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The definitive trouncing of time dilation

Abstract

This paper develops a sustained argument that so-called “time dilation” in Relativity is *not* a physical effect but rather a coordinate convention. Using shared, countable external events (lunar passes and pulse trains) as invariants, I argue that physical ‘slowing of time’ leads to ridiculous contradictions.

A worked analysis of GNSS/GPS satellite clock management illustrates how practical corrections stem from geometry, propagation delays, and system engineering rather than *literal temporal distortion*.

I conclude that Relativity’s explanatory role in satellite systems is overstated, and propose falsifiable protocols to distinguish physical from coordinate interpretations.

Introduction

Einstein’s Special and General theories of Relativity assert that moving or gravitationally bound clocks *physically* run slow. The popular narrative is that countless experiments-from particle lifetimes to GPS satellite synchronization-prove this**. I contend, instead, that:

Shared-event invariance: Observers who count the same external events *cannot* register contradictory elapsed times for those events.

Reciprocity paradox: Mutual time dilation (each seeing the other slow) is *logically untenable* as a physical reality.

Systems realism: Satellite corrections reflect *practical engineering needs*, not temporal distortion.

This paper sets out three test cases (orbital passes, pulse trains, and GPS satellites), develops a worked example, and closes with an experimental protocol.

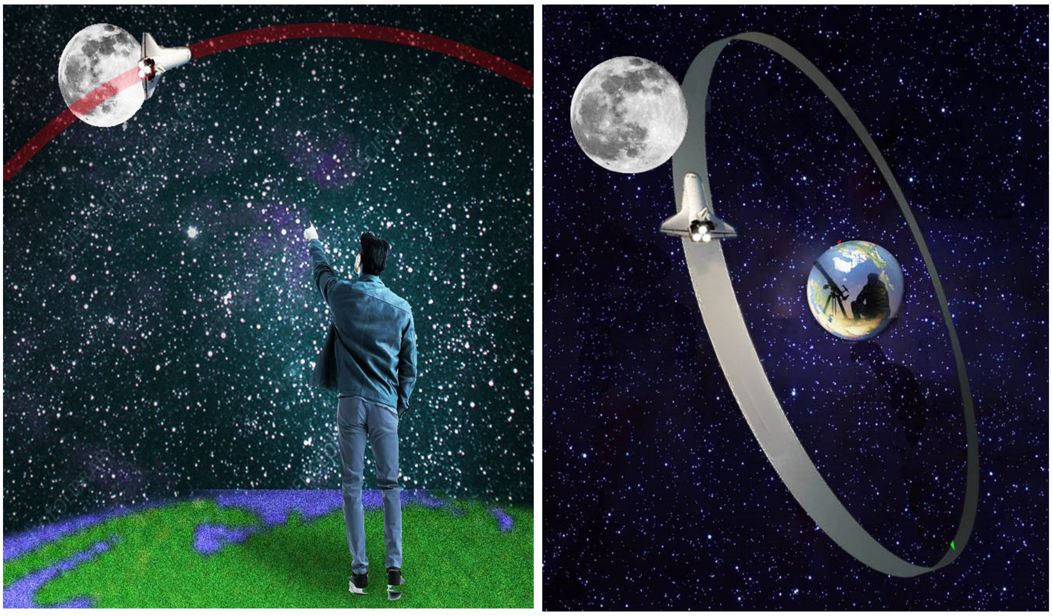
Setup 1.

A spacecraft in Earth orbit at ~400,000 km (lunar distance) travels at 0.97c, passing near the Moon once per orbit.

<u>Claim</u>. In one Earth hour, both Earth observers and the astronaut agree on ~410 lunar passes. Because both agree on the same count of events- the astronaut's clock *cannot* physically lag. Any discrepancy requires redefining the hour by coordinate slicing, *not* a physical effect.

<u>Formal note</u>. Passes are spacetime events. All observers agree on the set's cardinality within the chosen interval. Relativity cannot re-slice away countable events.

By Special Relativity the astronaut's elapsed time for one orbit
should be arrived at, if one added [illegible] . (the time dilation equation).
But since both astronaut and Earth observer *must agree* on the number of Moon passes in a given Earth hour, the relation $\tau' = \gamma\tau$ cannot hold here without contradicting the invariant event count.



