

# Time Dilated Light

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***Abstract:** While it seems clear that nothing can exceed the speed of light as it would be measured at a stationary point in an imaginary empty universe devoid of gravitational influences, it also seems clear that there are mathematical versus logic problems with a constant speed of light in our real universe.*

## I. EMISSION THEORY

According to Isaac Newton's "Corpuscular Theory" (a.k.a. "Emission Theory")<sup>[1]</sup>, if the speed of light is  $C$  and the velocity of a light source is  $V$ , light emitted by an object coming toward the observer would arrive at  $C + V$ . If the light emitting object was moving away from the observer, its light would arrive at  $C - V$ . The math worked, and it seemed very logical.

But then Emission Theory was shown to be invalid in 1913 when Willem de Sitter observed that, in the case of a double-star system viewed edge-on, light from the approaching star would be expected to travel faster than the light from its receding companion.<sup>[2]</sup> But that clearly wasn't what was being observed. Corpuscular Theory suddenly had logic problems, and the mathematical equations that worked fine for hundreds of years no longer represented observed reality.

## II. AN ILLOGICAL EMISSION THEORY

Then, apparently as a result of *misinterpretations* of Einstein's Special Theory of Relativity, it was next theorized that light coming from those binary stars – and all stars - must be traveling at a fixed, maximum speed of light that is also isotropic, i.e., the same whether the star is coming toward you or going away from you.

Since the theory worked fine mathematically, and since it appeared to solve the problem with binary star systems, the theory of a fixed speed of light became accepted by mathematicians and scientists everywhere. However today, a hundred years later, it is slowly becoming clear this theory has serious logic problems. It is an *illogical* Emission Theory.

If the binary stars are traveling at 1,000 kps and emit light at an isotropic, maximum fixed speed of 299,792 kps, what mechanism causes the light to slow down in order to stay within or at the maximum? What prevents a moving object from emitting light at a higher speed? How does the moving object detect that there is a maximum velocity and that its light must slow down to that maximum? "That's just the way it is," isn't a logical answer.

The lack of logic and the unanswered questions seem to have been brushed aside with a simple assumption that light is simply emitted at a fixed constant rate that is also the maximum velocity for everything. It is assumed that every light emitting object somehow emits light at 299,792 kps regardless of its proximity of a gravitational mass or the speed or direction the light emitting object is moving. It seems no one is supposed to ask how this is possible, they are supposed to just accept it because it works fine mathematically.

And of course, since the theory doesn't seem logical, there are more and more problems with this "Illogical Emission Theory." It simply fails to explain what is observed in the way other objects in the universe appear to work. <sup>[3][4][5][6]</sup> Mathematicians and others who are fully satisfied with the theory simply argue that anyone who has problems with it must be miscalculating something or measuring something incorrectly.

### III. EINSTEIN'S SPECIAL THEORY OF RELATIVITY

A careful reading of Albert Einstein's 1905 paper *On the Electrodynamics of Moving Bodies* <sup>[7]</sup> shows that Einstein did not state that all light travels at a fixed speed. He stated that in an "**imaginary**" stationary universe where there are only two synchronous clocks, the value of "c" can be considered "to be a universal constant – the velocity of light in empty space." And in the next sentence, he states, "It is essential to have time defined by means of stationary clocks in the stationary system, and the time now defined being appropriate to the stationary system we call it 'the time of the stationary system'."

Gravitational time dilation as described by Einstein in 1916 <sup>[8]</sup> can be viewed as varying velocity time dilation in that it is about acceleration, while velocity time dilation is about objects moving at a fixed speed.

Einstein famously stated, "Since the mathematicians have invaded the theory of relativity, I do not understand it myself anymore." <sup>[9]</sup> His conflicts with mathematicians are legendary. In an address he gave to the Prussian Academy of Sciences in 1921, he said, "As far as the laws of mathematics refer to reality, they are not certain; and as far as they are certain, they do not refer to reality." <sup>[10]</sup>

According to R. L. Shankland's "*Conversations with Albert Einstein*," <sup>[11]</sup> Einstein was thinking of his own emission theory. Shankland wrote: "He had thought of, and abandoned the (Ritz) emission theory before 1905. He gave up this approach because he could think of no form of differential equation which could have solutions representing waves whose velocity depended on the motion of the source. In this case, the emission theory would lead to phase relations such that the propagated light would be all badly 'mixed up' and might even 'back up on itself'."

Later, Shankland added: "When I suggested that [Walter] Ritz's theory was the best of the several emission theories of light, he shook his head and replied that Ritz's theory is very bad in spots. But he quickly added, 'Ritz made a great contribution when he showed that frequency differences are the crucial thing in spectral series'."

#### IV. A NEW EMISSION THEORY

It appears that Einstein had all the components for a better emission theory in his Special Theory of Relativity, but he didn't like the idea of light being "all mixed up," so he failed to pursue the subject.

