MOVING OBJECTS ALSO CURVE SPACE EXPLAINING LENGTH CONTRACTION, TIME DILATION AND OTHER PREDICTIONS OF RELATIVITY

DR. MOHAMMAD HUMAYOUN KHAN, Madinah Munawarra, Saudi Arabia. drkhan77@yahoo.com

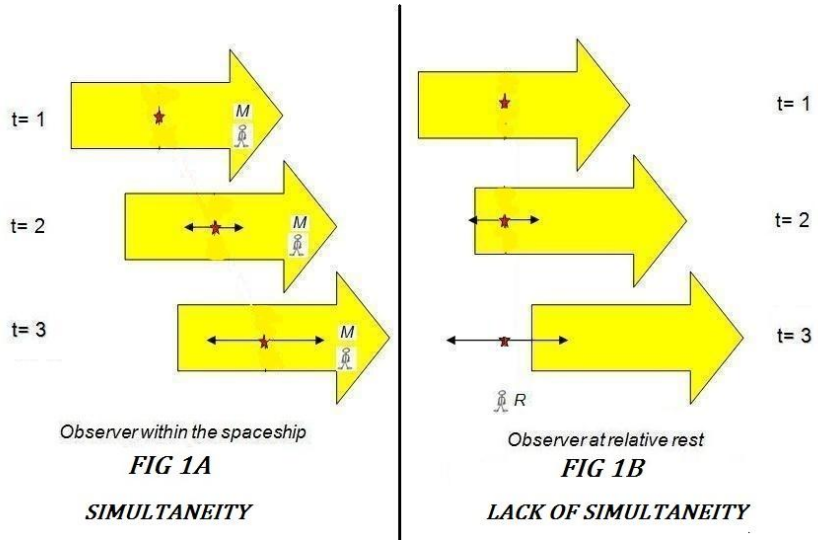
Abstract: Time dilation and increase in mass at high velocities predicted by Special Relativity (SR) has been observed in particle accelerators[3], however other predictions of SR like length contraction have not been be measured[8]. The reciprocity of time dilation in relativity and its consequence the twin paradox is a contentious issue. I propose that moving objects curve space differentiating them from nonmoving objects. This paradigm shift can enhance SR by resolving the twin paradox and precisely explain the mechanism for length contraction. It gives the reason for the constancy of the speed of light, the cause of inertia and shows that simultaneity is preserved. It provides a link between time dilation seen with motion and that seen with gravity. It shows the mechanism for the action of gravity and the reason a complete collapse into singularity cannot happen in a black hole. It also shows that motion and time can only exist in an expanding universe. An experimental setup is suggested which may precisely confirm these new concepts.

Resume´: La dilatation du temps et l'augmentation de la masse à des vitesses élevées prédites par la relativité restreinte (RR) ont été observé dans les accélérateurs de particules (3), cependant d'autres prédictions de RR comme la contraction des longueurs ne peuvent être mesurés. (8) La réciprocité de la dilatation du temps en relativité et les conséquences du paradoxe des jumeaux est une question controversée. Je propose que les objets en mouvement courbent l'espace ce qui les différencie des objets statiques. Ce changement de paradigme peut améliorer la RR en résolvant le paradoxe des jumeaux et en expliquant avec précision le mécanisme de contraction des longueurs. Il explique la raison de la constance de la vitesse de la lumière et montre que la simultanéité est préservée. Cela établit un lien entre la dilatation du temps observée avec le mouvement et la gravité. Cela démontre le mécanisme d'action de la gravité et la raison pour laquelle un effondrement complet de la singularité ne peut se produire dans un trou noir. Il montre également que le mouvement et le temps ne peuvent exister que dans un univers en expansion. Un dispositif expérimental est proposé et pourrait justement confirmer ces nouveaux concepts.

Key words: Relativity; Length contraction; Time dilation; Twin Paradox; Simultaneity; Constancy of the speed of light; Inertia; Gravity; Black holes; singularity; Cause of time.

SIMULTANEITY OR LACK OF SIMULTANEITY

Einstein's postulate of constancy of the speed of light in all reference frames leads to the concept that simultaneity cannot be preserved so events appearing to be simultaneous in one reference frame may not be simultaneous in another. Following is a typical thought experiment that demonstrates lack of simultaneity:



In figure 1, a spaceship is moving to the right at a constant velocity, an observer M on the spaceship (Figure 1A) will see rays of light emitted from the center reach the front and the backend of the spaceship simultaneously as if the rays of light are being dragged along with the spaceship. However according to relativity as the speed of light is c for all observers so the observer R, at rest (Figure 1B) will see the light reach the back of the spaceship first and the front later on. Thus what is simultaneous for an observer M on the spaceship is not simultaneous for the observer R, at rest.

To illustrate how violation of the concept of simultaneity is ignored in physics books[1] when it is convenient, we will repeat the thought experiment with ray of light moving perpendicular to the direction of motion as shown in figure 2.

