Einstein's Special Relativity, the Speed of Light and the Bible

By Dave DeWitt

Out of curiosity, I decided to see if there was any correlation between Einstein's Theory of Special Relativity and the Bible. Because this study can take a lifetime, I restricted my inquiry to Einstein's most fundamental discoveries about the nature of light. This paper is about some interesting ties between what Einstein discovered about light, and about the Bible. [And since I am usually asked, I know nothing about Einstein's beliefs about God or the lack thereof.] First, the Bible.

"Light" In the Bible

In the Bible, there are 229 references to "light," 156 in the Old Testament, 73 in the New Testament. In addition to these, there are references to the effects of light, such as rainbows (3x), stars (68x), brightness (23x), lightening (30x), and brilliant whiteness as in things that are "shining" (47x). These alone come to 400 references to some form of light. Needless to say, "light" is a huge subject in the Bible. I will here attempt to give a sample of these, arranged according to four theological areas.

1. God Himself Is Described As Being Light and Surrounded By Light

- **Job 36:30** *Behold, He spreads His **lightning** about Him.*
- **Psalm 104:1-2** *O LORD my God, You are very great; You are clothed with splendor and majesty, covering Yourself with **light** as with a cloak.*
- **Ezekiel 1:4** [Ezekiel saw] *a great cloud with **fire flashing** forth continually and a **bright light** around it, and in its midst something like glowing metal in the midst of the **fire**.*
- **Ezekiel 1:28** *As the appearance of the **rainbow** in the clouds on a rainy day, so was the appearance of the **surrounding radiance**. Such was the appearance of the likeness of the glory of the LORD.*
- **Daniel 2:22** *He knows what is in the darkness, And the **light dwells with Him**.*
- **Isaiah 9:2** *The people who walk in darkness will see a **great light**; Those who live in a dark land, the **light** will shine on them.*
- **John 1:6-9** *There came a man sent from God, whose name was John. He came as a witness, to testify about the **Light**, so that all might believe through him. He was not the Light, but he came to testify about the **Light**. There was the **true Light** which, coming into the world, enlightens every man.*
- **1 Timothy 6:15-16** *He who is the blessed and only Sovereign, the King of kings and Lord of lords, who alone possesses immortality and **dwells in unapproachable light**, whom no man has seen or can see. To Him be honor and eternal dominion! Amen.*
- **1 John 1:5** *This is the message we have heard from Him and announce to you, that **God is Light, and in Him there is no darkness at all.***
- **1 John 1:7** *...if we walk in the Light **as He Himself is in the Light**, we have fellowship with one another, and the blood of Jesus His Son cleanses us from all sin.*
- **Revelation 4:3** *He who was sitting was like a jasper stone and a sardius in appearance; and there was a **rainbow around the throne**, like an emerald in appearance.*
- **Revelation 21:23** *And the city has no need of the sun or of the moon to shine on it, for the **glory of God has illumined it, and its lamp is the Lamb.***

2. God Created Light

- **Genesis 1:3-5** *Then God said, "**Let there be light**"; and there was light. God saw that the **light** was good; and God separated the **light** from the darkness. God called the **light day**, and the darkness He called night. And there was evening and there was morning, one day.*
- **Genesis 1:14-17** *Then God said, "**Let there be lights** in the expanse of the heavens to separate the day from the night, and let them be for signs and for seasons and for days and years; and let them be for **lights** in the expanse of the heavens to give **light** on the earth… He made the **stars** also. God placed them in the expanse of the heavens to give **light** on the earth,*
- **Exodus 13:21** *The LORD was going before them in a pillar of cloud by day to lead them on the way, and in a **pillar of fire** by night to give them **light,** that they might travel by day and by night.*
- **Job 38:24** [God asked Job] *Where is the way that the **light is divided**…?*
- **Isaiah 45:6-7** *I am the Lord, there is no other. The One **forming light** and creating darkness*
- **Jeremiah 31:35** *Thus says the LORD, Who gives the **sun for light** by day And the fixed order of the moon and the **stars for light** by night*

3. Angels and Saints of God Are Often Described in Terms of Light

- **Isaiah 60:19** *No longer will you have the sun for light by day, Nor for brightness will the moon give you light; But **you will have the LORD for an everlasting light**.*
- **1 Peter 2:9** *But you are A CHOSEN RACE, A royal PRIESTHOOD, A HOLY NATION, A PEOPLE FOR God's OWN POSSESSION, so that you may proclaim the excellencies of Him who has called you out of darkness **into His marvelous light**.*
- **Matthew 17:2-3** *And He was transfigured before them; and His face **shone like the sun**, and His garments became as white as **light.** And behold, Moses and Elijah appeared to them, talking with Him.*
- **Revelation 10:1** *I saw another strong angel coming down out of heaven, clothed with a cloud; and the **rainbow** was upon his head, and his face was like the **sun**, and his feet like **pillars of fire**.*
- **Revelation 19:8** *It was given to her to clothe herself in fine linen, **bright and clean**; for the fine linen is the righteous acts of the saints.*
- **Revelation 22:5** *And there will no longer be any night; and they will not have need of the light of a lamp nor the light of the sun, because the **Lord God will illumine them**; and they will reign forever and ever.*

