International Journal of Mathematics and Statistics Studies
Vol.7, No.1, pp.1-12, January 2018
Published by European Centre for Research Training and Development UK (www.eajournals.org)

THE ACCELERATED WAVE

James H. Hughes

ABSTRACT: An electromagnetic wave may be accelerated.

KEYWORDS: Frame of Reference, Planck's Constant, Quantum Amplifier, Speed of Light, Time Travel.

INTRODUCTION

The idea of an accelerated wave may be explained by using the illustration of an ambulance that travels down a city street with its siren wailing. To an observer standing by the street, the sound of its siren increases in pitch and volume as the ambulance approaches, and falls off as the ambulance passes by.

The observer hears a change in pitch because of an apparent change in frequency of the siren's sound wave. The approaching ambulance consistently shortens the distance over which its sound waves travel in order to reach the observer. As the sound waves travel over a shorter distance, more of them reach the observer in a given interval of time, which increases their frequency or pitch.

While the siren generates the same sound waves, the observer notices a change in pitch due to the shift in distance of the origin of the sound waves from the moving ambulance compared to his frame of reference, an effect called the Doppler Effect.

In other words, as the ambulance approaches, the observer perceives its sound waves as having been accelerated, or increasing their in pitch or frequency, when, in fact the sound waves generated by the siren are the same. The moving ambulance causes the perceived acceleration of the sound waves, which shortens the distance that its sound waves travel in order to reach the observer.

As the ambulance passes by the observer, it consistently lengthens the distance over which its sound waves travel in order to reach him, so that its sound waves are perceived as decreasing in frequency or pitch as fewer sound waves reach the observer in a given interval of time.

The observer notices the change in pitch since the ambulance is moving at speed that is noticeable compared to the speed of sound in air. Where the ambulance may be moving at about 35 miles per hour, the speed of sound in air is around 760 miles hour and varies slightly depending on air pressure, temperature, and humidity.

As another point, when a jet aircraft travels faster than the speed of sound, or goes supersonic, it creates a sonic boom, a high energy pressure wave that travels through the atmosphere at the speed of sound, which is heard after the aircraft passes over an observer on the ground.

The sound wave generated by a supersonic aircraft is limited in its speed of propagation to the speed of sound, which is the maximum speed of propagation of a sound wave that propagates through the Earth's atmosphere. In other words, the medium that a wave travels through can affect its speed of propagation.

Print ISSN: 2053-2229 (Print), Online ISSN: 2053-2210 (Online)

A wave is mathematically ordered, or defined, according to its level of energy, which affects its amplitude, and length, or wavelength or frequency which is often defined as the reciprocal of its wavelength, and the medium it travels through. In other words, a wave involves the transmission or propagation of energy through a medium, which is organized in length or frequency with a crest or peak.

The idea of a wave that appears to be accelerated or de-accelerated as a result of a moving source, or point of origin, as compared an observer's frame of reference, plays a prominent role in astronomy.

Red Shift

In the early part of the 20th century, the field astronomy took a giant leap with the founding of new observatories such as the Mount Wilson Observatory in California. The Mount Wilson Observatory, the most famous observatory of its day, featured a 60 inch diameter reflecting telescope, and later added a 100 inch diameter reflecting telescope, the world's largest telescopes when they entered service.

The Mount Wilson Observatory was founded by George Ellery Hale, a leading organizer of American science. An astronomer and pioneer in the field of astrophysics, Hale earlier founded the Yerkes Observatory, which was associated with the University of Chicago, and later founded the Mount Palomar Observatory in California, which featured a 200 inch diameter reflecting telescope.

In fact, four times, with the 40 inch refracting telescope of the Yerkes Observatory, the 60 and 100 inch reflecting telescopes at Mount Wilson, and 200 inch reflecting telescope at Mount Palomar, Hale organized the construction of the world's largest telescopes. He gave a powerful example that continues to be followed today in the construction of large observatories, such as at the top of Mauna Kea in Hawaii, which has an altitude of over 13,000 feet, or the high desert of Chile.

Hale was instrumental in recruiting Edwin Hubble to work at the Mount Wilson Observatory. Hubble discovered that our galaxy of the Milky Way was only one of many galaxies, and that distant galaxies exhibit a shift in the color of their light emissions toward the red, as compared to nearby galaxies.

