophical way of stating this is that the fundamentals for that which currently exists, have always existed, and therefore they cannot be created or destroyed, they can only permute.

With that said, the only option is that time is simply the ability for change: It is not a dimension, it is a property of existence ("things" have the ability to change). The property of time allows the fundamentals that have always existed to permute. Since time is a property of existence, the force carriers propagate inside of the clock causing the clock to tick, and we measure events against the ticking of the clock. Since the force carriers cause the clock to tick, we effectively measure events by how far those force carriers propagated inside the clock between the events. This is confusing because it means that a clock doesn't measure time, it measures how far the force carriers traveled between events due to them having the property of time (One might conclude that the units of c are therefore dist/dist.). When referencing the "passing of time" or "time being eternal", such terminology references the fact that existence has always existed and time is a property of existence, and therefore the property of time has always existed.

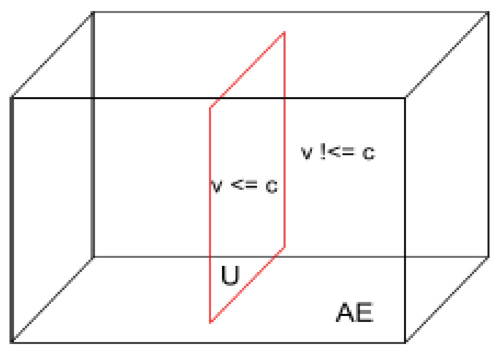
Since you cannot produce something from nothing, we define all existence (AE) as the set of fundamentals that have always existed. Since AE has always existed, it doesn't violate causality. At some place within AE the properties of our universe that are described by our laws of physics became defined, and the local speed of light became non-zero. The universe then began to organize itself from fundamentals, based on these physical properties, in a manner that is consistent with the evolutionary processes described by science. It follows that the observable universe is a subset of AE, and is therefore not all that exists. As predicted by the Big Bang model, after it begins, the universe starts to cool down resulting in the formation of particles, atoms, and the cosmic microwave background radiation (not from nothing). Eventually stars and galaxies form due to the pull of gravity, planets emerge from orbiting dust clouds, and abiogenesis/evolution begin to play out. Notice how each of these steps only occur due to the physical properties of the universe: without these physical properties nothing happens. We can test these physical properties with science, but such tests only help us to understand what the physical properties are, not why they exist in the first place. We therefore need a model that explains why the physical properties of the universe are what they are. It is important to note here the difference between laws of physics and logical principles. Any consistent set of laws of physics that tell fundamentals how to permute could theoretically apply to a universe, but at no point could a universe be inconsistent with logic. This is an important distinction. Just because different laws of physics might be viable, doesn't mean that different rules of logic are. Consider the following:

Any universe that emerges is a subset of AE as if this is not the case, said universe would need to be created from nothing. Assume that our universe emerged through natural processes. Since our universe emerged, it follows that with time being eternal other universes have emerged as well within AE. It follows that remnants of said universes would statistically be observable in our cosmological data in the form of galaxies and light headed towards us from all over. Since we do not observe these remnants in our cosmological data, it follows that the universe didn't emerge through natural means. While there are specific cases to consider, like the universe existing as a singularity for an eternity before "erupting", each of these violate known logical principles as shown further down in the article in more detail. Now, if such data were to be found, this could change the conclusion, but so far no indication of such data is known to the author. Since a universe emerging through natural means doesn't fit the cosmological data, it follows that the universe emerged through unnatural means. Now, please don't hate the author. You are welcome to point to any spot in which there is a mistake, and if you can't do that, then perhaps consider that what is stated is accurate.

Since time is a property that has always existed, if it is possible, it is guaranteed that at some point fundamentals naturally come together to form G. Given an infinite period, anything that can happen will happen (with constraints of course), so if it is possible for G to exist, then it is guaranteed that G exists. We now take the infinite period T in which AE exists, and we divide it into 2 infinite periods T_1 and T_2, where T_1 precedes T_2. Since T_1 is infinite, if the natural formation of G is possible then statistically it is guaranteed to have occurred in T_1. Since T_1 precedes T_2, and T_2 is infinite, the formation of G occurred an infinite time ago. Thus, no matter how far back in time you theoretically look, G has always existed. By this same logic, if it is possible for G to learn everything, become perfect, or develop rules that statistically yield the best outcome, then this was done an infinite time ago. Just to be clear, logically speaking, if G can be created naturally then we could just skip G and assume the universe could be naturally occurring. The problem is that this approach doesn't match the data as explained above, but if such data were to be found then this would be reasonable but unfortunately not conclusive. It follows that G must be the cause of the physical properties of the universe that cause it to organize itself.

The remaining part of the overview is not a mathematical derivation, it is a means of interpreting the results of quantum mechanics in terms of the framework mentioned above.

Figure 8: All Existence (AE) is represented by the 3D box, and the universe U is represented by the red plane contained within. The laws of physics hold inside of U, but not necessarily in AE\U.