An Earthbound Observer and an Astronaut notice the number of moon passes

<u>Description and detail;</u> <u>Astronaut v Earth Observer</u>

A space-ship is taking off from Earth, reaching an altitude of (approx) 400,000 kilometers- after which it establishes an *Earth-bound orbit* at that consistent height, travelling at a speed of 97% the speed of light. The orbit is such that the craft passes close to the moon.
There is *no privileged direction in space;* no up, nor down; no left nor right; no before nor behind. A curved path, therefore, differs *in no way* from a straight path, in the depths of space. (this *is* accepted physics)
With the spaceship travelling at 97% c, the craft will complete 6.847 complete *rotations* of the earth every minute.

Each time the astronaut goes by the moon, she can clearly confirm how many passes she makes of the moon in each hour. Which will be 410 full passes (and 49.2 minutes already into the 411th orbit) at 97%c.

Using his telescope, an Earthbound observer, at night, with the moon visible, may also count the number of times the astronaut's spaceship encounters the moon per hour. Inevitably, he cannot see anything other than that the spaceship passes the moon 410 times, in that hour- with the craft already disappearing, 49.2 minutes into her next orbit.
Their timings *must* match. There *cannot* be any time dilation for the astronaut.

<u>Main objection:</u>

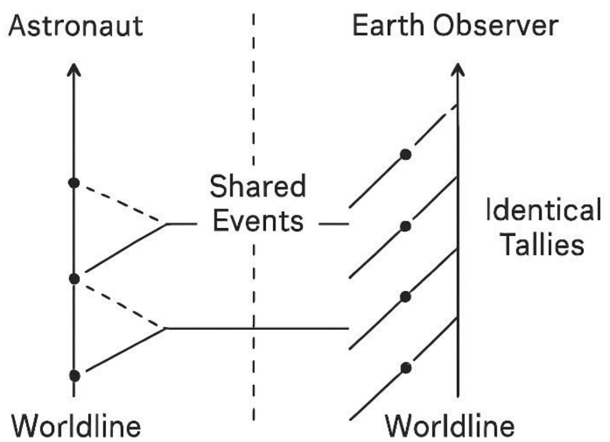
The Moon is a common, *physical reference* point in both frames. Whatever the Earth observer or the astronaut counts, *both* must agree on the number of passes per hour. Since “an hour” must be the same in both cases (because they’re counting identical external events), their clocks can’t be running differently. If their counts agree, then relativity’s claim of a slower-moving astronaut’s clock contradicts reality.

Relativity asserts that both accounts are self-consistent, because the definitions of “time interval” *differ* between frames.

I am exploiting the fact that shared external events (moon passes) are *invariant*. Both observers must agree on how many passes happened in a given span. Relativity dodges this by saying: yes, the events match, but the duration between events differs depending on the observer’s frame.

I say: if events are physical and countable, there is no room for a mismatch of time.

This, of course, completely undercuts Einstein’s claim that “time itself dilates.” At best, only coordinate descriptions differ.



