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Solving the Light Travel Time Problem

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An overview of the light travel time problem, how different biblical creationists have addressed it, and the *dasha solution* to the problem

Introduction

On this date 34 years ago, SN 1987A erupted. Located in the Large Magellanic Cloud (LMC), SN 1987A was the first naked-eye supernova in four centuries. The LMC is a small satellite galaxy of our Milky Way Galaxy, about 168,000 light-years away. Keep in mind that the light-year is a unit of distance, not time. A light-year is the distance that light travels in a year, about six trillion miles. Right away, the distance of the LMC raises a problem for recent creation. If the world is only a few thousand years old (more specifically, a little more than 6,000 years), how could we have seen SN 1987A? For that matter, what about all those other galaxies that are much farther away? How can we see anything in the universe that is more than 6,000 light-years away?

Creationists get this question so often that we have a name for it: the light travel time problem. Over the years, creationists have offered several answers to this problem. For instance, a few creationists have suggested that astronomical distances are not all that great and so light from all the universe could have reached us long ago. However, this would require a tremendous reduction in the long-established scale of the universe. But there is abundant evidence that astronomical distances are at least qualitatively correct, with many galaxies being millions of light-years away. For example, the Andromeda Galaxy, the closest galaxy similar in size to our own galaxy, is approximately two million light-years away, and that distance appears sound. Therefore, doubting astronomical distances is not a productive way to address the light travel time problem.

Mature Creation

A popular solution to the light travel time problem is the concept of mature creation. God did not create man and woman as babies or as embryos. Rather, the Genesis Creation account indicates that God made Adam and Eve as mature adults. Suppose one could go back in a time machine to shortly after the Creation Week, say on Day Eight. Examination of the first couple would have indicated that they were adults, perhaps in their twenties, even though Adam and Eve were only a few days old. That is, Adam and Eve were created mature, without the normal birth and growth process that humans go through to reach maturity. Likewise, the plants in the Garden of Eden (and elsewhere) would have looked mature too, even though they didn't exist more than three days before the creation of Adam and Eve. The Day Three account says that God caused the plants to grow out of the ground (Genesis 1:11–12). This happened in less than one day, because God made the dry land appear one day before he made the plants appear. Why was it important that the plants rapidly reach maturity so quickly? According to Genesis 1:29–30, originally man and animals were vegetarian. The plants could not fulfill this purpose if they were not mature. This pattern of maturity would seem to apply to all the creation week.

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This concept of maturity, or the appearance of age, also played out in some of the miracles that Jesus performed. Jesus' first public miracle was the changing of water into wine at the marriage feast in Cana (John 2:1–11). When the wine ran out, a very embarrassing thing for the bridegroom, Jesus changed water in six large stone vessels into wine to supply the need. The servants who witnessed the miracle took the wine to the master of the feast, who did not witness the miracle. The master of the feast was impressed with the quality of the wine and commended the bridegroom for not serving the best wine first, which was the common practice, but rather held back the best wine for later in the feast. A marriage feast could go on for days, so the master of the feast apparently thought that the wine was at least a few days old. However, anyone who did not witness the miracle would have thought the wine was even older than that. After grapes are grown, harvested, and crushed, the fermentation and aging process of wine takes some months. Any reasonable person would have concluded that the wine was the result of this process and hence was mature. When confronted with the fact the wine did not exist until a few minutes before, one would be left with the conclusion that the wine had the appearance of age.

Similarly, one may argue that feeding of the 5,000 (Matthew 14:15–21) required the appearance of age. Jesus multiplied the five loaves and two fish to feed the multitude. Anyone who did not witness the miracle but examined the fish created by the miracle would have reasonably concluded that the fish were hatched and grown in the Sea of Galilee before being caught, processed (cooked?), and transported to the location to be eaten. Likewise, one would reasonably conclude that the bread was the result of grain that was sown, grown, harvested, milled, and then baked. All these processes normally take considerable time, but none of these processes happened. Again, this miracle required the appearance of age.

Creationists who appeal to mature creation to solve the light travel time problem reason that if most astronomical bodies were not visible at least by the end of the Creation Week, then the astronomical bodies could not fulfill their functions given in the Day Four account (Genesis 1:14–19). Therefore, God must have created the universe mature, with light created in transit between them and the earth.