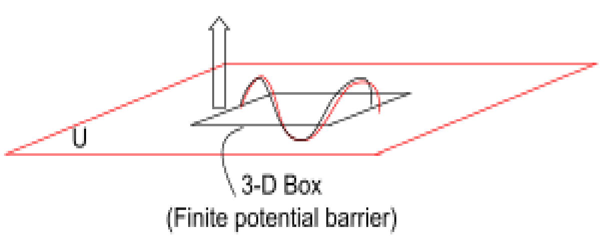


Figure 9: The universe U as depicted in Figure 8 with a semi-plane contained inside representing a 3D box of finite potential barrier. The wave function of a particle contained inside is represented by the black wave, and it extends perpendicular to U in a higher dimension. At some point, a perturbation occurs in the wave resulting in the endpoints extending past the barrier (red wave) causing quantum tunneling.

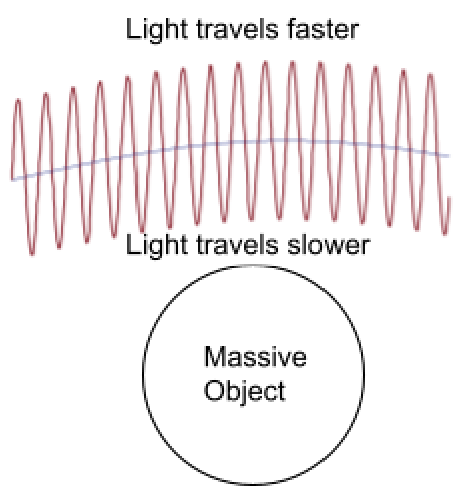
Since time is not a dimension, the structure of the universe is different from that predicted by general relativity, and thus quantum mechanics must also be interpreted differently. Consider that shown in Figure 8 where AE is represented by a 3D box, and the universe U is represented by a red plane contained inside. All we know is that the laws of physics hold inside of U, but they do not necessarily hold in AE\U. In Figure 9 there is the same 2D representation of U as that in Figure 8, with a 2D representation of a 3D box of finite potential barrier contained inside. A particle placed inside of the box has a wave function shown in black. Since the box is 3D, the wave function amplitude is 4D (ignore time), thus its amplitude extends perpendicular to U. When a perturbation occurs, one of the black wave end-points move to the exterior of the box as shown by the red wave. The particle therefore has a probability of escaping resulting in quantum tunneling. Since the speed v is not bounded by c in AE\U, force carriers for entangled particles are not limited to propagation speed c provided that they travel in AE\U.

Take the particle depicted in Figure 9 that is represented by the black wave. Assume that v >> c in AE\U, so that the particle is allowed to move rapidly. It therefore changes quantum states rapidly giving the illusion that all of the states exist at the same time. You can therefore take a measurement, and one of those rapidly changing states is observed. So to be clear, the states predicted by quantum mechanics do not exist at the same time, the particle simply changes states faster than the speed of light allows giving the illusion that the states exist in superposition.

Take the particle depicted in Figure 9 but without the box (particle in free space again). It travels through U, but also perpendicular to U and thus it doesn't exist in U continuously (it appears to pop in and out of existence in U). Now suppose that such a particle is joined with a second particle that has the exact opposite wave function. The 2 particle's wave functions cancel out, and therefore they begin to definitively exist in U. In reality, 2 particles are unlikely to have the exact opposite wave functions so a 2 particle pair will still travel in and out of U as one might conclude the uncertainty principle requires. However, the more particles that come together to form heavier objects, the more likely that the superposition of the individual waves becomes zero, and therefore heavy objects exist more definitively in U than quantum ones. So to be clear, if you take n number of individual particles, their wave functions cause them to travel in and out of U. When those particles are joined together to form larger objects, their wave functions cancel out causing them to exist more definitively in U which is why large objects such cars and people are always observable. You can then convert those heavier objects back into individual particles due to E = m c^2 and those individual particles then move in and out of U again and the object disappears. Those particles can then be forced back into U through a strong magnetic field as predicted by the Schwinger Effect.

Since a particle travels in and out of U, the information that we have about the particle only pertains to when it is in U, and therefore it can only be described statistically. However, with additional information pertaining to the particles' higher dimensional components (in AE\U), everything is deterministic. It is the lack of information regarding the higher dimension that results in the conclusion that QM is random.

Figure 10: Since the speed of light in a stationary reference frame decreases with radius from a massive object, the index of refraction increases with a decrease in radius. Since photons curve towards higher index of refractionA photon (red) travels past a massive object causing what is observed as gravitational lensing. The photon travels slower when it is closer to the massive object, then when it is further away causing the path to curve.



This structure is consistent with wave particle duality, superposition, quantization of fundamentals, entanglement, uncertainty, quantum tunneling, interference patterns, and it never violates causality. It explains why we obtain the experimental results that we do without any paradoxes.