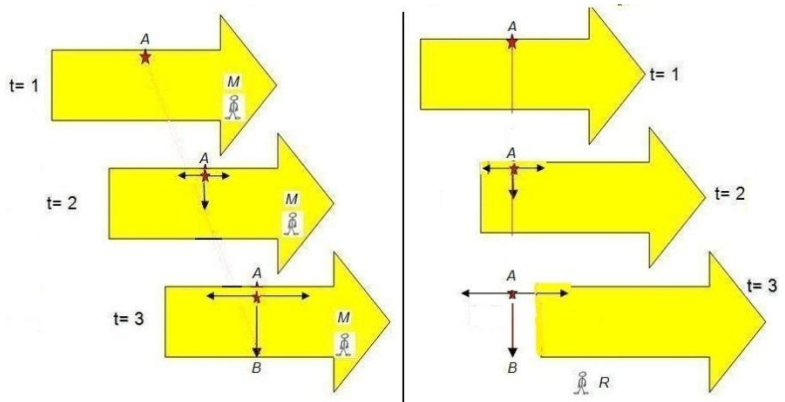
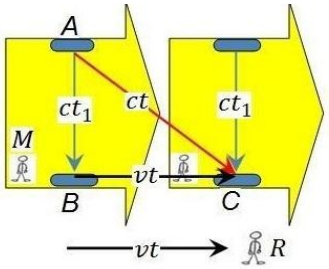


FIG 2A
SIMULTANEITY

FIG 2B
LACK OF SIMULTANEITY

In Figure 2A a spaceship is moving to the right at a constant velocity and a ray of light is shown to move down perpendicular to the direction of motion from the center. An observer M on the spaceship will see this ray move straight down through the center of the ship. According to relativity an observer R, at rest (Figure 2B) should see this ray of light move down in his reference frame independent of the motion of the spaceship.

In special relativity both the above scenarios are correct as the speed of light is constant and each observer has his own simultaneity. The above concept is completely ignored in relativity books[1] when deriving Einstein's and Lorentz's time dilation eq#1.



THE DERIVATION OF PRECISELY CORRECT TIME DILATION EQUATION
FIG 3

Figure 3 shows a spaceship moving to the right. The vertical ray of light AB= ct_1 within the spaceship is seen by an observer 'R' at rest to move diagonally AC= ct due to motion of the spaceship as if the light is being dragged along the direction of motion. The difference here from FIG 1 and FIG 2 is that

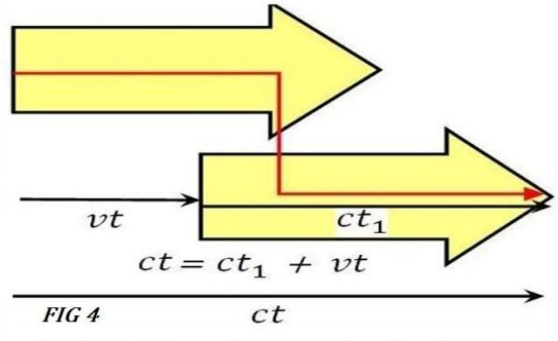
the point of view of the observer M in motion and the observer R, at rest coincide at every point, thus simultaneity is preserved.

Using Pythagorean Theorem we can derive eq#1.

$$t_1 = t\sqrt{1-\frac{v^2}{c^2}} \;..\; eq\#1A \quad or \quad t = \frac{t_1}{\sqrt{1-\frac{v^2}{c^2}}} \;..\; eq\#1B$$

It should be stressed that this equation cannot be derived if light beam is not dragged in the direction of motion as seen by the observer at rest. The turnaround points when light is reflected off the mirrors is the same for the observer M moving with the spaceship and observer R, at rest. These points coincide both in space and time. These points of reflection are the points of simultaneity and the concept on which Einstein's and Lorentz's time dilation eq#1 is based is consistent with preservation of simultaneity and presence of a dragging effect of moving objects on light. This derivation directly contradicts Lorentz transformation (LT) equations which are based on lack of simultaneity and have never been experimentally verified[8]. Equation #1 is the gold standard predicted by SR. All the experiments which demonstrate time dilation in motion are demonstrating the accuracy of this equation.[2, 3]

SIGNIFICANCE OF OTHER TIME DILATION EQUATIONS



Red line shows path of light moving in the direction of motion within the rocket

Time changes in variance to eq#1 are derived if the ray of light is moving horizontally in the direction of motion or opposite to the direction of motion within a moving object.

In FIG 4 a spaceship is moving to the right with velocity v. A beam of light moves from the back to the front in the direction of motion in time" t" covering the distance "ct" as seen by an observer at rest. This distance is seen as ct_1 by an observer within the spaceship. Time within the spaceship is measured as t_1

$$ct = ct_1 + vt \quad \text{Solving for } t_1 = t\left(1 - \frac{v}{c}\right) \text{....eq\#2a}$$

$$\text{or} \quad t = \frac{t_1}{\left(1-\frac{v}{c}\right)} \text{.... eq\# 2b}$$

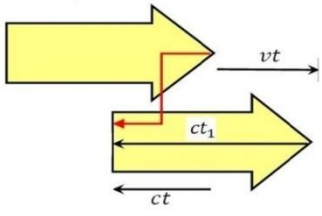
If we insert the length contraction factor as seen by observer at rest: $\sqrt{1 - \frac{v^2}{c^2}}$ ..... $eq\#1c$

Then the equation is:

$$ct = \left(ct_1\sqrt{1 - \frac{v^2}{c^2}}\right) + vt \quad \text{Solving for } t_1 = \frac{t}{\sqrt{1-\frac{v^2}{c^2}}}\left(1 - \frac{v}{c}\right)$$

$$\text{or} \quad t = \frac{t_1\sqrt{1-\frac{v^2}{c^2}}}{\left(1-\frac{v}{c}\right)} \text{ ..... } eq\#3$$

Neither eq#2 nor eq#3 have any resemblance to the original time dilation eq#1 although we have apparently used the same logic in the derivation process however we have ignored the dragging effect of the moving spaceship on light. Similarly if the light is passing backward within the spaceship opposite to the direction of motion (FIG 5) we can derive the following equations:



$ct = ct_1 - vt$

Red line shows path of light moving against the direction of motion within the rocket

FIG 5

$$ct = ct_1 - vt \quad \text{Solving for } t_1 = t\left(1 + \frac{v}{c}\right) \text{ ... eq\#4a}$$

$$\text{or} \quad t = \frac{t_1}{\left(1+\frac{v}{c}\right)} \text{ ...eq\#4b}$$

If we insert the length contraction factor as seen by the observer at rest: $\sqrt{1-\frac{v^2}{c^2}} \ldots . . eq\#1c$

Then the equation is:

$$ct = \left(ct_1\sqrt{1-\frac{v^2}{c^2}}\right) - vt. \quad \text{Solving for} \quad t_1 = \frac{t}{\sqrt{1-\frac{v^2}{c^2}}}\left(1+\frac{v}{c}\right)$$

$$\text{or} \quad t = \frac{t_1\sqrt{1-\frac{v^2}{c^2}}}{\left(1+\frac{v}{c}\right)} \ldots \ldots eq\#5$$

Nither eq#4 nor eq#5 have any resemblance to the original time dilation eq#1.

The above is to demonstrate that the equations derived with light moving horizontally in or against the direction of motion with or without length contraction factor give results for time t_1 that are at variance with eq#1. This is happening because we are ignoring any possibility of dragging effect on light in derivation of above equations just as it is done in derivation of LT. This also shows that use of unidirectional equations such as LT gives incorrect results for time as also pointed out by others[8]. Use of time in LT to predict change in line of simultaneity and to derive the Andromeda paradox[14] is likely a futile endeavor especially when we can see above that correct and tested eq# 1 can only be derived when simultaneity is preserved.

We can also get correct results for time as in eq#1 by averaging the above unidirectional equations as shown below. The eq#2 and eq#4 without the length contraction factor appear to represent a faster time with light moving toward the front and slower time with light moving toward the back of the moving object. The original and correct time dilation eq#1 is their geometric average.

$$\text{Multiply } t = \frac{t_1}{\left(1-\frac{v}{c}\right)} \ldots eq\#2 \quad by \quad t = \frac{t_1}{\left(1+\frac{v}{c}\right)} \ldots eq\#4$$

$$\text{Correct equation is the square root of the product:} \quad t = \frac{t_1}{\sqrt{1-\frac{v^2}{c^2}}} \quad \ldots \text{eq 1B}$$

The eq#3 and eq#5 with the length contraction factor can be arithmetically averaged to also obtain eq#1

$$t = \frac{t_1\sqrt{1-\frac{v^2}{c^2}}}{\left(1-\frac{v}{c}\right)} \ldots\ldots eq\#3 \quad t = \frac{t_1\sqrt{1-\frac{v^2}{c^2}}}{\left(1+\frac{v}{c}\right)} \ldots\ldots eq\#5$$

Arithmetic average of eq#3 and eq#5 gives the correct equation: $t = \frac{t_1}{\sqrt{1-\frac{v^2}{c^2}}}$ ....eq 1B

The significance of the averaging to get the correct time dilation eq#1 becomes clear when we look at the mechanism of length contraction.

INERTIA AND LENGTH CONTRACTION

I propose that length contraction is due to curving of space caused by motion. This phenomenon can only occur in an expanding space (universe) and is similar to the proposal of physicist Miguel Alcubierre.[6]

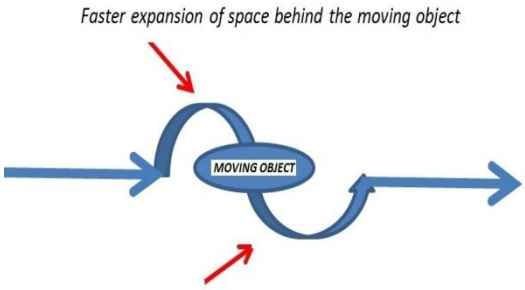
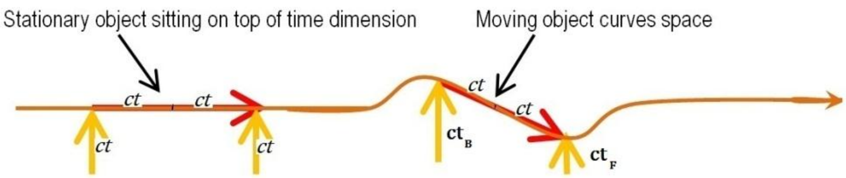


FIG 6 *ALCUBIERRE DRIVE*

Miguel Alcubierre in 1994 suggested the above mechanism (Fig 6) for a warp drive to move objects at high velocities by bending space. I propose that this happens normally when objects are pushed as we live in an expanding space (universe). The moving object interacts with space slowing the expansion of space in front of the object, slowing time (eq#2.) The space behind the object interacts with the object to expand faster causing faster time (eq#4), thus establishing time differential which then perpetuates motion. This is the significance of eq#2 and eq#4. The space resists motion however once motion begins with application of force and the curvature is produced then space perpetuates motion.

This is the mechanism of inertia which likely works at the atomic level so as to explain rotational motion as well.

TIME AND SPACE CURVATURE



Three dimensions of space are represented by one dimension line.
Time is multiplied by speed of light to get distance in higher dimension *FIG 7*

If "ct" is the distance in the time dimension which is perpendicular to our three dimensional space then a non-moving object is sitting on the top of this dimension. This distance I propose is equal to half the length of the object. If the time that light takes to cross half the length of the object is set as "t", then this is the time which changes when an object is set into motion.

