BASICS OF SPECIAL RELATIVITY

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ABSTRACT - Theory of relativity is derived in two parts Special and General. The main difference between special and general relativity is gravity. Special relativity applies to elementary particles and their interaction, describing all their physical phenomena except Gravity. General relativity explains the law of gravitation and its relation to other forces of nature. The special theory of relativity is the part of well influential theory of Relativity. This theory was an introduced a new framework for all of physics & proposed new concept of including space-time as a unified entity of space and time , Time dilation, Relativity of simultaneity, Length contraction, Energy mass equivalence, Maximum speed is finite, Relativistic mass . The theory of general relativity has many surprising and counterintuitive consequences like Frame dragging, Gravitational Time dilation, Rays of light bend in the presence of gravitational field. As the result show, maximum speed is going to be finite for an any object.

Keywords:

Special theory of relativity, Time dilation, Relativity of simultaneity, Length contraction.

INTRODUCTION:

In 1905, Albert Einstein determine that the laws of physics are the same for all non-accelerating observers, and the speed of light in a vacuum was independent of the motion of all observers.[2] This was the theory of special relativity.The special theory of relativity was based on two main postulates: first, that the speed of light is constant for all observers; and second,that observers moving at constant speedshould be subject to the same physical laws.[1]

"Everything is Relative to Each others"

RELATIVITY OF SIMULTANEITY

According to the special theory of relativity, it is impossible to say in an absolute sense that two distinct events occur at the same time if those events are separated in space. There are two types of observer first inertial (steady , no-Accelerating) and second is a frame or object in motion.Inertial observers in relative motion disagree timing of event at different place. For example, a car crash in Ahmedabad and another in Chennai, which appear to happen at the same time to an observer on earth, will appear to have occurred at slightly different times to an observer on an airplane flyingbetween Ahmedabad and Chennai. May be two events are happen at same time for "A" reference frame , and its might be possible that event is simultaneously or at different time for "B" reference frame.IN simple language,If one observer thinks that two events are simultaneously, another might not.

Case 1:

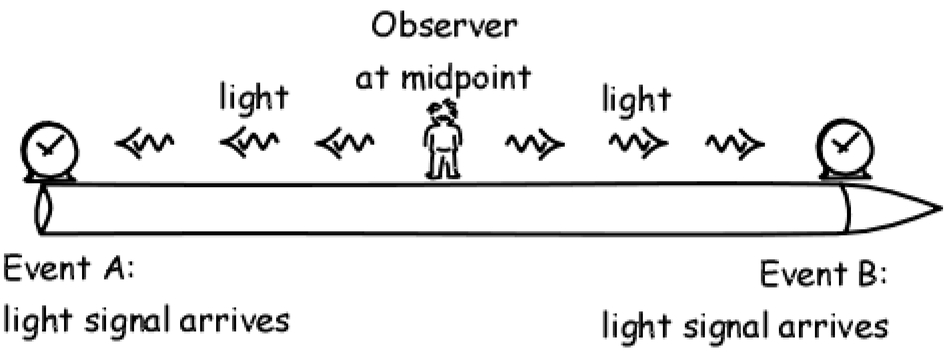


Figure 1http://www.pitt.edu/~jdnorton/teaching/HPS_0410/2008_Spring/assignments/03_rel_sim/index.html

A to midpoint distance ; "x"

B to midpoint distance ; "x"

There is a quick way to see how this comes about. Imagine a long platform with an observer located at its midpoint. At either end, at he places marked A and B, there are two momentary flashes of light. The light propagates from these events to the observer. Imagine that they arrive at the same moment, as the picture above. Noticing that they arrive at the same moment and that they come from places equal distance away, the observer will decide that the two events happen simultaneous.