In figure 10, a photon travels past a massive object so the side of the wave that is closest to the massive object travels slower than the opposite side resulting in gravitational lensing. The path that light takes in a gravitational field is derived herein and it accurately models the experimental results of GR for gravitational lensing and gravitational redshifting. One could say that it is because light travels in a wave, that it curves around massive objects. In this same manner, the wave-particle duality of all quantum particles is what causes the experimental results that are obtained through science.

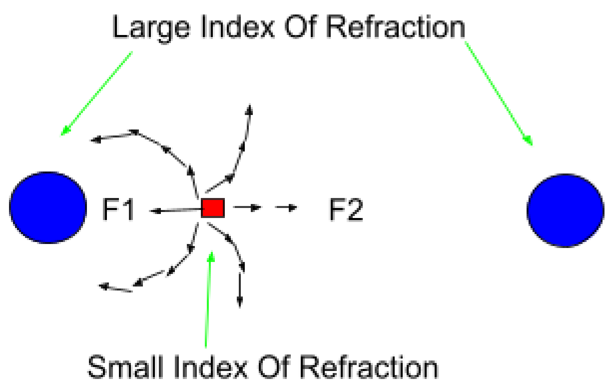


Figure 11: The 2 blue circles are massive objects, and the red rectangle is some other object. The black arrows show the path of force carriers due to a varying index of refraction. Notice that F1 > F2 because more of the force carriers interact in that direction resulting in the effects of gravity.

In Figure 11, two massive objects represented by two blue circles, and one smaller object represented by a red rectangle, are interacting. Since the speed of light decreases with a decrease in radius, this can be thought of as the index of refraction increasing with a decrease in radius. Since light tends to curve in the direction of the larger index of refraction, the path of the force carriers curve towards the massive object creating a non-uniform field which results in F1 > F2 (gravity).

This structure for U (and AE) is consistent with quantum mechanics, light propagation, and experimental results of GTR. With that said, everything that we observe points to the universe being isomorphic to a simulation meaning that every aspect of our reality can be modeled by a computer due to the universe's "mathematical nature". If the universe is a simulation, any programmer who designed it would know to write all of the physical laws in terms of one parameter so that everything changes collectively. In this case that parameter is light speed, and the programmer is G.

Definitions

System (A) denotes an entity or a collection of entities characterized by a specific state, denoted as A_n. An isolated system is one in which alterations in state are solely influenced by internal factors, precluding any external causes or effects. Moreover, no components exit or enter such a system.

Universe (U) encompasses all fundamental constituents within the framework of spacetime as defined in General Relativity. It excludes any entities existing beyond this cosmic framework, unless considering cyclic models where both preceding and emerging universes are encompassed in the definition.

All Existence (AE) constitutes the entirety of fundamental components that encompass everything in existence. This includes elements beyond our universe if they exist. AE, inherently isolated, adheres to the principle outlined in P2 below. Therefore, Universe (U) is a subset of All Existence (AE).

Nothing (∅) is defined as the absence of existence. Mathematically, if a set C is empty (∅), then for every subset C_i within C, C_i is also empty. This definition is crucial in demonstrating the impossibility of generating existence from non-existence, establishing that creation involves the transformation of existing entities while conserving specific properties.

Event (E) denotes a transformation $E_n \equiv A_n \rightarrow A_{n+1}$ within system A, signifying a progression from one state to the subsequent.

Causality denotes the chronological precedence of a cause preceding its effect.

Time is conceptualized as the inherent ability for change. Time, in this context, is binary—either the capacity for change exists, or it doesn't. The term "eternal" regarding time signifies its perpetual existence as a property inherent to the broader concept of existence itself. This aligns with the understanding that time is an unchanging property that has always been intrinsic to existence. It's crucial to emphasize that the concept of time in physics aligns with the notion of clock speed, indicating the rate at which change occurs within a given system.

Fundamental Principles And Proofs

P_1: For an isolated system **A** characterized by having a finite set of distinct possible states, any event E_n that remains possible will inevitably happen (A variation of the Poincare Recurrence Theorem.).

Proof: Let B = $\{B_1, \ldots B_m, B_{m+1}\}$ be the set of distinct states of **A** (which is in state B_j), and let $E_j \equiv B_j \rightarrow B_{j+1}$ be an event with a probability $P_1(E_j) = \varepsilon_j$ of occurring, where $0 < \varepsilon_j \leq 1$ $\forall$ j $\in$ [1, m]. It follows that $P_1(\neg E_j) = 1 - \varepsilon_j$, and $P_k(\neg E_j) = (1 - \varepsilon_j)^k$ where k is the number of opportunities. Since $|B| < \infty$, $1 < m < \infty$, and thus we define an infinite period T = $\{T_1, T_2, \ldots T_m\}$ | [$T_j = \frac{T}{m} = \infty$ and $T_i \cap T_j = 0$] $\forall$ i $\in$ [1,m] where i ≠ j. We also define some minimal unit of time $\infty > t_{min} > 0$ in which a state change can occur | $k = \lfloor \frac{t}{t_{min}} \rfloor$. Since $\lim_{t \to T_j} P_{\lfloor \frac{t}{t_{min}} \rfloor}(\neg E_j) = 0$ $\forall$ j, all of the states of **A** have a 0 probability of not occurring in T. Since T is arbitrary, this holds for any infinite period. If such a t_{min} doesn't exist, then ε = 0.