Called the red shift, this shift in the frequency of the light emissions of distant galaxies is thought to be caused by the lengthening of their distance away from an observer on Earth and its local galaxy, called the Milky Way.

In other words, like an ambulance that passes an observer on the street, who hears its siren lower its pitch since its sound waves arrive at a slower rate or lower frequency due to the consistent lengthening of distance between them, the light emissions from distant galaxies appears to shift to the red, or have a lower frequency due to their movement away from an observer on Earth.

In other words, since the light emissions of distant galaxies is shifted toward the red, the shift in their light frequency is thought to be caused by the consistent lengthening of their distance away from the Milky Way, which is induced by the movement of galaxies on a cosmic scale.

Print ISSN: 2053-2229 (Print), Online ISSN: 2053-2210 (Online)

In 1929 the astronomer Edwin Hubble announced that, based on his observations of galaxies beyond the Milky Way, they appear to be moving away from us, and the farther away the galaxy, the faster it was receding. In effect, Hubble appeared to discover that the universe was expanding.

The value for this rate of expansion became known as Hubble's constant. While the exact value of Hubble's constant has undergone revision with new observations of distant galaxies and the use of different methods for calculating distances between galaxies, the idea is commonly accepted that the red shift is caused by the lengthening of distance between galaxies.

In other words, like the Doppler Effect of an ambulance that passes by an observer on a street, the red shift is caused by the apparent de-acceleration of light when it crosses long distances. Over long distances, the movement of a light source away from an observer, or the lengthening of distance between the light source and an observer causes the light that the observer sees to shift frequency to the red.

Inference

Just as light appears to be de-accelerated, or shifted to the red by the movement of its source away from an observer, as seen in the apparent red shift of distant galaxies, it may be inferred that a wavelength of light may appear to be shifted in the opposite direction, or accelerated toward the blue due to the movement of a source toward an observer, or vice versa, within a frame of reference.

In other words, if an observer was stationary compared to the galaxies that were moving toward him, he would see a blue shift, or the relative acceleration of light caused by the movement of one object toward another over long distances.

Alternatively, if an observer was moving toward a galaxy onboard a fast spaceship, he would again see a blue shift, or the relative acceleration of light caused by the movement of one object toward another.

This argument merely restates the Doppler Effect, where, at least as far as how sound waves travel through the atmosphere, an observer on a street hears an increase in pitch of the siren of an approaching ambulance, or perceives a higher frequency of sound waves caused by the movement of one object toward another.

However, this inference applies only to a signal, or wave that is propagated at a standard rate or speed from its source, such as the sound wave from the siren of an ambulance, or the propagation of light in the vacuum of space, meaning that its perceived acceleration or de-acceleration is caused by the relative movement of its source compared to an observer within a frame of reference.

In other words, one of the characteristics of light, which is a form of electromagnetic radiation, is how it naturally propagates at the speed of light, a constant usually denoted as c, so that light appears to be accelerated or de-accelerated due to the relative movement of its source with respect to an observer.

However, the law of vectors, which says that like forces pointing in the same direction may be added together, may be used to suggest that light, as a wave of electromagnetic radiation, may

Print ISSN: 2053-2229 (Print), Online ISSN: 2053-2210 (Online)

be accelerated beyond its normal speed of propagation or the speed of light, by adding force to a light wave.

In other words, by adding a like electromagnetic force in the same direction that a light wave is traveling, light and other forms of electromagnetic radiation may be accelerated to travel faster than the speed of light.

While the law of vectors has some other requirements, such as the two vectors appearing in the same location at the same time, mathematics allows the addition of two like vectors, whether of force or velocity. The idea that light or another wave form of electromagnetic radiation may be accelerated beyond the speed of light is also suggested by how light propagates freely in the vacuum of space.

In other words, unlike the medium of the Earth's atmosphere, which limits the propagation of a sound wave to the speed of sound, it may be reasoned that in the vacuum of space, light or a wave of electromagnetic radiation may travel faster than the speed of light since there is no medium to speak of to limit its speed.

Unlike a sound wave traveling in the Earth's atmosphere, whose propagation involves a change in atmospheric pressure, induced by a pulse of energy, the propagation of light in the atmosphere does not involve the atmosphere as a medium of transmission. Instead, the atmosphere attenuates the transmission of light.

