

General Relativistic Argument For a Young Earth In Big Bang Cosmology

ABSTRACT

Geologists, evolutionists, and others require ages for the universe and for the earth to be in the realm of the billions of years. This paper demonstrates that there cannot be a single number called "the age of the universe" (at least, not one observable by anyone other than the creator... an observer outside of the internal processes of a dynamical universe). Indeed, the number of differing ages of the matter and energy in the universe is the same as the number of particles comprising it. Also shown herein, is that even within the broad framework of Big Bang cosmologies, an earth age on the order of a few thousand years is practicable, if not necessary.

The results strongly indicate that one cannot rely upon Big Bang cosmologies to promulgate an old earth age. One cannot discount the likelihood of a young-earth simply through adherence to the concepts associated with Big Bang cosmologies.

Introduction

The concept of **time** is one of the fundamental cornerstones of both the General and Special theories of relativity. Both theories point to the Proper Time of an observer as the only realistic and accurate determinant of time.

Proper Time is nothing more than the time on your personal, local watch. It's as simple as that. Everyone else's Proper Times are the separate times on their individual watches.

We'll shortly see that even when observers synchronize watches, the subsequent flow of time can be different for them.

Here, Special Relativity is first used to demonstrate that time is not the same for all observers of it. In violation of our common sense notions, it will be seen to depend on the path one takes while observing events.

Having made Proper Time as clear as possible through the simpler viewpoint of Special Relativity, we step into the same concept in the

General Theory of Relativity. We'll see how the curvature of spacetime also affects the flow of Proper Time. We'll see that time associated with the matter comprising the earth, the solar system, our galaxy, and possibly even our Local Group runs much more slowly than the time far removed from the matter of the universe. The latter time, by the way, is an unobservable, since one would necessarily need to be out of the universe, and looking back at it from a vantage point unaffected by the curvature of spacetime (such curvature being induced by the presence of matter within the universe). Such time, observable only by the universe's Creator, is usually designated by the term, "Coordinate Time."

Special Relativity Example

Before dealing with the central theme, it seems helpful to clarify how Proper Time can differ from one observer to another. We'll use an example from Special Relativity (SR) to carry out this effort.

This diversion into (SR) is necessary to help avoid the usual impasses when one tries to understand relativistic phenomena. The consequences of Special and General Relativity just don't seem to line up with our feelings of what makes for common sense. Unfortunately that which we consider common sense, is tailored to our life experiences and to the concepts presented to us in 12 or more years of fundamental education. For example, concepts of Euclidean geometry exist in every nook and cranny of our early formal education. It then becomes a difficult task to realize later, that Euclid's is but a very special case of more generalized geometries (e.g., Riemannian) which are better equipped to help us understand natural phenomena. These latter geometries often display characteristics which defy our common senses... such as the intersection of parallel lines, or the ratio of a circle's circumference to diameter no longer being the invariant 3.14159... By the way, the same difficulties occur in understanding elementary physics as well. Try for example, to explain from common sense notions, the phenomenon of quantum mechanical tunneling, or even the notorious double slit experiment.

In our present situation, the difficulties with our notions of common sense are related to the fact that lightspeed is not infinite, and to the fact that all inertial reference frames record the same speed of light, and to the fact that we cannot talk about **when** something happens unless we discuss **where** it happens. Just as important, we cannot talk about **where** an event occurs without considering **when** it

occurs). That is, space and time are immutably linked in an arena designated, spacetime.

For the purpose of our ultimate goal then, we'll endeavor to demonstrate that your own personal time (e.g., as determined by a watch kept with you) properly portrays events at your location. Someone else's watch (even though initially synchronized with yours) will in general, show a different time when you met up again.

Our example is taken from Hermann Bondi's work on the K-calculus (Reference 1). It's the simplest means I've found, for explaining and for understanding relativity principles and their consequences for inertial systems. Bondi's methods don't really use the calculus (as the meaning of the word has come to be known). There will however, be plenty of calculus to throw around once we transfer the discussion of Proper Time to consequences from General Relativity.

So, here's the example:

Look at Diagrams #1 - #4.

Dad (D), Mom (M), and Junior (J) are all situated in inertial reference frames (i.e., they are moving at constant speed with respect to one another). Mom is stationary, in the same reference frame as you, the reader.

In Diagram #1, Dad is approaching Mom from the left. Junior is quite a bit farther away, and is approaching Mom from the right.

In Diagram #2, Dad and Mom synchronize their watches as Dad passes Mom. Let's say they are set for 12:00 AM.