Clarification: *Suppose that A and B are 2 mutually exclusive events each with a non-zero probability of occurring | once either A or B occurs, the probability of the other event occurring becomes 0.*

Let t_a and $t_b \in$ [0, t) be the respective time periods in which events A and B remain possible. We let A represent the event that occurs, and since A and B are mutually exclusive, they cannot occur at the same time. Thus, $0 \leq t_b < t_a \leq t$. Thus event B not occurring doesn't violate P_1 even as $t \rightarrow \infty$ since $t_b < t$.

P_2**:** The generation of existence from a state of nonexistence is inherently precluded.

Clarification: Suppose that x = ∅. It follows that since x DNE, x is not restricted to follow any physical laws or logical principles. However, x DNE to utilize such properties so even though x has no restrictions, x DNE for it to matter. Therefore, even if some law required that x produce y ≠ ∅, x doesn't exist to follow said rule. Therefore nothing cannot produce something. It is therefore not a logical issue, but an existence one.

Proof: Suppose that y exists. Then k components of $\frac{y}{k}$ must also exist for each k $\in$ N. Since $[\lim_{k\to\infty} k(\frac{y}{k}) = y] \neq [\infty(x) = x]$, $(\frac{y}{k}) \not\Leftrightarrow$ (x) proving that y cannot be produced from even an infinite amount of x. Therefore, something cannot be produced from nothing. This can be summed up with the following diagram:

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Clarification: Rather than limits, suppose that k, the number of individual components of y, is already at infinity in the same sense that the number of points between (0,1) is already at infinity. Furthermore, consider where each component of y is $x \stackrel{\text{def}}{=} 0 \mid k(0) = |\frac{y}{0}|(0) = z$, where $|\frac{y}{0}| \stackrel{\text{def}}{=} \infty$. It follows that $z = |\frac{y}{0}|(0) = |\frac{y}{0}|(\frac{0}{2}) = \frac{1}{2}[|\frac{y}{0}|(0)] = \frac{z}{2} \Rightarrow z = \frac{z}{2}$ which is only true for z = 0, ∞. Let $z = \infty = |\frac{y}{0}|$ so that $|\frac{y}{0}| = |\frac{y}{0}|(0) \Rightarrow 1 = (0)$ resulting in a contradiction. Let z = 0 so that $0 = |\frac{y}{0}|(0) \Rightarrow 1 = \infty$ also resulting in a contradiction. Thus, all values of z result in a contradiction proving that when you attempt to produce something from nothing, you get a contradiction. This is an important case to consider, as some try to use division by zero as a means of attempting to produce something from nothing.

Consider producing y from x | y + (-y) = x. Since y doesn't exist to produce (-y), and (-y) doesn't exist to produce y, y and (-y) must be produced from x independently. Thus the above proof holds for such cases.

P_3: The entirety of All Existence (AE) has persisted throughout eternity with the unceasing progression of time, and each state within the realm of AE is finite in continuous duration.

Proof: Let **A** represent an isolated system in the state A_{n+1} where A is the set of all states of **A** in order of occurrence; A_n and $A_{n+1} \in$ A; n $\in$ Z; and $A_{n+1} \neq \varnothing$. Let $\check{T}(A_i)$ be the length of time in which **A** is in state A_i.

1) Prove that if $A_c \in$ A, then $A_c \neq \varnothing$:

   Since $A_{n+1} \neq \varnothing$, and **A** is isolated, then by P_2, $A_c \neq \varnothing$.

2) Prove that $A_{n-1} \in$ A:

   a) Suppose that $\check{T}(A_n) = \infty$. Since $|\{A_n, A_{n+1}\}| = [2 < \infty]$, by P_1, state A_{n+1} isn't possible, contradicting the premise that $A_{n+1} \in$ A. Since **A** is isolated and P_2 holds, by contradiction, $\check{T}(A_n) < \infty$, thus $A_{n-1} \in$ A.

b) Suppose that $\check{T}(A_n) < \infty$. Since P_2 holds, $\exists\ A_{n-1} \in$ A.

3) Prove that the $|A| = \infty$:

Since A_n and A_{n+1} being elements of A proves that $A_{n-1} \in$ A, A_{n-1} and A_n being elements of A proves that $A_{n-2} \in$ A. It follows that $\exists\ A_{k+1} \in$ A $\forall$ k ≤ n, where k ∈ Z ⇒ |A| = ∞.