CASE 2;

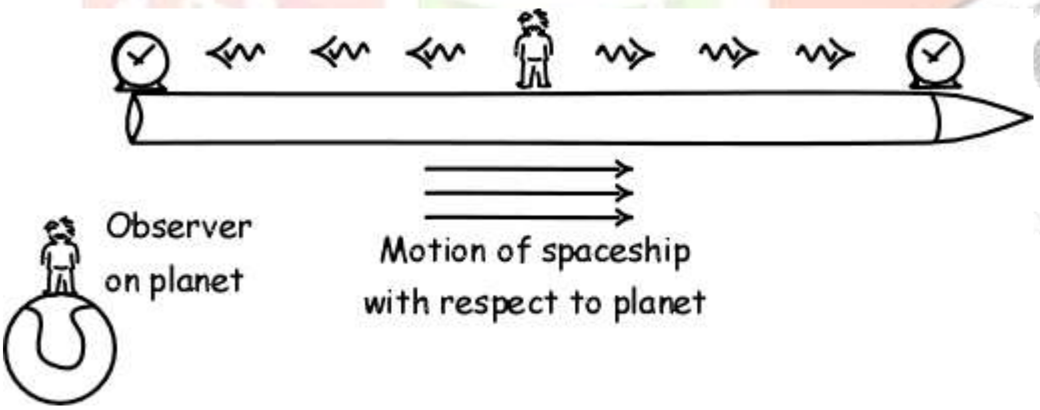
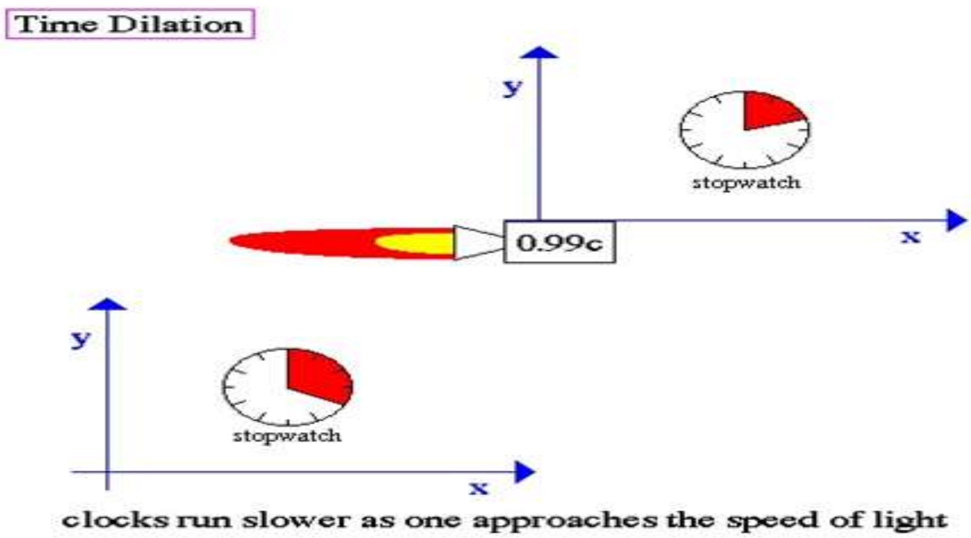


Figure 2http://www.pitt.edu/~jdnorton/teaching/HPS_0410/2008_Spring/assignments/03_rel_sim/index.html

Now consider this process from the point of view of an observer who moves relative to the platform along its length, For that new observer, the platform moves rapidly and, in the picture above, in the direction from A towards B. Once again there will be two flashes and light from them will propagate towards the observer at the midpoint of the platform. However the midpoint is in motion. It is rushing away from light coming from A; and rushing toward the light coming from B. Nonetheless, the two signals arrive at the midpoint at the same moment and cover the same distance. So, for the observer at rest the light beam



from A must cover a greatest distance to catch up with the receding mid point, the light beam from B must cover a lesser distance to arrive at the mid point. And if we talking about time than the light from A must have left earlier than B's light beam so this takes a greater time to reach at initial position. From the second figure, The clock is well synchronized and it's at "0" for a midpoint observer. For an inertial observer clock ain't synchronized "A" clock is earlier than "B".

Time dilation;

Time dilation is a difference in elapsed time measured by two observer either due to velocity difference relative to each other or by being differently situated relative to a gravitational field.[3]

A clock that is moving relative to an observer will be measured to tick slower than a clock that is at rest in the observers own reference frame. This occurred same if clock or object is moving under strong influence of gravitational field.

