On the gravitational nature of time

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Abstract

A novel geometry is presented which yields several observed quantities that are not accounted for by classical relativistic models. Relative motion is re-examined under which a numerically equivalent function is applied. This function dictates that velocities should remain equivalent across reference frames, which in turn implies that it is not time alone that dilates, but rather the time elapsed between two points in space for a given velocity as space itself dilates.

A peculiar velocity of $\boldsymbol{\bar{v} \approx 526.6}$ km s$^{\boldsymbol{-1}}$ is presented and briefly compared with studies carried out through direct observation via supernovae luminosity and CMB research. A velocity proportional spatial dilation of $\boldsymbol{\frac{ds}{dx} = \Phi \approx 1.618}$ is also presented with an error of **0.002%**.

This model predicts a mechanism of gravity which can, with further research, offer an explanation for the bullet cluster's varied mass effects, the apparent lack of gravitational aberration, and potentially excess galactic rotation curves without the need for CDM.

Keywords: gravity, relativity, time

1 Introduction

Consider an observer at relative rest O. If this observer agrees with another observer, O' that O' should travel at precisely velocity v between two arbitrary points in space, A and B, it is inconceivable that O' should reach point B at a time greater than $t = \frac{d}{v}$. While current relativistic models rightly ascertain that time dependent quantities might *appear* dilated as an observer approaches the speed of causality, c, it is unreasonable to conclude that a quantity can actually *be* of two different magnitudes.

Following the premise that if an observer who will remain at relative rest conspires with a second observer that the second observer should travel at precisely velocity v, and that v in the rest reference frame should be of an equivalent magnitude to that same velocity in the moving reference frame, v', it is trivial to deduce that it must be the distance that dilates between two previously shared points in space; not time alone.

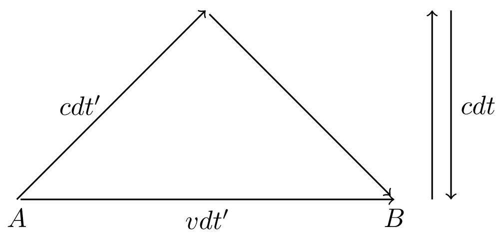
Despite the mathematical convenience of describing many physical processes as a function of time, γ as described in equation 1 indicates that time is in fact a function of velocity, and consequentially, dilating velocity as proportional to $\frac{dx}{dt'}$ may produce unforeseen asymmetries. While differential forms of the relationship between velocity and time may exist, the most fundamental of symmetries, $d = vt$ should remain intact.

$$\Delta t' = \Delta t\gamma = \Delta t \frac{1}{\sqrt{1 - \frac{v^2}{c^2}}} \tag{1}$$

Given further that velocity is a vector of a magnitude directly influenced by the observer, and that t dilates with respect to the magnitude of v, it is apparent that it is distance that maintains the most dependent nature in the primary identity, $d = vt$.

Of course the approximation of describing some physical process f with respect to time as $\frac{df}{dt}$ is accurate for $v \ll c$, but how should a *'final'* derivative be defined if not as $\frac{df}{dt}$?[1] Of course any changing parameter can be measured as a rate of change with respect to another changing parameter, but current differential forms of relativistic geometries produce asymmetries that are yet to be remedied, and a true understanding of time and it's rate of change remains elusive. Let us address these asymmetries here.

2 Covariance, Contravariance and Shared Coordinate Systems



A critical piece of the model being proposed is the notion that absolute motion is indeed physically consequential. This should not discount the significance of relative motion as defined by SR[2], but rather expand upon it to include external, tertiary reference frames.

