Time and Distance: A New Approach

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Abstract

Time is generally regarded as a universal constant, integrated into mathematical models as an immutable parameter—except in relativistic and quantum frameworks. However, I propose that "clock time," or the time we measure, does not reflect actual time itself. Instead, it measures the rate at which actual time changes, functioning as a derivative of time rather than a direct measure of it.

Building on this foundational idea, I explore its implications for distance and energy-mass equivalency in this document. Please note that these proposals are speculative and have not been peer-reviewed, tested, or formally examined. They are offered here simply as considerations and conversation starters.

1. Time is Not Constant

Time itself is not what we measure directly with clocks. I postulate that **clocks measure the rate at which time changes** - a derivative of actual time with respect to some constant or reference.

If actual time is a function T, then our measurement of time (e.g. clocks) captures:

$$\frac{d^nT}{dC^n}$$

where C is some constant or reference and n is the order of the derivative.

To produce the equation for actual time – we integrate the derivative (removing the constant of integration for brevity):

$$\int \frac{d^nT}{dC^n} dt$$

We then have measured time (T'),

$$T' = \frac{d^nT}{dC^n}$$

and actual time (T),

$$T = \int \frac{d^nT}{dC^n} dt$$

2. Equivalency of Time and Distance

The postulation that clocks do not measure time but rather the rate at which time changes and time (T) is changing relative to measured time (T') creates a need to redefine distance (D) to keep the speed of light (c) immutable. I postulate that **time and distance are equivalent in a manner analogous to matter-energy equivalency in $\boldsymbol{E = mc^2}$**. This equivalency establishes a framework within which we can further understand the relationship between time and distance.

$E = mc^2$ establishes a direct equivalence between energy (E) and mass (m) with the speed of light (c) as the conversion factor. Analogously, we seek an equivalence between time (T) and distance (D).

We use the time-distance equivalence relationship:

$$D = \alpha\, T$$

where,

D is Distance.

T is time.

α is a proportionality constant analogous to c^2 in $E = mc^2$.

To maintain the consistency of $E = mc^2$, we utilize the speed of light (c) as the link between time and distance. Since $c = \left(\frac{D}{T}\right)$, it follows that:

$$\alpha = c$$

thus, the equivalence becomes,

$$D = cT$$

The time-distance equivalence equation $D = cT$, or equivalently, $T = \frac{D}{c}$, reflects that time and distance are proportional, with c as the proportionality constant, preserving its role as the universal speed limit.

The equivalence of $D = cT$ operates orthogonally to $E = mc^2$, introducing no interruption.

By incorporating $D = cT$ into $E = mc^2$, we obtain a new unified expression:

$$E = mc^2 = \frac{mD^2}{T^2}$$

To solve for time (T) we arrive at:

$$T = \frac{D\sqrt{m}}{\sqrt{E}}$$

We now have time (T) explicitly tied to distance (D), mass (m), and energy (E).

3. Establishing Measured Time

We have designed a framework to provide us with visibility into time through the following:

Time and distance equivalency:

$$D = cT$$

Linking time and distance to mass and energy:

$$E = \frac{mD^2}{T^2}$$

Establishing an equation to represent time:

$$T = \frac{D\sqrt{m}}{\sqrt{E}}$$

The next step is to develop the equation that will represent measured time (or the rate at which time changes). With the time equation (T) established as the integral of measured time (T') and measured time as the derivative of time then it is natural to differentiate the time equation (T) to create the measured time equation (T').

To find dT, we compute the total derivative of T with respect to D, m, and E:

$$dT = \frac{\partial T}{\partial D}dD + \frac{\partial T}{\partial m}dm + \frac{\partial T}{\partial E}dE$$

Partial derivative with respect to D:

$$\frac{\partial T}{\partial D} = \frac{\sqrt{m}}{\sqrt{E}}$$

Contribution to dT:

$$\frac{\sqrt{m}}{\sqrt{E}}dD$$

Partial derivative with respect to m:

$$\frac{\partial T}{\partial m} = \frac{D}{2\sqrt{m}\sqrt{E}}$$

Contribution to dT:

$$\frac{D}{2\sqrt{m}\sqrt{E}}dm$$

Partial derivative with respect to E:

$$\frac{\partial T}{\partial E} = -\frac{D\sqrt{m}}{2E^{\frac{3}{2}}}$$

Contribution to dT:

$$-\frac{D\sqrt{m}}{2E^{\frac{3}{2}}}dE$$

Combing the contributions produces its total differential,

$$dT = \frac{\sqrt{m}}{\sqrt{E}}dD + \frac{D}{2\sqrt{m}\sqrt{E}}dm - \frac{D\sqrt{m}}{2E^{\frac{3}{2}}}dE$$

This total differential represents how distance, mass, and energy influence measured time (the rate at which time changes) at any given point along its journey.