As per below picture first graph shows that a space ship travel with 0.99c (c=speed of light 293792458 m/s) so the clock run slower than clock of inertial observer as per second graph.[4]

Figure 3

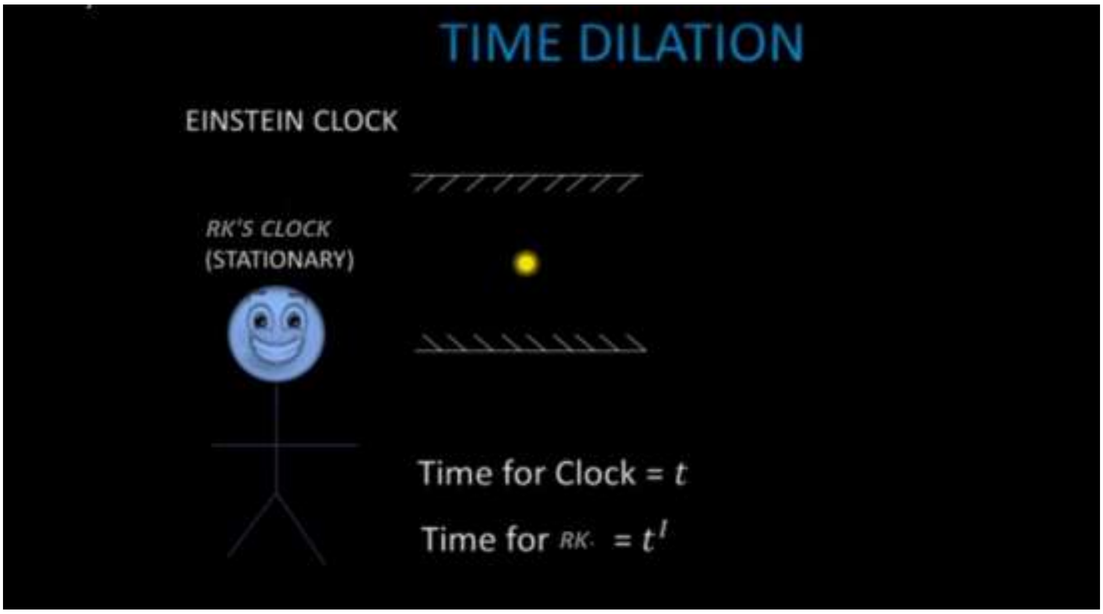


Figure 3http://abyss.uoregon.edu/~js/cosmo/lectures/lec06.html4

Mathematical solution;

What is a effect on time if we go fast?let see how maths can help for a solution. As per figure let's imagine a light beam constantly travel between two mirror. As we know that the passage of time of light beam travelling is vary with different reference frame. The time which experience by clock is "t" and for a stationary observer RK is (" t| ").

'For the both observer light beam travel same distance '

Distance between two mirror = " d "

But,

Distance = velocity * time

If, velocity of light beam = " c "

Time of travelling = " t "

So, d = ct ....(i)

