IT'S JUST A MATTER OF TIME

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Abstract

Many people accept what they read as the clear message of Genesis: That the Earth was formed about 10 thousand years ago, on the first day, and that the stars were formed on the fourth day. This has led to disagreement with others who see the hugeness of the perceived distances to most stars and their apparent ages as a compelling argument against this reading. From discussions in which this writer has participated, the argument seems to be based on the required travel time of the light arriving from the distant stars and the estimated ages of stars.

However, there is a solution. This paper uses the Theory of Relativity to illustrate the observed phenomenon that the measurement of travel time is a function of the time keeper. Furthermore, this allows for billions-of-years-old stars that were created after the creation of the few-thousand-year old Earth. The preceding statement is not self-contradicting. One could take the viewpoint that time-keeping processes, such as radioactive decay rates, occurring out in the universe proceeded at a rapid rate as measure by Earth time. Thus, old Earthers should recognize that the perceived size and age of the universe is no bar to a young Earth and universe, at least from the view-of Earth time.

Introduction

The hugeness of the perceived distances to most stars has been considered by some, Christians and non-Christians alike, to be a powerful argument against a young Earth. The logic goes like this: "It is known that stars lie billions of light years from us. Light from those stars that we now see left them billions of years ago." They also derive estimates of the ages of stars based on models of the progression rate of physical processes which affect stellar radiation characteristics and on the observed radiation of stars.

Many others simply accept what they perceive as the clear message of Genesis that the Earth was formed on the order of ten thousand years ago and that the stars were formed on the fourth day, after the Earth. Many non-Christians, and many young-Earth Christians, including this writer, also testify that the wording of the Bible could not even allow for a significantly older Earth. Many young-Earth Christians believe that God placed the stars in the heavens with light from those stars already in place between them and the Earth.

Some who believe in the infallibility of the Bible also believe in an old Earth. Some, but not all of these Christians admit that the plain reading of Genesis implies a several-thousand year old Earth. However, they argue that revelation through the creation itself (i.e. scientific observation and theories) requires another interpretation, which they believe is not precluded by the wording in the Bible. Some also argue that placing the light en route would have been deception on God's part because the light would imply a history that was not real.

The two sides in this disagreement could just agree to disagree. On the one side are Bible believing young-Earthers, while on the other side are old-Earthers, some Bible believing Christians and others not believers. Still, there are those searching non-Christians, and there are some believers, who are troubled by the discrepancy between what they read in the Bible and what they interpret from scientific data or hear from the scientific community. Thus, it seems worthwhile to address the concerns of those people. At the same time, it also seems valuable to attempt to widen the areas of agreement between young-Earth and old-Earth Christians.

Stated assumptions for the old-Earth argument usually include the constancy of the speed of light in a vacuum and that physical objects, including light which consists of photons, cannot travel faster than this speed. A proper understanding of this assumption, however, shows that it has been incorrectly applied in the old-Earth argument.

It is also seen that the immediate presence of light in the path between the distant stars and the several-thousand year-old Earth is a natural consequence not an unnatural one) of what God describes in the Bible. Therefore, no deception by God is indicated.

The Classic Clock Paradox Story

To begin, consider the so-called "clock paradox," which is based on the theory of relativity. The usual example involves two twins on Earth. One travels to a distant star system. He accelerates to a tremendous speed to reach that point thousands of light years away, and then returns while aging only a few years. However, he finds the Earth is much older.

That this time differential, predicted by relativity theory, can occur may be hard to believe, but there is evidence that supports this theory—see McGraw Hill Encyclopedia (1987). This evidence includes measurements of the decay rate of mesons at high speeds that agree with theoretical predictions. Also, clocks were flown around the world and the clocks "ticked slower" while orbiting. They resumed normal rates when returned to the Earth. The traveling clocks were synchronized with identical Earth-bound clocks before flight, and had, as predicted, time missing (post-flight) when brought back for comparison.