Such evidence would seem to be deceptive, which would violate the character of God. The light we receive from distant astronomical bodies is not just illumination. Details of the light often bear evidence of processes.

However, there are is a problem with this solution. Our bodies have subtle evidence of things that occurred during our growth and maturing processes. The most obvious of these are small scars of minor injuries sustained while growing up, but there are other evidences, such as the sealing off the ends of our leg bones upon completion of the growth process. Did Adam and Eve bear in their bodies any evidence of a childhood they never experienced? Most supporters of mature creation would opine that Adam and Eve did not. This amounts to an affirmation that while Adam and Eve were created mature, they did not bear any detailed evidence of processes that never happened. Such evidence would seem to be deceptive, which would violate the character of God. The light we receive from distant astronomical bodies is not just illumination. Details of the light often bear evidence of processes. For instance, I have more than four decades of experience observing eclipsing binary stars. An eclipsing binary star is a system of two stars that orbit one another very closely with an orbital plane that lies close to our line of sight to the binary. From the distance we view close binaries, we cannot see the individual stars, so their combined light blends into what appears to be one star. However, as the two stars orbit each other, they alternately eclipse one another, causing their combined light to dim. I measure the brightness of eclipsing binaries as a function of time to obtain their light curves, a plot of how their light varies over complete cycles. We can use light curves to deduce properties of the stars involved. However, if the light of these stars were created in transit so that the light never left the stars, then we would see evidence of events (eclipses, for example) that would have never happened. This is deceptive.

Decreasing Speed of Light?

It was this realization that led many creation scientists to look for alternate solutions for the light travel time problem. One of the first of these alternate explanations was the suggestion that the speed of light had changed over time. If the speed of light were infinite or near infinite when God made the stars, then their light could have reached the earth in a very short length of time. Supposedly, the speed of light has decreased since the creation week to the relatively modest 186,282 miles per second today. In the late 1980s, attention was drawn to the fact that the earliest measurements of the speed of light a few centuries ago were higher than the currently accepted value. Intervening measurement of the speed of light appeared as if they were gradually decreasing toward the modern value. If taken at face value, this would indicate the speed of light has decreased in modern times, though it raises the question of why this trend recently ceased.

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The possibility that the speed of light was decreasing or had decreased in the past drew much attention among creationists, but soon problems with this hypothesis were pointed out. One problem is that the speed of light is not an arbitrary constant. Its value depends upon two fundamental constants of nature, constants that govern the strength of electrical and magnetic forces. These forces play important roles in the structure of matter. If the speed of light were changed even a small amount, it would greatly change the structure of matter. There is no evidence that this has ever happened. In fact, there is good evidence that this has not happened in the past. Therefore, it seems unlikely that the speed of light has ever changed to any appreciable degree.

What about the evidence in the form of historical measurements of the speed of light that indicate that the speed of light has decreased? This trend shows up only if one treats all measurements of the speed of light as having equal errors of measurement, but this is not the case. The earliest measurements of the speed of light were subject to the greatest amount of error. With improvements in technology, the errors in the measurements have greatly decreased. When making measurements, people do not operate in a vacuum. Rather, they generally are aware of the work that preceded them and hence "know" what the right answer is. If researchers' measurements are at variance with previous results, there is a tendency to interpret new measurements in the direction of the "known" value. Some people call this trending.

I first experienced trending many years ago when I took general physics as a university sophomore. Our labs were partly graded on how good our results were. We could follow all procedures properly and still get poor results because of the limitations of the equipment. I was a bit naïve in that I followed the procedures, made the measurements, and then proceeded to compare our results to standard values to find a percent error. If our results had high percent error, this surely would result in a poorer grade. Aware of this, one of my lab partners was more astute than I was and looked up the established values beforehand and computed what measurements we ought to expect. If we made measurements that were at variance from what he expected, he insisted on repeating the experiment until we got results that produced measurements that were within the acceptable percent error to get a good grade. This approach assumes that we were wrong, and the established values were right. That probably is a true assumption, but one can never be too sure about that.

When one is aware of trending, one begins to understand that an apparent change in measurements of something that is supposed to be a constant may not constitute evidence of change at all. It is likely a matter of the earliest measurements, which were subject to the greatest error, happening to have been greater than the true value. If the earliest measurements happened to be less than the established value, then one might interpret that as evidence of an increase in that established value. If an increasing speed of light were indicated by historical data, we wouldn't be having this discussion because it would exacerbate the light travel time problem, not possibly solve it.