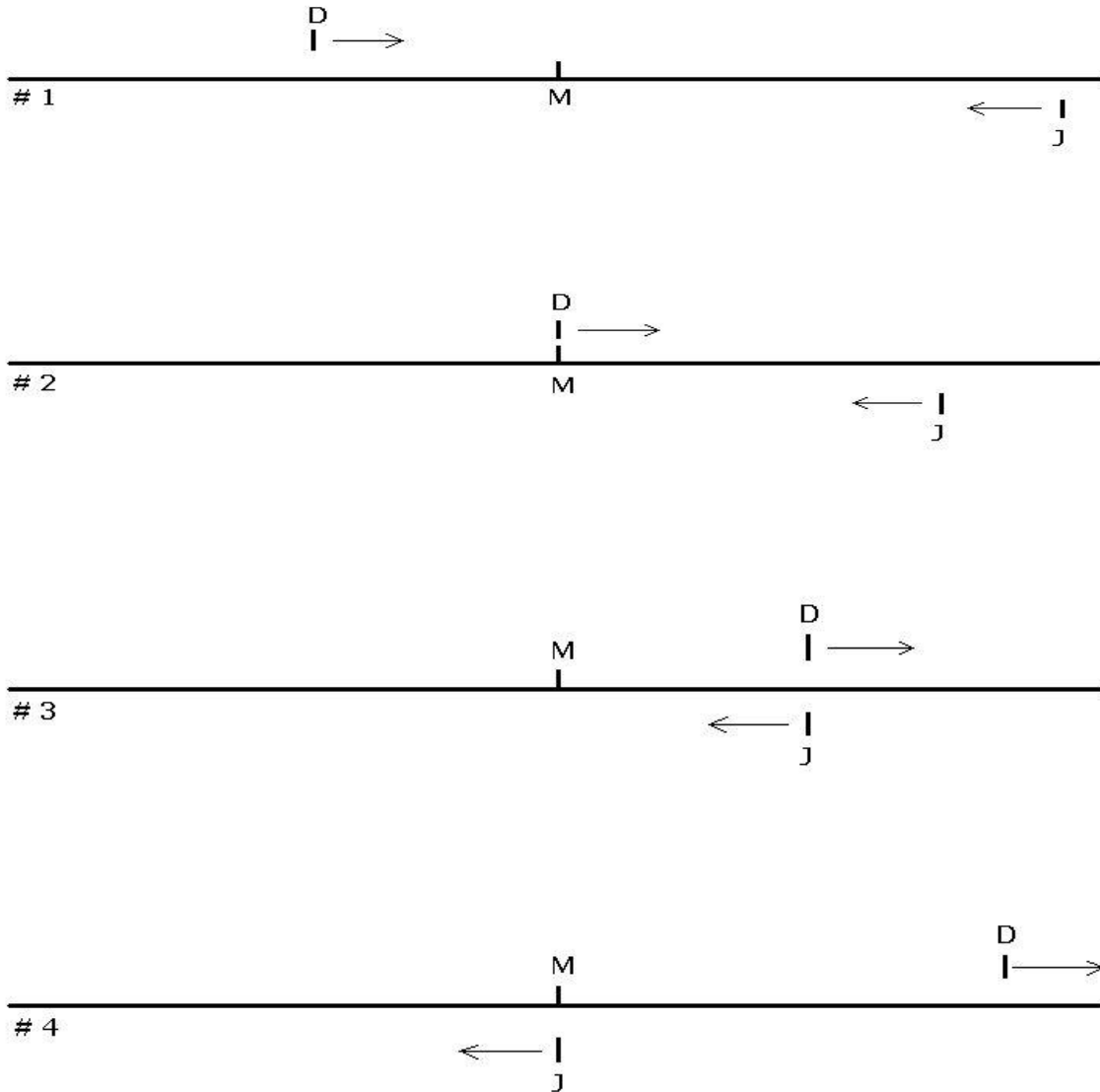
In Diagram #3, Dad and Junior finally pass one another. As they do, Junior synchronizes his watch to the time on Dad's watch.

In Diagram #4, Junior reaches Mom. As they pass, Mom and Junior read the times on their watches. What are these times? And most important, do Mom's watch and Junior's watch read the same time?

The common sense answer is that (M) and (J) have watches reading the same time.

The correct answer though, is that (M)'s watch will have run a longer time than Junior's watch. Their Proper times are different!

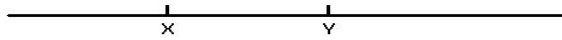
Let's use some numbers to quantify and verify this conclusion. To do so, we'll need to get more involved with Bondi's K-calculus.



