Time-Dilated Light

(A Constructive Theory)

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Abstract: *Albert Einstein's* ***Principled*** *Special Theory of Relativity* [1] *states that a moving object will experience time running slower than a stationary object. I.e., it will experience* ***dilated*** *time. This has been confirmed many times with atomic clocks. If the speed of light is defined as 299,792 kilometers* ***per second****, the question then becomes:* ***Whose*** *second? The* ***Constructive*** *Theory defined here shows that light emitted by a distant time-dilated object will arrive at the earth at 299,792 kilometers per* ***the object's*** *second,* ***not*** *per Earth second. Light from celestial objects does not arrive at any "universal speed of light," but arrives at widely varied velocities depending upon the emitting object's velocity through space and its proximity to any gravitational mass.*

A photon or wave of light is created when an electron orbiting the nucleus of an atom drops from a high energy orbit to a lower energy orbit. That creates an excess amount of energy. The excess energy can't just disappear, so it is emitted from the atom as a photon of light. The energy of the photon depends on the difference in energy between the two orbits of the electron.[2]

When light is emitted from the atom, it does not have to accelerate to the "speed of light." It is emitted **at** the speed of light. When the electron drops from its high orbit to its lower orbit, it supposedly does so **instantly**. However, the light that is emitted is emitted at a **finite** speed. The question then becomes: What is the speed of that specific photon of light?

The postulate defined here is: When a photon or wave of light is emitted from an atom, it is emitted at **the "speed of light" at the location of the atom that emitted the photon.** As stated previously, the photon does not have to accelerate up to the speed of light. It instantly goes from velocity zero to 299,792 kilometers per **local** second. [3] However, as Einstein's Theories of Relativity show, Time does **not** pass at a constant rate throughout the universe.

Emission Theory

Emission theory [4] is the thoroughly disproved theory that light emitted by an object will travel at the speed of light plus or minus the speed of the object. It was first proposed by Isaac Newton. In his "corpuscular theory," Newton visualized light "corpuscles" being thrown off from hot bodies at a nominal speed of c with respect to the emitting object, and obeying the usual laws of Newtonian mechanics. If true, that would cause the light from a moving object that is coming straight toward the observer to travel at a velocity that is combined with the velocity of the distant emitter (c + v). Likewise, if the object was moving away from the observer, light would travel at a velocity where the object's receding velocity is subtracted from the emitted speed of light (c – v).

Simple experiments have thoroughly proved this theory to be untrue. For example, it would require a moon orbiting around Mars, Jupiter or Saturn to appear to travel noticeably faster when moving toward an observer on Earth (c + v) than when it is at the opposite side of its orbit and moving away from the observer on Earth (c – v). That doesn't happen.

Some argue that James Clerk Maxwell discovered that the speed of light was a "universal constant" when he disproved Emission Theory. His equations include nothing about time dilation. [5]

Albert Einstein is supposed to have worked on his own emission theory before abandoning it in favor of the version of his Special Theory of Relativity that he published in 1905. Many years later R.S. Shankland reported Einstein as saying that Walter Ritz' emission theory had been "very bad" in places and that he himself had eventually discarded emission theory because he could think of no form of differential equations that described it, since it leads to the waves of light becoming "all mixed up".[6]

But, while light may not come to us in the way that was used to disprove Corpuscular/Emission Theory, it appears light still comes to us "all mixed up," i.e. at different velocities.

Time Dilation due to Velocity

In his 1905 paper, "*On the Electrodynamics of Moving Bodies*," Albert Einstein explained that Time will run slower for an object that *is moving*, compared to a stationary object. For convenience, he used clocks to describe how movement (velocity) dilates (slows down) Time:

> If at the points A and B of K there are stationary clocks which, viewed in the stationary system, are synchronous; and if the clock at A is moved with the velocity *v* along the line AB to B, then on its arrival at B the two clocks no longer synchronize, but the clock moved from A to B lags behind the other which has remained at B by $\frac{1}{2}tv^2/c^2$ (up to magnitudes of fourth and higher order), *t* being the time occupied in the journey from A to B.

