On the Importance of Derek Muller's Asymmetric Light Speeds

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https://www.youtube.com/watch?v=pTn6Ewhb27k&lc=Ugx_ooIbbm0XlcpMpk94AaABAg

A Comment on the Veritasium post:
Why No One Has Measured The Speed Of Light
https://youtu.be/pTn6Ewhb27k

[4:46] "It's possible [lightspeed is ½] c in one direction, and … instantaneous on the return." The deep and far more experimentally relevant relation is c/R forward and Rc backward, where "forward" is the direction of motion of an inertial frame and R is a ratio of the forward light path to reach the mirror for the moving-versus-rest cases.

I suspect the ½ c papers never interpreted this as an inertial frame problem and thus overlooked the impact of Lorentz contraction and forward motion. At high R, the backward path shortens in space until backward light catches up almost instantly, corresponding to light velocity Rc. Conversely, light must "catch up" to the moving object in the forward direction. This chase can extend to infinity at high velocities, resulting in c/R slowdowns, not just ½ c. Think of it as time dilation, which is pretty much just what it is. The fixed-distance version idea of making ½ c the limit is not advisable since it assumes the existence of entirely classical, fully space-like distances, and those don't exist.

For folks in moving frames, such as our solar system, such numbers are hidden [16:13] from any experiments they can do internally due to special relativity. There's no getting around special relativity, ever. On the other hand, these ratios are fully observable from the launch frame, especially if that frame previously set up a well-synchronized, cloud-of-clocks definition of what it interprets as simultaneous points in its "space." In that launch frame, the varying forward and backward velocities look like ordinary asymmetric delays introduced by motion. This situation is hierarchical since the launch frame can never know whether some earlier frame launched it. Again, there's no getting around special relativity.

Why the Launch Hierarchy is Important

The only thing that stays invariant in these increasingly asymmetric light speed reciprocals is their launcher/launched relationships. These form a hierarchy going back to the origin of the universe. This "linear momentum energy excitation hierarchy" — you can also call it an "inertial frame ball," but one with an intricate branching network of historical launch events drawn inside it — ensures well-quantified determinations of extreme relativistic problems. Without it, special relativity is incomplete and ends up encouraging rather dumb, mystical-sounding assertions that fail to give clarity or results.

The extreme space slopes of the highest-energy inertial frames cause their seconds to scrape up vast swaths of our timeline, so they see us moving slowly, too. It's authentic time-dilation. However, the clocks of these _created_ and energized frames don't begin ticking until launch. While they can instantly begin reinterpreting photon data from the rest of the universe, they cannot change how it looked before their launch. The total mass, enclosed space, and length of existence as measured in their launcher frame often are limited. The higher the frame energy, the lonelier it tends to be.

In combination with the perspective symmetries of Poincaré and Lorentz, the constructive symmetries of the launcher/launched momentum hierarchy nicely resolve classical time paradoxes without invoking a deterministic universe, and reciprocal forward-backward lightspeed pairs are at the heart of how this works.

The Angular Excitation Hierarchy and Mach's Bucket

By symmetry, there is also an _angular_ momentum hierarchy. This one unexpectedly resolves Mach's bucket conundrum: The bucket creates its "own" rotating frame as a collective state without help from distant stars or a pre-existing spacetime fabric. The angular excitation hierarchy is essential to particle physics because it's quantized, unlike the linear momentum hierarchy.

Other Impacts of Reciprocal Light Speeds

[16:44] "Or maybe, when physics takes the next paradigmatic leap, our inability to measure the one-way speed of light will be the obvious clue to the way General Relativity, Quantum Mechanics, space, and time are all connected, and we'll wonder why we didn't see it before."

I broke out laughing when I read this! Sorry, it's just that I think you made quite a point there. I commented on this video a year ago and then forgot about it. I've worked on this topic for years but never noticed the reciprocal light velocity interpretation of the issues until last week. That's why I looked at your video again.