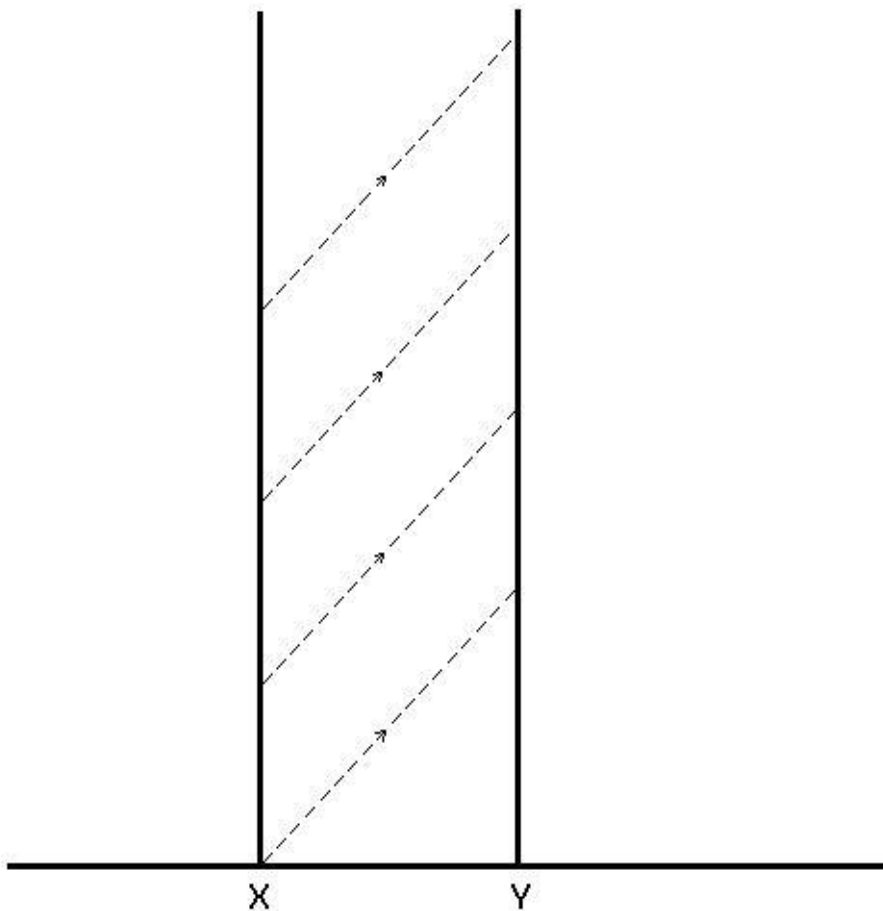
More on Bondi's K-Calculus

Let's consider a universe having only 1-spatial dimension. In it, are two observers (X) and (Y). They are stationary with respect to each other, and to you, the reader.

Now, (X) sends out pulses of light at regular intervals. These pulses are received at the same regular intervals by (Y).



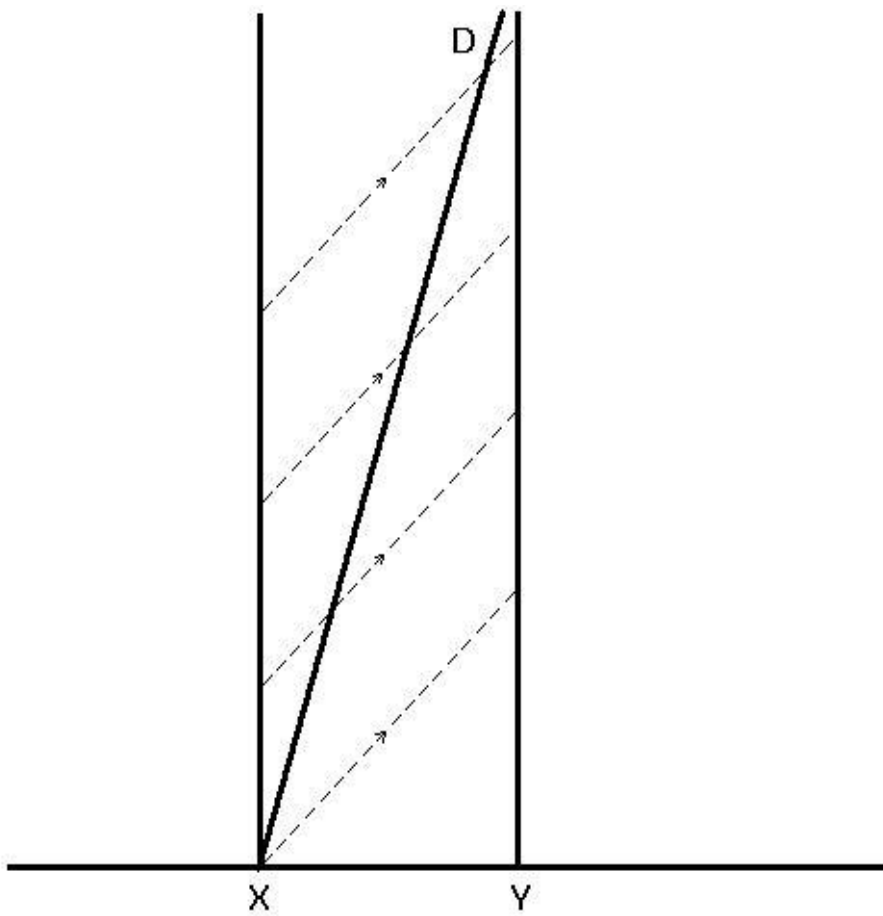
Bondi added a time coordinate, perpendicular to the horizontal space coordinate. Now, even though (X) and (Y) are stationary, they are moving in time:



The light pulses are represented by the dashed lines. They are not horizontal, because light does not get from (X) to (Y) instantly. By the time the first pulse leaves (X), the stationary observer (Y) has moved in time, up to the indicated point. Bondi used a system of units

that require the speed of light to be ($C = 1$). From the above diagram, this unit speed requires that the light pulses travel along 45 degree lines. That is, the ratio of an increment of distance to the corresponding increment in time, is the velocity of the light pulse. That ratio being 1.0, the tangent function requires a 45 degree angle for light, as shown above. Also notice that the regularity and number of pulses of light leaving (X) are the same as they arrive at (Y). For example, if (X) sends out 10 pulses separated by 30 minutes each, then (Y) receives ten pulses separated by 30 minutes each.