In other words, if you have two stationary clocks that are in sync and one is moved, the clock that was moved will show less time has passed than the clock that remained stationary.

Einstein then goes on to explain that a clock at the equator, where the earth is moving around its axis at about 1,000 miles per hour, will run slower than a clock at the North Pole, which is not really moving but just rotating in place once every 24 hours. While the paper doesn't explicitly say so, the implication is that every location between the equator and the North Pole will experience time moving at a slightly different rate. Time will run slower in Los Angeles than in San Francisco, and time in San Diego will run slower than time in Los Angeles. The differences are, of course, so tiny – fractions of a microsecond – that the differences would not only be unnoticed, they also would be extremely difficult to measure by our best instruments.

Unfortunately, Einstein's 1905 paper doesn't make clear exactly how Time Dilation works. What ***is*** "Time" if it can slow down? It certainly isn't just a "concept." Einstein doesn't say because it is a principle-based theory, not a constructive theory based upon observations.

In my paper "What is Time?"[7] I explain that "Time is particle spin." While no one currently really knows exactly what "particle spin" is, it can be visualized as a regularly repeating phenomenon within the particles within atoms, which has the effect of generating or controlling local time. If the atom containing the particle is **stationary** in otherwise empty space, the result will be that time is generated at its maximum interval value. A "second" measured by that particle will be as short in duration as it is possible for a second to be. So, the speed of light will be 299,792.458 kilometers per the shortest possible second.

If some force causes the atom and its particles to move, the duration of a second for that atom will increase. Of course, atoms that are part of a larger body, such as a space ship, will all experience the same or similar amount of time dilation when the space ship moves.

This means that, if some phenomenon occurs once per second in an "at rest" or "stationary" environment, it will also occur once per second in a moving environment – even though the length of a second will be different. Thus, if you are measuring the speed of light by bouncing the light off of mirrors in a laboratory on earth, you will find that the speed of light is 299,792 kilometers per second (kps). And if you perform the same experiment aboard a space ship that is traveling through space at very high velocities, you will also find that the speed of light is 299,792 kilometers per second. What must then be understood is that the reason this happens is because the length of a second is different at the locations of the two experiments.

Special Relativity

Most discussions of Time Dilation usually quickly turn into discussions about Relativity. The discussions stop being about what is ***actually*** happening and become discussions about what is ***perceived*** to be happening. There seems to be a popular misconception that if something is "relative," it isn't real, it is just what is *perceived*. That seems particularly true when talking

with mathematicians. In my paper "Time Dilation Re-visualized"[8] I explained that Time Dilation works independently from Relativity and needs to be understood independently before you can fully understand all of the relativistic aspects of Time itself. It must also be understood that when Einstein wrote the words "a universal constant—the velocity of light in empty space" in his 1905 paper, the "universe" he was writing about was a ***hypothetical*** universe he created in which there existed only two clocks. It appears that a great many people understand his phrase "universal constant" to apply to our massive universe where there are countless objects that can be considered to be "clocks" measuring the passage of time, and most such "clocks" do not tick at the same rate as clocks on Earth.

Einstein also wrote,

> If we wish to describe the motion of a material point, we give the values of its co-ordinates as functions of the time. Now we must bear carefully in mind that a mathematical description of this kind has no physical meaning unless we are quite clear as to what we understand by "time."

He says Time must be defined as it occurs in a "stationary system." The problem is that a "stationary system" is also entirely hypothetical. No one can create such a system with current technology. This also aggravates the problem of viewing Time Dilation as being all about what is perceived instead of being about what actually happens.

When the speed of light is measured here on Earth as being 299,792.458 kps, and it is also measured as traveling at 299,792.458 kps aboard a space ship moving at 10% of the speed of light, it should be clear that there is some **actual** difference in the length of a second, not just a **perceived** difference. If the crew of the space ship sends a beam of laser light toward the Earth, the laser light will travel at the speed of light as it is determined to be (and actually is) aboard the space ship. It will not somehow change speed when it exits the space ship. The light will arrive at the Earth traveling much slower than light is measured to travel from point to point on Earth.