AE is isolated because P_2 holds, and it has at least 2 states that are not ∅. The association **A** = AE can therefore be made.

1. Since $\exists\ A_{k-1}$ (cause) $\forall\ A_k$ (effect), every effect has a cause, and the property of time has always existed.
2. From 2) $\check{T}(A_n) < \infty\ \forall\ A_n \in$ **A**.

In-Depth Analysis

In the proposed model, the relationship U ⊆ AE is established, and time is conceptualized as the inherent capacity for change. The collective propagation rate of fundamental forces is universally constrained by the speed of light (c), implicating that alterations in c induce corresponding adjustments in clock speed. This analogy is exemplified through the utilization of a light clock to gauge the speed of light: Despite fluctuations in the speed of light, both the photons within the light clock and those subjected to measurement undergo proportional dilation, ultimately resulting in the consistent measurement of c. Essentially, all clocks are akin to light clocks. While event coordinates may conventionally be represented as (r, t), the parameter t = t(c) is intricately tied to the speed of light in flat space. Consequently, t can be interchangeably expressed as a relational measure of the distance light traversed between events, rendering the parameter t redundant in this context. It is for convenience that it is used.

Starting with equation (4), $c_0(r,\ r_s,\ v) = \sqrt{g_{\mu\nu}\frac{dx^\mu}{dt}\frac{dx^\nu}{dt}}$. Therefore $|c_0| \leq \sqrt{\frac{r-r_s}{r}}c$, and thus it follows that $c_0(r_s,\ r_s,\ v) = 0$ which implies that v = 0 for both light and mass at the EH of a black hole.

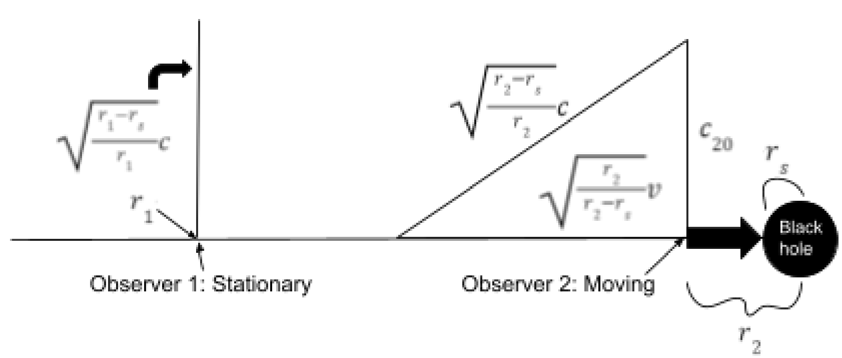

Figure 12: Shows the relationship between the components of the Schwartzchild metric.

From Figure 12, observer 2 starts at $r_2 = \infty$ (far left), and moves towards observer 1. The proper velocity is:

$$v_0 = \sqrt{\frac{r_2}{r_2 - r_s}}\, v_2 \quad (28)$$

So initially, the proper velocity is $v_0 = \sqrt{\frac{\infty}{\infty - r_s}}\, v$ = v. This means that when Observer 2 passes Observer 1,

$v_0 = \sqrt{\frac{r_1}{r_1 - r_s}}\, v_1 = \sqrt{\frac{r_2}{r_2 - r_s}}\, v_2$, where v_1 is the velocity of Observer 2 according to Observer 1. Since v_2 is the velocity of Observer 2 as viewed from a stationary reference frame at r_2, for Observer 1:

$$v_1 = \sqrt{\frac{r_2(r_1 - r_s)}{r_1(r_2 - r_s)}}\, v_2 \quad (29)$$

Since this is also constant, as $r_2 \rightarrow r_s$, $v_2 \rightarrow 0$. It follows that Observer 1 sees Observer 2's velocity go to 0, and Observer 2 sees their velocity remaining the same. This is only possible because all velocities are measured against their local speeds of light (see the definition of Time above). This tells us that:

$$v_0 = \frac{c}{c_0}\frac{dr}{dt} \quad (30)$$

where c_0 is the proper speed of light at r, and $\frac{dr}{dt}$ is how quickly r changes with time (not relative to light) as viewed from r = ∞. For example, $v_0 = \frac{c}{c}\frac{dr}{dt}$ at r = ∞; and since $c_0(r_s, r_s, v) = 0$, $\frac{dr}{dt} = 0$ at the EH. For light, $c_0 = 0$, so $\frac{dr}{dt}$ = 0 as perceived at r = ∞ (you can't see light once it is gone). It's important to note that length contraction doesn't physically occur. If we wanted to say that there is some clock speed $\boldsymbol{\tau}$ in the universe relating velocity to the local speed of light such that $v_0 = \frac{dr}{d\boldsymbol{\tau}}$, then $\frac{dr}{d\boldsymbol{\tau}} = \frac{c}{c_0}\frac{dr}{dt} \Rightarrow c_0 dt = c\, d\boldsymbol{\tau}$ which is what we concluded above. In fact, all we really care about is the relationships between clock speeds so it is easiest to use $\boldsymbol{\tau}$ in calculations, but in reality it is the speed of light that dilates, not time.