Consider equation 1 with respect to figure 2. If observer O' is moving between points A and B at velocity v', how is it possible that O' should reach point B at a time that is larger than $\frac{d}{v}$ where d is the Euclidean distance between A and B and v is the velocity of O' agreed upon by both observers?

$$\Delta t' = \Delta t\gamma > \frac{d}{v} \tag{2}$$

While current relativistic models dilate time in accordance with both SR and GR[3], they in turn must dilate time dependent variables. This breaks the most fundamental symmetries, including those that exist not as a matter of observation and experiment, but of pure definition. Symmetry breaking models are objectively permissible when nature itself appears to break symmetries we've come to take for granted, but breaking identities that flow from pure definition is a clear indicator that the model is based on a misunderstanding of the underlying mechanisms.

$$d = vt \quad \Rightarrow \quad d \neq vt' \iff t' = t\gamma \tag{3}$$

Let us further examine the scenario described earlier, in which an observer in relative motion travels at a predetermined velocity. Despite the fact that v might *appear* different to the observer in relative motion as causality itself red shifts, this dilation of causality should be completely inconsequential for the observer at relative rest. If c does indeed remain constant in each reference frame as Maxwell's equations surmise, and $v \equiv v'$, then the Euclidean distance between points A and B must be larger in the primed frame of reference.

This yields a geometric interpretation of time as a density axis, such that

$$S' = S \begin{bmatrix} \frac{1}{\sqrt{1-\frac{v^2}{c^2}}} & 0 & 0 \\ 0 & \frac{1}{\sqrt{1-\frac{v^2}{c^2}}} & 0 \\ 0 & 0 & \frac{1}{\sqrt{1-\frac{v^2}{c^2}}} \end{bmatrix} dt \tag{4}$$

While contradictory to current relativistic models, this dilation of space is in accordance with the concept of cosmic inflation, and requires fewer modifications to pre-relativity theories than SR itself. By providing the ability to define a state of absolute rest and absolute motion this model can provide a significant leap forward in observational astronomy while remedying multiple relativistic paradoxes. As this model of spatial dilation is examined further, a gravitational and inflationary geometry arises that no longer yields singularities or a 'big bang'. This does not discredit the theory that those states at one time existed, but rather calls into question the fundamental nature of chronological ordering on a cosmic scale.

3 Relativity and Tertiary Reference Frames

Let us consider this proposed dilation of space as it relates to both cosmic inflation and the equivalence principle. As SR and GR rely heavily on both the equivalence principle and Mach's principle, we should then examine the inflationary properties of this model necessary to produce local gravitational effects. Recall that:

$$\vec{g} = \sum_{i \neq j} G \frac{m_i}{R_{ji}^2} \hat{R}_{ji} \tag{5}$$

If we instead inverse this equation so that it is not m_j that is being pulled towards m_i, but rather the space around m_i that is dilating in the direction of m_j we find a nearly identical equation as:

$$\vec{g} = \sum_{i \neq j} -G \frac{m_i}{R_{ij}^2} \hat{R}_{ij} \tag{6}$$

Differentiating this with respect to R gives:

$$\delta_{(R)} = \frac{d}{dR}\left[-G\frac{m_i}{R_{ij}^2}\hat{R}_{ij}\right] = 2G\frac{m_i}{R_{ij}^3}dR \tag{7}$$

3.1 Applying $\delta_{(R)}$ as a Spatial Dilation Scalar

As γ is applied as a scalar of time dependent relativistic quantities, let us then consider $\delta_{(R)}$ as it would be applied under a similar mathematical context. As integrating $\delta_{(R)}$ with respect to R gives $\vec{g} + R_{\text{initial}}$, we find the following:

$$\int_0^{R_\oplus}\left[2G\frac{M_\oplus}{R_\oplus^3}\hat{R}\right]dR = R_\oplus - g \tag{8}$$

Note that the negative g in this result is reference frame dependent. If an observer is initially at some radial vector $\vec{r} = \langle x,\ 0,\ 0\rangle$ with respect to the source of gravitation, then $\|r'\| = \|r\| - g$ according to the underlying $\mathbb{R}^3$ space in a larger $\mathbb{R}^4$ spatial context after this spatial dilation is applied.[4] This is to say that for an observer at $l = \langle x,\ 0,\ 0,\ s\rangle$, l remains unchanged. However as the space around that observer dilates according to the model being proposed, $l \mapsto \langle x - g,\ 0,\ 0,\ s - f(t)\rangle$ where f is some function of time required to scale physically accurate time scales to our own units of time. This negative g would be accurate for any $\|r\| > 0$. In order to consider observations such that the center of mass of the gravitational source is at $(0,\ 0,\ 0)$ and the observer is at some $\|r\| > 0$, let us allow that:

$$ds = R_\oplus + g \iff r = 0 \tag{9}$$

Let us then factor $R_\oplus$ from equation 8 in order to yield a mathematical context similar to that of γ. We then find:

$$R_\oplus\bar{\gamma} = R_\oplus\left(1 + \frac{g}{R_\oplus}\right) \tag{10}$$

While numerically equivalent, this result in the form of $\bar{\gamma}$ as opposed to $\int\delta$ allows us to apply this quantity in a manner that is symmetrical with that of the classical γ.