The fact that the traveling twin traveled thousands of light years while aging only a few years may seem to contradict the requirement that one cannot travel faster than the speed of light. However, a violation of that limit by the traveling twin has not occurred, from the perspective (i.e., frame of reference) of either twin. As we will see, the above old-Earth argument misconstrues that same requirement in a similar manner.

From the stationary twin's point of view, the traveling twin traversed a huge distance but took a long time

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(the Earth aged a lot while the traveling twin was gone). From the traveling twin's view, he took a short trip (he only aged a few years) but as his velocity approached the speed of light, his measurement of distance to the distant star system shortened, according to the Fitzgerald contraction (a sample calculation, using the Lorentz transformation, is provided later). The result keeps the ratio of distance covered to elapsed time less than the speed of light. Thus, from both perspectives the velocity of the traveling twin did not exceed the speed of light. Yet, when he reaches the distant star system, he will have traveled the thousands of light years while hardly aging. The ratio of the distance to the star system, before contraction, to the change in age of the traveling twin is not bounded by the speed of light (Bondi, 1964).

This paper resulted from considering the situation if the twin stayed on the distant star system.

A New Clock Paradox Story

Consider a story, where the traveling twin is going to the Earth, instead of leaving it, and he stays there. We want him to stay there because what he sees in the sky is analogous in some ways to what we see when we look to the heavens. The story goes as follows. God creates Planet X, orbiting Star Y. He also creates a pair of twins, A and B (and wives for each), and places them on Planet X. The twins both have accurate clocks, given to them by the Creator, which they synchronize. Immediately, Twin B and his wife enter the spaceship Ark, given to them by God, and they leave on a journey to far-off Earth, which orbits a star called the Sun, about 5000 light-years (in Earth years) from Planet X. Twin A and his wife stay on planet X. Twin B accelerates immediately to a velocity of 0.99999998 of the speed of light.* In his new frame of reference, the initial distance to the Sun contracts to about one light-year (see Appendix I), and his clock rate, as measured by Twin A and his descendants, is reduced by the Lorentz factor:

$$F_c = \sqrt{1 - v^2} \qquad (1)$$

where the velocity, v, is normalized to the speed of light and is therefore unitless (See Appendix I). After traveling at this speed for one year, Twin B decelerates instantaneously and lands on Earth. Since Earth is relatively stationary in Planet X's frame of reference, Twin B's clock rate, as observed by descendants of Twin A on Planet X, "speeds up" to the rate of clocks on Planet X, since v, in Equation (1) equals 0.

What are the perceptions of these events from the perspective of Planet X? As prearranged, Twin A uses a light beam provided by God and sends out one light pulse when his twin leaves and a second light pulse at 0.0001 years later. The reflection from the first pulse is seen immediately. The second pulse overtakes Twin B, at the Earth just as he arrives, 5,000 years after leaving Planet X. The light pulse is received and immediately sent (or reflected) back to Twin A. A descendant of Twin A, on Planet X, receives it approximately 10,000 years after Twin B left Planet X, and correctly calculates the time of reflection, the distance and Twin B's velocity. The time of reflection is the average of the times the pulse was sent and the reflection was received, calculated as 5000.00005 years after Twin B departed (see Appendix II). The distance is calculated as 4999.99995 light-years, based on the ½ of the round-trip travel time of the pulse.

What time has elapsed as far as Twin B is concerned? Upon landing on Earth, the second pulse from Planet X arrives. He looks at his clock and correctly determines that he left Planet X one year earlier. He looks at his wife, and in a mirror, and correctly observes that no significant aging occurred during the journey, and certainly not 5,000 years worth.*

Looking back after he landed, what would Twin B observe about the light from Planet X and Star Y? (Even if he had our best present day technology.) Two significant observations would be that the light would be dim, as it has traveled 5000 light years, and it would have no velocity-induced red shift, since the clock rates are now the same. Yet, the light has traveled those 5,000 light years in less than one year, since they only came into existence a year earlier. Thus, from his vantage point, both he and the light from Star X have violated one of the stated assumptions of the old-Earth argument mentioned earlier.