In other words, since light is able to propagate freely where there is no atmosphere, or attenuation or scattering from the atmosphere, space appears to contain no barriers to the propagation of light or other types waves of electromagnetic radiation that travel faster than the speed of light.

While light is known to bend around large masses to form a gravitational lens, which astronomers sometimes take advantage of in observing distant objects, this bending does not appear to alter its speed.

The idea of an accelerated wave is suggested by the tsunami, which is generated by an undersea earthquake and travels faster and is more energetic than the usual ocean waves, generated by wind or current. A tsunami travels nearly imperceptibly through the ocean until it begins to reaches a shallow shoreline, where it suddenly takes on the appearance of a giant wave or set of waves.

In comparison, the waves formed by the wind or currents tend to be surface waves, whose size is clearly visible as they are formed, and may increase in size or amplitude with the prevailing wind.

Just as a tsunami travels faster than the waves generated by wind and current that may be likened to the light and other electromagnetic radiation that is emitted by stars, it may be suggested that an energetic wave of light or some other form electromagnetic radiation may be generated, which travels faster than the speed of light.

Moreover, a wave can be captured and channeled just as a breakwater can alter and channel the movement of ocean waves, or a parabolic mirror can focus a light beam. If a wave is given a push by a force of the same type that created it, which is pointed in the same direction, it may

Print ISSN: 2053-2229 (Print), Online ISSN: 2053-2210 (Online)

be argued that the wave may travel faster, or translates the additional force into speed rather than amplitude.

However, for surface waves generated by wind or current, the push of more wind or current tends to increase the size or amplitude of the wave, just as the storm waves from a hurricane are large, and tend to gather together into a surge, which advances with the front of a hurricane.

But the tsunami, which is generated by an earthquake, or the sudden shift in geological plates, shows how a pulse of energy can create a powerful, fast moving wave that travels through the ocean nearly imperceptibly. This suggests an electromagnetic force may be applied close to the origin of an electromagnetic wave and point in its line of movement to increase its level of energy, and accelerate it to faster than the speed of light.

This acceleration of an electromagnetic wave would not require the acceleration of mass faster than the speed of light. Light and other types of electromagnetic waves or radiation evidently do not possess mass, which could otherwise complicate their acceleration past the speed of light.

Quantum Amplifier

In 1900 Max Planck discovered how light from a heated blackbody is emitted in discrete packets of energy, which may be calculated by using the value of his constant, denoted as ħ, and the equation of $E = \hbar c v$, where E stands for the energy of the packet of light, ħ is Planck's constant, c is the speed of light, and v stands for the frequency of the light, which is equal to the reciprocal of its wavelength.

Planck's discovery startled the world of physics. Until his discovery, the calculation of physical quantities such as energy was thought to be continuous. But he had discovered how light was emitted in discrete packets of energy, or quantized. Einstein later called these discrete packets of energy photons.

Planck's determination of ħ represented a masterpiece of mathematical analysis. By carefully examining the emission of light from a heated blackbody at various frequencies, he was able to propose that light was emitted in discrete packets, where the energy in an individual packet was directly proportional to the frequency of the light, or inversely proportional to its wavelength.

While Planck's constant is widely used in determining the energy carried by light, and in determining the location of atomic particles, Planck's constant may also be seen as a type of quantum amplifier, which organizes or amplifies a tiny burst or pulse of energy into a wave of electromagnetic energy, mainly as a result of an atomic process, which often involves an electron.

In other words, Planck's constant of ħ is a quantum amplifier because it takes a tiny, discrete amount of energy and translates it into a wave, which propagates at the speed of light, or c, as a normal characteristic of the speed of propagation of an electromagnetic wave in a vacuum or void of space.

In other words, as a tiny burst or pulse of energy is released into the quantum realm, such as from a shift in an electron's orbit around the nucleus of an atom, the electron's change in orbit

Print ISSN: 2053-2229 (Print), Online ISSN: 2053-2210 (Online)

involves a change in its level of energy, which creates a wave of electromagnetic energy. The amount of energy carried by the electromagnetic wave is determined by the following factors:

One factor is the value of Planck's constant, or ħ.

A second factor is the speed of light, or c as light and other types of electromagnetic waves propagate at the speed of light as one of their traits or characteristics.

A third factor is the type of physical activity that generates the wave, which determines its frequency, such as the mixing of chemical reactants in a chemical laser that produces light at a specific series of wavelengths.