If a third inertial observer were to be added to the above diagram, the slope of the straight path line would necessarily be greater than 45 degrees, to preserve the requirement that no object can attain a speed in excess of light (C). Study the next diagram.



In the above diagram, (X) and (Y) and the reader are all stationary, moving only "upward" in time. The third observer (D) is moving from (X) to (Y) at a speed less than (C). Observer (D) is moving slower than the speed of light, because light pulses get to (Y) before (D) arrives.

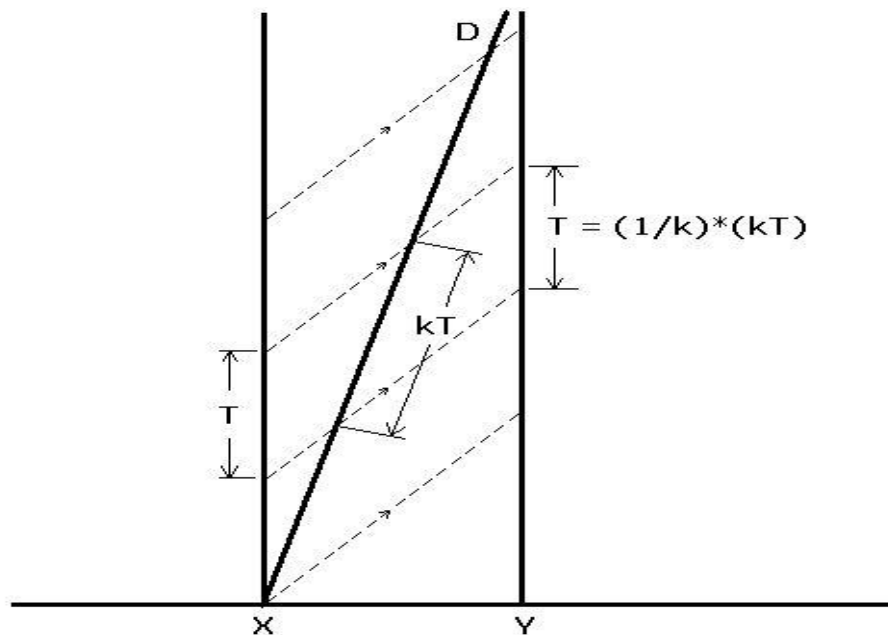
Bondi (Reference 1) defines a parameter (k) in the following way:

$$k = \frac{T_{receiver}}{T_{transmitter}} \quad \text{Eq.-1}$$

where,

the numerator is the time interval between light pulses observed by the receiver, and the denominator is the time interval between pulses as determined by the transmitting observer.

Let's put a half-silvered mirror with observer (D). Now the light pulses received from (X) are simultaneously reflected from (D) back to (X) and simultaneously transmitted from (D) towards (Y).



The above diagram shows that $k > 1$. That is, the pulses arriving at (D) from (X), take more time than (X)'s pulse interval. That's because (D)'s recessional motion demands that the **finite-speed** light pulse take more time to catch up to reach him.

Moreover, remember that if (D) were not present, then the stationary observers (X) and (Y) would note the same interval between pulses. But (D) has that half-silvered mirror. That means, as soon as a pulse arrives at (D) from (X), it may be considered as being transmitted from (D) to (Y). Since (D) is now the transmitter of pulses (at intervals, (kT) then for (Y) to still see (X)'s pulses at intervals (T), we must include the factor (1/k) on the approaching signals from (D).

Here's a numerical example:

Let k=100 and T=10 days. Then,

(X) sends a pulse every 10 days beginning when (D) and (X) first meet. So, (X) sees a pulse interval of T=10 days.

(D) sees these pulses every 1000 days (i.e., kT = 100 * 10).

(Y) sees the pulses every 10 days, i.e., (1/100)*(100*10).