Twin A sends a third pulse one year after the second pulse was sent, and then one pulse every year thereafter. The third pulse is received by Twin B one year after the second pulse was received, and subsequent pulses every year thereafter.

Just before his death, in the year 50 AC (after creation), Twin B prepared a journal of his creation, his trip and life on Earth. He correctly states that he and his brother and their wives were created, along with Planet X and Star Y, 50 years earlier. In the year 500 AC, after Twin B's death, some of his descendants decide the story in the journal is not true. That they came from a planet circling Star Y, just after its creation, only 500 years earlier, appears to contradict their scientific observations and newly-devised theories. They note that, based on its measured intensity, Star Y is 5000 light-years away. They use an estimate of the star's brightness to calculate the distance, and it correctly seems that the light pulses from Planet X, and the light from Star Y, presently being observed on Earth have been traveling in space for 5000 years. Consequently, they believe that Star Y and the creation, if true, are well over 5000 years old, and Twin B was a liar or insane. One grandson refused to accept that conclusion, so he reasoned that his grandfather, Twin B, was using poetic symbolism, and that the first time the word year was used in the journal, it was symbolic for 5000 years.

For a very similar mathematical treatment of the clock paradox issue, but with considerably more de-

*Admittedly, this acceleration is physically impossible, but it keeps the mathematics simple compared with analysis using finite acceleration, and the qualitative effect is the same. See the clock paradox article in the McGraw Hill Encyclopedia, 1987, which also uses infinite acceleration in their illustration of the so-called clock paradox.

*The time of creation of the Earth and Sun in this story is not relevant to the point of the story. If created at the same time, light from them would not be immediately visible at Planet X and Star Y, and God could place the Ark on autopilot. On arrival, the traveling twin would be a year old and objects on the Earth would be 5,000 years old. In fact, the story could have had the Earth and Sun created near Planet X and Star Y, and Twin B and his wife placed on the Earth as it and the Sun were whisked by God to its new location 5,000 light years away. In this case, all objects on Earth would also be one year old on arrival at the new location.

tail, see the Clock Paradox entry in the McGraw-Hill Encyclopedia of Science and Technology (1987).

Concluding Comments

Conditions existing at the beginning, as described by the Bible are obviously different than those in the new story of the clock paradox. However, just as it is true in the story a decision regarding "how long ago" the stars were created cannot be made even with the best technology. What the story hopefully does accomplish is to establish in the reader's mind the concept that elapsed time can be dependent on conditions of which we are not unaware, and that elapsed time can be different in different places. Once we accept that, the idea of an old, large universe does not conflict with the thought of a young Earth.

Another aspect of the issue is the effect of gravity. Gravity has an effect on clocks similar to that of acceleration. Appendix III shows how the effects of gravitational potentials on clock rates may be computed. Using Equation 9, it may be shown that significant differences in clock rates would exist between clocks on the surfaces of the Earth and Jupiter, for example.

Consider what the Bible says about the making of the heavens. Genesis states that the Sun, Moon and stars were made on Day four and then set in the heavens. [The light present on the first day may have been God's Glory–see Revelation 21:23 and 22:5.] Isaiah 40:22 states that God, who dwells on the circle of the Earth, stretched and spread out the heavens as a dwelling place.

With the stars being formed near the Earth, and then quickly sent to their places in the heavens on Day 4, strong gravitational potentials may have been present at the Earth. If Earth were experiencing a strong gravitational potential until the stars were spread out, then Earth's time measurement would have been very different from other heavenly bodies. Furthermore, once the potential was diminished, there would not necessarily be any observable residual red, or blue shift to the light from the stars.