4. Revelation from God Is Referred to As Light

- **Psalm 4:6** *Many are saying, "Who will show us any good?" Lift up the **light of Your countenance** upon us, O LORD!*
- **Psalm 18:28** *For You **light my lamp**; The LORD my God **illumines** my darkness.*
- **Psalm 27:1** *The LORD is my **light** and my salvation.*
- **Psalm 97:11** ***Light** is sown like seed for the righteous.*
- **Psalm 119:105** *Your word is a lamp to my feet and a **light** to my path.*
- **Psalm 119:130** *The unfolding of Your words gives **light**; It gives understanding to the simple.*
- **John 3:19-21** *This is the judgment, that the **Light** has come into the world, and men loved the darkness rather than the Light, for their deeds were evil. For everyone who does evil hates the **Light**, and does not come to the **Light** for fear that his deeds will be exposed. But he who **practices the truth comes to the Light**, so that his deeds may be manifested as having been wrought in God."*

- **John 5:35** *He was the **lamp that was burning and was shining** and you were willing to rejoice for a while in his **light**.*
- **John 8:12** *Then Jesus again spoke to them, saying, "**I am the Light of the world**; he who follows Me will not walk in the darkness, but will have the **Light** of life."*
- **John 9:5** *"While I am in the world, **I am the Light of the world**.*

Light and Special Relativity

- In 1676, the Danish astronomer Ole Roemer (1644–1710) announced that the speed of light was 186,282 miles per second or 299,792 kilometers per second.
- In 1687, Newton said gravity affects everything, in that everything pulls on everything else.
- In 1905, Einstein published his Theory of Special Relativity: Non-accelerating Objects in Motion Display "Time Dilation" and "Length Contraction."
- In 1915, Einstein published his Theory of General Relativity: Accelerating Objects Warp the Time-Space around Them, Causing Objects to Exert a Gravitational Pull on One Another.
- Around 1927, the Big Bang Theory was developed, so it was not part of Einstein's relativity.

We will not here study General Relativity which Einstein developed out of and after his study of Special Relativity. We shall confine our study here to the aspect of Einstein's Special Relativity known as "Time Dilation."

Classic Relativity

First, we should think about the obvious conclusion that all things move relative to one another. Imagine two boys are playing catch on the back of a flatbed truck. One boy on the back of the truck throws a ball to the other boy near the front of the truck, with the ball moving at 10 mph. But let's say the truck is traveling at 50 mph. From the bed of the truck, the ball is moving 10 mph. But from an observer alongside the road, the ball is moving 10+50 = 60 mph. So the speed of the ball is relative to position of its observer.

But the observer alongside the road is on an earth. The surface of the earth at the equator moves at a speed of 460 meters per second—or roughly 1,000 miles per hour. So (at the equator) the ball is going 10+50+1000 =1060 miles (1,700 kilometers) per hour. But the earth moves around the sun at nearly 30 kilometers per second, or 67,000 miles per hour. So the ball is moving at 10+50+1000+ 67,000 = 68,060 miles (109,532 kilometers) per hour. But the sun controls a solar system that itself is moving through space at a tremendous speed. And the speed of the solar system through space can only be measured relative to other bodies which are also moving through space at tremendous speeds, all different from each other and all relative to each other. Classic Relativity only recognizes the obvious fact that everything is in motion, nothing is standing still, so there is no unmoving reference point to use to judge speed. You can't eye it up to a post and see how fast it's moving. There is no post.

Relativity and Relative Truth

It's important to note here that nothing in Einstein's relativity is about relative truth. Relative truth says what is true in one place and for one person at one time is not necessarily true in all places for all people at all times. Relative truth is nonsense. It's an idea which leaves all rational thought behind. Einstein made it clear that his theories were based on the fact that everyone observes everything the same. Take, for example, the above case of the boys throwing a ball on the back of a flatbed truck. Relative truth

says that it is only relatively true that the ball traveled 10 mph for the boys on the truck. But that is nonsense. It is absolutely true for everyone everywhere and for all time that the ball traveled 10 mph for the boys on that flatbed truck at that time. Whether you were beside the road at the time, or on the moon a hundred years from now, it is absolutely true that the ball traveled 10 mph for those boys on that truck at that time. What is true for one person in one place at one time is true for all persons in all places at all times. Truth is always absolute, and Einstein's relativity, and all rational thought, depends on it.