4. Testing with the Estimated Age of the Universe

Let us test the new time equations against the current estimated age of our universe based on the best information that we know now. Our test results for time (T) should ensure that the resulting ratio of Distance (D) to calculated time (T) is c, thus satisfying $c = \frac{D}{T}$. Our test results for (dT) should provide a rate of change factor for time (T) that provides an accurate estimate of the current estimated age of the universe.

With,

$D = 8.8\ x\ 10^{26}m$ (estimated length of the observable universe)

$m = 1.5\ x\ 10^{53}kg$ (estimated mass of the observable universe)

$E = 1.35\ x\ 10^{70}J$ (hypothetical total energy)

we have,

$$T\ = \frac{D\sqrt{m}}{\sqrt{E}}$$

so,

$$T = \frac{8.8\ x\ 10^{26}m * \sqrt{1.5\ x\ 10^{53}kg}}{\sqrt{1.35\ x\ 10^{70}J}}$$

resulting in,

$$T = 2.933\ x\ 10^{18}s \approx 92.95 \text{ billion years}$$

Since (T) is the integral of (dT) this result represents the total cumulative measured time in our universe since its event of origin.

Check the distance to time equation result ratio:

With,

$$D = cT$$

time and distance must always keep the speed of light immutable therefore,

$$\frac{D}{T} = c$$

so it must be that,

$$\frac{D\ (diameter\ of\ observable\ universe)}{T\ (calculated\ total\ cumulative\ time)} = c$$

calculate the following,

$$\frac{8.8\ x\ 10^{26} m}{2.933\ x\ 10^{18} s} = 3.000\ x\ 10^{8}\frac{m}{s}$$

The result is close to the speed of light ($3.00\ x\ 10^{8}\frac{m}{s}$) coming in at roughly 0.01% higher. Taking variables into consideration we can quickly arrive at adjustments in our current estimates for universe distance, mass, or energy values thus arriving our result exactly at the immutable speed of light.

We can now use dT to correlate results from the previous cumulative age of the universe calculation for T. To utilize our total differential for this simple test we assume that energy and mass are entropic and – even though they constantly change – we will consider their respective differentials as unchanging:

With:

$$dT = \frac{\sqrt{m}}{\sqrt{E}} dD + \frac{D}{2\sqrt{m}\sqrt{E}} dm - \frac{D\sqrt{m}}{2E^{\frac{3}{2}}} dE$$

given,

$$dm = 0$$

$$dE = 0$$

therefore,

$$dT = \frac{\sqrt{m}}{\sqrt{E}} dD$$

interpret dT per unit of measured time t,

$$\frac{dT}{dt} = \frac{\sqrt{m}}{\sqrt{E}}\frac{dD}{dt}$$

use Hubble's law for recession speed,

$$\frac{dD}{dt} = H_0 D$$

arrive at,

$$\frac{dT}{dt} = \frac{\sqrt{m}}{\sqrt{E}} H_0 D$$

with the following values,

$D = 8.8\ x\ 10^{26} m$ (estimated length of the observable universe)

$m = 1.5\ x\ 10^{53} kg$ (estimated mass of the observable universe)

$E = 1.35\ x\ 10^{70} J$ (hypothetical total energy)

$H_0 \approx 2.268 \text{ x } 10^{-18} \text{s}^{-1}$ (for illustration)

we calculate,

$$\frac{dT}{dt} = \frac{\sqrt{1.5\ x\ 10^{53}\ kg}}{\sqrt{1.35\ x\ 10^{70} J}} * (2.268\ x\ 10^{-18} s^{-1}) * (8.8\ x\ 10^{26} m)$$

resulting in,

$$\frac{dT}{dt} \approx\ 6.65\ seconds\ of\ time\ T\ per\ second\ of\ t$$

Therefore, for every second of measured time (dT), time (T) increases by roughly 6.65 seconds based on our assumptions to this point.

We have,

$$\frac{T}{t} \approx 6.65$$

solve for t,

$$t = \frac{T}{6.65}$$

Using our 92.95 billion years from our previous time (T) calculation and assuming the temporal rate of change since the event of origin for the universe is constant,

$$t = \frac{92.95\ billion\ years}{6.65} = 13.98\ x\ 10^9 years\ (\approx 14\ billion\ years)$$

The result of our calculation falls within 1.5% of our current age estimates of the universe.

5. In Closing

To be clear, this document is humbly and respectfully offered as a starting point for discussion. None of its contents have been reviewed by others, and it represents an effort to explore how we perceive and measure time from a broader perspective. This work aims to unpack the concept of time and examine its components in greater detail.

I envision matter, energy, time, and distance as different expressions of the same underlying phenomenon. This work brings me one step closer to articulating that vision.

If these ideas prove mathematically viable, they could offer new opportunities to explore and understand many aspects of our reality from a fresh perspective.

If you've made it this far, I sincerely thank you for your time. Your engagement with this work is deeply appreciated.

With Gratitude –

Colin Lynch

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