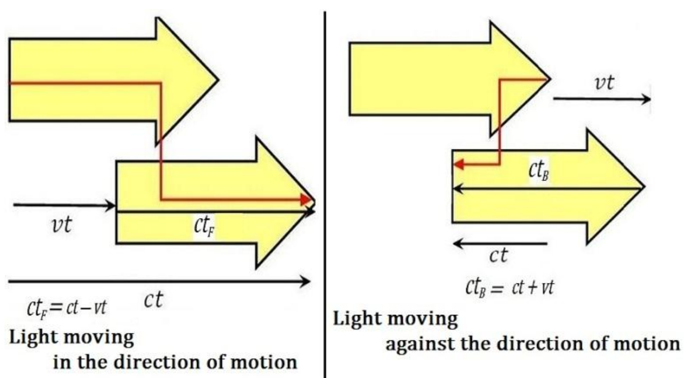


FIG 8A *FIG 8B*

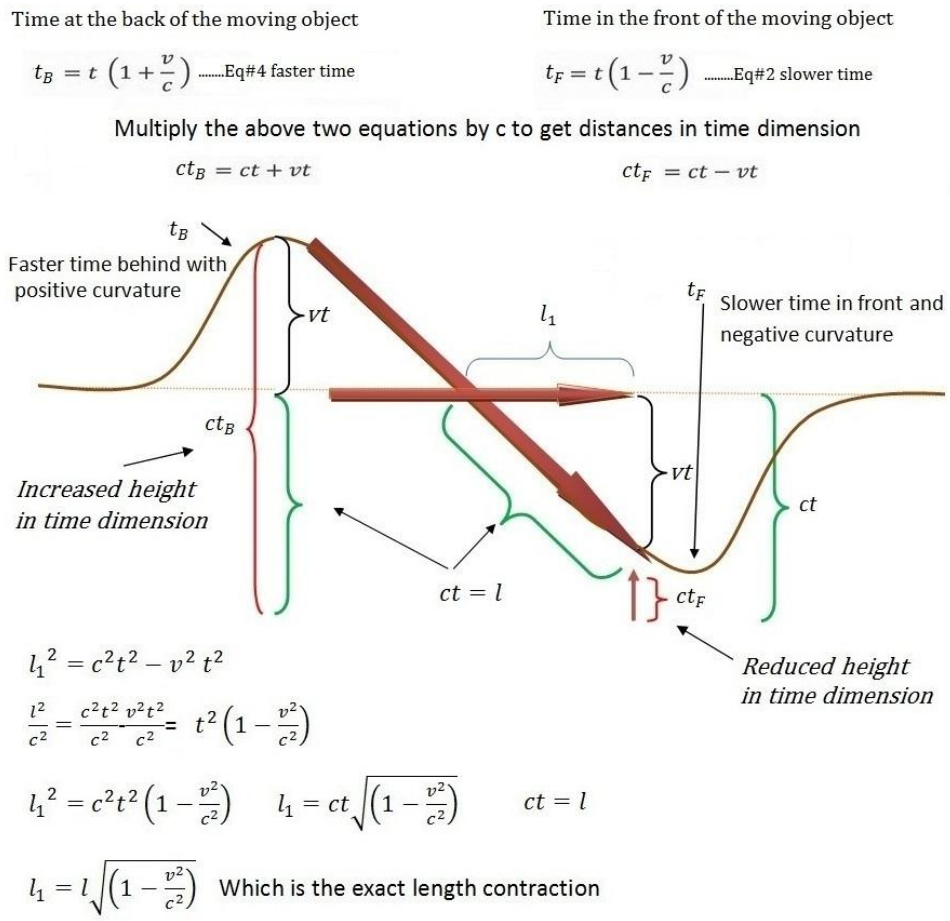
The object (Figure 8A and 8B) is moving to the right and light passes in direction of motion and then opposite to the direction of motion. The red line is the ray of light moving through the moving object as seen by a non-moving observer. The time t_F is the time toward the front end of the object and t_B is the time toward the back end of the object.

$$ct_F = ct - vt \quad \text{solving for} \quad t_F = t\left(1 - \frac{v}{c}\right) \quad \text{eq\#2a} \quad \text{slower time}$$

$$ct_B = ct + vt \quad \text{solving for} \quad t_B = t\left(1 + \frac{v}{c}\right) \quad \text{eq\#4a} \quad \text{faster time}$$

Pushing on an object would cause it to interact with the expanding space. The expansion of space slows in front of the moving object and becomes faster behind thus propelling the object in a time differential that is created. This phenomenon may happen only in an expanding space. Thus expansion of space (i.e. expansion of the universe) is essential for motion to exist.

Fig 9 shows how the object rotates in curved space-time. The object moves in a time differential and follows the curvature that is produced with motion.



LENGTH CONTRACTION

FIG 9

The curving of space and rotation of the moving object in this curved space is the real cause of the length contraction. We can see above that in the rotated state the length is not contracted and eq#2 and eq#4 represent this rotated state. The geometric average of these two equations give us the correct

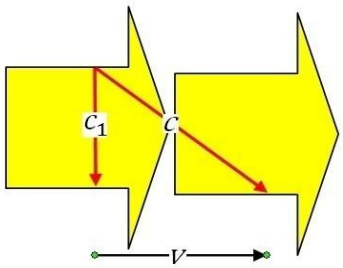
time (eq#1) within the moving object, while eq#3 and eq#5 represent the non-rotated state as seen by an observer at rest where length contraction is needed and a simple arithmetic averaging of these equations gives us the correct time dilation eq#1.