This type of physical activity tends to reflect how the electron carries its charge in the form of a wave, or a piece of electrical string, which creates a series of orbital resonances, making its orbit quantized, appearing at discrete intervals.

A fourth factor is a multiplicative relationship, where the above factors are multiplied together to arrive at the equation of $E = \hbar c v$.

In other words, Planck's equation shows how light that is emitted at a high frequency or a short wavelength, such as the visible light the human eye sees, has more energy than light that is emitted a low frequency or a long wavelength such as infrared radiation, which is often perceived as heat.

In other words, the amount of energy in an individual packet of light, which may be called a quantum wave, is directly proportional to its frequency, or inversely proportional to its wavelength.

Since the energy in a packet of light is directly proportional to its frequency, Planck's constant may be viewed as a type of minimum displacement of the space time continuum, which generates a wave of electromagnetic energy. In other words, a displacement of the space time continuum generates a ripple, which may be observed.

While Planck's constant is often expressed in units of joules seconds, joules may be converted into equivalent units of energy that involve mass, distance, and time or velocity. This enables his constant to be viewed as a minimum displacement of the space time continuum over time, which generates a wave of light or electromagnetic energy.

Just as a ripple may appear on the surface of a pond of water by dipping a finger into it and requires a minimum displacement or input of energy in order to disturb its smooth surface or the surface tension of the water, so a ripple within the space time continuum requires a minimum displacement or level of energy in order to generate a wave of electromagnetic energy.

Understanding that Planck's constant represents a minimum displacement or input of energy in order to generate an electromagnetic wave, the energy carried by the wave will depend on the frequency of the disturbance.

In other words, since making a ripple within the space time continuum requires a minimum displacement or amount of work, making more ripples over an interval of time, or a higher frequency of rippling, requires more work to generate an electromagnetic wave with a higher frequency.

Print ISSN: 2053-2229 (Print), Online ISSN: 2053-2210 (Online)

In other words, since it requires a minimum amount of work to make a wave, it requires more work to make a faster wave, or more waves faster, or a wave with higher frequency since the frequency of a wave is directly proportional to the amount of work applied to make it over an interval of time.

Since Planck's constant tells us that the amount of energy it takes to make a minimum wave in the electromagnetic spectrum is fixed, that is why the relationship of $E = \hbar c v$ is directly proportional to the frequency of the wave, or number of times a ripple in the space time continuum is used to create an electromagnetic wave, and is inversely proportional to its wavelength.

Proposition

Understanding Planck's constant serves as a quantum amplifier in creating a wave of electromagnetic energy, it may be suggested that the addition of more energy to the wave will result in a wave that propagates at a higher speed, instead of compressing the frequency of the wave or creating another wave.

In other words, since the value of Planck's constant remains the same, as does the wavelength or frequency of wave, adding more energy to the wave does not compress it, or increase its frequency, but instead it accelerates the wave, and increases its speed of propagation.

Since a wave is identified by its wavelength of frequency, the addition of energy to a wave of electromagnetic energy results in its acceleration past the speed of light. In other words, the addition of energy to a wave of electromagnetic energy increases its speed instead of increasing its frequency, or generating another wave.

This idea is suggested by how the Doppler Effect, which goes both ways. An observer hears a change in the pitch or the frequency of an ambulance siren that both increases and decreases. So, just as a sound wave may increase and decrease in frequency or accelerate and de-accelerate with respect to a frame of reference, so may a wave of light be observed to increase in its frequency, or shift to the blue.

In other words, the red shift from receding galaxies that astronomers observe on Earth could be seen as a blue shift to a properly positioned observer. Knowing it is possible to observe light with a blue shift, due to a moving frame of reference, suggests a wave of light may be accelerated past the speed of light.

In other words, by treating $\hbar$ as an invariant in the construction of a quantum wave, or a wave of electromagnetic energy, the addition of energy to the wave accelerates the wave, which results in its traveling faster than the speed of light. If a wave is accelerated, its speed of propagation needs to increase in proportion to the push it was given by the application of a force along its line of propagation.

In other words, an electromagnetic wave may propagate faster than the speed of light as additional energy is imparted to it, using the law of vectors where the additional energy, which is presumably electromagnetic, so that the vectors may add, points in the same direction.