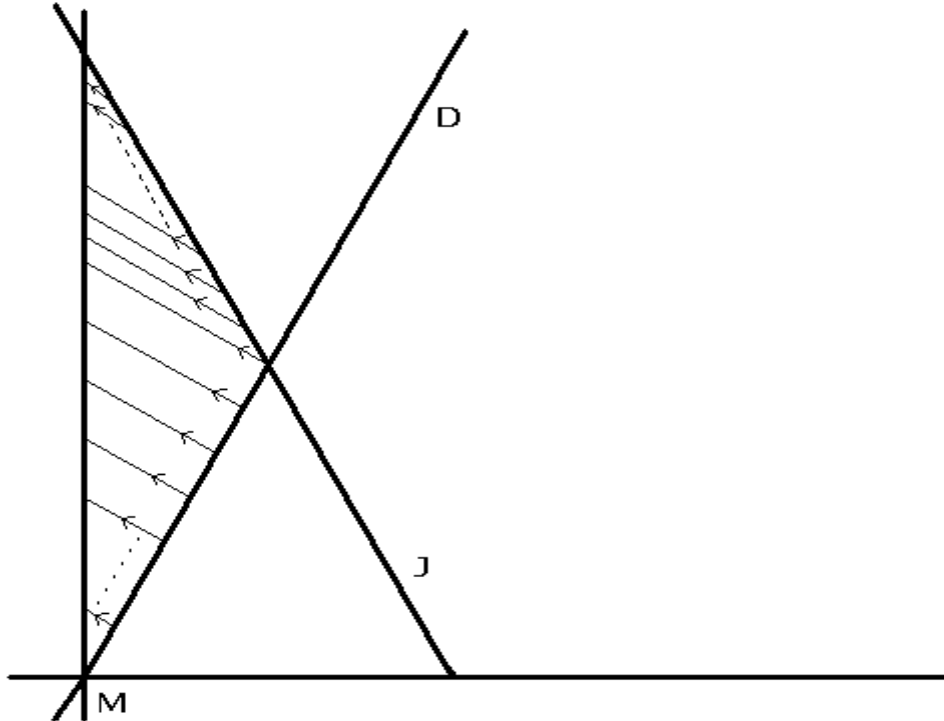
Of central importance for the work to follow then, are these facts:

(X) and (D) are inertial observers. Now, If the receding observer (D) **emits** pulses at intervals (T), then the other observer (X) notes that the pulses occur at an interval, (kT). Also, let (Y) be an inertial observer stationary relative to (X), seeing (D) approaching. If the approaching observer **emits** light pulses at an interval (T) then (Y) observes the interval between pulses as (1/k)*T. Clearly, (k) must be related to the relative speeds of the inertial observers. Bondi derived the relation between the speed (V) and the value of (k). It will not be derived here, since that would be too much of an already too-long digression from the primary mission here. Bondi's simple result (Reference -1) is,

$$\frac{V}{C} = \frac{k^2 - 1}{k^2 + 1} \quad \text{Eq.-2}$$

In the above example where k=100, (V/C) = 0.9998. that is, (D) is receding from (X) at 99.98% of the speed of light. He is approaching (Y) at the same speed.

We are now in a position to see why the previous discussion is of so much importance. Let's go back to the situation depicted in Diagrams #1 - #4. But this time, we'll add the vertical time coordinate:



Using the above diagram, let's establish the following specific set of events.

When (D) passes (M) they synchronize watches (calendars ?) to read ($t = 0$). And beginning when they are coincident, (D) begins emitting light pulses to (M). He emits a total of (n) pulses, each having a duration of time (T). Coincident with (D)'s last pulse, he meets with (J) who is traveling at the same speed but towards (instead of away from) (M). As they pass one another, (J) synchronizes watches with (D). As shown, (J) continues on, towards (M). On the way, (J) emits pulses of light just as (D) did. That is, (J) emits (n) pulses, separated in time, by the interval, (T).

When (D) crosses (J) the amount of time (D) thinks transpired since (D) left (M) is given by, ($n \times T$). That is also the time to which (J) sets his watch when he passes (D). Remembering that when they cross paths, (J) and (D) are the same distance from (M) and that (J) and (D) have the same speed, then (J) will see the same amount of time elapse (as D observed) while on the way back to (M).

So, when (J) meets up with (M), (J)'s watch reads the time on (D)'s watch (since they synchronized), plus the time taken to get from (D) to (M), i.e.,

$$T_J = (n \times T) + (n \times T)$$

$$T_J = (nT) \times (2) \quad \text{Eq.-3}$$

But (M), however, sees a different local (proper) time. She sees the (n) light pulses (transmitted by D), each being received at intervals, (kT). The (k) is a multiplier since (D) is receding from (M). In addition though, (M) receives signals from the approaching (J), and the interval between pulses from the approaching observer is $(1/k) \times T$. The total time on (M)'s watch is then given by,

$$T_M = (n) \times (kT) + (n) \times \left(\frac{1}{k} \times T\right)$$

$$T_M = (nT) \times \left(k + \frac{1}{k}\right) \quad \text{Eq.-4}$$

Compare the equations for T_J and for T_M . They are the same, only when $k=1$. But $k=1$ corresponds to no relative velocity between the observers. *The relative motions of the inertial observers leads to the differences in their observed proper times.*

Lets look at a couple of examples demonstrating that the proper times of observers can be different, within the demands of the Special Theory.

Example - 1: This is the same as Bondi's example (Reference -1).