SPEED OF LIGHT

Earlier we had seen that simultaneity is preserved as light appears to be dragged in the direction of motion within moving objects. Speed of light is only constant in a local reference frame and may be measured slower or faster depending upon from where the observation is made. Time is faster at the top of a mountain compared to sea level due to the effect of gravity[9]. Speed of light will be "c" if measured at the top of a mountain or at sea level in their respective local frame of reference. However for a faster clock (due to weaker gravity) at the top of mountain the speed of light at sea level will be slower and the slower clock at sea level (due to stronger gravity) will measure the speed of light at the top of the mountain to be faster. This concept shows us that it is possible to observe slower or faster speed of light depending upon the reference frame from where the measurements are made. Speed of light is constant "c" in the respective local reference frames. Neither time can be observed to run faster or slower in a local reference frame nor can the speed of light be observed to be faster or slower in a local reference frame.

SPEED OF LIGHT AS A VECTOR

Speed of light within a moving object can be calculated by using velocity as a vector. In figure 10 the yellow spaceship is moving to the right with velocity v. A ray of light passes vertically in reference frame of observer moving with the spaceship and this is seen to move diagonally in reference frame of a stationary observer.



$$c_1{}^2 = c^2 - v^2$$

Dividing both sides by c^2 and solving

$$\frac{c_1{}^2}{c^2} = \frac{c^2 - v^2}{c^2}$$

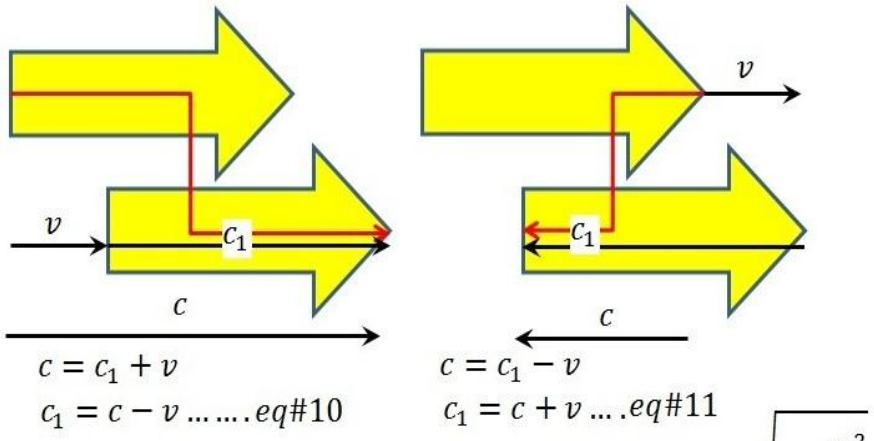
$$c_1 = c\sqrt{\left(1 - \frac{v^2}{c^2}\right)} \quad \text{.....eq7}$$

Calculating speed of light within a moving object using vectors

FIG 10

By just using velocities as vectors we can show that the vertical ray of light within the spaceship should be moving slowly from the point of view of a non-moving observer. As this observer also sees slower time in the moving spaceship ship he should conclude that slowing of all motion within the moving spaceship including the motion of the photon is part of slowing of time. This compares with the concept of slowing of speed of light at the base of mountain where time is slower when observed from the top of the mountain where time is faster.

Similarly we get the same result for light moving horizontally (fig 11) through a spaceship in or against the direction of motion to show that velocity of light reduces within moving objects as part of slowing of time.



Multiply eq# 10 to eq#11 and taking square root $c_1 = c\sqrt{1 - \frac{v^2}{c^2}}$

Calculating speed of light within a moving object using vectors

FIG 11

WHY THE SPEED OF LIGHT IS CONSTANT

The velocity of light slows within moving objects (above thought experiments) as part of slowing of time and is a constant only within the local (or moving) reference frame. Simultaneity is also preserved as light is dragged in the direction of motion in the time differential that is created by moving objects as shown above. This dual effect of dragging of photon in the direction of motion and slowing of velocity of light to match the slowing of time within moving objects is the reason that the speed of light is a constant in reference frame of the moving masses like earth and the reason for the negative results of Michelson and Morley experiment. This also shows that even one way speed of light experiments will fail to show any variation from c. However if we understand the mechanism behind the constancy of the speed of light we may be able to design innovative experiments to reveal any apparent variation in the measurement of speed of light as demonstrated by Roemer and Gift[12, 13].

PHOTON ACCELERATION EXPERIMENT TO CONFIRM

LENGTH CONTRACTION, LIGHT DRAGGING EFFECT, AND SIMULTANITY

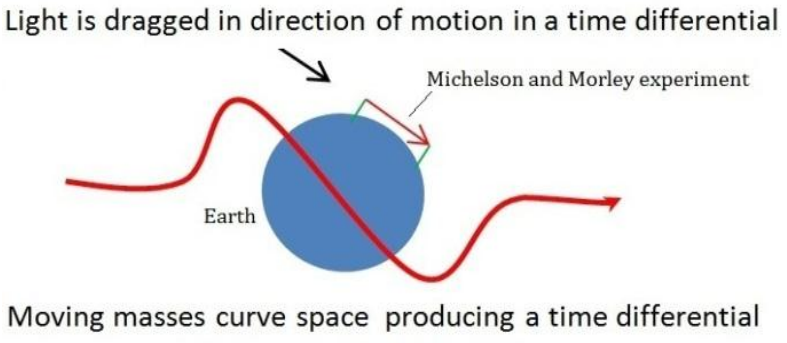


FIG 12

Plasmas moving at high velocity can up-shift photon frequency[10] thus leading to the term "Photon acceleration." Photons passed through particle beams which have relativistic motion may be used to precisely test predictions of special relativity like length contraction, light dragging effect, preservation of simultaneity, Einstein's velocity addition equation and Fresnel's ether drag formula. This will be like performing Fizeau's 1851 experiment using high velocity plasma instead of low velocity water or air.

