Re: time dilation

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* *From*: rbwinn <rbwinn3@xxxxxxxx>
* *Date*: Thu, 10 Apr 2008 20:20:21 −0700 (PDT)

On Apr 10, 7:45ýpm, mitchg...@xxxxxxxxxxx wrote:

> On Apr 10, 5:39ýpm, Darwin123 <drosen0...@xxxxxxxxx> wrote:
>
> > > On Apr 10, 7:40 pm, 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−v^2/c^2). According 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 ýWell, the law of physics is the same in both frames.
In your case, the initial conditions are different.
In S,
2at=v^2−v_0^2
In S',
2a't'=v'^2−v_0'^2
ý ý ýIn your example, the boundary conditions are the same. In other
words, the distance from roof to floor is the same in both frames.
ý ý ýObviously v is not v', v_0 is not v_0', and a is not a'. One has
to perform a Lorentz transformation on each quantity. However, the
equation (i.e., the law of physics) is exactly the same.
ý ý ýThe laws of physics are the same in the two frames. The initial
and boundary conditions do not have to be the same in the two
frames.
ý ý ýIf you want to include force laws, you have to Lorentz transform
the forces. In SR, the transformation of the gravitational field is
exactly the same as the transformation of an electromagnetic field.
Therefore, when you transform the gravitational field you will get a
gravitomagnetic field, which is analogous to the magnetic field. The
gravitomagnetic field is what transforms turns a to a'. However, both
S and S' describe the drop with the same equations. The S' frame may
use a zero gravitomagnetic field, while the S frame has a nonzero
gravitomagnetic field.
ý ý ýI know, some purists will say it is a GR problem and to some
extent I agree. I just wish to point out that SR is a valid

approximation in this case.
ý ý The accurate laws of physics are the same in S and S', because the most accurate laws are Lorentz invariant. If you use a law that isn't Lorentz invariant (like a=a'), you are using a law that isn't accurate. What you are doing is assuming an inaccurate law, a=a'. This law isn't true for relative velocities close to c.− Hide quoted text −

− Show quoted text −

Motion time is Gamma and there is gravitational time slowing the metric.

Mitch Raemsch Twice Nobel Laureate 2008− Hide quoted text −

Well, I should have known. So what does slowing the metric do?
Robert B. Winn

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