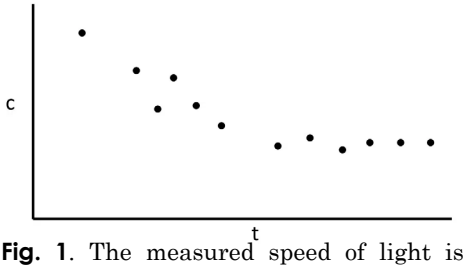

Fig. 1. The measured speed of light is plotted vertically against a horizontal plot of the year of measurement. You can see that the measured speed of light looks like the speed of light has decreased over the years. However, this conclusion ignores the relatively high probable errors of the earliest measurements of the speed of light.

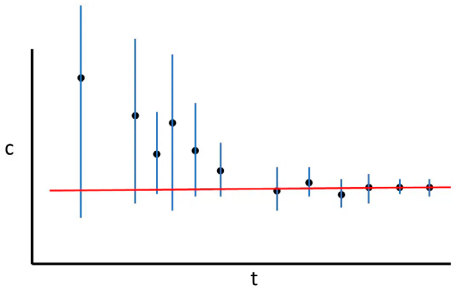

Fig. 2. With improvements in technology, the accuracy of the measurements of the speed of light has improved tremendously over the years. A good way to show how accurately measurements are made is with error bars. An error bar is a vertical line that passes through a data point and extends to the maximum and minimum values the measurement could have, knowing the error of measurement.

The key evidence in the supposed decrease in the speed of light is a plot of the measurements of the speed of light as a function of time below. See fig. 1 for a representation of what this plot looks like. Fig. 2 shows the same plot of data, but with error bars added. Notice that the earliest measurements have the tallest error bars, indicating that those measurements were subject to the greatest errors. A good fit to the data would be any curve or line that passes within the error bars. Aware of trending, I have drawn a red horizontal line that fits all the data well. A horizontal line means that the speed of light has not changed. Therefore, the data do not necessarily indicate a decreasing speed of light after all. Add to this the fact that the measured speed of light has been constant to a high degree of precision for more than a half-century, and the decay in the speed of light does not appear to be a successful answer to the light travel time problem.

General Relativistic Solutions

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With the problems of the mature creation and the decay of the speed of light solutions to the light travel time problem, creation physicists began to explore solutions involving general relativity. General relativity is the current, dominant theory of gravity, but it also is a theory of space and time. According to general relativity, time is a fourth dimension that we must consider along with the three dimensions of space. The difference between time and the

other three dimensions is that motion in time is in only one direction: forward. In fact, all objects move forward in time at the same rate, so we can't even remain motionless in time. Motion through this four-dimensional spacetime is along a geodesic, the shortest distance between two points. If geometry is flat, such as in a plane, geodesics are straight lines. However, if geometry is curved, then geodesics are curved, though they may appear flat within the geometry. According to general relativity, the presence of great mass or energy bends spacetime. As objects follow their geodesics in this curved spacetime, we perceive the geodesics as acceleration of gravity.

The effects of relativity can have some interesting manifestations in the world. For instance, the passage of time is not at the same rate to all observers. Depending upon location, time can pass more slowly in some reference frames than in others. This was the key to Russ Humphreys' white hole cosmology, published in 1994. According to this model, God initially created the earth inside a white hole. A white hole is an alternate solution to a black hole, with matter and energy streaming outward rather than inward. Because of this loss of mass, white holes would be unstable and would cease to exist. Therefore, if there ever were white holes, they likely no longer exist now. Furthermore, while there are theories of how black holes could form naturally, there is no theory of how white holes could form. With these constraints, few physicists think that white holes are around today. In the white hole cosmology, the white hole evaporated on day four. With the earth at the center of the white hole, it would be the last thing to emerge from the white hole as the white hole vanished. Humphreys reasoned that time on earth would pass very slowly compared to locations outside the event horizon, the outer boundary of the white hole. This would allow for billions of years to pass in much of the universe while only a few days might have elapsed on the earth. This would have provided ample time for light to reach the earth from the most distant parts of the universe.