Earth would have, from the viewpoint of the stars, been almost frozen in time. From Earth's view, the heavens would have developed almost instantly. This is reminiscent of Psalm 90:4 and II Peter 3:8, where it says that with God, one day is as a thousand years and a thousand years is as a day. In fact, one could take the viewpoint that the timekeepers, i.e. physical processes, such as radioactive decay, occurring out in the universe proceeded at a rapid rate as measured by an "absolute" Earth time. Thus, our ability to measure elapsed time from the beginning would be frustrated even more than the descendants of Twin B in the example given above.

Even without a high gravitational potential, God may have miraculously slowed Earth's time clocks (or increased the rate of other clocks). Once we make use of the concept, put forth by relativistic physics many years ago, that time is not the fixed quantity previously thought by many, a young age for the Earth indicated in Genesis should no longer present a problem to those troubled by the apparently huge and old heavens.

Clearly, the old-Earth argument at the beginning of this paper fails to consider all the possibilities. Dr. Russell Humphreys, a physicist with Sandia National Labs—see Humphreys (1995), applied the field equations of the General Theory of Relativity, taking into account conditions implied by the Bible to have been present at the beginning and arrived at a young Earth, a vast universe, and "old ages" of stars (i.e., according to their "clocks"). (Humphreys' book was an encouragement that ultimately led to this paper.)

This is not to say that we can scientifically determine the answers to all questions about the creation of the universe. On the contrary, this analysis shows that we need to be careful with our pronouncements about what observations prove. However, it seems that if young-Earthers could restrict their position to the age of the Earth, and old-Earthers could restrict their position to an old "heavens," much of the disagreement would disappear. As someone once said, "All time is local." See Bondi (1964).

The theory of general relativity itself may need modification (Peterson, 1994). The US Government is performing experiments this year to determine whether the change is necessary. If it is, the impact will be great, according to its proponents; concepts like black holes will no longer be valid.

Finally, other explanations have been proposed to explain the apparent vastness and age of the universe as being consistent with a young Earth. We obviously cannot determine scientifically the details of the creation, but we can say that any further use of the old-Earth argument stated at the beginning of this paper will be, almost certainly, poorly timed.

Appendix I
The Lorentz Transformation and the Fitzgerald Contraction

The Lorentz transformation is used to relate coordinate systems that are moving with a constant velocity relative to each other. It is used extensively in relativistic computations, and can be used to evaluate the amount of shrinking in the perceived distances (Fitzgerald contraction) according to the two twins, and the difference in perceived clock rates. Equations 2 and 3 give the pertinent relations.

$$d_B = \frac{d_A - vt_A}{\sqrt{1 - v^2}} \tag{2}$$

$$t_B = \frac{t_A - vd_A}{\sqrt{1 - v^2}} \tag{3}$$

where d_A, d_B, t_A and t_B are distances and time measurements in the perspectives of Twins A and B, respectively. Notice that the distance and time are both measured in units of years. The velocity v is normalized to c, and is unitless. The axes coincide when $t_A = t_B = 0$. From the time transformation Equation 3, the apparent clock rates differ by the Lorentz factor:

$$F_c = \sqrt{1 - v^2}. \tag{4}$$

The distance to the Sun in Twin A's frame of reference, d_{A0}, is always 5000.00005 light years. Using this value and the value for v, eliminate t_A by combining Equations 2 and 3 to get the relation between time on Twin B's clock and his perceived distance to the Sun:

$$d_b = d_{A0}\sqrt{1 - v^2} - vt_B. \tag{5}$$

The distance d_b to the Sun seen by Twin B at the start of his journey is 1.0000000041857 light years. The end of his journey occurs when the distance to the Sun is zero, a time of 1.0000000241857 years. Thus the ratio of the distance covered to the time elapsed on his journey is 0.99999998 times the speed of light, the same speed measured by Twin A, but with much greater distance and time. Thus, the concept that the speed of light cannot be exceeded was not violated in the strict sense. Nevertheless, when he reached the Earth, he had traveled the thousands of light years which was his goal before he left, in one light year, a "speed" of 5000 light years per year. Such a measure is termed the proper speed in relativity jargon.

