Re: time dilation

Source: http://sci.tech−archive.net/Archive/sci.physics.relativity/2008−04/msg00842.html

- *From*: rbwinn <rbwinn3@xxxxxxxx>
- *Date*: Thu, 10 Apr 2008 19:06:43 −0700 (PDT)

On Apr 10, 6:04ýpm, xxein <xx...@xxxxxxxxxxx> wrote:

> On Apr 10, 7:40ýpm, rbwinn <rbwi...@xxxxxxxx> wrote:
>
> > > The work of famous scientist Galileo Galilei provides us with a question about time dilation and Dr. Albert Einstein's statement that the laws of physics must remain the same in all frames of reference. Galileo carried two lead weights of unequal sizes to the top of the leaning tower of Pisa and dropped them at the same time, disproving the idea of scientists of his time that the heavier of the two weights would strike the ground first. ýOf course, it took some time before scientists accepted the results of his experiment. ýThey did not all believe in the principle of equivalence the moment the two lead weights hit the ground.
> > > ý ý ý ý This brings us to another question about falling objects which arises from the idea of dropping an object in a moving train car, which writers of textbooks about relativity often use to show how the Lorentz equations work. ýIf a weight is dropped from the top of a train car to the floor, it falls a distance of y'. ýIn any transformation equations this is always expressed as y'=y. ý The object travels the same distance vertically in S' as it does in S.
> > > In Galileo's equations, it takes the same amount of time for the object to travel from the roof of the train car to the floor in either frame of reference. ýt'=t.
> > > ý ý ýIn the Lorentz equations, a clock in S', the frame of reference of the train car, is slower than a clock in S, the frame of reference of the train tracks.
> > > t'=(t−vx/c^)/sqrt(1−v2/c^2). ýAccording to this equation, it takes less time for the object to fall from the roof of the train car to the floor in S' than it does in S. ýSo how are the laws of physics the same in both frames of reference?
> > > ý ý ý If a clock in S ticks once while an object is falling in the train car, it will not tick in S' until after the object has hit the floor. ýThis means that the object is falling with a faster velocity

in S' than in S.
ý ý ý I am sure that some of our scientific friends who believe in a distance contraction will be anxious to explain this phenomenon.
Robert B. Winn

xxein: ýThis is not a case of any distance contraction. ýIn a train, however, the speed is non−relativistic.

So let me explain it to you. ýIf you posed the question of how fast light traveled in a traincar from the front to back, the answer is not contained in any particular measurement. ýYou know that your clock to measure by is also affected. (I hope you do anyway). ýBut it is mathematically realised as c because that is what you will measure.

Here's the problem with your question. ýAny notion of length contraction (real or supposed) is based upon the 'direction' of travel. ýWhile any moving clock will beat slower, a distance will remain the same distance. ýIt is only when a physical object like a barn vs. pole is relativised that a contraction has to occur in some fashion or another. ýWhy? ýBecause that's what we can measure.

But xxein, the question was not about distance contraction. I just said that some of the people who believe in distance contraction should want to answer this question. As I said, in anyone's equations, y'=y. The problem I see is that a clock in S ticks once while the object is falling from the ceiling to the floor of the train car. A clock in the train car does not tick until after the object hits the floor. The object is falling faster in the train car than in S.

Is it real? ýI'll let you make a stew for a while.

Well, the distance contraction is not real. As we can see from the Galilean transformation equations, a clock that shows t' in those equations ticks at the same time the clock in S ticks, when the object hits the floor. The problem that scientists have with this is that they have put clocks in satellites, and they came back reading less time than an identical clock kept on earth. So let's look at what scientists say a clock would read in the train car.

t'=(x−vt)/sqrt(1−v^2/c^2)

That clock would definitely tick after the object hits the floor if a clock in S ticks when it hits the floor. This t' is less than t. So we use two clocks in S'. One clock ticks exactly when the t clock in S ticks, the other ticks when this t' clock from the Lorentz equations ticks. If you measure the velocity of the falling object with the Lorentz equation t' clock, the object is falling faster in S'

than the t clock in S shows it falling.
Now consider how Einstein came to the conclusion that the Lorentz equation t' clock was running slower. He said that the Lorentz equations satisfied the results of the Michelson−Morley experiment because light was traveling at c=300,000 km per second in both frames of reference. Therefore, these two equations would be true with regard to the distance traveled by light.

x=ct

x'=ct'

That is fine for the Lorentz equations with their distance contraction, but we are going to use the Galilean transformation equations because we already have a clock running at a rate such that t'=t as measured by that clock. If we are going to express the above relationship with regard to the Lorentz equation clock using the Galilean transformation equations, we have to use a different variable than t' for the time on that clock, so we use n'. Calculating from the Galilean transformation equations, we find that this n' clock has a rate of n'=t(1−v/c). If the train were traveling at the speed of the planet Mercury, 30 miles per second, n' would agree with t' from the Lorentz equations to several decimal places. So this n' clock, which we can say represents a cesium clock on the train, shows a time contraction in terms of what clocks will show. However, we still have the problem of this falling object which hits the floor before the n' clock ticks. How fast is it falling? To keep the laws of physics the same in all frames of reference, do we use the t'=t clock, or do we use the n' clock?

It seems to me that if we are measuring the speed of light, we use the n' clock. If we are measuring the velocity of the falling object, we use the t'=t clock. That is just my opinion.

> OK. ýBut a length contraction is only functional in a single dimension. ýYou got that?

I already had that. y'=y.

> ýA clock will slow regardless of dimension.
> Velocity only. ýVelocity wrt what?

The velocity of the object is relative to the top of the train car and the floor of the train car as seen from either frame of reference.

y'=y

> We can measure pretty good. ýWe developed a math to cover it. ýGood for us. ýBut does it mean we understand the logic of a physic?
> Apparently not.

Well, the distance from the top of the train car to the floor is the

same from either frame of reference. What we are concerned about is
the time dilation. A cesium clock in the train car shows the object
falling faster than an identical clock on the ground.

> Missed you for a while. ýNow bug off before you become the pest you
> were in the past.

Well, I just can't believe you would think I am a pest since I have
the correct equations for the time dilation.
Robert B. Winn
.