In other words, running a wave through an accelerator where the direction of acceleration or its line of force is parallel to the wave, can add energy to the wave, which is translated into a

Print ISSN: 2053-2229 (Print), Online ISSN: 2053-2210 (Online)

higher speed of propagation. Since the added energy does not change the wave's frequency or wavelength, the wave travels faster.

The acceleration of a wave of electromagnetic energy may be thought to take place near its point of origin. Otherwise, the wave travels so fast that the apparatus or circumstances needed to accelerate it would seem to be expensive.

The idea that an electromagnetic wave may be accelerated close to its point of origin is suggested by how a tsunami appears close to its point of origin of an undersea earthquake, and is quickly generated in time and space compared to the generation of surface waves from the wind and currents.

The Lorentz Transformation

Having considered the idea that a wave of electromagnetic energy may be accelerated to a speed faster than the speed of light, it may be helpful to recall that an acceleration of a wave or object affects its local frame of reference, including the passage of time, as compared to a stationary observer.

Physicists have worked out the mathematical effects of this transformation, which is similar to the Doppler Effect, by using a transformation called the Lorentz transformation, which relies heavily on a comparison of the speed of the moving wave or object to the speed of light, or c.

The Lorentz transformation relies on the speed of light as a basis of comparison since an observer measures distance using light waves or other forms of electromagnetic radiation, which propagate at the speed of light, similar to how the sound wave of an ambulance siren, which propagates no faster than the speed of sound, lets the Doppler Effect be perceived by an observer on a city street as an ambulance passes by.

In other words, the speed of light is able to serve as a constant in comparing two spatial frames of reference moving at different speeds and directions compared to each other due to the speed of light is a constant used in observing both frames of reference and for measuring distance.

The idea of an accelerated wave and the Lorentz transformation may be illustrated by considering a spaceship that is traveling to Alpha Centauri, the nearest star system, which is 4.3 light years away from Earth. Using an advanced propulsion unit, the spaceship quickly accelerates to travel at a speed of 0.9 c, or nine tenths the speed of light.

Since the spaceship is traveling directly away from Earth, after a year the spaceship has traveled a distance of 0.9 light years, which is equal to its velocity of 0.9 c multiplied by the time of a year.

The Lorentz transformation is used to determine the passage of time aboard the spaceship compared to an observer on Earth. Based on Einstein's theory of special relativity, which recognizes how local conditions of time and space may differ for two moving frames of reference, it determines the time aboard the spaceship by multiplying the time on Earth by two factors.

The first factor in the Lorentz transformation, which is often called the Lorentz factor, is the reciprocal of the square root of one less the ratio of the velocity of the spaceship over the speed of light, where the ratio is squared, or its numerator and denominator are both squared. The

Print ISSN: 2053-2229 (Print), Online ISSN: 2053-2210 (Online)

Lorentz factor is generally small unless the speed of the spaceship, or the second frame of reference, is a significant fraction of c.

The second factor is the time on Earth less the ratio of the velocity of the spaceship multiplied by the distance traveled over the speed of light squared. This factor is nearly equal to the passage of time on Earth unless the velocity of the spaceship and distance traveled are a significant fraction of c.

Algebraically, the Lorentz transformation is $1/\sqrt{(1- v^2/c^2)}$ multiplied by $(t - vx/c^2)$

Where v is the speed or velocity of the spaceship at 0.9 c, x is the distance traveled of 0.9 light years, and t is one year.

Plugging in values, $v^2/c^2 = 0.9^2\, c^2/c^2 = 0.81$, so the Lorentz factor becomes

$1/\sqrt{(1- v^2/c^2)} = 1/\sqrt{(1 - 0.81)} = 1/\sqrt{(0.19)} = 1/0.4359 = 2.2942$

Using the Lorentz factor to multiply the expression of $(t - vx/c^2)$ gives

Time aboard the spaceship = 2.2942 (1 year on Earth – 0.9 c (0.9 light years)/c^2) =

2.2942 (1 year – 0.81 light years/c) = 2.2942 (1 year – 0.81 years) = .4359 years

This is the value of the reciprocal of the Lorentz factor applied to the passage of time on Earth. The passage of time aboard the spaceship is often described as having been dilated compared to an observer on Earth, meaning that time moves at a slower pace.