You may have noticed that I keep talking about frames as small, local, created entities composed mainly of ordinary matter. That's because it's what they are. Frames are always functions of matter, not nebulous pre-existing continuums. They integrate with other matter and frames, but without creation points that consume energy, they don't exist. They even create reciprocal definitions of the velocity of light.

Here are a few more consequences of matter creating reciprocal light velocity frames:

Spacetime Becomes Low-Resolution and Bottom-Up

If isolated systems of matter implement their own linear and rotating inertial frames, large-scale spacetime becomes the bottom-up cooperation of many smaller units. Large-scale flat space and curved space thus become functions of matter and energy, not independently-existing structures. This soft universe is one without Planck foams.

General Relativity Becomes Approximate

If energy and matter define the local rules of spacetime, then General Relativity necessarily loses resolution and predictive power at both tiny (not enough mass available; think electrons) and immense (mass is too scattered; think cosmic voids). There's nothing wrong with the equations of General Relativity. One cannot assume that the mass and energy that creates spacetime can support infinitely dense information (resolution) at zero energy cost.

Quantum Mechanics Becomes a Subset of Special Relativity

Mentioning quantum was remarkably prescient of you.

The asymmetric light speeds resolve in the space representation to what I've been calling _age gradients._ These form in every Lorentz compressed object, and they are just what they sound like: the back of a moving object becomes older than the front end, with reciprocal light speeds ensuring no time paradoxes ensue.

But here's the kicker: Age gradients make Schrödinger wave structure and dynamics a subset of special relativity.

The at-rest wave function of a massive particle rotates symmetrically in what looks amusingly similar to a one-loop skip rope whose volume encompasses its region of highest probability, and the rotation rate defines its mass. Boosting the wave into linear motion means it Lorentz contracts and so forms an age gradient.

But what does this initially simple skip rope loop look like after adding a time gradient?

It becomes a helix, a Schrödinger momentum wave function.

The point is this: There's no "complex plane" or "imaginary" axis in any physical quantum wave function. Those are just handy math abstractions and somewhat noisy ones at that. Quantum phases are instead _age gradients,_ the shapes of waves forced to exist at multiple points in time. This age gradient is directly visible in the launch frame but remains intransigently invisible in the moving frame due to special relativity.

So again, yeah, you were spot on with that one. Add age gradients due to reciprocal light speeds, and big chunks of quantum mechanics start looking a _lot_ like some form of special-relativity temporal mechanics waiting for further exploration. Wave functions become little time travelers — but then so do we, ever so slightly, every time we launch into a faster frame.

Why XYZT makes a Lousy Model of Quantum Reality

Finally, there's this:

[16:33] "And does it even make sense to talk about things happening at the 'same time' if they're separated by distance."

Well, no, it doesn't. If you think a bit about it, even _saying_ "xyzt" violates special relativity by assuming, for example, that "space" has a well-defined meaning in all situations.

Here's a seldom-used physics unit: meter-seconds. Why is it interesting? Because it's the unit of area for the three relativistically invariant surfaces that describe the location of an object relative to some encompassing rest frame. No space or time, just three mutually orthogonal _areas_ — areas, not vectors — each of which is inherently Lorentz invariant.

Any detectable spacetime event, such as one clock tick, has a length along its axis of motion. That length is _divided_ by the Lorentz factor. The duration of the event is _multiplied_ by that Lorentz factor. Multiply these two measures, and the Lorentz factors cancel out, leaving a meter-second "coordinate area" that better captures the interchangeability of event length and duration along that axis. Adding all three Lorentz areas, one for each axis, gives Lx, Ly, and Lz. These create a non-vector space from which the more familiar xyzt space emerges as a cooperative and context-dependent venture.

Are Lorentz area coordinates useful, however? That's to be seen, but for a start, they have the same structure as relativistic electromagnetic fields.

Whether or not Lorentz areas are a better choice for relativistic coordinates, I rather like the idea that at some deeper level, we may live in a 3-space of area-like quantities rather than a 4-space of vector-like quantities, with time and space as we know them emerging as a sort of cooperative approximation. That's just funny!

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