Empirical Assessment of PLS Theory and GTR

Clock-speed dilation: From equation (28), $v_0 = \sqrt{\frac{r}{r - r_s}}\, v$. Thus $\frac{dr}{d\boldsymbol{\tau}}\sqrt{1 - \frac{r_s}{r}} = \frac{dr}{dt}$, and therefore $d\boldsymbol{\tau} = \sqrt{1 - \frac{r_s}{r}}\, dt$ which is the gravitational time dilation equation of GTR.

Black holes: Explained above.

Gravitational Redshift: Explained above.

Gravitational Lensing: From equation (27), in a stationary RF the index of refraction is $n_2 = \sqrt{\frac{r}{r - r_s}}$.

When deriving the gravitational lens equation for GR using a Fermat Surface, n = $\sqrt{(\frac{r + r_s}{r - r_s})}$ (Bacon). Using the calculus of variations to minimize the functional $\int_b^R N\sqrt{1 + r^2(\frac{d\theta}{dr})^2}\, dr$, where N ∈ {n, n_2} and θ is as shown in Figure 2, θ(r) can be derived. However, the solutions are integrals, so it is easiest to compare $\frac{d\theta}{dr}$ as shown in Figure

13 where we use the mass of the sun. It is important to note that the left side doesn't matter since those points are inside of the sun. In fact, $r_{sun} \cong 6.96 * 10^8$ meters, so the entire plot shown in Figure 13 is still inside of the sun. This means that the predictions of this theory and those of GR are identical in any region that can be tested in our solar system.

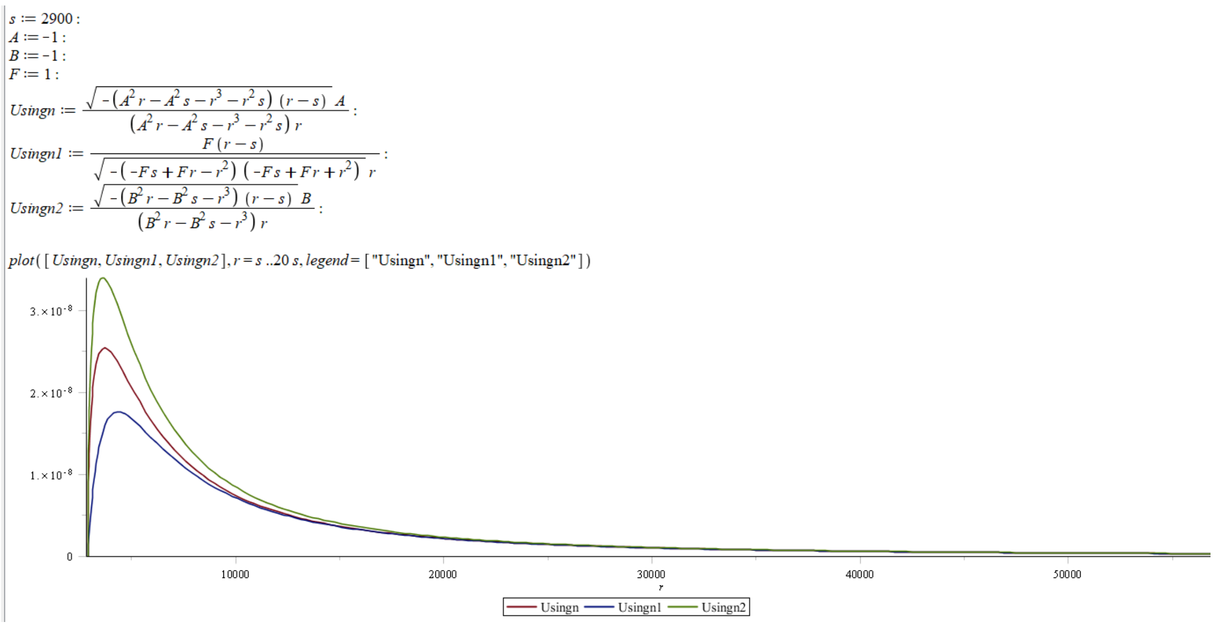

Figure 13: (Units in meters) These are plots of $\frac{d\theta(r)}{dr}$ where $s = r_s = r_{s,\,sun}$. They are only meant to show the relationship between the solutions as the constants were arbitrarily selected. Note that every point on this plot is still inside of the sun, so in the region where this is testable, the solutions are identical.

Gravitational Waves: It appears that there exists some fabric of lightspace that expands and contracts based on energy density, and this expanding and contracting changes its local index of refraction in the same capacity as time was thought to do so. It thus makes sense that such expanding and contracting would propagate through space as a wave.