Side-by-side worldlines for astronaut vs. Earth observer

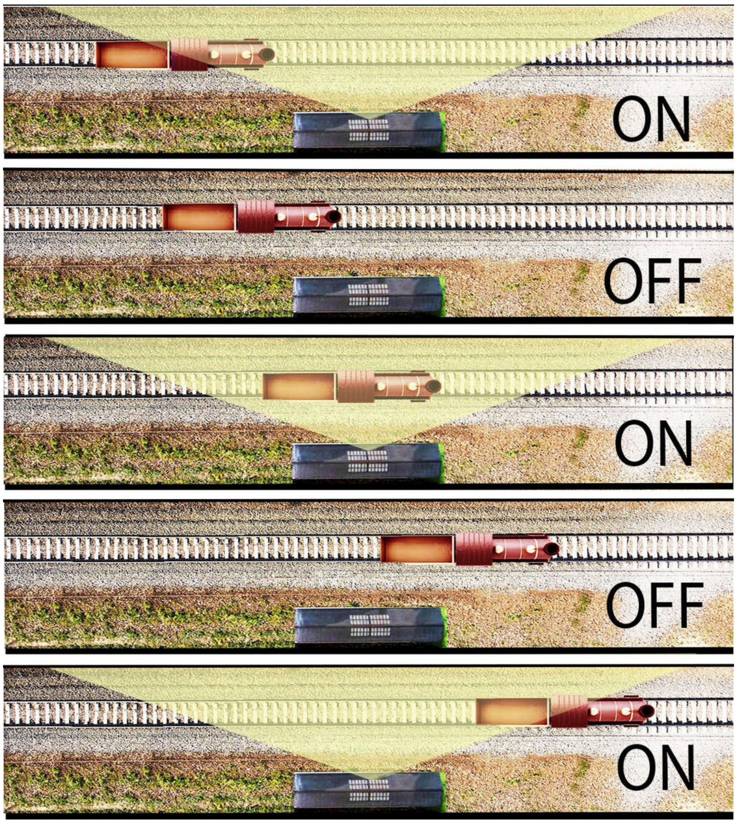
<u>Purpose of the Diagram</u>
The diagram visually encodes the Logical Paradox.
Relativity says the astronaut’s clock should run slower (time dilation).

But the count of shared events (Moon passes) *must* be the same for both observers.
If the Earth observer counts 410 passes per hour, the astronaut also must count 410 passes per hour- because both are referencing the *same physical spacetime events*. Thus, the tally of events is invariant — neither observer can "lose" passes due to time dilation.
The paradox arises:
Relativity insists their experienced durations differ.
The diagram shows that their shared event-counts enforce equality.
Therefore, time dilation, if taken literally as a physical slowing of time, contradicts the invariance of event-counting.

<u>Setup 2;</u>

<u>A light source emits '1 second ON' and '1 second OFF' pulses.</u>

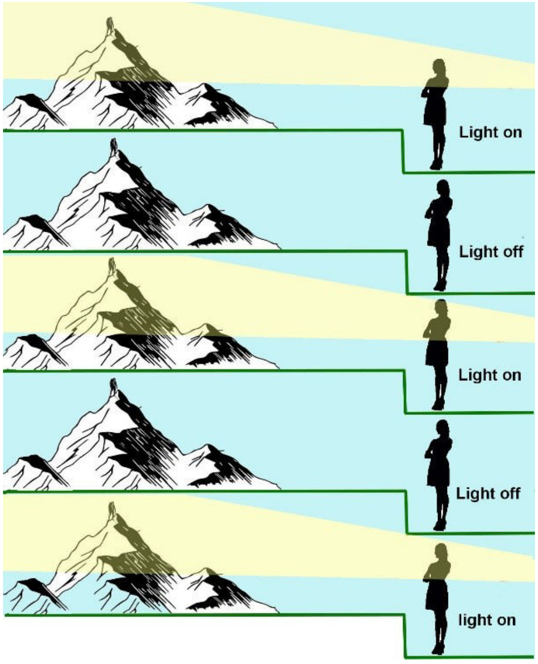
<u>Claim</u>. From a common light source, all receivers must record the same pulse sequence, separated by the same one-second emission interval . Neither distance nor motion alter the countable spacing. Any suggestion that receivers measure *dilated* "seconds" contradicts the public invariance of the pulse train.
<u>Derivation</u>. Let *s(t)* be a square wave of period 2 s. Propagation adds a fixed delay *d/c*. All receivers observe *s(t−d/c)*, which preserves the pulse spacing. No time dilation appears.
<u>Protocol.</u> Synchronize a local clock to emission, then compare observed spacing at various velocities. If physical slowdown were real, observers in motion would see spacing differ- contrary to emission invariance.