In 1851 Hippolyte Fizeau[11] carried out an experiment to measure the drag effect on light passed through moving water. The speed of water was 7.059 meters per second and some effect was noticed. Air with almost zero refractive index was also used in another experiment at the speed of 25 meters per second with completely negative results. These velocities (7 to 25 meters per second) are a minute fraction (0.023 to 0.083 parts per million) of the speed of light and the experiment may have missed any effect which may become apparent at higher velocities.

One of the explanations of photon acceleration in moving plasma is "space-time refraction[7]". It is possible that photons when grazing the relativistic moving particles will be dragged in the direction of motion resulting in photon acceleration thus preserving simultaneity and showing measurable fringe changes. Both Fresnel's ether drag formula and Einstein's velocity addition formula do not take into account effect of time dilation or length contraction within or near moving masses and cannot explain photon acceleration. When these factors are considered in the equations, the graphs (Fig 14) shows that peak photon frequency up-shift occur at different points depending upon presence or absence of length contraction. We will now extend the above concept to a beam of light passed through an object in the direction of motion. We use an object in FIG 13 for clarity although light is supposed to be passed through a particle beam in the suggested experiment.

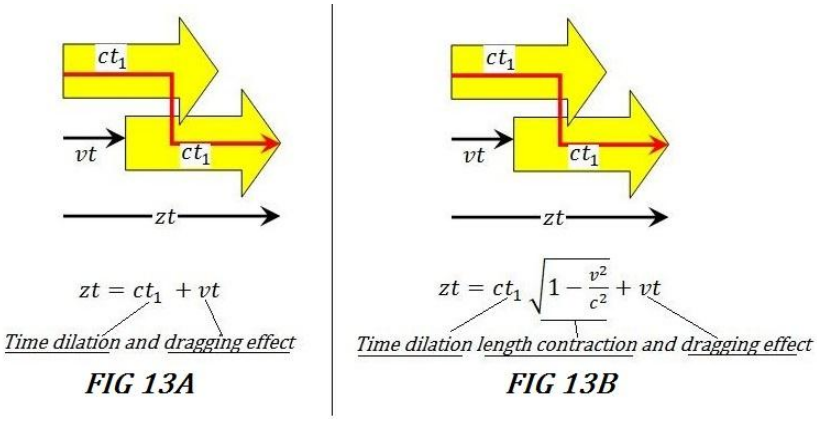


FIG 13A FIG 13B

In figures 13A and 13B the yellow object is moving with velocity 'v' to the right in time t. During that time interval a ray of light passes through the object as it moves through the distance vt, as seen by observer R, at rest. The distance covered by light within the moving object is ct_1 (t_1 is the time measured by observer within the moving object.)

The apparent speed of light as seen by rest reference frame observer is set as an unknown factor z. This is done to keep in mind that light is possibly dragged in the direction of motion by the moving object covering the distance zt. The group velocity of photons in this special case is then is not equal to c and this will manifest itself by upshift in photon frequency. The group velocity is set as z due to the dragging, the length contraction and time dilation effect surrounding the moving particles. Figure 13A shows the equation with only time dilation and dragging effect. Figure 13B shows the equation with time dilation, length contraction, as well as the dragging effect.

The photon frequency may be up-shifted by a dragging effect of the velocity 'v' of the particle beam. Moving particles may curve space and photons entering this curved space should be dragged in the time differential surrounding the moving particle. This would effectively show that simultaneity is preserved. Time dilation surrounding the moving particle would cause photon frequency to downshift by a factor of $\sqrt{1-\frac{v^2}{c^2}}$ ….. $eq\#1c$ The combined effect of dragging, and time dilation but without length contraction is given by $zt = ct_1 + vt$ … $eq\#12$. However as $t_1 = t\sqrt{1-\frac{v^2}{c^2}}$ ….. $eq\#1A$

Therefore: $z = c\sqrt{1-\frac{v^2}{c^2}} + v$ ….. $eq\#13$

This equation (eq#13 without length contraction factor) has a distinctive graph which peaks at particle beam velocity of 222132.034 km per sec derived as follows:

$$\mathrm{z} = \mathrm{c}\sqrt{1-\frac{\mathrm{v}^2}{\mathrm{c}^2}} + \mathrm{v} \text{ .....eq\#13} \quad \text{Derivative } \mathrm{z}' = -\frac{\mathrm{v}}{\mathrm{c}\sqrt{1-\frac{\mathrm{v}^2}{\mathrm{c}^2}}} + 1$$

$$\text{set } \mathrm{z}' = 0, \quad \text{then } \mathrm{v} = \mathrm{c}\sqrt{1-\frac{\mathrm{v}^2}{\mathrm{c}^2}} \quad \text{and } \mathrm{v} = \frac{\mathrm{c}}{\sqrt{2}} = 212132.034 \text{ km/sec}$$

Length contraction if present around the moving particle should cause the photon frequency to additionally downshift by a factor of: $\sqrt{1-\frac{v^2}{c^2}}$ ….. $eq\#1c$