(D) is receding from (M), and (J) is approaching (M). Both (D) and (J) have the same speed relative to (M). For this example, the "k" parameter has the value, $k=3/2$.

(D) and (M) synchronize watches at their crossing, and then (J) and (D) synchronize watches at their crossing. (D) emits 6 light pulses

towards (M) at 10 minute intervals, and (J) does the same thing. When (J) and (M) meet let's check their watches.

$$T_J = (nT) \times (2)$$

$$T_J = (6 \times 10) \times 2$$

$$T_J = 120 \text{ minutes, i.e., } \mathbf{2:00} \text{ hrs.}$$

and,

$$T_M = (nT) \times \left(k + \frac{1}{k}\right)$$

$$T_M = (6 \times 10) \times \left(\frac{3}{2} + \frac{2}{3}\right)$$

$$T_M = 130 \text{ minutes, i.e., } \mathbf{2:10} \text{ hrs.}$$

This 10 minute difference in the observers' times is real, and the nature of this relativistic phenomenon is observable. In the above case, the 10 minute difference in their watches occurred as a result of the inertial observers' relative motion at a rate of,

$$\frac{V}{C} = \frac{k^2 - 1}{k^2 + 1} \quad \text{Eq.-5}$$

$$\frac{V}{C} = \frac{\left(\frac{3}{2}\right)^2 - 1}{\left(\frac{3}{2}\right)^2 + 1}$$

$$\frac{V}{C} = \frac{5}{13} \quad \text{i.e., a speed, 38\% of the speed of light.}$$

Example #2: $k = 100$ (relative speed, $V = 99.98\%$ of C)

Between meetings with (M) and (J), we have (D) emitting light pulses for four years, each pulse at one year intervals. Then (J) does the same, after passing (D).

$$T_J = (nT) \times (2)$$

$$T_J = (4 \times 1) \times 2$$

$$T_J = 8 \text{ years,}$$

and

$$T_M = (nT) \times \left(k + \frac{1}{k}\right)$$

$$T_M = (4 \times 1) \times \left(100 + \frac{1}{100}\right)$$

$$T_M = 400.04 \text{ years.}$$

Notice, (M) figures that just over 200 years have elapsed since (D) passed by, and the conjunction of (D) and (J). On the other hand, (D) experiences only a 4 year passage of time.

Conclusion from Special Relativity:

Among the three observers (M), (D), and (J), none has what can be considered to be the single "real" or "actual" or "true" time. The time on each of their clocks is the real time *for that observer*. There is no preferred time among the observers. There is however, a Proper Time for each observer... that is, the time kept by each observer is the only version of the actual, real, true time for that observer.

Time is not the rigid absolute parameter we expect from our common senses. Depending on the circumstances, it can be very different from one observer of it, to another.

Proper Time and General Relativity:

You can take one of two grand views of the fundamental meaning of Einstein's general relativity, as expressed in,

$$R_{\mu\nu} - \frac{1}{2} g_{\mu\nu} R = \left(\frac{-8\pi\kappa}{c^4} \right) T_{\mu\nu} \quad \text{Eq. - 6}$$

In one view, energy and ponderable matter exist and their presence causes the warping of spacetime. That is, the right hand side of the above equation (i.e., the stress-energy tensor) causes the purely geometric phenomena described by the left hand side of this equation.

In the other view a warping of spacetime **is** the existence of matter in the region where spacetime departs from a Minkowskian character. That is, the left hand side of Eq-6 manifests itself as the energy-momentum described by the right hand side of Eq-6.

For our purpose here, it is only sufficient to indicate that in **either** view, the simple presence of matter and energy is associated with a departure of the metric tensor components (i.e., $g_{\mu\nu}$) from the flat Minkowskian form.

Solutions of Eq-6 provide the metric tensor components. Among other things, these components specify the interval between two events in the spacetime:

$$ds^2 = g_{\mu\nu} dx^\mu dx^\nu \quad \text{Eq. - 7}$$

The (g_{44}) component of the metric tensor will be used to determine the departure of an observer's Proper Time from that (Coordinate Time) for another observer infinitely far removed from the matter-energy distribution.

For example, given a spherically symmetric diagonal metric in our 4-spacetime, the interval between two events is,

$$(ds)^2 = g_{11}(dr)^2 + r^2(d\theta)^2 + r^2 \sin^2\theta(d\phi)^2 - g_{44}c^2(dt)^2 \quad \text{Eq.-8}$$

If our two events are time observations at the same position, then;

$$dr = d\theta = d\phi = 0 \quad \text{Eq.-9}$$

The interval is then given by;

$$-c^2(d\tau)^2 = -g_{44}c^2(dt)^2$$

or,

$$\left(\frac{d\tau}{dt}\right)^2 = g_{44} \quad \text{Eq.-10}$$

We have to determine whether or not one can reasonably expect that region(s) exist within our matter-energy filled universe, whose Proper Time(s) are remarkably different from the time associated with an observer asymptotically beyond the matter comprising the universe.