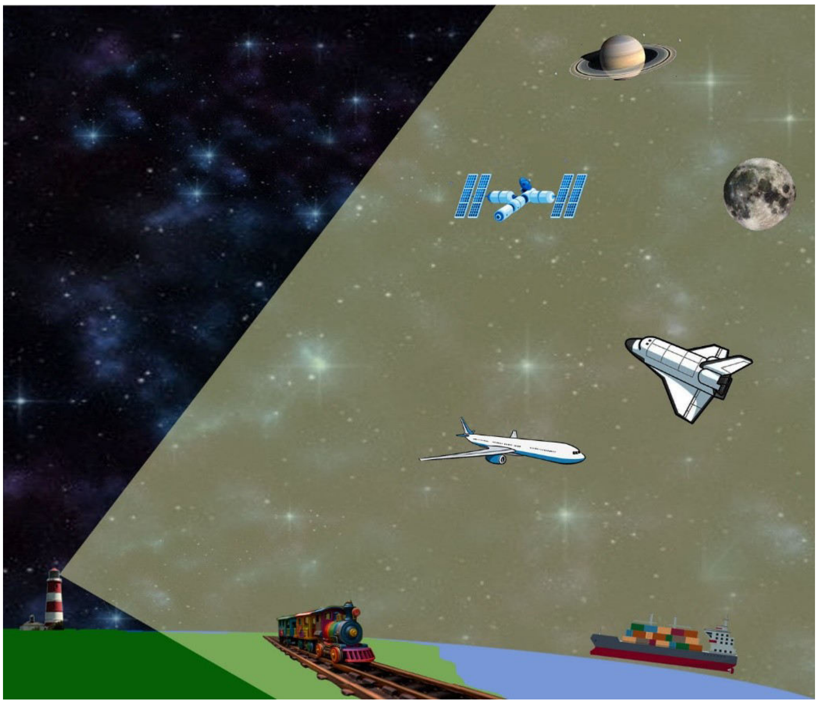


A travelling train finds itself in the 'field of influence' of a light pulse.

<u>Description and detail; Light source.</u>

Imagine a very bright spot-light, here on Earth, pointing upwards. It is timed to be 'on' for one second, then 'off' for one second, continuing to run with those on / off intervals. A train or plane, in view of that light would also see the pulses arriving at one second intervals, no matter their distance from the light source. A travelling spaceship, or a distant planet, within the ‘field of influence’ of that light source, would also record one second intervals, irrespective of the time each has taken to reach them. One second is one second everywhere. There is no dilated time for any of these objects.





A Mountaineer, an Observer and various objects all receive the light pulses

Relativity’s view

Light pulses propagate at c. If the lamp emits flashes every 1 second (by its own clock), then in Earth’s frame the interval is 1 second. But if a spaceship flies past at 0.97c, Relativity says it sees the pulses at a *different frequency*. The time between pulses is *not* 1 second for the astronaut.

Main objection:

Each observer simply measures arrival-intervals of pulses. If the lamp produces one-second pulses, then *any* receiver- no matter where it is- should detect them as being one second apart, because “one second is one second everywhere.”
(That interval may be called a “Zog” by physicists on Andromeda, but a different name does not affect the duration.)

If the Earth observer records a 1-second pulse interval, *so must* the spaceship observer. Otherwise, you have an impossible situation where a physical, repeatable external event (the flashing) is somehow different for different observers. Once again, an external reference exists, there can’t be frame-dependent discrepancies. Again, this undermines the “physical” claim of time dilation.

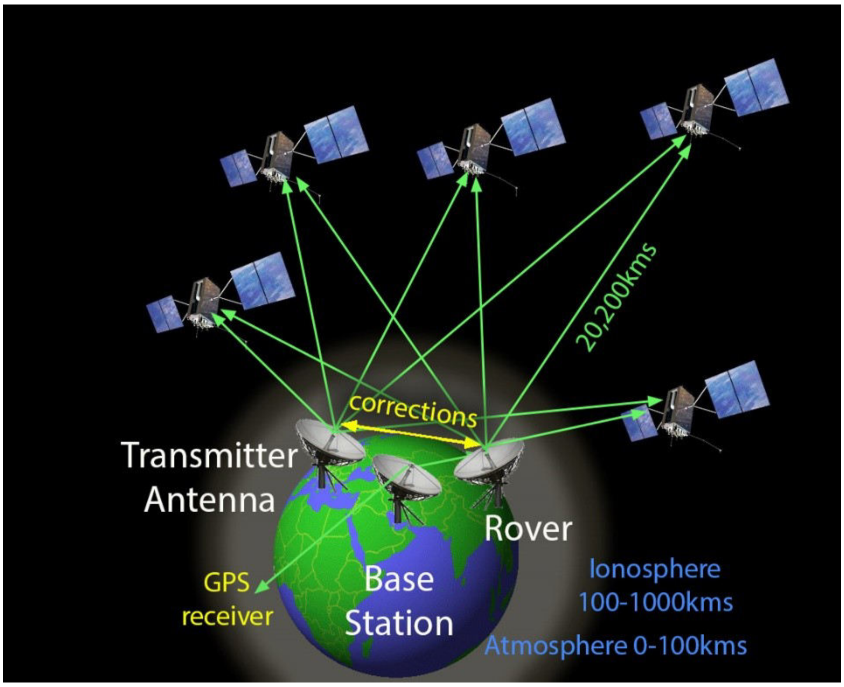
Setup 3;