The Universe's Expansion: This has not been considered.

Muon Decay: From equation (6) without rotational velocities, $c_0^2 = \frac{r-r_s}{r}c^2 - \frac{r}{r-r_s}\left(\frac{dr}{dt}\right)^2$. In zero-g this yields: $c_0^2 = c^2 - v^2$, and restructuring this gives us equation (2) [$\frac{c_0}{c} = \sqrt{1 - \left(\frac{v}{c}\right)^2}$], so any perceived effects of special relativity are immediately recovered without time and length contraction, and gravity is already built-in. So the lorentz factor appearing in the relativistic decay equation can be interpreted further as meaning that the half life of a particle is a function of how the particle perceives light. That is:

$$\boldsymbol{T}_{1/2}(c_0) = \boldsymbol{\tau}_{1/2}\frac{c}{c_0} \quad (31)$$

Thus, the faster the particle moves, the slower the particle perceives light, and thus everything that occurs within the particle is slowed down without the need for time or length contraction.

Length Contraction: Consider Muons produced at a height H above the Earth's surface, where the percentage of Muons hitting the surface before decaying aligns consistently with the predictions of special relativity. It is crucial to note that H does not undergo any physical shrinkage in either reference frame. While special relativity provides the correct outcome, the mechanism leading to this result is not entirely endorsed by the author. The logical inference is that H remains unchanged, and the particle's decay rate is contingent on how the particle perceives light, as elucidated in equation (31). This alignment is sensible, given that all involved forces communicate at a rate governed by the speed of light.

Transcending Definitions: Metaphysical Considerations

Deterministic refers to an event $E_n \equiv A_n \rightarrow (C_{a1}A_{a1} \vee C_{a2}A_{a2} \ldots \vee C_{am}A_{am})$ with fixed probabilities (C_{a1}, C_{a2},... C_{am}) respectively. The fact that there is a fixed weight or probability, tells us that there is an underlying rule that ensures those weights are obeyed. In the classical case am = n+1, $A_n \rightarrow A_{am}$, and C_{am}=1. In the quantum case, A_{a1} through A_{am} represent the possible states, and C_a through C_{am} are the probabilities of those states. Thus quantum mechanics is deterministic.

Free Will refers to an event $E_n \equiv A_n \rightarrow (C_{a1}A_{a1} \vee C_{a2}A_{a2} \ldots \vee C_{am}A_{am})$ where the respective probabilities (C_{a1}, C_{a2},... C_{am}) are not fixed.

Suppose that you have a dart board with different states or sections ($A_{a1} \vee A_{a2} \ldots \vee A_{am}$), each with their respective probability (C_{a1}, C_{a2},... C_{am}) of getting hit. As long as the board is far enough away that one's skill in throwing darts is not valuable, the probabilities of each state can be calculated based entirely on the areas of each state in relation to the others (ignoring misses). This is only true because everything about the dart is deterministic. If the dart had free will, there would be no way to assign such probabilities.

Claim 1: There must exist G = {..., $A_{n-1,j}$, $A_{n,j}$} $\subsetneq$ AE where $A_{n,j} \subsetneq A_n$| G has free will, and G organized U.

Conformal Cyclic Cosmology:

Let u be a m-dimensional volume in which the laws of quantum mechanics, and general relativity hold, and let u $\subseteq$ U. Since space is expanding $\exists$ some distance D in which 2 events are non-existent to each other due to the finite speed limit c. We thus define a point P in U in which event $E_{n,P\pm\epsilon} \equiv U_{n,P\pm\epsilon} \rightarrow U_{n+1,P\pm\epsilon}$ representing the universe's beginning (or this cycle of it) occurs, and then define u as being the volume enclosed by distance D around P in m-space. Since space expands uniformly, there is nothing unique about point P, thus every point in u has the same probability for a similar event $E_{a,i}$ (a $\geq$ n) to occur. We thus establish all of the points in u as a grid, where each point is separated by a planck length l_p: We then define t_{min} (from P_1) to be the Planck time | every t_{min} an event $E_{a,i}$ could occur at each point in u (outside of the light radius of P). We now calculate the probability that $E_{n,P\pm\epsilon}$ is the only such event that occurs in u over time D/c, for m = 3.