Right away, the white hole cosmology gained many adherents among creationists. The appeal was that it was the first rigorously scientific approach to the light travel time problem. Few creationists realized that, while the white hole cosmology was young earth, it was an old universe theory. That didn't matter to most people who understood this, because with general relativity, the passage of time depends upon one's location. The perspective of the Creation account is from the earth's surface, so the white hole cosmology would seem to preserve recent creation.

Many supporters of the white hole cosmology don't know that Humphreys has since abandoned his model. For several years, Humphreys has been pursuing a different approach, again relying upon general relativity. Humphreys now believes an expansion early in the Creation Week produced what he calls a "timeless zone," which again allowed much time to elapse in part of the universe but not everywhere. He is still refining this model.

Encouraged by Humphreys' incorporation of general relativity, two other creation scientists attempted their own solutions to the light travel time using general relativity. John Hartnett studied the work of the theoretical physicist Moshe Carmeli. Carmeli modified general relativity to include a fifth dimension, a space-velocity that incorporates the Hubble flow of galaxies. Hartnett adapted Carmelian physics to a recent creation model to solve the light travel time problem.

Jason Lisle took a different approach. Lisle noted that all direct measurements of the speed of light rely upon measuring how long it takes light to travel one way and then back to the observer by a similar path. Knowing the distance involved, we compute the average speed of light over the round trip. We assume that the speed of light is the same in either direction, but how do we know that this is the case? We don't. What if the speed of light on the outgoing leg is one-half what we think the speed of light is and is infinite on the return leg? The amount of time required to make the round trip would be identical to the time if the speed of light were the same on both legs of the trip. To most people, this second possibility doesn't make sense, but there is no way of knowing whether this alternative is true. Furthermore, with general relativity, it doesn't make any difference, nor could we be certain either way. The assumption that the two-way speed of light is the same is the Einstein synchrony convention; assuming that the speed of light is infinite on the return trip is the anisotropic synchrony convention (ASC). Again, either possibility is compatible with general relativity.

The ASC solution to the light travel time problem has gained supporters among recent creationists (such as John Hartnett). However, many supporters of solutions of the light travel time problem based upon general relativity don't truly understand these solutions. For instance, many creationists think that the ASC solution means that light coming toward the earth travels infinitely fast; thus we are receiving light from the most distant objects in the universe instantly. However, this is not what the ASC solution claims. Rather, with general relativity we don't know whether the ASC is true, but it really doesn't matter. What does matter is that any timing convention consistent with general relativity can be considered as correct.

However, many supporters of solutions of the light travel time problem based upon general relativity don't truly understand these solutions. For instance, many creationists think that the ASC solution means that light coming toward the earth travels infinitely fast; thus we are receiving light from the most distant objects in the universe instantly.

To illustrate this, consider SN 1987A, the naked-eye supernova in 1987 that I began this article with. When did this supernova happen? I've already just told you: in 1987. But SN 1987A was in the LMC, which is 168,000 light years away. Therefore, one could say that SN 1987A happened 168,000 years ago, as opposed to 34 years ago. Which is correct? Either is correct, and either is consistent with general relativity. ASC allows for God creating the heavenly realm over billions of years in a shell of creation that shrank at the speed of light that collapsed onto the earth on Day Four of the Creation Week. Alternately, God could have rapidly created everything in the heavenly realm on day four with the light arriving instantly on earth. Either possibility is consistent with general relativity, and we cannot tell which is the correct one.

Is There a Better Way?

But how much science as we now know it should we allow during the Creation Week? By its very nature, wasn't the Creation Week miraculous? The creation of plants on Day Three hardly followed science as we know it.

General relativity is one of the best scientific theories we have. This is why solutions to the light travel time problem based upon general relativity are so attractive. But how much science as we now know it should we allow during the Creation Week? By its very nature, wasn't the Creation Week miraculous? The creation of plants on Day Three hardly followed science as we know it. Ditto for the creation of swimming and flying things on Day Five and the creation of land animals and man on Day Xix. The creation of light on day one seems to have not followed the pattern of how light is understood to work today. The creation of astronomical bodies on Day Four likely wasn't accomplished by physical processes currently in operation. Ultimately, the sudden appearance of matter and energy during the Creation Week violated the conservation of matter. In short, all the processes during the Creation Week did not conform to how the world now operates, the description of which we call science. So, isn't it inconsistent to expect the light travel time problem to have a naturalistic (scientific) explanation? Is this not an assumption of uniformitarianism, something that we creationists frequently call out evolutionist on?