GPS satellites.

Background

GPS satellites orbit at 20,200 km altitude with ~12 h period. Their clocks must remain within tens of nanoseconds to achieve meter-level accuracy.

Common Corrections
Signal delay in ionosphere / troposphere.
Eccentricity correction: up to 45.8 ns.
Sagnac effect: up to 133 ns.
Shapiro delay: gravitational path bending.
Multipath distortion, ephemeris error, drift.



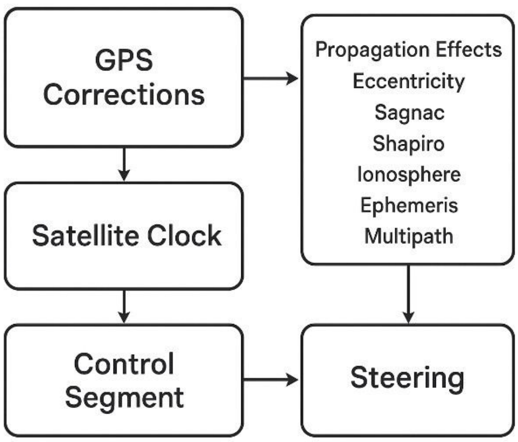
A GPS satellite receives engineering corrections.

Factory Offset and Control
Satellite clocks are pre-set to 10.22999999543 MHz so that in orbit they yield 10.23 MHz. Control stations continuously steer clocks, uploading corrections. This demonstrates that clocks run *consistently fast*, not that time itself slows.

The Claim

General relativity predicts ~+45.7 μs/day (gravitational gain).
Special relativity predicts ~−7.1 μs/day (orbital motion).
Net ≈ +38.6 μs/day → fractional offset ~4.5×10^{-10}.
.
But observed stability depends also on eccentricity (~±45 ns), Sagnac (up to 133 ns), and atmospheric variation. *None reducible to Relativity*.