Note that $\bar{\gamma}$ is equivalent to the average of δ over a definite integral from 0 to $R_\oplus$, as:

$$\frac{1}{R_\oplus}\int_0^{R_\oplus}\left[2G\frac{M_\oplus}{R_\oplus^3}\hat{R}\right]dR = \bar{\gamma} \tag{11}$$

4 $\delta_{(R)}$ as a Function of Velocity

Let us re-examine the classical γ factor as:

$$\gamma = \frac{1}{\sqrt{1 - \frac{v^2}{c^2}}} \tag{12}$$

Rearranging this to find v gives:

$$v = c\sqrt{1 - \frac{1}{\gamma^2}} \tag{13}$$

If we consider equation 13 in the context of equation 10, we find:

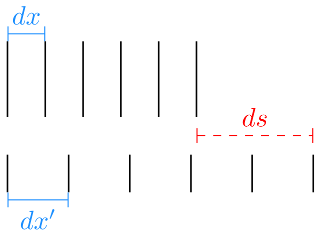
$$\boxed{\bar{v} = c\sqrt{1 - \frac{1}{\left(1 + \frac{g}{R_\oplus}\right)^2}} = 526,596.4\ \frac{\mathrm{m}}{\mathrm{s}}} \tag{14}$$

While observational astronomy struggles to accurately quantify our local peculiar velocity on a super-galactic[5] scale due to inherent hurdles fundamental to the measurement of light traveling through interstellar dust, this value follows closely with several observational studies[1][2] and can offer a foundation for observational astronomy.

5 Physically Accurate Time Scales

This model of divergent coordinate systems supposes that the fourth coordinate in 4-vector equations, commonly attributed to time, is a position along this density axis. Let us further examine how the nature of this density axis differs from our current understanding of time, and describe the physics of a Universe without the need for a time derivative in any classical sense.

Let ds represent the dilation of $\mathbb{R}^3$ space as a function of both position and the velocity of surrounding massive bodies.



Consider figure 5, in which over the course of the integral $\int_0^{dx}$ the linear distance according to the observer at relative rest, dx, dilates to the density of dx' in the coordinate system of the observer in relative motion.

Since this model proposes that it is distance rather than time that dilates, and that velocity is more accurately described as the rate of a motion *through* space proportional to the motion *of* space, let us consider these two distances as time independent. We can find ds by

$$\begin{aligned} ds &= dx' - dx \\ &= dx\left(1 + \delta_{(dx)}\right) - dx \\ &= dx\delta_{(dx)} \end{aligned} \tag{15}$$

Let us then consider this rate of change, $\frac{ds}{dx}$ with respect to the magnitude of $\bar{v}$. We find

$$ds_{(\bar{v})} = \bar{v}\delta_{(\bar{v})} = 1.61800 = \Phi - 3.29 \times 10^{-5}$$
$$= \Phi - 0.00203\% \tag{16}$$

6 Gravitational Acceleration

Let a body of mass m be at some height h above the surface of the Earth. As that body falls, it's velocity appears to accelerate proportional to t^2, however this scalar of t^2 occurs as a consequence of integrating t. This indicates that while ds varies across space, it is not changing temporally. Consider the equation for this apparent free fall velocity as it appears in standard theories of gravity:

$$v = \int [gt]\, dt = \frac{1}{2}gt^2 \tag{17}$$

If we then consider this equation in the context of relative spatial dilation, where $\ddot{x} = 0$ but $ds = \int_0^r \delta$, we should first integrate δ with respect to r as:

$$\int_0^r \delta_{(r)} = g + R \tag{18}$$

As we are only concerned with the positional derivative at R, and not R itself, we can find the dilation of space at R to be