The Speed of Light

Einstein was not the first person to measure the speed of light. That was accomplished by the Danish astronomer Ole Roemer (1644–1710). Until that time, scientists assumed that the speed of light was either too fast to measure or infinite. Roemer based his observations on the movement of planets and moons. Studying one of Jupiter's moons, Roemer noticed that the time between eclipses would vary throughout the year (based on whether the Earth was moving towards Jupiter or away from it). He announced his groundbreaking results about the speed of light on August 22, 1676.

Einstein's theory of special relativity used Roemer's speed of light in a vacuum at 186,282 miles per second (299,792 kilometers per second), approximately 6 trillion miles (9.7 trillion kilometers) per year. About 150 years ago, James Clark Maxwell concluded that light was an electromagnetic wave. Radio waves are a form of electromagnetic radiation and so, by definition, both electromagnetic waves and radio waves move at the speed of light (in a vacuum) because they are a form of light. So there is nothing observable that is faster than the speed of light. Light is the speed limit of the universe. In 1865, Maxwell used a capital "V" to designate the speed of light. Around the turn of the 1900s, "c" became used as a symbol for the speed of light because it was a "constant." Others used "c" because of classic Latin texts in which "c" stood for "celeritas," meaning "speed." At any rate, the simple "c" became the universal symbol for the speed of light.

The Speed of Light Is Constant

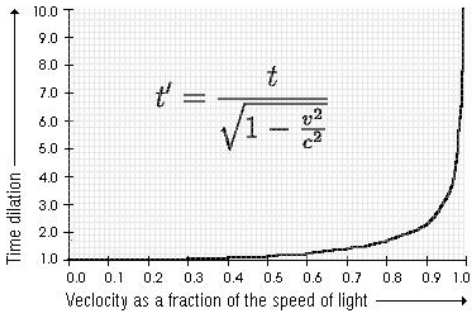
Einstein's observation led him to the conclusion that the speed of light never changes, no matter what the position of the observer. So, in that sense, the speed of light is the only physically observable constant in the universe. Let's go back to our travelling truck example. If instead of a boy throwing a ball, suppose the ball was a photon of light traveling from the back to the front of a moving truck. Of course, that photon would measure 186,282 miles per second on the truck. But what if the truck was going 50 mph. Classic Relativity would say that the light photon is now going 186,282 miles per second + 50 mph. But, as a matter of fact, the light photon would measure at 186,282 miles per second whether the observer were on the truck or standing on the road or anywhere in the universe. For an observer off the truck, the speed of light (in a vacuum) is constant for everyone everywhere.

$$\text{truck speed} + c = c.$$

Time Dilation

The theory of time dilation says that time diminishes with speed. As an object approaches the speed of light, time for that object slows down exponentially. Let's imagine we could travel to a distant planet in a space ship going very very fast. Our trip might take, let's say, a couple of weeks. So during our trip, we would age two weeks. Meanwhile back on earth, years would have passed. The reason is, time had to stretch out for us because we covered so much distance so fast. Using the formula for time dilation,

somebody (more energetic than I am) calculated the time that would pass on earth if we took a trip at 99% of the speed of light. The math shows that if we traveled for 14 years, 99 years would pass on earth.



The increase in time dilation is exponential, so in the example, the person used a high velocity to emphasize his point. Nonetheless, the formula is accurate even at lower speeds. This has been verified using atomic clocks which measure very small units of time. It was first observed when such clocks were placed on satellites. After the satellites circled the earth at great speeds, it could be observed that the clocks on the satellites were running slower than the ones on earth. This has recently even been observed putting such clocks on fast airplanes.

t_0 = time for us in our 99% light speed ship
t = time for the losers back on Earth

$$t = t_0 * \frac{1}{\sqrt{1-\frac{v^2}{c^2}}}$$

$$t = 14 years * \frac{1}{\sqrt{1-\frac{(.99c)^2}{c^2}}}$$

$$t = \frac{14 years}{\sqrt{.02}}$$

$$t = 99 years$$

$(ct)^2 + (vt')^2 = (ct')^2$
$(ct)^2 = (ct')^2 - (vt')^2$
$c^2t^2 = v^2t'^2 - c^2t'^2$
$c^2t^2 = t'^2(v^2 - c^2)$
$\frac{c^2t^2}{c^2} = \frac{t'^2(v^2-c^2)}{c^2}$
$t^2 = t'^2(1 - \frac{v^2}{c^2})$
$\frac{t^2}{(1-\frac{v^2}{c^2})} = t'^2$
$\sqrt{t^2} = \frac{\sqrt{t^2}}{\sqrt{(1-\frac{v^2}{c^2})}}$
$t' = \frac{t}{\sqrt{(1-\frac{v^2}{c^2})}}$