The simplest model we can take for this purpose is the interior Schwarzschild solution (e.g., Eq.-14.47 of Reference - 2). It describes a static cloud of incompressible matter, having constant density. A static model is, in fact quite unrealistic since such a cloud would necessarily have a very dynamic character. That is, its self-gravity would tend to compress it, and the buildup of internal energy during compression would lead to secondary phenomena all characteristically dynamic in nature. Such a static cloud of matter-energy would be inherently unstable, and one might therefore be a bit suspicious of any conclusions gleaned from that interior solution.

However, we should be able to determine if a young Proper Age of the earth is at least *plausible* from such a model. After all what we seek is a determination of the Proper Time variations due to the mere *existence* of the matter in the cloud. Consideration of the dynamics within the cloud would, indeed, change the result. However the concept that Proper Times can vary enormously within the cloud (simply because the enormous mass of the cloud severely distorts the fabric of spacetime) can be determined conservatively from a study of the static solution.

All the solutions of Eq-6, (when applied to cosmological situations) have deficiencies of various sorts... even the dynamic ones. For example, the Robertson-Walker (RW) metric is often used to study the dynamic expansion of a homogeneous universe. It is constructed

around a time-dependent expansion/contraction parameter, $a(t)$. That parameter, however, is introduced in such a way that it violates the very spirit of general covariance upon which Einstein's fundamental equation is established. Note this statement (Reference – 2) for example:

“...the use of a distinguished time coordinate marks the abandonment of a completely covariant treatment of the cosmological problem, This is the price one has to pay to simplify the cosmological models and to describe physical reality in convenient mathematical terms...”

Perhaps more important, the (RW) metric is designed to assume at the outset, that there is only one single time parameter describing the universe. It makes no room for the concept that the matter distribution it describes, can in any way affect an observer's Proper Time within the cloud of matter-energy from which the universe is presumed to have been formed. The form assumed for the (RW) metric demands that Proper Time and Coordinate Time are identical under all conditions.

Here, we will *not* use the common form of Schwarzschild's interior solution shown for example in Reference – 2 (Eq.-14.47). That's because it is manifestly unstable. Instead, we'll study the effect on Proper Time, of using Florides' formulation of the Schwarzschild interior solution (see Reference – 3). This solution attempts to incorporate a measure of stability to the system, by including tangential, radially dependent stresses in the stress tensor on the right side of Eq.-6)

Here then, is Florides' version (Reference - 3) of the spherically symmetric Schwarzschild **interior** solution for our static cloud of matter-energy having total mass-energy, (M) and radius (a):

$$ds^2 = \frac{dr^2}{(1-2\mu/r)} + r^2 d\theta^2 + (r^2 \sin^2 \theta) d\phi^2 - \left(1 - \frac{2m}{a}\right) \text{Exp} \left[\int_a^r \frac{(2\mu) dr}{r^2 (1-2\mu/r)} \right] dt^2 \quad \text{Eq.-11}$$

where,

$$\mu(r) = \left(\frac{\kappa}{c^2}\right) 4\pi \int_0^r r^2 \rho(r) dr \quad \text{with,}$$

$$m = \mu(a)$$

$$m = \frac{M\kappa}{c^2}$$

$$c = 3 \times 10^{10} \text{ cm/sec}$$

$$\kappa = 6.67 \times 10^{-8} \text{ dyne - cm}^2 / \text{gm}^2$$

Florides (Reference – 3) generated the constant density solution, and it will be of interest to us here;

$$ds^2 = \frac{dr^2}{1 - r^2/R^2} + r^2 d\theta^2 + (r^2 \sin^2 \theta) d\phi^2 - \sqrt{\frac{(1 - a^2/R^2)^3}{(1 - r^2/R^2)}} dt^2 \quad \text{Eq.-12}$$

where,

$$\frac{1}{R^2} = \frac{1}{3} \left(\frac{8\pi\kappa}{c^2} \right) \rho \quad \text{Eq.-13}$$

with,
$$\rho = \frac{M}{\frac{4}{3}\pi a^3} \quad \text{Eq.-14}$$

and with the constraints that $r < R$ and $a < R$. The above equations also show that an alternative way of expressing the second constraint is, $a > 2m$.

We are interested in events purely separated in time only. That is, two events occurring within the cloud are separated only in time (i.e., the ticks of the clock at a specified point in space).

Therefore, in the interior solution, the spatial intervals vanish. That is,

$$dr = 0 \quad \text{and} \quad d\theta = 0 \quad \text{and} \quad d\phi = 0 .$$

Establish the proper time (τ) at radius (r) then, from the following:

$$ds^2 = -c^2 d\tau^2$$

The interior solution for timelike events is then given by:

$$-c^2 d\tau^2 = -c^2 dt^2 \sqrt{\frac{(1-a^2/R^2)^3}{(1-r^2/R^2)}} \quad \text{Eq.-15}$$

Let's for convenience, identify a simplifying parameter:

$$\varepsilon = \frac{d\tau}{dt} \quad \text{Eq.-16}$$

then,

$$\varepsilon = \left[\frac{(1-a^2/R^2)^3}{(1-r^2/R^2)} \right]^{\frac{1}{4}} \quad \text{Eq.-17}$$

The issue finally comes to the following question:

Is there any place within this static cloud comprising the matter of the universe, where the value of (ε) can be made to be arbitrarily small?