Many people have preconceptions about the Creation Week that they impose on the text. One preconception is that God created everything ex nihilo (out of nothing) during the Creation Week, but this is not true. God formed man from the dust of the ground (Genesis 2:7) and woman from his side (Genesis 2:21–22). Neither creation was ex nihilo. In similar manner, out of the ground God made the land animals (Genesis 1:24), as well as the birds (Genesis 2:19). Furthermore, God caused the plants to grow out of the ground on Day Three (Genesis 1:11–12). It is possible that God fashioned other things from matter he had created ex nihilo earlier in the Creation Week. For instance, did God make dry land from the water on Day Three (Genesis 1:9–10), or was the solid ground already there but far below a primordial ocean that completely covered the earth's surface? Similarly, did God create astronomical bodies ex nihilo on Day Four, or did he make them from matter he had created earlier in the Creation Week?

Another preconception is that God made everything instantly during the Creation Week, but this is not true either. The process of the creation of man, plants, land animals, and flying things from the ground required at least a little time. Ditto for the creation of Eve. The separation of light and dark on Day One may have taken some time, as well as the making of the expanse of Day Two. We may surmise that God similarly used processes on Day Four to make the astronomical bodies. Note that none of these were the gradual processes required by evolutionary theories but rather were rapid (taking less than a day), directed processes.

Notice that the manner of creation of plants is described twice, once in verse 11, and the other in verse 12. These two verses use different Hebrew verbs to describe the earth bringing forth plants. These verbs get across the idea of producing, sprouting, shooting, or thrusting. These are very active verbs, indicating rapid growth. If we would have been witnesses to this process on Day Three, we may have seen something like a time-lapse movie of plant growth. This suggests that the development of plants on day three might have been what we see with plant growth and development today but was abnormally fast. In other words, it was miraculous. Why was this fast growth and development of plants necessary? According to Genesis 1:29–30, both man

and animals originally had a vegetarian diet. To fulfill this purpose, the plants had to be rapidly brought to maturity. The statements of Genesis 1 that what God had made was good has the implication of completeness, that what God made was meeting the purposes intended for them.

The astronomical bodies also have purposes (Genesis 1:14–18), but they could not fulfill those purposes if they were not visible, at least by two days after God made them when man was on the scene. As God rapidly brought forth the plants on Day Three to meet their purposes, could God similarly have rapidly brought forth the light of the stars on Day Four so that they could fulfill their purposes? Note that I am not suggesting this was done through the physics of general relativity or by altering physics so that the speed of light changed. Rather, I'm suggesting that God miraculously brought the light to earth from the farthest reaches of the universe right after he filled the universe with astronomical bodies. Because of the comparison to how God made the earth rapidly grow plants on Day Three, I have called this the *dasha* solution to the light time problem, from the Hebrew verb used in Genesis 1:11. An alternate name for this solution is *matured creation*, emphasizing that God did not instantly create things mature during the Creation Week but rapidly matured them upon creating them.

Conclusion

The popular mature creation solution to the light travel time problem introduces the difficulty of false history of processes that never happened. While the *dasha* solution superficially resembles the mature creation solution, it differs in a fundamental way: all of the processes that we see playing out, such as SN 1987A, actually happened. With the mature creation solution, none of these distant events occurred. Rather, evidence of those events was artificially introduced into the light when God created that light in transit on day four. Since in the mature creation solution, the light from distant objects never left those objects, none of those distant objects need exist at all. Consequently, in the mature creation solution, much of the universe could be an illusion. In the *dasha* solution, when did distant events such as supernovae in other galaxies occur? The *dasha* solution would require that they happened relatively early in the universe. While I believe that distant galaxies are millions, and even billions, of light-years away, I don't believe the light has been traveling to us for much more than 6,000 years. Given the tremendous distances and otherwise implied light travel times, we are seeing much of the universe in something close to real time.

The other solutions to the light travel time problem rely upon physics, the way that the universe now operates. We recognize the role of the miraculous in so much of the rest of the creation week, so why must we restrict ourselves to a natural, physical mechanism to solve the light travel time problem? The *dasha* solution is the only answer for the light travel time problem that is consistent with the miracle of creation and the character of God.