Calculating the math on this is not very difficult. There is nothing magical about it. It is a relatively simple matter of using basic trigonometry and algebra. [I actually did the calculations myself. It's not that hard.] When you plug the symbols for time and velocity into the basic Pythagorean theorem for a right triangle you come up with the formula to the right. Here T is the time that elapses on your reference point (like earth) and T_0 is the time that elapses with the moving object (like a spaceship, or anything moving). So if we solve the equation for the time which passes on the moving object Then,

$$T = \frac{T_0}{\sqrt{1-(\frac{v}{c})^2}}$$

$$T_0 = T \times \sqrt{1-(\frac{v}{c})^2}$$

Now we can see that if our velocity (v) was the speed of light (v =c), then c/c = 1, 1 squared = 1 and 1 – 1 = 0. 0 times T (or 0 times anything) = 0. So at the speed of light time goes to 0. If any object could reach the speed of light, time would stop altogether. This is impossible, however, for everything except light itself. Einstein's $E=MC^2$ (see the discussion in Appendix A) tells us that mass increases with kinetic energy, and kinetic energy increases with speed. As speed approaches the speed of light, mass would approach infinity, requiring nearly an infinite amount of energy to accelerate it faster. Therefore, no material body could ever reach the speed of light, at least not in our universe. But one thing does travel at the speed of light even in our universe. Light itself! And when light travels at the speed of light, it is observed the same everywhere, and no time passes for the light as it travels.

George Alestas, graduate theoretical physics student, wrote on September 1, 2014,

> "…one reaches the conclusion that the faster the particle moves the heavier it gets, for a velocity equal to the speed of light the particle would have an infinite mass. Having said that you should not look at the speed of light (c) as a finite quantity, for **it is such only for us outsiders.** If you were a photon you would have every reason of reaching the conclusion that c is infinitely great. That's because for a photon time is infinitely dilated and space is infinitely contracted, **that**

> **means that a photon in its perspective covers every distance instantly simply because there is no distance for it to cover** [emphasis mine, https://www.quora.com/Why-does-the-universe-have-a-speed-limit#!n=12].

We are regularly told that the light from a distant star took x number of years to get here. Let's say 8 billion years. But "**it is such only for us outsiders**." For the light itself, the time was zero. Therefore, it is misleading, actually incorrect, to say the light took that long to get to earth. Let's go back to the example pictured above. Someone did the math demonstrating that if he traveled at .99c for 14 years, 99 years would pass on earth. So let's say this guy and his space crew traveled from a distant planet at .99c and arrived on earth. An astronomer on earth might ask the travelers where they came from. When the travelers told him, the earth astronomer would calculate the time of travel and say, "Wow, you guys have been traveling for 99 years." But the traveler and his team would insist they have been traveling for 14 years. They would disagree about the time it took the space crew to get there.

Actually, the earth astronomer would be incorrect saying it took them 99 years to get there because he would not be considering the time dilation of Special Relativity. If the trip started from earth and returned to earth, then the earth astronomer could say, "Okay only 14 years passed for you guys, but 99 years passed for us. But the trip started on some distant planet [(.99c) x (99 years) away, d=vt]. So the time it took was t =d/v or 99 years. But the reference point is the distant planet, not the earth. So the only way to measure the time is by using the time dilation formula not the standard t = d/v which is incorrect at high speeds.
[It's actually incorrect at all speeds but unnoticeable at low speeds.]

$$T = \frac{T_0}{\sqrt{1-(\frac{v}{c})^2}}$$

Now let's say our space travelers were not going .99c but c itself. Suppose, even though it's impossible because they have mass, that they were riding on a photon of light. The earth astronomer would still add up all the 186,282 miles per seconds (6 trillion miles per year) that represented the distance to the planet, divide by 186,282 miles per second and say they traveled for 99 years when actually their trip took no time at all. The earth astronomer would say the same about the light arriving from a star, say, 8 billion light years away. He would incorrectly say that it took that light 8 billion light years to get to earth, where actually it took that light no time at all.