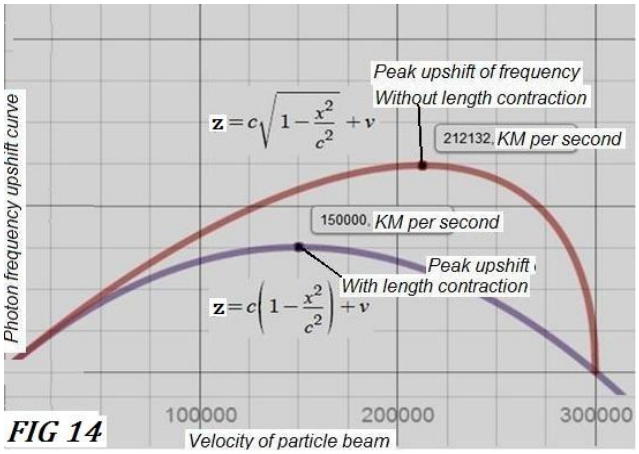
The combined effect of all three factors the dragging, time dilation, and length contraction which can change photon frequency would be seen in graph of:

$$z = \left(c\sqrt{1-\frac{v^2}{c^2}} * \sqrt{1-\frac{v^2}{c^2}}\right) + v \text{ or } z = \left(1-\frac{v^2}{c^2}\right) + v \text{ .....eq\#14}$$

This equation has a distinctive graph which peaks at particle beam velocity of 150000 km/sec derived as follows:

$$z = c\left(1-\frac{v^2}{c^2}\right) + v \text{ ...eq\#14} \qquad \text{Derivative } z' = -2\frac{v}{c} + 1,$$
$$\text{set } z' = 0, \text{ then } 2\frac{v}{c} = 1 \text{ and } v = \frac{c}{2} = 150000 \text{ km/sec}$$

Both Einstein's equation and Fresnel's formula with refractive index close to 1 predict flat curves with no photon frequency up shift. It should be noted that Fresnel's drag coefficient is based on concept of ether and Einstein's velocity addition formula does not take into account the length contraction or time dilation around the moving particles.



An exagerated photon frequency upshift curve

Figure 14 shows the graphs of the equations showing peak increase in group velocity of photons due to the drag effect, the length contraction, and the time dilation.

Above are the examples of effect of full dragging, time dilation and length contraction on the photons by the particle beam. However as the relative size of photon and distances between particles in the beam are relatively vast this much effect is not expected and this may be the reason no effect was

seen in the original Fizeau's experiment using air as the photons will normally follow the much larger drag of the earth's gravitational field. Experimentalist should use dense particle beams to insure the effects will be seen. We are looking for peaks of interference pattern and they are expected to occur at particle beam velocity of 222132.034 km per sec if there is no length contraction but only time dilation and dragging effect and at particle beam velocity of 150000km per sec if there is length contraction time dilation as well as dragging effect. No effect is predicted by Einstein's velocity addition formula and Fizeau's ether drag formula

The suggested experimental setup is shown in fig 15. The photon beam from source is split into two. One goes through the interacting tube to interact with the high density particle (proton) beam and the other goes to the straight unimpeded to the spectrometer. The two photon beams are then united in the spectroscope to see changes in the interference pattern through a spectrum of proton beam velocity from zero to near c. The graphs then can be compared to what is predicted by the equations so as to ascertain which equation is correct. Light beam travelling in opposite direction (as done by Fizeau) should not be used as it destroys the peaks of the interference pattern.

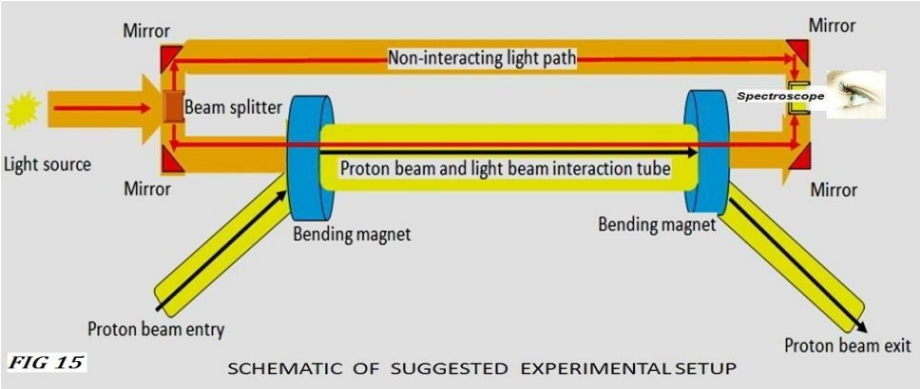


FIG 15 SCHEMATIC OF SUGGESTED EXPERIMENTAL SETUP

DISCUSSION

Einstein having successfully applied the concept of space curvature in General Relativity (GR) could have applied it to moving objects as well to explain time dilation in motion. Slowing of time in gravity and motion has a common denominator the expanding space providing a link between expansion of space and time. Many relativity books try to explain slowing of time in motion on acceleration[1] as it was

felt that acceleration in gravity is the cause of slower time in gravity. Now we know from experiments using circular particle accelerators[3] that time dilation can be precisely calculated using velocity only and acceleration has no effect on time. This calls into question the common wisdom that gravitational acceleration is responsible for time dilation in gravity. In actuality similar to velocity of a moving body which gives precise time dilation “escape velocity” and not acceleration is used to derive time dilation in gravity[1]. The other concept used to explain time dilation of travelling twin and the twin paradox is the Lorentz transformation and its associated lack of simultaneity which further complicates the picture by creating yet another anomaly the Andromeda paradox[14]. Volumes have been written on LT in books and articles on the lack of simultaneity which has never been experimentally verified[8]. As shown above the accurate and precisely verified[2, 3] eq# 1 depends on preservation of simultaneity while LT describes lack of simultaneity.