In other words, aboard the spaceship, a passenger would have experienced the passage of less than a year, so if the spaceship reaches Alpha Centauri and returns to Earth without stopping, the passenger would have experienced less than half the passage of time compared to an observer on Earth.

Moreover, for larger values of v, or a faster spaceship, which, however, travels sub-light, or at a speed less than the speed of light, the dilation of time increases so that a passenger on the spaceship experiences relatively little time aboard the spaceship compared to an observer on Earth.

The Accelerated Wave

The idea accelerated wave may be illustrated by how, after the spaceship travels for a year at a speed of 0.9 c toward Alpha Centauri, it sends a radio signal to Earth, which it accelerates to a speed of 10^6 c, or a million times the speed of light.

Traveling at this speed, the accelerated radio wave takes 28.38 seconds to reach Earth, calculated as follows:

Time = distance/speed = 0.9 light years/10^6 light years per year = 0.9 years/10^6

Converting this value from years into seconds gives:

(0.9 years) (365 days/year) (24 hours/day) (60 minutes/hour) (60 seconds/minute) /10^6 or

28.38 seconds

Print ISSN: 2053-2229 (Print), Online ISSN: 2053-2210 (Online)

However, this length of time measures is only appropriate for a frame of reference that lies outside the radio signal, such as the spaceship, which is the source of the signal, or an observer on Earth, which is the destination of the signal. These two points define the measurement of time and distance as a radio signal is normally used.

But for an observer within the accelerated wave, or the moving frame of reference with respect to the spaceship and an observer on Earth, the Lorentz transformation gives the value of local time within the signal, as follows.

Plugging in values, $v^2/c^2 = (10^6\ c)^2/c^2 = 10^{12}\ c^2/c^2 = 10^{12}$, so the Lorentz factor becomes

$1/\sqrt{(1- v^2/c^2)} = 1/\sqrt{(1 - 10^{12})}$

Using -10^{12} to approximate the value of $(1 - 10^{12})$, the Lorentz factor becomes

$1/\sqrt{(1 - 10^{12})} = 1/(\sqrt{-1})(\sqrt{10^{12}}) = 1/\ i\ 10^6$

Using the Lorentz factor to multiply the expression of $(t - vx/c^2)$ gives the value of time within the accelerated wave as:

$1/\ i\ 10^6$ (28.38 seconds – c 10^6 (0.9 light years)/c^2)

Substituting 0.9 years/10^6 for 28.38 seconds, results in a value for the local time within the wave as

$1/\ i\ 10^6$ (0.9 years/10^6 – c 10^6 (0.9 light years)/c^2) =

$1/\ i\ 10^6$ (0.9 years/10^6 – (0.9) light years 10^6/ 1 light year per year) =

$1/\ i\ 10^6$ (0.9 years/10^6 – (0.9) years 10^6)

Using -(0.9) 10^6 to approximate the value of (0.9/10^6 – (0.9) 10^6 results in

$1/\ i\ 10^6$ (0.9 years/10^6 – (0.9) years 10^6) = ($1/\ i\ 10^6$) (-0.9 10^6 years) =

-0.9 years 10^6 / i 10^6 = -0.9 years/ i = (-1/ i) 0.9 years

$-1/i = i$ since $-1/i = -1/\sqrt{-1} = -1/(-1)^{1/2} = (-1)^{1/2} = \sqrt{-1} =$ i by definition, or

$-1/i = -1(i)/i^2 = (-1)(i)/(-1) = (i)((-1)/(-1)) = (i)1 = i$, so that

(-1 / i) 0.9 years = i (0.9 years)

As a result, the accelerated wave travels nearly 0.9 years backwards in time. This reflects how i, when used as a multiplier of time, expresses the idea that time that runs backwards. In other words, multiplication by i represents a change in the trait or characteristic of an object or quantity such as the movement of time, rather than a change in existence that could involve the disappearance of time, a circumstance which could be implied by a multiplier of -1 (Hughes, The Anti-Existence Theorem).

The accelerated electromagnetic wave continues to exist, although moving backwards in time with respect to itself, or local time. As a result, for an observer who lies outside the wave and its local time, aboard the spaceship or on Earth, the movement of the wave reflects the forward movement of time.

Print ISSN: 2053-2229 (Print), Online ISSN: 2053-2210 (Online)

The idea that the accelerated wave travels backwards in time is suggested by how the passage of time aboard the spaceship becomes increasingly dilated for values of v that are increasing, but less than the speed of light. As the velocity of the spaceship approaches the speed of light, time aboard the spaceship slows down.