Actually, distance and time both collapse at the speed of light. [d = vt, so if t = 0, which is does at the speed of light, then d also = 0.] The reason it takes light no time to travel a given distance is because, for the light photon, there is no distance to travel. A "**photon in its perspective covers every distance instantly simply because there is no distance for it to cover.**"

Time Travel

We have determined with mathematical certainty that time slows down with speed, and if speed could reach the speed of light, time would stop altogether. That's impossible for anything but light itself. But since it is true of light, light moves without time. But now let's look at our formula again.

$$T_0 = T \times \sqrt{1-(\frac{v}{c})^2}$$

What would happen if we could move faster than the speed of light? Some suggest that T_0 (time one our space ship, or whatever) would be a negative number thus time would go backwards. In other words, if we could travel faster than the speed of light, we could travel back in time. But is that really possible?

Let's say v = 4c. Then 4 squared x c squared over c squared = 16. 1-16 = -15 The square root of 15 is 3.872… so it is tempting to say we would move back in time, because T_0 would be a negative number. But that won't work because actually we end up taking the square root of -15 and you can't take the square root of a negative number. In math, it is called an imaginary number. There is no such thing. So we can mathematically demonstrate that going faster than the speed of light to go back in time is impossible. This proves that Einstein was right that nothing goes faster than the speed of light. As he said, the speed of light is the speed limit of the universe.

Implications, Not Applications, Of Special Relativity Light Dilation

The Bible is not a science book. We cannot always replace biblical terms such as *light, star,* or *radiance* with scientific definitions. But there are two things to consider.

First, sometimes we can. Light is light, rainbows are rainbows, lightening is lightening, and brightness is brightness. The word *stars* in the Bible always refers to lights in the sky, not the celestial bodies that produce that light, but the light in the sky is the same light.

Second, when light is used metaphorically, the source of the metaphor is the same scientific light. When the Bible says: (1) God is light, (2) God creates light, (3) angels and saints will dwell in eternal light, and (4) God's revelation is light, it is not always using scientific terms. Our scientific definition of light may be used metaphorically in Scripture, but the source of the metaphor is the same as scientific light.

The interesting thing is not that light tells us about God—the Bible tells us about God. When we talk about light we should not say this it that, but this is like that. Light is not a definition, it's a metaphor The interesting thing is that we know a whole lot more about light as a metaphor. Namely:

1. The speed of light absolute. It is the only thing that measures the same from everywhere.
2. The speed of light is the speed limit of the universe. Nothing can go faster than the speed of light.
3. When traveling at the speed of light, time collapses to zero.
4. When traveling at the speed of light, distance collapses to zero.
5. Light is essential for stating the relationship between matter and energy ($E = MC^2$).
6. The speed of light is essential for understanding light coming from distant stars.
7. Time would stop for anything (not just light) if it moved at the speed of light.

1. Let's think about light as a descriptive metaphor of the immutability of God

Remember: the speed of light is absolute. It is the only thing that measures the same from everywhere.

- **Malachi 3:6** *For I, the LORD, do not change.*
- **James 1:17** *Every good thing given and every perfect gift is from above, coming down from the Father of lights, with whom there is no variation or shifting shadow.*
- **Hebrews 13:8** *Jesus Christ is the same yesterday and today and forever.*
- **Luke 21:33** *Heaven and earth will pass away, but My words will not pass away.*

God doesn't change. His laws, dispensations, and proclamations change, just as the same parent's rules for small children are different than those for teen agers. But God and His Word never do. The same

God we read about in Genesis 1 is the God we read about in Revelation 22, and all the chapters in between. He is not different today than He was when He spoke to Abraham 4000 years ago, or when Christ instructed the apostles 2000 years ago. Everything else in the universe changes, but God and His Word never change.

When we look at light, we find that it has the only absolute speed in the universe. Everything is in motion, so it is impossible to determine the actual speed of anything. As mentioned above, the surface of the earth at the equator moves at a speed of 460 meters per second—or roughly 1,000 miles per hour, and it moves around the sun at nearly 30 kilometers per second, or 67,000 miles per hour. But the earth and sun are also moving through space. Our sun is moving towards Lambda Herculis (a star in the constellation Herculis) at 72,000 kilometers per hour or 45,000 miles per hour. But Lambda Herculis is also moving at speeds that can only be calculated by comparing it to other celestial bodies all of which are also moving. There is simply no way to calculate the absolute speed of anything – EXCEPT LIGHT. Light always moves at 186,282 miles (299,792 kilometers) per second. It does not matter what we measure it from or or how we look at it. Light is always the same, it never changes.

- The speed of light is immutable. It never changes. It is the speed that is always the same.
- God is immutable. He never changes. He is *the same yesterday and today and forever.*

2. Let's think about light as a descriptive metaphor of the perfection of God

Remember: the speed of light is the speed limit of the universe. Nothing can go faster than the speed of light.