Let the radius of a sphere be a multiple (k) of l_p. We divide the area of the sphere by the area of an equilateral triangle of side length l_p, to get the ~ number of triangles that grid the sphere. Thus, the approx. number of triangles ▲(k) is:

$$▲(k) \cong \frac{4Pi(k{*}l_p)^2}{(\frac{l_p^{\,2}sin(Pi/3)}{2})} = \frac{16Pi(k)^2}{\sqrt{3}}$$

The number of triangles on the surface of the sphere relates to the number of points *(k) by the approx. relation *(k) $\cong \frac{1}{2}$▲(k). Thus:

$$*(k) = \frac{8Pi(k)^2}{\sqrt{3}}$$

It follows, that at the moment of $E_{n,P\pm\epsilon}$, there existed $\frac{8Pi}{\sqrt{3}}\sum_{k=1}^{q}(k)^2$ opportunities for $E_{a,i}$ to occur elsewhere within u, where q = $\lfloor D/l_p \rfloor$. By the time that light from P reached the next planck length to communicate that $E_{n,P\pm\epsilon}$ occurred, another $\frac{8Pi}{\sqrt{3}}\sum_{k=2}^{q}(k)^2$ opportunities passed, followed by $\frac{8Pi}{\sqrt{3}}\sum_{k=3}^{q}(k)^2$ the following t_{min}... Thus, the number of opportunities for $E_{a,i}$ to occur in D is:

$$\frac{8Pi}{\sqrt{3}}\sum_{j=1}^{q}\sum_{k=j}^{q}(k)^2 = \frac{8Pi}{\sqrt{3}}\sum_{j=1}^{q}\left(\frac{q(q+1)(2q+1)}{6} - \frac{(j-1)j(2j-1)}{6}\right)$$

$$= \frac{4Pi}{3\sqrt{3}}\left(q^2(q+1)(2q+1) - \sum_{j=1}^{q} j(2j^2-3j+1) \right)$$

$$= \frac{4Pi}{3\sqrt{3}}\left(q^2(q+1)(2q+1) - \left[2\left(\frac{q(q+1)}{2}\right)^2 - 3\frac{q(q+1)(2q+1)}{6} + \frac{q(q+1)}{2}\right] \right)$$

$$= \frac{2q^2Pi}{\sqrt{3}}(q^2+2q+1)$$

If we now think of each point in u as a die with η distinct states in which only 1 results in $E_{a,i}$, then the probability that $E_{a,i}$ doesn't ever occur in u over time D/c is $\left(\frac{\eta-1}{\eta}\right)^{\frac{2q^2Pi}{\sqrt{3}}(q^2+2q+1)}$. If we set this to greater than or equal to what is typically considered to be "impossible" we get $\left(\frac{\eta-1}{\eta}\right)^{\frac{2q^2Pi}{\sqrt{3}}(q^2+2q+1)} \geq 10^{-50}$, which $\Rightarrow \eta \geq \frac{1}{1-10^{\frac{-25\sqrt{3}}{q^2Pi(q+1)^2}}}$. This means that the vacuum of space must have at least η distinct states (not energy levels) with one being able to cause $E_{n,P\pm\epsilon}$. Using just the values for when D is one light-second we get η > 10^{170}. There isn't anything in the vacuum that is known to even remotely come close to this value. Thus $E_{a,i}$ should have occurred many times over, and those events occurring should be apparent in the cosmological data: We should observe galaxies and radiation heading towards us from all directions.

In addition to this, if $E_{a,i}$ and $E_{n,P\pm\epsilon}$ both occur, which according to P_1 this must happen at some point, neither event is aware of the other, so the scale factor in the Conformal Cyclic Cosmology model could not be coordinated leading to inconsistencies.

It follows that the CCC model of cosmology, or any theory attempting to “smoothly” cycle through universes, suffers from these issues.

Other Cyclic Models:

These models are either known to violate the laws of entropy, or they are known to require a beginning a finite number of cycles into the past.

Big Bang Model:

From P_3- 2, the universe cannot exist in a singularity state for an infinite period. So, the BB could occur, but a non-singularity state had to precede the singularity in which our universe emerged: This can’t happen without violating the laws of entropy unless an outside force caused it ([non-singularity state → singularity state (for all of U)] is a decrease in total entropy.).

Multiverse:

This model has the same issues as the CCC in that we should observe interactions of other universes with our own, and those interactions should be apparent through the CMB which they aren’t. Additionally, unless the universes get recycled, they must be made from nothing (even if AE is infinite) violating P_2.

Conclusion: The universe can’t be cyclic (infinitely), it can only begin with a BB if the BB were started from an outside force, and the multiverse isn’t supported by the cosmological data. The only other known option is that the process that organized U is controlled. Therefore there must exist G = {..., $A_{n-1,j}$, $A_{n,j}$, $A_{n+1,j}$,..} ⊊ AE where $A_{n,j} \subsetneq A_n$| G has free will, and G organized U.

Conclusion

In conclusion, this article introduces the PLS theory, presenting a novel perspective that unifies light propagation, quantum mechanics, and the experimental outcomes of General Theory of Relativity (GTR) into a cohesive framework. The theory posits that time dilation in GTR results from the dilation of light speed, wherein all fundamental forces exhibit a rate of propagation that dilates with the speed of light. This leads to changes in clock speed with varying light speed, ensuring that the local measurement of the speed of light remains constant at \(c\). By formulating equations that describe the actual processes in a reference frame and accounting for the observed differences arising from the variable speed of light, the theory reconciles the quantization of Quantum Mechanics with the smoothness required by GTR.

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