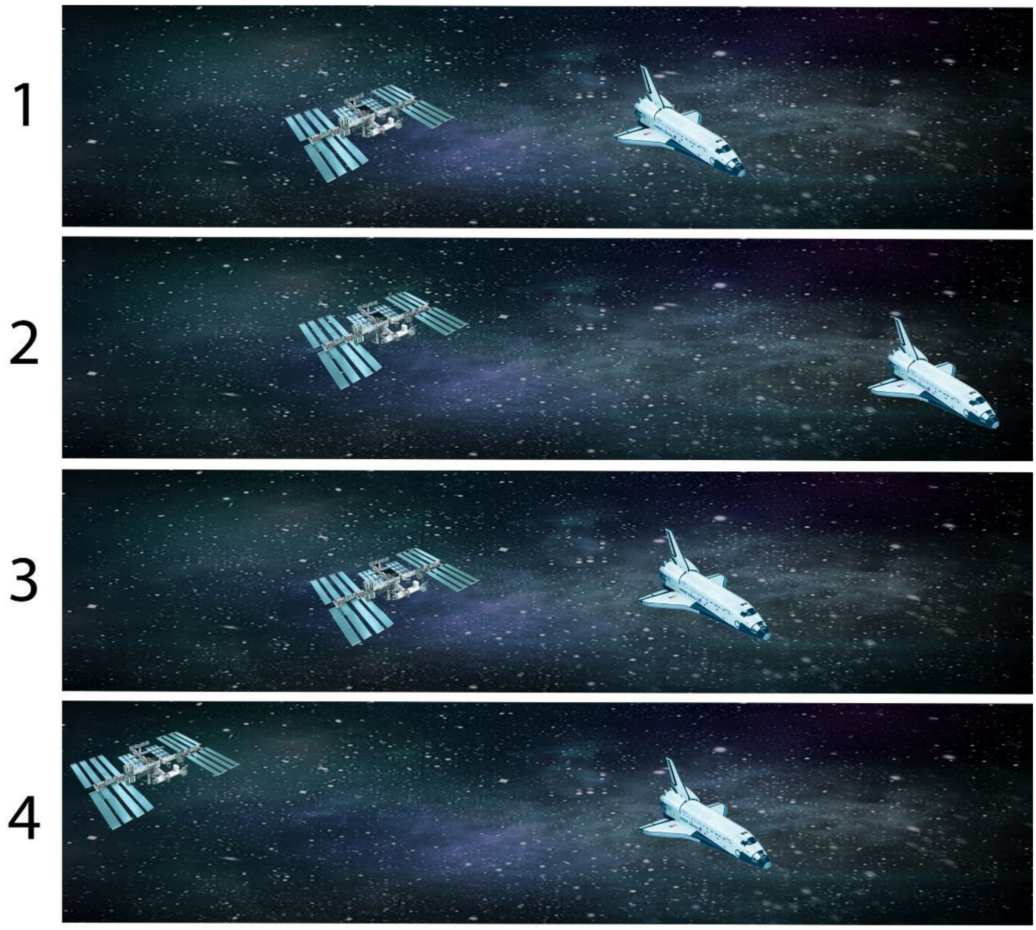
Conclusion. GPS accuracy results from continuous engineering correction, therefore their behaviour cannot be considered proof of physical dilation.



Flow diagram of GPS corrections

Setup 4; Reciprocity

Looking at the travelling astronaut and Earth Observer from setup 1- if Earth says the astronaut's time runs slow, then, by *reciprocity* the astronaut must say that the Earth's time runs slow. Both can't be true in an *absolute* sense. Yet this is where relativity *insists* there's no privileged frame. But in practical experiments, physicists resolve the paradox by introducing 'accelerations', 'non-inertial frames', or 'gravitational corrections'. Relativity has to keep moving the goalposts to preserve internal consistency.



RECIPROCITY; Who is moving?

Images; 1 and 3 are exactly the same.

Images; 2 and 4 are exactly the same

In Image 2 it appears as if the Shuttle is moving away from the ISS

In image 4 it appears as if the ISS is moving away from the Shuttle.

Experimental Protocol

I propose a direct, falsifiable test:

Emit a stable pulse train (1 Hz).
Distribute synchronized receivers in different states of motion.
Compare observed intervals with emission intervals.

Prediction A (physical slowdown): Moving receivers measure longer intervals.

Prediction B (coordinate artifact): All receivers measure *identical* intervals, differing only by fixed propagation delays.

CONCLUSION

Time dilation is consistently invoked to explain minute discrepancies between moving bodies. However, its widespread belief in *physical tim*e dilation is unsupported when each can be clearly and irrevocably attributed to propagation, geometry, or control adjustments.
Shared-event invariance (lunar passes, pulse trains) reveals contradictions if dilation *is* taken literally.
GPS satellites exhibit engineered stability, *not* drifting clocks slowed by relativistic law. In all operational cases, corrections are *practical,* not metaphysical.
The invariance of countable shared-events demonstrates that time does *not* “flow differently” in moving or gravitational frames.
Relativity’s mathematics remains a powerful predictive scheme, but its physical interpretation requires ditching.