- **Leviticus 11:44** *For I am the LORD your God. Consecrate yourselves therefore, and be holy, for I am holy.*
- **Psalm 77:13** *Your way, O God, is holy; What god is great like our God?*
- **Revelation 15:3-4** *Great and marvelous are Your works, O Lord God, the Almighty; Righteous and true are Your ways, King of the nations! Who will not fear, O Lord, and glorify Your name? For You alone are holy.*

God is perfect and holy, by definition. Holiness is not a standard which God keeps. Holiness is what God is. God Himself defines perfection, and since He does not change, the standard does not change.

When we look at light, we find that it is the speed limit of the universe. Nothing can go faster than the speed of light. Mathematically, anything faster results in the square root of a negative number, and that's impossible. So we might say the speed of light is the perfect speed.

- The speed of light is the perfect speed because nothing can go faster than the speed of light.
- God is perfect in holiness because He is the ultimate. Nothing can be holier than God.

3. Let's think about light as a descriptive metaphor of the eternality of God

Remember: when traveling at the speed of light time collapses to zero.

The Bible tells us that God is eternal.

- **Deuteronomy 33:27** *The eternal God is a dwelling place, And underneath are the everlasting arms.*
- **Psalm 90:2 & 4** *Even from everlasting to everlasting, You are God… For a thousand years in*

Your sight are like yesterday when it passes by, or as a watch in the night.

- **1 Timothy 6:15-16** *He is the blessed and only Sovereign, the King of kings and Lord of lords, who alone possesses immortality*

The eternal everlasting nature of God means that, for God, time does not pass, while, for His creation, it does. When Moses says, *For a thousand years in Your sight are like yesterday when it passes,* he is not giving a formula for measuring time with God. Moses is saying that for God there is no time, yet for His creation there is. There is time on earth, there is time in heaven, but for God, time does not pass. He is eternal.

It can be demonstrated, mathematically and experimentally, that time slows down with speed until speed reaches the speed of light, where time stops altogether. So there is one place in our own universe where time does not happen, the speed of light. Meanwhile, everything around the speed of light takes place at a given time depending on its motion. If we were in a theoretical space ship traveling very fast, time would slow down until the ship reached the speed of light when time would stop. But inside the space ship, time would seem to go on, as it would outside the ship.

- The speed of light is not affected by time, yet time exists for everything else.
- God is not effected by time, yet everything in God's creation is subject to time.

4. Let's think about light as a descriptive metaphor of the omnipresence of God

Remember: for the speed of light distance collapses to zero.

The Bible tells us that God, although He has a specific location [*The LORD has established His throne in the heavens* (Psalm 103:19)], He is present everywhere.

- **Psalm 139:7-12** *Where can I go from Your Spirit? Or where can I flee from Your presence? If I ascend to heaven, You are there; If I make my bed in Sheol, behold, You are there. If I take the wings of the dawn, If I dwell in the remotest part of the sea, Even there Your hand will lead me, And Your right hand will lay hold of me. If I say, "Surely the darkness will overwhelm me, And the light around me will be night," Even the darkness is not dark to You, And the night is as bright as the day. Darkness and light are alike to You.*

We don't need what we have learned about light to know God is everywhere while still being somewhere. But it is consistent with the statement He *dwells in unapproachable light* (1 Timothy 6:15-16). Since *God is light, and in Him there is no darkness at all* (1 John 1:5), it would be consistent to say time is zero and distance is zero for both light and God [$d = v\,t$]. Therefore, it is also consistent to say *where can I flee from Your presence?* Since God is light, and distance for light is zero, we cannot flee from the presence of God because there is no distance between God and anything anywhere.

- There is no distance between light and anywhere it goes because it has no distance to cover.
- There is no distance between God and anything else because He is omnipresent.

5. Let's think about God's creation

Light is essential for stating the relationship between matter and energy ($E = MC^2$).

- **Genesis 1:1-3** *In the beginning God created the heavens and the earth. The earth was formless and void, and darkness was over the surface of the deep, and the Spirit of God was moving over the surface of the waters. Then God said, "Let there be light"; and there was light.*

In Genesis 1, God made a summary statement about all creation (verse 1), then tells us there was a dark formless void, and it remained a formless void until God added light. It is very important to notice that this light was not from the sun or moon, which were created on the fourth day. This light was supplied by God as part of creation itself, on the first day. Without the existence of light, mass and energy were just *formless and void.*

The relationship between matter and energy are measured through light ($E = MC^2$, $M = E/C^2$). According to Einstein's relativity, the matter, which the Bible says God created, is just a form of energy that is measurable as some form of mass when it is related to light. Unless light is taken into consideration, the relation between mass and energy cannot be stated.

We are also told, Jesus is light (John 1:6-9) and *in Him all things hold together* (Colossians 1:17). So the metaphor of light is connected to creation and holding things together.

