

Re: The Spin Proviso to Relativity

Source: <http://sci.tech-archive.net/Archive/sci.physics.relativity/2004-10/5049.html>

From: Paul B. Andersen (paul.b.andersen_at_hia.no)

Date: 10/22/04

Date: Fri, 22 Oct 2004 16:00:48 +0200

"Ben Bean" <kavs_delethis_@sysmatrix.net> skrev i melding
news:RO-dnYVWccAX2OXcRVn-jA@sysmatrix.net...

>

> "Ben Bean" <kavs_delethis_@sysmatrix.net> wrote in message
> news:3M2dncxUAuaje-rcRVn-jg@sysmatrix.net...

>>

>> "Paul B. Andersen" <paul.b.andersen@hia.no> wrote in message
>> news:cl899p\$25n\$I@dolly.uninett.no...

>>>

>>> "Ben Bean" <kavs_delethis_@sysmatrix.net> skrev i melding
>>> news:ktKdnS2bLsm8GurcRVn-rg@sysmatrix.net...

>>>>

>>>> "Paul B. Andersen" <paul.b.andersen@hia.no> wrote in message
>>>> news:cl6d07\$8jb\$I@dolly.uninett.no...

>>>>>

>>>>> "Ben Bean" <kavs_delethis_@sysmatrix.net> skrev i melding
>>>>> news:B8SdncZcW_z2v-ncRVn-oA@sysmatrix.net...

>>>>>> I am eager to hear wisdoms in answer to the quandary below stated.

>>>>>>

>>>>>>> SCENARIO: You stand on a planet just like Earth, but there's no
>>>>>>> atmosphere.

>>>>>>> You stand on the equator and hold your hands up to the air so that
>>>>>>> they

>>>>>>> are

>>>>>>> a meter apart. [Relax, this is NOT a study in relative
> simultaneity

>>>>>>> like

>>>>>>> the

>>>>>>>> Barn/Pole thing.] As you stand there a huge spacecraft coasts by
>>>>>>>> just

>>>>>>>> overhead, just beyond your reach. The ship seems motionless to
>>>>>>>> you,

>>>>>>>> hovering, because it is going eastward at a speed to exactly match
>>>>>>>> the

>>>>>>>> planet's tangential rotational speed. As you reach up, your
>>>>>>>> outstretched

>>>>>>>> fingertips are just about touching the 842-meter mark and the

> > 843-meter
> > > mark
> > > > on the rule graduated on the enormous ship's straight exterior.
> > > > >
> > > > > Here's the quandary: the spaceship occupants can EMPHATICALLY
> assert
> > > > that an
> > > > > all-way light beacon pulse emitted midway between their ship's 842
> &
> > > > > 843-meter marks will hit the two nearby meter marks
> simultaneously,
> > > > > according to their native frame's clocks and such. Yet the guy on
> > the
> > > planet
> > > > > cannot make the same claim?? When does an arbitrary local span
> > become
> > > > > tantamount to an SR scenario. In spite of Sagnac, there must
> > surely
> > be
> > > some
> > > > > carry-over; I mean you're just about TOUCHING that other frame,
> > > > comoving.
> > > > >
> > > > > -Ben
> > > >
> > > > > Of course the guy on the planet will agree that the light will hit
> > the
> > two
> > > metre
> > > > marks simultaneously. That is, if he had one clock at each side of
> > > > himself,
> > > > > and he E-synched those clocks, they would show the same when hit
> > > > > by the light.
> > > > > However, if the two clocks were showing UTC, they would NOT
> > > > > show the same when hit by the light.
> > > > > Clocks on the surface of the Earth showing UTC are NOT synchronous
> > > > > in the Earth fixed frame. They are synchronous in the non rotating
> > > > > ECI-frame.
> > > > >
> > > > > Paul
> > > > >
> > > > >
> > > > > Great answer! Uh, but, whereas I know what ECI stands for, I am at a
> > > loss as
> > > > to what UTC stands for.
> > >
> > > > UTC means "Coordinated Universal Time", and to say it simple,
> > > > it is the same as local mean time.
> > > > See also my response to "sal".
> > >
> > > > But I think it matters not. You say that Earth's