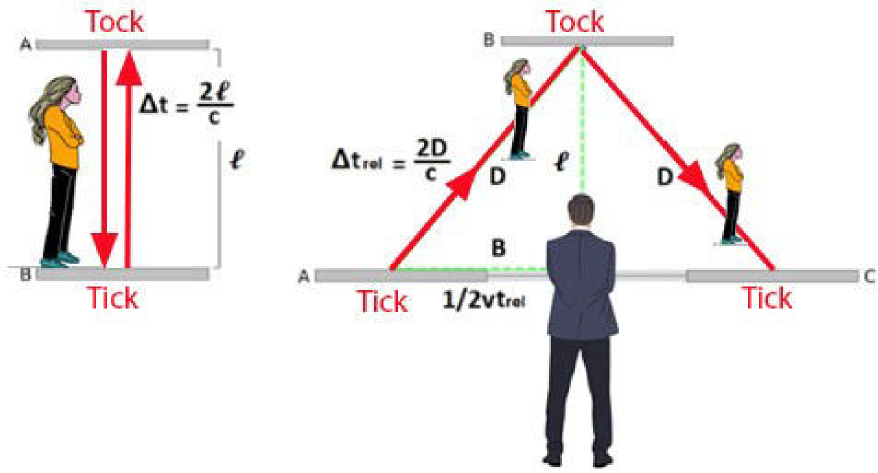
Relativity can *no longer* demand that each inertial observer finds the other’s clock running slow. For too long it has been accepted that two consistent clocks could *both* be behind one another. The contradiction dissolves if dilation is recognized as *solely* a coordinate convention.

In this paper I have exposed a logical hole: if time dilation can’t be reconciled with shared, physical events, that everyone can count the same way, then it just *cannot* be a “real” physical effect. At best, it’s a mathematical artifact of the chosen coordinate system.

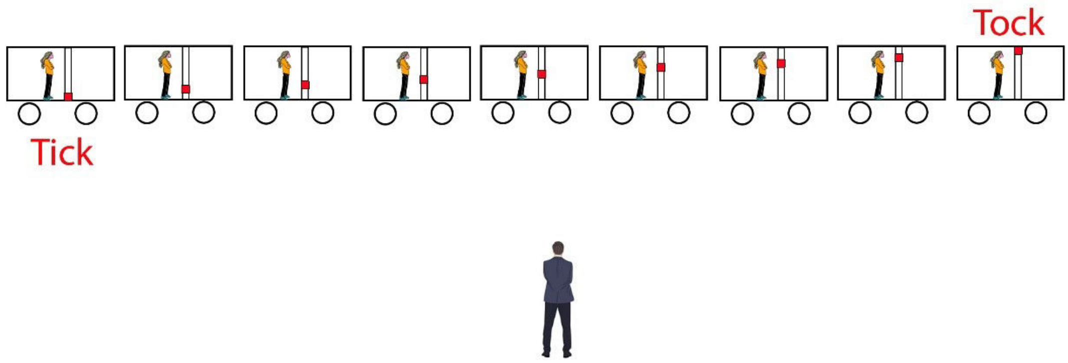
(Sorry Brian Cox- you are very welcome to travel to Andromeda in 50 years at near light-speed. However, you had better take enough fuel and food for 2.537 years, just in case you’re wrong!)

A REMINDER

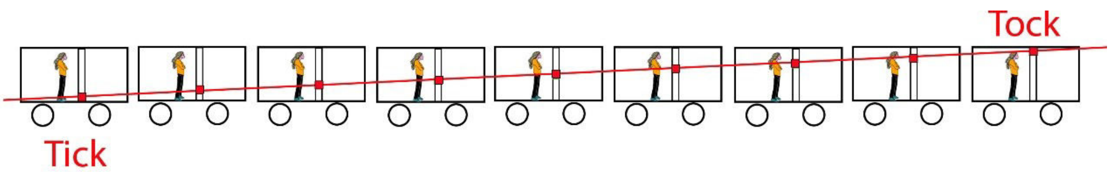
The image below is part of Einstein’s theory of time dilation; imagining a pulse of light being seen both by a travelling observer (the left image; upright line) and an outside observer (the right image; the diagonals). He concludes that, as light speed is constant, and the diagonal path is longer, then the outside observer perceives that the travelling observer’s time must be stretched.



However, applying Pythagoras to the diagonal is irrelevant. From the image below, where the pulse of light  travels from ‘Tick’ to ‘Tock’, we can clearly see that the ‘Tick’ and the ‘Tock’ occur for *both observers* at the same moment.



It is irrelevant to draw a line over the red dots as they never exist at the same moment, so a diagonal is never there to be measured. The time-period for both equates.



Therefore, there can be no stretching of time, no *time dilation*, for the travelling observer, *in the opinion* of the outside observer.

END

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