- Light is essential for measuring the relationship between matter and energy ($E = MC^2$).
- Light is essential for stating God's creation of matter and energy (Genesis 1:3).

6. Let's think about God creating the stars

Remember: the speed of light is essential for understanding light coming from distant stars.

- **Genesis 1:14-17** *Then God said, "Let there be lights in the expanse of the heavens to separate the day from the night, and let them be for signs and for seasons and for days and years; and let them be for lights in the expanse of the heavens to give light on the earth … He made the stars also. God placed them in the expanse of the heavens to give light on the earth.*

A star in the Bible is always a light in the sky, not a celestial body in the universe. For example, the star the wise men followed from the East could not have been more than about a hundred yards or so in the air or they would not have been able to follow it. In no sense was it a distant sun. When Moses said, *He made the stars also. God placed them in the expanse of the heavens,* he was talking about the light as it appears in the sky.

But let's say some of the *lights in the expanse of the heavens* were coming from stars 8 billion light years away. How long did it take the light to get there? We are told it took 8 billion light years for the light to travel to the earth. Well, if we knew how far the celestial body was and divide that by 186,282 miles (299,792 kilometers) miles per second (6 trillion miles, or 9.7 kilometers, per year) we would indeed conclude that's how long it took [t = d/v]. The problem is, that is not true for the light itself. The faster anything travels the slower the time goes for the traveler.

For example, if I told you I came from a town 100 miles away and I was traveling at 50 miles per hour, you would say it took me two hours to get here. Actually, it took just a tiny bit less than that because the speed caused my time to slow down just a bit. The difference is so small that we ignore it. But it is technically just a little incorrect to say it took **me** two hours to get here. It took **me** just a bit less than that,

since time slowed down **for me** at that speed. If, however, I was traveling very fast, the difference would be very much different, **for me**. As I theoretically approached the speed of light, the t = d/v formula for you would be way off **for me,** since I am the one traveling. At the speed of light, no time would pass for me at all. So it is incorrect to say that the light from a distant star 8 billion light years away took 8 billion light years to get here. Since we are talking about light, it took no time at all. [That is only true, of course, for light in a vacuum. If light was deflected around some galaxies it might take a few seconds instead of zero, but it would still get to earth almost instantly.]

- The speed of light is essential for understanding light coming from distant stars.
- The light from the stars God created on the fourth day took no time to get here, for the light itself.

7. Let's think about the eternality of the human soul

Remember: theoretically it is easy for time to stop for anything, just move it at the speed of light.

- **Matthew 25:46** *These will go away into eternal punishment, but the righteous into eternal life.*
- **John 3:16** *For God so loved the world, that He gave His only begotten Son, that whoever believes in Him shall not perish, but have eternal life.*
- **Romans 6:23** *For the wages of sin is death, but the free gift of God is eternal life in Christ Jesus our Lord.*

The Bible tells us that believers in Jesus Christ have eternal life. What would it take for humans to live forever? Simple. Travel at the speed of light. No time passes at the speed of light. Eternity only requires the speed of light. Of course, that is impossible for anything in this universe having mass because mass increases with energy ($E = MC^2$). But what if we were not in this universe and we did not have mass? What if the heavenly realm were moving at the speed of light instead of the earth we now live on, which is moving at some unknown speed (because it can only be measured by the speeds of other bodies in our universe) that is determining our time. Of course, we should say that these are things which God simply creates, and we have no idea how He does that. But what we know about light shows us that such a creation is not contradictory.

- Theoretically, it is easy to create an eternal heavenly universe, just move it at the speed of light.
- For God, angels, and saints in the heavenly realm, there is eternal life.

Appendix A

$E=MC^2$

After Einstein developed the theory that time contrasts with speed, he went on to relate mass to energy. For Newton, mass and energy were completely different things. Potential energy (as in a rock held above the floor) could be transformed into kinetic energy (the rock hitting the floor), but according to Newton they were entirely different things.

What Einstein understood was that matter was not changed into energy, matter was energy. Matter does not actually exist except as a form of energy. This he originally expressed in the formula $M = E/C^2$ which if solved for E becomes $E=MC^2$. E is the kinetic energy of an object. It's the actual moving energy, not just the potential energy. M is the object's mass. C is the speed of light, which is constant in vacuum. Energy cannot be either created or destroyed, it can only take a different form.

Mass is the quantification of matter in an object. We could think of weight as mass, the problem is our weight changes depending on our location, mass does not. Weight is the gravitational pull on mass. So, for example, your weight on the moon is 6 times less than it is on the earth. Your weight on a mountain top is less than in a valley.

$E = MC^2$ so $M = E/C^2$ Relative mass = the kinetic energy derived from the velocity of an object divided by the speed of light squared.