>>>> *surface clocks can all be synched to the non-rotating ECI, which*
>> *suffices.*
>>>
>>> *Yes, and I say that this IS how we synchronize clocks on the Earth.*
>>>
>>>> *I*
>>>> *don't necessarily buy your dismissal of Sagnac (of course I am*
>>>> *misinterpreting perhaps), but your answer suggests that a light signal*
>> *takes*
>>>> *the same time to go from NY to LA as the reverse, as long as you use*
>> *the*
>>>> *non-rotating ECI clocks as your basis.*
>>>>
>>>> *UTC clocks on the Earth ARE "rotating" along with the Earth.*
>>>> *I said they are synchronised (simultaneously showing the same)*
>>>> *in the ECI-frame, NOT that they are stationary in the ECI-frame.*
>>>> *And if you measure the time light takes to go from NY to LA with*
>>>> *these UTC clocks, you will find that it is different from the time*
>>>> *it takes to go in the reverse direction.*
>>>> *This IS the "Sagnac effect".*
>>>>
>>>>> *I guess that makes sense alright, but*
>>>>> *it's insufficient. The guy reaching up and touching the inertially*
>>> *moving*
>>>>> *space ship -- he has a wrist watch on each arm and he claims they are*
>>>>> *synchronized. His clocks belong to a frame that IS rotating. I'm just*
>>> *not*
>>>>> *sure. Again, what is UTC, Universal Time something?*
>>>>>
>>>>> *If this guy claims his wrist watches to be synchronized, he will*
>>>>> *probably mean that they simultaneously show the same in*
>>>>> *his instantly inertial rest frame. (The inertial frame in which he*
>>>>> *instantly is at rest.)*
>>>>> *And his clocks will stay in synch.*
>>>>> *If he measure the speed of light with these clocks, he will find*
>>>>> *that it will use the same time in both directions.*
>>>>>
>>>>> *But if he compare them to two adjacent UTC clocks, he will*
>>>>> *see that they are different, because his watches are NOT*
>>>>> *synchronous in the ECI-frame.*
>>>>>
>>>>>> *The central question is, "How does light behave in the frame of the*
>>>>> *man*
>>>>>> *standing with his arms outstretched (over his head), and ONLY*
>>>>> *according*
>>>>> *to*
>>>>>> *that man's native clocks & measures"? Can the man say that a light*
>>>>> *signal*
>>>>>> *emitted midway between his hands arrives at each hand at precisely the*
>>>>> *same*
>>>>>> *time? Probably not.*

>>>
>>> *Yes, he can.*
>>> *He will use his local frame.*
>>>
>>>> *But light would clearly not move relative to a*
>>>> *theoretical aether fixed at the planet's center either. So there must*
> *be*
>>>> *some give. Light must take less time to go westward than eastward (on*
>> *the*
>>>> *spinning planet), which would be in line with the Sagnac findings, but*
>> *not*
>>>> *so much less time as would be predicted by imagining the light*
>> *travelling*
>>>> *through some fixed aether frame anchored at the planet's center.*
>>>>
>>>> *It's confusing alright.*
>>>
>>> *Yes, it IS confusing. :-)*
>>> *But remember this:*
>>> *According to SR, the speed of light is c _in an inertial frame_.*
>>> *As long as you remember this, it is quite obvious that if you*
>>> *emit light in both directions from some point on the equator,*
>>> *and guide the light (mirrors) around the Earth, the two light beams*
>>> *will meet each other at the same point _in the ECI frame_*
>>> *as they were emitted from. But then the point on the Earth*
>>> *has moved, so one of the light beams has already passed*
>>> *this point, while the other one has not yet reached it.*
>>> *So _because_ the speed of light is c in the ECI-frame,*
>>> *the two beams will NOT simultaneously reach the point*
>>> *on the Earth from where they were emitted.*
>>> *A clock at that point will thus measure the light to use*
>>> *different times around the Earth in opposite directions.*
>>>
>>> *Paul*
>>>
>>>
>>>
>>>
>>> *****
>> *I REALLY REALLY GOT TO HAND IT TO YOU, PAUL B. ANDERSON...*
>> *That's some mighty fine STRAIGHT SHOOTING and you sure as dang heck got me*
>> *to understand PERFECTLY!*
>>
>> *The guy can invent an inertial frame in which his two wristwatches are*
>> *synched (but NOT E-synched, which is WRT the non-rotating ECI frame), so*
>> *long as the times and distances are minute enough. I garner this from your*
>>
>>>> *..Can the man say that a light signal emitted midway between*
>>>> *his hands arrives at each hand at precisely the same*
>>>> *time? Probably not.*
>>> *Yes, he can.*

> > > *He will use his local frame.*
> > >
> >
> > *It must get messy if you try to concoct an inertial frame (too large) to*
> > *encompass eg. the span NY to LA for the duration it takes light to*
> *transit.*
> >
> > *Yeah but nevermind -- I get it -- MANY MANY THANKS!*
> >
> > *-BB*
> >
> >
> >
> >
> *PBA:*
> *I'm here to fix an apparent misunderstanding I had of your terminology. What*
> *E-synched (capital E) implies I'm not 100% certain, but it is NOT*
> *specifically associated with UTC. The standing man can synchronize the*
> *watches on his left and right hands WRT a concocted inertial frame that*
> *closely approximates the actual arc he is moving on, and thus conclude that*
> *any light/radio pulse emitted halfway between his hands arrives at those*
> *hands simultaneously. This works for the suitably small scale, but not the*
> *large?? ie. NY to LA.*

More or less, yes.

Your shouting tells me that elaboration would be futile.

> *HONEST! I understood every word of your explanation (Many thanks) about how*
> *Sagnac truth messes up any hope of surface-resident synchronized clocks,*
> *except by resorting to UTC (which is ECI-based); but under that UTC scheme*
> *you cannot make the claim which the standing man so yearns to make, ie. that*
> *light will expand outward uniformly east/west from a source point, per his*
> *vantage.*

Let me say it like this:

I can claim that the light will expand uniformly from
the point it is emitted _in the inertial frame in which he
is instantly at rest when the light is emitted_.

He is not stationary in said frame, but during the 2 ns the light
takes to reach his hand, he will have moved 10^{-33} meters
from the point of emission.

But 12 hours later, the light he emitted westwards will
be 12 light hours east of him.

Paul