As the spaceship reaches the speed of light, the Lorentz factor becomes the reciprocal of the square root of zero, an instance of division by zero, which the Lorentz transformation uses to multiply the expression of $(t – (c\ x/c^2))$, or $(t – x/c)$, which becomes zero since, when the speed of the spaceship reaches the speed of light, time equals the distance traveled divided by the speed or velocity of the spaceship.

In other words, for a spaceship that reaches the speed of light, the value of t or time in the Lorentz transformation becomes equal to the distance traveled divided by its speed, or x/c, so that (t – x/c) essentially becomes (x/c – x/c), or zero.

While mathematics generally prohibits division by zero, or leaves it undefined, division by zero is allowed and has a clear answer, when the numerator is also zero, which results in an answer of one, or the identity element of multiplication and division (Hughes, Division by Zero).

This means that as the Lorentz factor becomes the reciprocal of the square root of zero, which the Lorentz transformation uses to multiply an expression that also becomes zero, the Lorentz transformation becomes equal to one.

As the Lorentz transformation gives a value of one, the passage of time aboard the spaceship effectively becomes frozen, since its local time is no longer dilating, or slowing down, but reaches a point of stopping at one, which is equal to the identity element of multiplication.

The local time value of one may be viewed as the appropriate limit for this time dilation problem since using a value of zero to represent the freezing of time, or a frozen moment in the passage of time could imply the anti-existence of time, or its disappearance (Hughes, The Anti-Existence Theorem).

In other words, no matter what time it was aboard the spaceship, the value of time aboard the spaceship now stays the same, or is a constant, since it is equal to the identity element of multiplication. In contrast, a value of zero for time would imply its disappearance.

In this regard, i appears as an intermediate value between -1 and 0, which allows its use as a multiplier in physical systems that do not imply the anti-existence of a quantity such as time, or the disappearance of time, but indicate a shift in direction, such as time that runs backwards.

In other words, where in most circumstances, time flows at a natural rate, its rate of flow can change in local circumstances, as allowed by Einstein's theory of special relativity, to where its rate of flow can stop, or become frozen when the spaceship travels at the speed of light, so that its identity element is one.

In other words, as time dilates, it contracts in its movement to approach a value of one, a multiplier that returns no change to an initial value, or freezes time, and allows no further movement or passage of time.

In a sense, time is like a river, which flows forward. As the riverbank, or its spatial system accelerates and moves forward, the river of time also keeps moving forward, but the passage of time appears to dilate or slow down for an observer on a boat flowing down the river.

Print ISSN: 2053-2229 (Print), Online ISSN: 2053-2210 (Online)

In other words, space is also traveling as an observer travels on the river of time. As the observer runs fast, and reaches the speed of light, the observer reaches where he was, and then time appears to go backwards as the observer runs faster.

As the spaceship transmits a radio signal at a velocity of 10^6 c, the signal travels backwards in time, as signified by the multiplier of i, an intermediate value between zero and negative one.

Since time continues to flow, for the accelerated radio signal, time travels backwards as it moves faster than the speed of light, where the Lorentz transformation gives a limit that is essentially equal to the time that it would take for a normal wave of light or some other electromagnetic wave to travel from the position of the spaceship, at a distance of 0.9 light years, to an observer on Earth.

Moreover, since time has passed, or its flow has gone past a particular point, it should be easier to reach that point, instead of venturing outwards to a point whose time has yet to pass. In other words, moving forwards in time would require a different geometry than an accelerated radio wave.

REFERENCES

[1] James H. Hughes, "Division by Zero," International Journal of Mathematics and Statistics Studies, Volume 6, No. 3, September 2018, pp. 8-17.
[2] James H. Hughes, "The Uniqueness Theorem," International Journal of Mathematics and Statistics Studies, Volume 6, No. 2, June 2018, pp. 46-65.
[3] James H. Hughes, "The Anti-Existence Theorem," International Journal of Mathematics and Statistics Studies, Volume 6, No. 1, March 2018, pp. 12-22.
[4] James H. Hughes, "The Identity Crisis (Element)," International Journal of Arts and Science Research, ijasrjournal.com, archives, 2017, Volume 4, No. 1, pp. 48-62.