*Figure 4*https://www.youtube.com/watch?v=aZrjMmMBa_8&t=5s

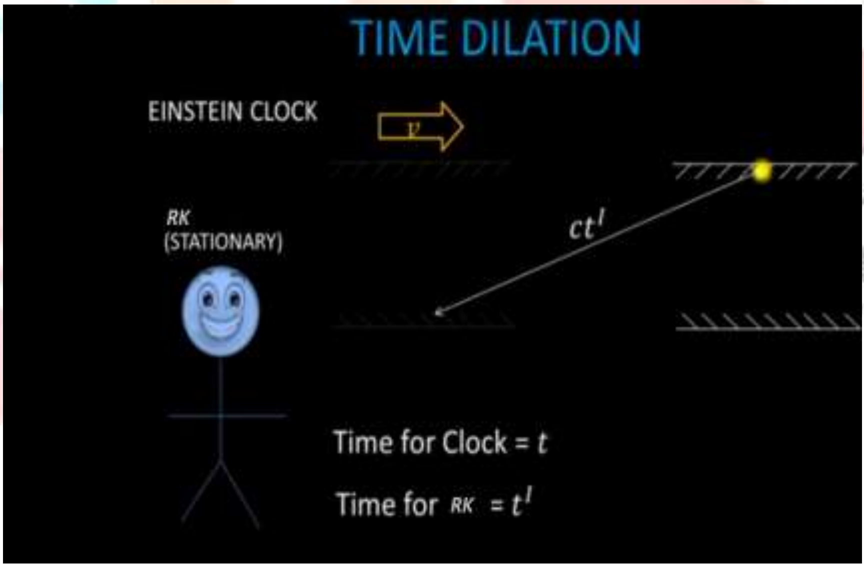


Figure 5https://www.youtube.com/watch?v=aZrjMmMBa_8&t=5s

If the Einstein clock and mirrors move right side with velocity " V ". Then we can show that to light instead of taking a vertical path does take a diagonal path and its distance would be C times T|. this diagonal path would not seen by moving or Einstein but for RK a stationary object it would be diagonal.

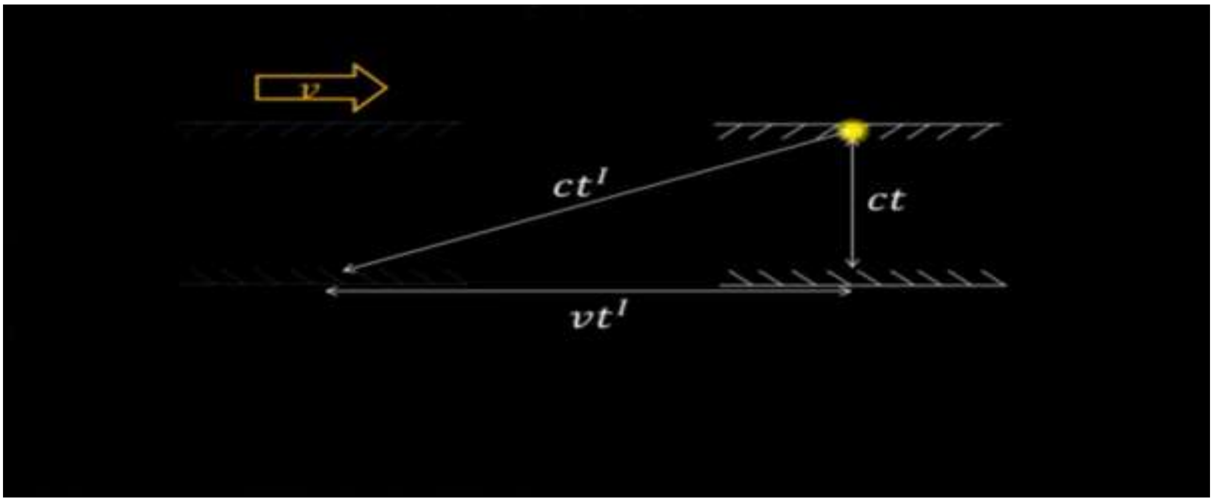


Figure 6 https://www.youtube.com/watch?v=aZrjMmMBa_8&t=5s

As per equation (i)

Ct = its distance travelled by light as per Einstein clock

Ct| = diagonal distance (travelled by light which is seen by stationary observer)

Vt| = vertical distance (travelled by mirror which is seen by stationary observer)

(ct|)2 = (vt|)2 + (ct)2

C2(t|)2 = v2(t|)2 + c2(t)2

(t|)2 = v2 / c2 (t|)2 + t2

t2 = (t|)2 * [1 – (v2 / c2)]

t = (t|) * [sqrt(1 – (v2 / c2))]

t = moving object time,

t| = stationary time,

v = velocity of moving object,

c = speed of light.

For example, at the ISS time goes slower, lagging 0.007 seconds behind foe every six months. [3]

Basically……..

In this equation there are three scenario would be happen.

If C light speed is greater than V (moving object) speed than you can travel to the future.

If C light speed is equal to V (moving object) speed than time going to be freeze.

If C light speed is lesser than V (moving object) speed than we can travel to the past.

Note ;

Third scenario would not be occurred because its next to impossible go beyond light speed. And maximum speed is finite.