The proposal that moving objects curve space hopes to bridge a gap in the understanding of many predictions of relativity and lead to the understanding of gravity, inertia, length contraction, time dilation, and the phenomenon of time. The curvature in space caused by motion creates a time differential. Length contraction is due to curving of space and rotation into a higher dimension. There is no twin paradox if moving objects curve space, so that there is a real difference between rest and motion.

Objects are composed of trillions of atoms with kinetic energy of electrons moving in tremendous orbital velocities. Imagine placing this mass in a time differential (and no gravity) and the internal kinetic motion of the electrons is converted to external linear motion. This is how I believe gravitational acceleration is produced.

The differences in time follow differential expansion of space around large masses linking expansion of space with time. This is reinforced by the concept that objects in gravity as well as motion move from a faster expanding space to a slower expanding space therefore from faster to a slower time. Gravity can only work between zero time and positive time excluding the possibility of negative gravity. The prime mover behind time and gravity is the expansion of space, once expansion of space in large masses is brought to zero as within the Schwartz radius, limit to time differential is reached and gravity cannot increase any further. This is why black holes do not collapse and disappear from the universe.

Further explanation of “What is time?” requires a separate article. Suffices to say here that time is the presence of motion and forces and is related to the expansion of space. That is why time is slower where expansion of space is slower as around large masses. If the amount of motion and forces imparted by expanding space to a mass is a constant then we can see that when external motion or velocity of an object is increased the internal motion of atoms slows as part of slowing of time. Slower time where expansion of space is slow leads to negative curvature of space; however time is not a dimension in which we can travel. There is no past or future existing out there and only present is real. There is no block universe and that is why there are no time travelling visitors from an advanced futuristic civilization and there is no grandfather paradox.

SUMMARY

1. Moving objects curve space and rotate in a higher dimension to produce length contraction.
2. Space resists motion however once an object is pushed a curvature is produced in the expanding space and time differential is created perpetuating motion. This is the cause of inertia.
3. Motion is possible only in an expanding space as only in such a space expansion can be slower in the front of moving object and faster behind it creating time differential. Objects move in a time differential.
4. Light within moving objects is dragged in the direction of motion in the time differential.
5. Time as well as the speed of light slows within moving objects and this along with dragging in direction of motion explains the constancy of the speed of light as observed on earth.
6. Simultaneity is preserved as light is dragged in the direction of motion.
7. Amount of time (motion and forces) imparted by expanding space to a mass is a constant therefore when motion (velocity) of an object is increased internal motion of the atoms as well as forces reduce, which is then seen as slowing of time with motion
8. Gravitons radiated by masses interact with space slowing its expansion.

9. Slower time around large masses is due to slower expansion of space. Time is related to the expansion of space.

10. Time differential around large masses is the cause of gravitational acceleration. There is no force of gravity only time differential.

11. Once expansion of space approaches zero as within the Schwartz radius of the black holes, time also approaches zero and there is no further increase in time differential or gravity. This concept rules out infinite gravity or singularity in the black holes.

REFERENCES

1. Relativity for Scientists and Engineers. By Ray Skinner. (Dover Books 1982)
2. Rossi, B.; Hall, D. B. "Variation of the Rate of Decay of Mesotrons with Momentum". Phys. Rev. 59, 3: (1941).
3. Bailey, H.; Borer, K.; Combley F.; Drumm H.; Krienen F.; Lange F.; Picasso E.; Ruden W. von; Farley F. J. M. ; Field J. H.; Flegel W. & Hattersley P. M. "Measurements of relativistic time dilatation for positive and negative muons in a circular orbit". Nature 268, 301 (1977).
4. C.M. Misner, K.S.Thorne, and J.A.Wheeler,Gravitation (W.H. Freeman, San Francisco, CA, 1973)
5. Sherwin, “Some Recent Experimental Tests of the 'Clock Paradox'”, Phys. Rev. 129 no. 1 (1960)
6. The warp drive: hyper-fast travel within general relativity. Miguel Alcubierre. Class Quantum Grav. 11-5, L73-L77 (1994)
7. Time Refraction and Time Reflection: Two Basic Concepts J T Mendonça and P K Shukla. *Phys. Scr.* 65 160. (2002)
8. The Clock Riddle: The Failure of Einstein’s Lorentz Transformation. Robert J. Buenker, *Apeiron*, 19, 1, (2012).
9. A precision measurement of the gravitational redshift by the interference of matter waves. *Nature* 463, 926 (2010)
10. Microwave frequency shifting using photon acceleration. Mark Rader, Igor Alexeff, International Journal of Infrared and Millimeter Waves. 12, 7,(1991)
11. The Hypotheses Relating to the Luminous Aether. Hippolyte Fizeau. Philosophical Magazine, 2, 568, Internet Archive.

12. One-way light speed measurement using the synchronized clocks of the global positioning system, GPS. Stephan J. G. Gift. PHYSICS ESSAYS. 23, 2 (2010)

13. Light speed invariance is a remarkable illusion. Stephan J. G. Gift. PHYSICS ESSAYS. 23, 1 (2010)

14. Is There an Alternative to the Block Universe View? Petkov, Vesselin. The Ontology of Spacetime, Ed. D. Dieks. Utrecht, the Netherlands: pp 207-228. (Elsevier, 2006.)

15. Consequences for special relativity theory of restoring Einstein's neglected additive constants in the Lorentz Transformation. J.H. Field. Fundamental J. Modern Physics. 2, 2 (2011)