In particular, If the cumulative ticks of the "Coordinate Time" (dt) sum to, say 12 billion years, can we find a location within the cloud where the accumulated "Proper Time" ($d\tau$) is only, say, 6000 years? That is,

$$\varepsilon = \frac{d\tau}{dt}$$

$$\varepsilon = \frac{6000 \text{ yr}}{12 \times 10^9 \text{ yr}} = 5 \times 10^{-7} \quad \text{Eq.-18}$$

Should such a location exist, then place(s) exist within that universe whose clocks have only ticked off 6000 years of time... while the watch of the asymptotically distant external observer(i.e., the Creator) has indeed ticked off 12 billion years.

Inspecting Eq.-17, it appears that the right side can be made arbitrarily small, by selecting a value for (a) very close to, but still less than (R), and determining which value of (r) makes both sides of the equation the same.

For example, take

$$a = 0.999999999 \times R . \quad \text{Eq.-19}$$

Then the radial position corresponding to $r = 0.95 \times R$, gives the right side of Eq.-17 the value, 5.3×10^{-7} .

So, for the universe modeled, a radial position exists within the cloud wherein an observer considers the age of the (local) matter to be 6000 years, while a corresponding observer asymptotically distant from the cloud, observes an age of 12 billion years.

What kind of universe do our selected numbers represent?

Well, it surely wasn't accidental that we selected the cloud's radius (a) to be 12 billion light years. In years, that's a dominant choice by many cosmologists, for the age of the universe. From Eq.-19, (R) must be ever so slightly larger than this 12 billion light years.

Now, we can use Eq.-13 to get a good idea of (ρ), the density of matter-energy within the cloud. Taking ($R \rightarrow a$) and noting that,

$$1 \text{ Light Year} = 94.61 \times 10^{16} \text{ cm}$$

The uniform density of this universe is,

$$\rho = 1.25 \times 10^{-29} \text{ gm} / \text{cm}^3 .$$

The order of magnitude of this result is remarkably consistent with the data presented for the "Standard" Cosmological Model of the universe (e.g. see Fig 28.1 of Reference -4).

Using this density along with Eq.-14 and Eq.-19, we can see what our result says about the amount of matter in this uniform density cloud. The computation yields;

$$M = 7.66 \times 10^{55} \text{ gm} .$$

Taking the sun as an average star with mass, $m_{sun} = 2 \times 10^{33} \text{ gm}$, the mass of this universe is equivalent to that of about 4×10^{22} suns.

One way (of many) to distribute these suns, is;

$$4 \times 10^{22} = (400 \times 10^9) \times (100 \times 10^9)$$

A possible distribution is, then, 400 billion galaxies, each containing one hundred billion average stars... once again, a universe considered *reasonable* by many cosmologists, even in light of the fact that the true extent of the universe's size or mass is unknown.

Conclusion

It is possible within the framework of both the General Theory of Relativity, and the Standard Cosmological Model, to expect that regions exist within the universe whose (local) Proper Time is on the order of 6000 years.

This conclusion is obtained from a generalized solution of Einstein's field equation in which the radial solution is rendered stable. It does not *demand* that such region(s) exist however. To demand such a Proper Time, one would need to investigate a much more complex model of the universe. That model would include such factors as the dynamics of galaxy and star formation, galaxy and stellar transient phenomena, and the properties of elementary particles under extremely high temperatures and pressures. Applying such a solution to the age of the earth would be virtually impossible, since the initial conditions and boundary conditions applicable to formation of the earth in the Standard Model, would only be completely knowable to God and Jesus Christ (e.g., Heb 1:2).

The homogeneous model, however, is not necessarily a poor choice for the universe. That's because galaxies are small relative to the size of the universe, and within current observational limits, they are dispersed quite uniformly throughout the universe.

Note that our result doesn't include the effects on spacetime curvature due to the dark matter, and the energy in photons, neutrinos, etc. present in this universe's cloud. Including these sources would produce further departure of the metric from the Minkowskian form... and

therefore further enhance the separation between Proper and Coordinate Times. While that doesn't mean that the earth is younger than 6000 years, it does mean that complex, interacting factors would be involved in the ultimate solution of this problem... but the introduction of such factors would tend to demonstrate that the solution presented herein, is conservative.

References

1. Relativity and Common Sense; Hermann Bondi; Dover, 1964.
2. Introduction to General Relativity; Adler, Bazin, Schiffer; McGraw-Hill, 1975.
3. A New Interior Schwarzschild Solution; P. S. Florides; Proc. R. Soc Lond. A; 337, 529-535, (1974).
4. Gravitation; Misner, Thorne, Wheeler; W.H. Freeman, 1973.

