Age Gradients and Reciprocal Light Velocities Are Real Phenomena

Terry Bollinger
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[Email Excerpt]

Hi Ron,

> *VERY interesting, even though the maths is beyond me. I do understand the principle, which is intriguing and makes sense.*

Thanks, that's encouraging. I'm trying to make that particular paper as broadly readable as possible, which is why the apt time zone analogy comes in handy. The concepts are remarkably similar.

> *A point: Would it not be more correct to add "for an observer" to "a smooth, naturally-occurring set of time zones in which the leading edge of the object is always a bit younger for an observer than the trailing edge"?*

This is important: Nope!

While it's true that the age gradients exist in their most stark form from an external observer's perspective, like the space station observer, it's also true for the object in motion. The gradient there is less stark since it's not multiplied by the Lorentz factor, coming out as just $-v/c^2$. That means that if you, Ron, are six feet tall and snoozing with your head forward in a spaceship traveling just under the speed of light, your feet will be six nanoseconds older than your head.

Special relativity guarantees no experiment you can perform inside your spaceship can prove that, but it also guarantees there is no experiment you can do to *disprove* it. Given that the age difference is real and experimentally recordable in the frame that launched you, it makes more physical sense just to say, "it's real, just not detectable inside the ship."

Now you should think, "well, fine... but six nanoseconds? that's not much! And it isn't, except for this: It's this age difference that requires light to have two different speeds in opposite directions. The closer you get to your feet being 6 nanoseconds older than your head, the more extreme this difference in light velocities becomes. It gets pretty crazy as you approach lightspeed.

Here's an example: If your ship travels at 99.5% of lightspeed as measured by someone in the ship's launch frame and you shine a light down at your trailing-end feet, the light travels *20 times faster than c*. When it hits a mirror at your feet and returns, the same light in the return phase of its journey travels 20 times *slower* than c! That return slowdown also makes *your* time slower, as measured by the launch frame.

What is the source of these differences, though? They are created by the ship's motion. In the launch frame, the speed of light is always just c. In the launch frame view, your downward light beam hits faster simply because the floor of the spaceship is rushing towards it near lightspeed. Similarly, the return journey of your light beam is slowed down because the light beam must race with your spaceship to get back to you. The closer you move to lightspeed, the longer the light beam takes to catch up.

So, if it is the ship's motion that is causing the differences light pulse arrival times, are these "real" lightspeeds, or just "effective" lightspeeds?

The same argument I made for "real" age differences applies here. The launch frame sees real, measurable accelerations and decelerations in how long it takes light to cross the length of your ship in two directions. *You* cannot see those delays in your ship, but you also cannot say they *don't* exist. If special relativity is true, your spaceship view is just as good as anyone else's, yet there's experimental evidence in the launch frame that your light speeds vary. The most self-consistent description, then, is to stop insisting that c has a singular velocity and acknowledge that what's going on is pairs of lightspeed whose product is c squared.

> *This is very interesting to me. Any object (even a short one) is approximate - has an approximate length - for an observer. So what does 'an object' even mean? There is no objective object, in other words.*

One of the original messages of special relativity that has gotten a bit lost is that concepts of distance and time, and thus even the lengths of objects, are more properly thought of as *interpretations* specific to individual viewers. The spaceship, again, is a good example. Launching your spaceship *does not* change the universe as a whole since *only* your spaceship gets a huge wallop of momentum energy. However, that momentum boost dramatically changes how you *interpret* the same photons coming in from the rest of the universe. You now interpret some of them as providing more "time-like" data and others as more "space-like" data, but the photons coming in from the unaccelerated universe themselves *did not change*. It's all you!

Think about that a bit. It's saying that *any* set of coordinates — any set of space and time interpretations — is more like a program in a computer than it is "reality." There *is* a constancy, but every $xyzt$ view is just an "interpretation" of that constancy.

So what is the deeper constancy that supersedes all $xyzt$ interpretations?

It certainly doesn't obey our usual insistence on strict separation of space and time. For whatever it's worth, my best guess at this point is that the deeper, less observer-dependent structure of the world uses measures that are more like what we think of as areas, and it has only three of them: L_x, L_y, and L_z. When the areas get squished (math term) and added in one way, you get time, and when squished in another way, you get space. However, since the squishing requires an observer who insists on $xyzt$ coordinates, whether they make sense or not. They make sense if there's enough consistency for the space view to give a decent model of what's happening, but that's not always the case.

This is an area that needs a *lot* of work. However convenient it is to believe in "lengths" and "durations," that's *not* what's going on the next level down. Special relativity shouts just that message, but our $xyzt$ brains don't like hearing it.

> *Now to me, that brings up an even deeper point. Is an object truly younger up front than at its rear? If that is proposed, it would mean that the observer has the 'real' picture rather than the object (the participant) him/itself.*

Yes! This gets into an important but touchy area, which is that even though every individual view has identical physics and is just as "real" as any other view, that by itself isn't the full picture. Every object in every frame has a history, which always involves what I've lately been calling "excitations" rather than "boosts": Events in which momentum energy is added to a system to get it into motion.

The observer (like earth) who is *not* subjected to new energy can *always* interpret excited items (like spaceships) as undergoing entirely real, historical events for the rest of their existence. When interpreting reality, the lazy guy who never budged wins every time!

When I first looked into this issue many years ago, I called this hierarchical perspective (with intentional irony) "absolute relativity" since it creates a tree-like hierarchy of inertial frames that are historical and in no way relative. When you *combine* that tree with the Poincare symmetries, you get special relativity with a hierarchy of interpretations in which each root frame can *always* treat any new inertial frames it creates from its share of matter and energy as "just" excited states still in that root frame, with *no* relativity of the final results. This is why folks at places like the CERN LHC don't go moping about and wringing their hands about how ambiguous and relative their extremely relativistic collision results are. They are the root frame, and for *them,* there is no need to treat the energies and strange time dilations of their particles as anything but absolutely real.

> *All of this may be more on the philosophy side, but it should have a bearing on the nature of what is being discussed.*

I'd say it was pretty apt (see above)!

Cheers,
Terry

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PDF: https://sarxiv.org/apa.2022-09-22.1015.pdf