$$ds = \int_0^r \delta_{(r)} = g + 0 \tag{19}$$

If we consider that time itself *is* this dilation of space as a function of the magnitude of motion through space, as

$$\bar{v} = c\sqrt{1 - \frac{1}{\left(\frac{1}{R}\int_0^R \delta_{(R)}\right)^2}} \iff \frac{1}{R}\int_0^R \delta_{(R)} = \gamma = \frac{1}{\sqrt{1 - \frac{\bar{v}^2}{c^2}}} \tag{20}$$

then we should scale $dx = \bar{v}$ to be equivalent to our scales of time. Let σ be the proportionality constant such that $\tau = \sigma x$

$$\int \tau\ d\tau = \int t\ dt \Rightarrow \sigma = \frac{1}{x} \tag{21}$$

We can then define the velocity of a body in free fall for time t with an initial velocity of 0 at height h to be

$$v_o = \iint \left[\delta_{(R)}x\right] \partial R\ \partial x = \frac{1}{2}G\frac{M}{R^2}\tau^2 x^2 = \frac{1}{2}G\frac{M}{R^2}t^2 \tag{22}$$

By finding the spatial dilation at every point along the radial vector $\vec{r}$ from the center of mass of the gravitational source, for every point along the trajectory x of that same body, we can describe a physically and numerically equivalent gravitational effect without the need for time as a mysterious, perpetual medium. All kinematic equations and physical processes should be able to be defined as functions of the motion ***of*** space, ds, and the motion ***through*** space, dx. The passage of this mysterious medium we've described as time is no longer necessary to describe the Universe as we know it.

Note that while the coordinate of the body in free fall changes with the dilation of space, the velocity of that body does not change from it's inertial state. As it is the coordinate system dilating that leads to the body's change in displacement, $\ddot{x} = 0$, and therefore

$$F_g = m\ddot{x} = 0 \tag{23}$$

which fits closely with the mass independent nature of g.

7 Conclusion

While Einstein changed our understanding of the Universe on a fundamental level with his revelation regarding time dilation, SR and GR break down under extreme quantities, either very massive or very small, and produce paradoxes at velocities of equal or greater magnitude than c. This description of time as a concurrent density axis no longer requires a beginning or an end of time, only a trajectory and a magnitude of motion. Distant galaxies may appear more developed than the elapsed period since the big bang permits, because a greater period has elapsed according to their displacement 4-vector, with the fourth coordinate being a position along this concurrent density axis. Gravity may appear to have no observable aberration not because the velocity of gravitational waves is infinite, but because the medium at which this gravitational dilation was emitted is more dense and therefore, in the 'past' with respect to the orbiting body, producing an elongated 4-vector as the temporal component is initial separated. The bullet cluster may express mass effects that appear extra-spacial, because space itself is dilating as two extremely massive and fast moving clusters dilate space toward the other. Black holes may no longer lead to singularities, and may not even exist in the form that they are currently understood. If space itself is relative and all bodies within a dilating coordinate system scale with the dilation of that coordinate system, black holes and singularities only arise as $ds \geq c$. SR's dependence upon a constant speed of light must be re-examined, as Maxwell's equations do not indicate a constant speed of light, but a speed of light that is proportional to h and the charge radius r. If c dilates proportionally to the density of space, black holes may exist in the same manner as the end of the rainbow; if one were to approach and experience this dilation of c, causality, space and time might remain completely intact.

And perhaps most importantly, if c is proportional to both the density of space and Maxwell's equations describing electromagnetic fields, and we experience an almost perpetual dilation of space, can electromagnetism and the dilation of space be unified to harness this endless supply of pollutionless power?

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space and time obey laws far beyond our own understanding; without whom this theory wouldn't exist.

References

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[1]The word *final* here is used very loosely. What is meant by "final" is something analogous to a tensor quantity of sorts; a rate of change that remains unchanged *between* reference frames. As described elsewhere, the notion that a quantity remains constant **in** each reference frame does not necessarily require that that same quantity remains constant **between** reference frames.

[2]Special Relativity

[3]General Relativity

[4]Spatial system accounting for the three dimensions of Euclidean space, as well as the non-Euclidean density axis being proposed.

[5]Of a distance scale that extends beyond our own galaxy.