Appendix II
Effect of Velocity on the Periodicity of Light

Assume two objects are receding from each other with constant velocity v, normalized to the speed of light. Light pulses sent, by either one, at intervals Δ t will be received by the other object at intervals of k times Δ t, with k being a constant.

Bondi (1964) derives the relation between relative velocity and k. When Twin A sends pulses at intervals Δ t, Twin B receives the pulses at intervals of k Δ t. According to relativity the effect is the same in both directions and Twin A receives the reflection at intervals of k times k Δ t, or at k^2 Δ t. The time Twin A reckons it took Twin B to get from Planet X to the point of reflection of the second pulse is the average of the times the pulse was sent-and the reflection was received. $\Delta t(k^2 + 1)/2$. The distance is calculated as ½ of the round-trip travel time of the pulse, or $\Delta t(k^2 - 1)/2$. Since the velocity is the ratio of distance to time, Bondi derives Equation (6)

$$v = \frac{k^2 - 1}{k^2 + 1}$$

which leads to Equation (7):

$$k = \sqrt{\frac{1 + v}{1 - v}}. \qquad (7)$$

Appendix III
Equivalent Effect of Gravitational Fields

Einstein (1961) claimed that the parameter v^2 in Equations 2-4 can be replaced by $-\Phi/c^2$. where Φ is the gravitational potential, given by:

$$\Phi = -\frac{KM}{d}$$

where K is Newton's constant of gravitation. M is the mass of the body generating the potential and d is the distance from the center of mass. A slower clock rate is experienced by objects at a stronger gravitational potential:

$$\nu = \nu_0\sqrt{1 - \frac{KM}{c^2 d}} \qquad (9)$$

where n is the rate of the clock with the gravitational potential. and n_0 is the clock rate at the center of mass, implying a zero potential.

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BOOK REVIEWS

Foundation, Fall and Flood: A Harmonization* of *Genesis and Science by Glenn R. Morton. 1995. DMD Publishing Co. 16075 Longvista Dr., Dallas, TX 75248. 165 pp. $15.00 + $2.00 postage.

Reviewed by R. H. Brown*

The author is a geophysicist who claims to have "once believed in a world-wide flood and a young earth . . ." [p. 52], and has 29 previous publications concerning creationism. Growing doubts led to a nearly 10 year withdrawal from publication. According to his testimony these doubts eventually drove him to the edge of becoming an atheist. He offers this book in hope that it will help others avoid a crisis of faith such as he has experienced [outside back cover].

According to the author's introduction, "The book . . . is . . . a rejection of young-earth creationism. . . . [in] The first part . . . All of the problems with young-earth creationism are discussed. . . . The second part of the book presents a new interpretation of Genesis which has only been seen once before in the creationist literature" [p. 2]. In his opinion "The most contentious issue in the evolution-creation debate is that concerning the age of the universe" [p. 4].

Part 1 begins with a summary presentation of five interpretations of the Genesis account that have been widely discussed in creationist and theological literature.

(1) Traditional View: Creation of the universe within seven literal and consecutive 24-hour Earth days approximately 6000 years ago, with a subsequent destruction of Earth's surface features by a universal Flood of approximately one year duration.

(2) Gap Theory: Creation of the universe at an unspecified time in the remote past (~18 billion years B.P., according to Morton), with re-creation in seven literal 24-hour days after an unspecified millions-of-years gap in time following a catastrophe that destroyed the original life on Earth.

(3) Day-Age Theory: Evolutionary development of the universe, including life on planet Earth, over seven successive millions-of-years long epochs, following initial beginning of creation possibly ~18 billions years B.P.

(4) Progressive Creation: Six successive millions-of-years long epochs of development, each begin-

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