Time Dilated Light

Therefore, we can use Einstein's formula for calculating Time Dilation[9] to calculate the difference in the speed of light emitted from a stationary object versus a moving object. If light is emitted from an object that is traveling at 10% of the speed of light (29,979.2 kps), one second at a stationary location (assume Earth is stationary) will be 1.0050377997499 seconds aboard that space ship. That means that the emitted light from the space ship will be traveling 292,792.458 kilometers in 1.0050377997499 seconds. And light traveling at that speed would be traveling at 298,289.675 kilometers ***per Earth second*** when it reaches "stationary" Earth, or 1,502.78 kps ***slower*** than the speed of light is measured here on Earth.

If a stationary observer (or an observer on Earth) mistakenly assumes that **all** light is coming to him at 299,792.458 kilometers per **his** second, he may mistakenly assume the moving object in

the previous paragraph is farther away than it really is. If the moving object is actually 298,289 kilometers away, he may mistakenly assume that it is 299,792 kilometers away if he believes it took one Earth second for the light from it to reach him, an error of 1,503 kilometers. In other words: Distant objects may be closer than they appear.

Another key point is that light coming from a distant object is affected by the speed of that object, but unlike classical Corpuscular/Emission Theory, the **direction** the object is moving has no effect on the light it emits. The only slowing effect comes from the magnitude of dilated time being experienced by the object.

Gravitational Time Dilation

Of course, light emitted by some massive object, like virtually any star in the visible universe, will also be affected by **gravitational** time dilation. This may result in a significantly larger error than would be caused only by velocity time dilation, because photons are not created at the surface of a star, they are created deep in the core. However, since the only difference is the specific *cause* of the dilation of time, and that cause will not affect the postulate that "light emitted from a time-dilated object will be correspondingly time dilated," there seems no need to provide here any examples of the slowing of light due to gravitational time dilation. The bigger the star, the larger the error will be whenever it is falsely assumed that light from it travels at 299,792.458 kilometers per ***the observer's*** second. Light from our Sun does not arrive at the Earth at the speed of light measured by equipment here on Earth. It travels at a *slower* speed.

Implications

What are the implications of this Theory of Time Dilated Light? While it does mean that the speed of light coming to us from distant stars is highly variable and is mostly coming slower than we assume, there can be no effect on any part of Einstein's theories, since, as far as Relativity is concerned, both this Time Dilated Light Theory and Einstein's Theories of Relativity merely confirm that all Time is "local" and thus can and will be different in different locations.

Time-Dilated Light certainly does not affect simultaneity. If time-dilated light travels from Point A to Point B at the same speed as it travels from point B to Point A, Time at those two points are synchronous, and the speed of light will be identical – because the length of a second will be identical at both points.

The primary technique for calculating the distance to nearby stars is called "trigonometric parallax"[10] and is based on geometry, but it is only good for up to about 500 light-years. Trigonometry is not affected by time dilation. For stars that are farther away than 500 light-years, the angles are too small to use trigonometry, so astronomers use various techniques involving the brightness of the star to determine its distance. Such techniques also appear to

be unaffected by time dilation. But they only work to distances of about 150,000 light years, or just beyond the borders of our Milky Way galaxy.

For measuring the distance to stars in other galaxies (the Large Magellanic Cloud is the nearest at 160,000 light-years away) astronomers must measure the magnitude of stars that vary a little in their brightness, called Cepheid Variables. Cepheid Variables are pulsating variable stars have a period over which they go from maximum brightness to minimum brightness and then back to maximum brightness. In addition, the star's variable period is directly related to its absolute magnitude (i.e., the greater its absolute magnitude, the longer its period), as discovered by Henrietta Leavitt (1868 - 1921). Since Cepheid variable stars are rather abundant in space, astronomers simply measure the star's period, determine its absolute magnitude and then, together with the relative magnitude that can also be measured, use mathematics to determine distance. Time-dilation does not appear to be a factor because the only time involved is the variation period as viewed from earth.