Length contraction:

Length contraction is the phenomenon that a moving object's length is measured to be shorter than its proper length, which is the length as measured in the object's own rest frame.[5] When you approach speed of light, your measurement of space is changing just like time.Length contraction is negligible at everyday speeds and can be ignored for all regular purposes. Length contraction becomes noticeable at a substantial fraction of the speed of light with the contraction only in the direction parallel to the direction in which the observed body is travelling.An observer at rest viewing an object travelling very close to the speed of light would observe the length of the object in the direction of motion as very near zero. When an object is moving faster than length of path and as well as object's length going to be shrink in same direction of moving reference frame. To get straight to the point the length of an object will contract (in the direction parallel to its motion) when traveling at relativistic speeds. This "shortening" of length is called length contraction. The equation for calculating the length as seen by an outside observer is as follows.

L = L0((1 - v2/c2))1/2

where: L = its length which observed by an observer in relative motion with respect to object. Or its also for distance which observed by observer in relative motion with respect to object.

L0 = it is the proper length when object is in rest. Or its actual distance measured by rest objectore.

v = the speed of the object.

c = the speed of light in a vacuum.

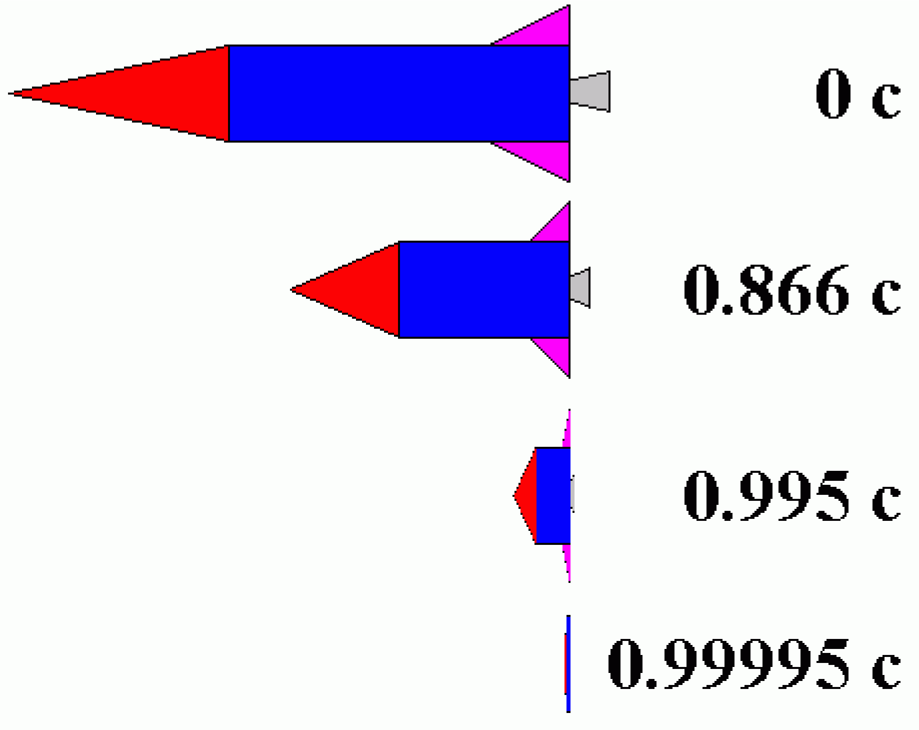


Figure 7https://www.google.co.in/url?sa=i&rct=j&q=&esrc=s&source=images&cd=&cad=rja&uact=8&ved=0ahUKEwiFp7aZ5fTXAhWKErwKHQpDCAEQjhwIBQ&url=https%3A%2F%2Fcourses.lumenlearning.com%2Fboundless-physics%2Fchapter%2Fconsequences-of-special-relativity%2F&psig=AOvVaw1PuOaEFFcYdUgP0h9-szKU&ust=1512626335794908

Conclusion:

Speed of light is constant for all reference frame.

If you go enough faster than your time goes down, as well as object length and distance would be shrinking.

The way that anything except light moves through time &movement of someone who is watching and where they stand.

Your age passes slower when you go faster.

Theory of relativity gives us better understanding of space, time.

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