Originally, Einstein wrote $E = MC^2$ as $M = E/C^2$ because his focus was on what happens to mass. Even though two objects have the same contents, they will not have equal masses. The mass of an object is not just the sum of the mass of its parts because the mass depends upon how those parts are arranged and the motion of those parts. For example, suppose you have two watches, one is wound up and running while the other is stopped. According to Einstein, the one that is running has the greater mass because an increase in its energy means it has an increase in mass. The moving parts have some kinetic energy, the springs in the watch have potential energy, and the movement will cause a slight amount of friction which will cause a bit of heat which is thermal energy. So the weight of a stopped watch is less than a running watch, if both are in the same place. But, of course, it's so tiny that it is unnoticed in everyday life, that's why we have always incorrectly believed that Mass = the amount of matter in an object.

If you turn on a flashlight, its mass decreases because the light it emits takes energy out of the flashlight. The sun, for example, is like a giant flashlight that is emitting 4 billion kilograms of mass every second. The sun does not convert mass to energy, all the energy of the sunlight came at the expense of other energy. The sun is slowly burning itself out. Before any amount of light was emitted from the sun, there was more kinetic and potential energy contained within the volume of the sun. As the light goes out, the sun's mass is reduced. The punch line to all of this is that mass isn't really a thing at all. Mass is not really converted to energy, rather mass is just a property that all energy exhibits. So it is actually incorrect to think of mass as an amount of stuff, but rather it is an amount of energy. So every time you use a scale, you are actually measuring the cumulative amount of energy being weighed. So we are all just energy. We think of ourselves as solid mass, but our mass is just a property of our energy.

Why C^2 Rather than Just C

It's just that when light goes out in all directions it measures as $C^{2.}$ For example, if you ask someone, "what's the area of your living room?" and they answer, "Thirty feet," you know they misunderstood the question because an area has to be in square-feet. You would say, "No, that can't be the area of your living room. Thirty feet can be the length of your living room, but the area is measured in feet ^{2}. So it would have to something like 30 square feet." If light were one directional they we could express Einstein's equation E=MC, but since light goes out in all directions, it measures as $E=MC^2$. The speed of energy (light) squared accounts for all of the energy that would released, once multiplied by the mass.

How Did $E=MC^2$ Lead to The Atomic Bomb

Pure energy released from its mass, be it light waves or radiation, travels at the speed of light. The energy of an atom inside a nuclear power plant or an atomic bomb releases at the speed of light. The speed of light squared is a huge number indicating how much energy there is in even a tiny amount of matter. That's why a small amount of uranium or plutonium can produce a massive atomic blast. Radioactivity is MC^2 in action.

Elements like radium and uranium continually break down into ever smaller elements. What is actually happening is that tiny amounts of mass from an unstable atom are spontaneously released in the form of energy which is carried away as radiation. But the amount of radiation in the form of heat released from radium and uranium is very small. In order to release more energy, it took more energy. Einstein concluded that it would take more energy to release the energy than the energy you would get out of the release.

By the 1930s, scientists began to devise ways to split atoms open, but repeatedly they hit Einstein's paradox where they had to put in more energy than they got out. Then Leo Szilard in 1933 realized that the alpha particles used to bombard atoms had a positive electric charge and so did the nucleus of the radioactive atoms, so they repelled each other, causing the alpha particles to slide off to one side or the other. So it took more energy to penetrate the nucleus than would be released. Szilard then realized that the recently discovered neutrons, which had no electric charge would penetrate the nucleus of unstable atoms, thus splitting the atom. Szilard also theorized that as the atom split apart, it would release more neutrons which would hit more atoms splitting them and so on. Every time that happened, it would release vast amounts of energy according to $E=MC^2$. That would cause a chain reaction causing an atomic bomb. The neutrons released would be exponential 2, 4, 8, 16, 32 … Radium and uranium are unstable, but they could be refined into plutonium (a chemical element of atomic number 94, a dense silvery radioactive metal of the actinide series) which is very unstable, and can produce radiation burns if not contained. Plutonium only occurs in trace amounts in nature but is manufactured in nuclear reactors from uranium-238. Vast amounts of energy could be produced by hitting the unstable nucleus of plutonium with neutrons instead of alpha particles. When Leo Szilard realized this he also realized that the Germans would also soon figure it out. So Szilard went to Einstein asking him to write a letter to Franklin Roosevelt in July of 1939. Roosevelt began funding the work for facilities to refine plutonium, and test the results for creating an atomic bomb.

Szilard was right. The German scientists accidentally figured it out and actually carried out such a reaction, and the bomb race was on. But by then Roosevelt already had the production in place and simply beat the Germans to the production of the bomb.