The Expanding Universe

Theories about the rate the universe is expanding around us do not come from changes in the measurements of distances to stars. Expansion theories primarily come from the calculated velocities of celestial objects as they move through the visible universe. Primarily, they come from the differences in the "red shift" of light for objects at different distances.

In 1929 Edwin Hubble, working at the Carnegie Observatories in Pasadena, California, measured the redshifts of a number of distant galaxies.[11] He also measured their relative distances by measuring the apparent brightness of the Cepheid class of variable stars in each galaxy. When he plotted redshift against relative distance, he found that the redshift of distant galaxies increased as a linear function of their distance. The only explanation for this observation was that the universe was expanding.

Unfortunately, red-shifting doesn't tell you **who** is moving. It just says the distance between the light emitter and the observer is increasing. In addition, equipment used to measure red-shifting is presumably calibrated for Earth's speed of light, which means that such equipment cannot tell if the increase in wave length is the result of the velocity of the source or if it is due to the wave moving slower through the measuring equipment than the equipment was calibrated to assume.

The question then becomes: Are cosmologists and mathematicians taking into consideration the time-dilated light as described in this paper? If, due to time-dilation, light from a distant object is coming slower than they assume, then the distance to the emitting object is actually closer than they assume.

More importantly, if everything was moving faster when they universe was younger, when we were all closer to the spot where "The Big Bang" occurred, then light from distant objects

would be coming at significantly slower speeds than is currently assumed. When we look back at an object as it existed 10 billion light years ago, that object would have been moving a lot faster away from the center of the Big Bang back then than it is today. So, if we attempt to calculate the rate of expansion for the universe, we first have to understand how fast a distant object was moving when the light was emitted. Plus, we have to consider the apparent fact that we here on Earth are not moving away from the source of the Big Bang at the same rate as the distant object emitting the light. Depending upon who you ask, we are either moving faster now or we were moving faster in the distant past.

Red shift calculations appear to use the "universal speed of light" based upon how the velocity of light is measured here on Earth.[12] If the light being measured is actually traveling slower (or faster) than assumed, the calculated recession speeds of distant galaxies will be incorrect.

Conclusion

Every atom in the universe is its own clock and measures time at its own rate. When it emits a photon or ray of light, it emits it at 299,292.458 kilometers per *the atom's* second. Thus, in this constructive theory, every photon or ray of light coming to Earth from space may be coming at a different speed. Any theory that depends upon a "universal fixed speed of light" contains a logical flaw. While light may be measured at 299,792.458 kilometers per second everywhere, such as at the top of a mountain and at the bottom of a mountain, a **second** is of greater duration at the bottom of the mountain than at the top of the mountain.

A **gravitation-based** validation of this Constructive Time Dilated Light Theory can be accomplished by measuring the speed of light **vertically,** instead of parallel to the Earth's surface as is commonly done. All that is required is for someone to use an atomic clock to measure both the speed of light ***and*** the length of a second at ground level, bouncing the light off a mirror 10 meters **directly *above* the emitter.** Then to do the reverse, i.e., use an atomic clock to measure both the speed of light ***and*** the length of a second at a high point, bouncing the light off a mirror 10 meters **directly *below* the emitter**. If done with two sets of equipment side by side, the light that is emitted from the higher point should travel faster than the light that is emitted from the lower point, thereby sending light "**faster than the speed of light**" as it is typically measured. We already know that it has been repeatedly proven that atomic clocks will show that the length of a second is different at those different heights.[13]

A **velocity-based** validation of this Constructive Time Dilated Light Theory simply needs someone to put an atomic clock and the equipment for measuring the speed of light aboard a ship, then to measure both the speed of light and the length of a second at a far north point, such as Nome, Alaska, and then again near the Equator, such as in Singapore harbor. If the speed of light is the same at both locations, it is conclusive proof that the speed of light is actually ***different*** in the two locations, because the earth is spinning on its axis at roughly 1,000 miles per hour at the equator and far less than that at Nome, Alaska. And, therefore, as has

been repeatedly proven in velocity-based time dilation experiments and in GPS satellites, the length of a second becomes longer when the clock or object is moving faster.

References

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