Einstein stated very clearly in his 1905 paper that time is local. Time changes with the local velocity. He put it this way: a "clock at the equator must go more slowly, by a very small amount, than a precisely similar clock situated at one of the poles under otherwise identical conditions." In other words, a clock at one of the poles would be just slowly rotating in place as the earth spins around its axis while a clock at the equator would be moving at roughly 1,674 kilometers per hour (1,040 miles per hour) as the earth spins on its axis. And that means that, if time runs more slowly at the equator than at the North Pole, then time must also run more slowly in Morocco than in France, and time in France must run more slowly than time in Sweden.

Today, we have seen many experiments with atomic clocks that have confirmed Einstein's principles of Velocity Time Dilation and Gravitational Time Dilation.<sup>[12][13][14][15]</sup> Time does indeed run slower when an object moves or when it is positioned near a gravitational mass. When time runs slower in one place than in another, and when the speed of light is defined as 299,792 kilometers per **second**, the question that needs to be asked is: *Whose* second?

The answer seems to be that when light is emitted from an atom, that wave or photon of light will be emitted at the maximum speed of light *minus* the time dilation factors being experienced by that atom.

#### V. CREATING LIGHT

There are three ways that astronomical objects make light.<sup>[16]</sup> One way, called "synchrotron emission," is only important in a few situations. The second way is "thermal emission," which produces a *continuous* wave of light. The third way is "line emission," where 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 in a *random direction* as a photon or wave of light. The energy of the photon or wave depends on the difference in energy between the two orbits of the electron. The question then becomes: What is the speed of that specific wave or photon of light?

The postulate defined here is: When a photon or wave of light is emitted from an atom (and also thereby from a star), it is emitted **at the speed of light at the location of the atom that emitted the wave or photon**. It instantly goes from velocity zero to 299,792.458 kilometers per **local** second.

As Einstein made clear in his 1905 paper, the maximum speed of light is its velocity in a stationary location in empty space. As far as we know, nothing can exceed that maximum velocity. Therefore, any movement of the light emitting atom cannot be *added* to the maximum speed of light, which also means a *moving* object cannot emit light at the maximum velocity. Thus, time dilation effects of the atom's velocity can only be **subtracted** from the maximum.

## VI. TIME DILATED LIGHT

We can use Einstein's formula for calculating Velocity Time Dilation  $T = T_0/(1 - v^2/c^2)^{1/2}$  (or an on-line calculator <sup>[17]</sup>) to calculate the difference in the speed of light emitted from a stationary object versus a moving object. If a radio signal (or light) is emitted from a spacecraft traveling at 10 percent of the speed of light (29,979.2 kps), one second at a stationary location will be 1.0050377997499 seconds aboard that spacecraft. That means that the emitted light from the spacecraft 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 stationary second when it reaches the stationary point, or 1,502.78 kps slower than the speed of light as it is measured at the stationary point. Faster moving objects, of course, will emit light at slower time dilated speeds.

Einstein's formula for gravitational time dilation can be similarly used to determine the effect gravitation will also have on the speed of light emitted from massive moving objects such stars and Supernovae.

## VII. IMPLICATIONS FOR ASTROPHYSICS

What are the implications of this Theory of Time Dilated Light for astrophysics and astronomy? While it does mean that the speed of light coming to us from the stars is highly variable and is mostly coming slower than the speed of light as it is measured on Earth, the distances to most nearby stars is typically determined via trigonometry,<sup>[18]</sup> which still provides valid results.

Theories about the rate the universe is expanding, however, primarily come from calculations of the red shift of light for objects at different distances.<sup>[19]</sup> Unfortunately, the equipment used to measure red-shifting is typically calibrated for Earth's speed of light (the assumed "universal speed of light"), which means that such equipment cannot tell if the increase in wave length is the result of the recessional velocity of the source or if it is due to the light wave moving slower through the measuring equipment than the equipment was calibrated to assume.<sup>[20]</sup>

In addition, if everything was moving faster when the universe was younger, as is required by "The Big Bang Theory," then light from very distant objects would be coming at significantly slower speeds than is currently assumed.

## VIII. VALIDATION METHODS

Assuming that current equipment and methodologies are precise enough, a **gravitation-based** validation of this Time Dilated Light Theory can be easily accomplished. 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 some distance 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 that same distance 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. In both situations, of course, the speed of light would be less than the speed of light from a stationary object in empty space.

A **velocity-based** validation of this Time Dilated Light Theory can be accomplished by putting an atomic clock and the equipment for measuring the speed of light aboard a ship, then measuring both the speed of light and the length of a second at a point as close as possible to the North Pole, and then again near the Equator, such as in Singapore harbor. If the speed of light is the same at both locations and the atomic clocks show the length of a second to be different, that is conclusive proof that the speed of light is actually different in the two locations due to the earth spinning on its axis at roughly 1,040 miles per hour at the equator and far less than that near the North Pole.

## IX. CONCLUSION

Every atom in the universe is its own clock and measures time at its own rate based upon Time Dilation conditions. When an atom emits a photon or ray of light, it emits it at 299,792.458 kilometers per the atom's second. Thus, 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.

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