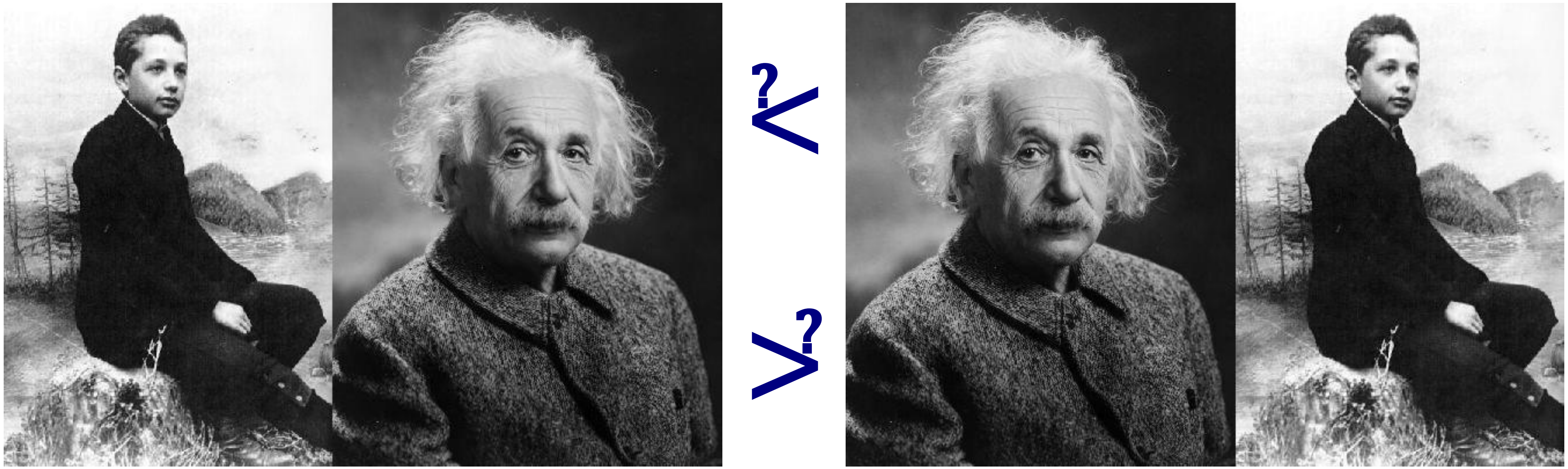


Twin ~~paradox~~

Twin **contradiction!**

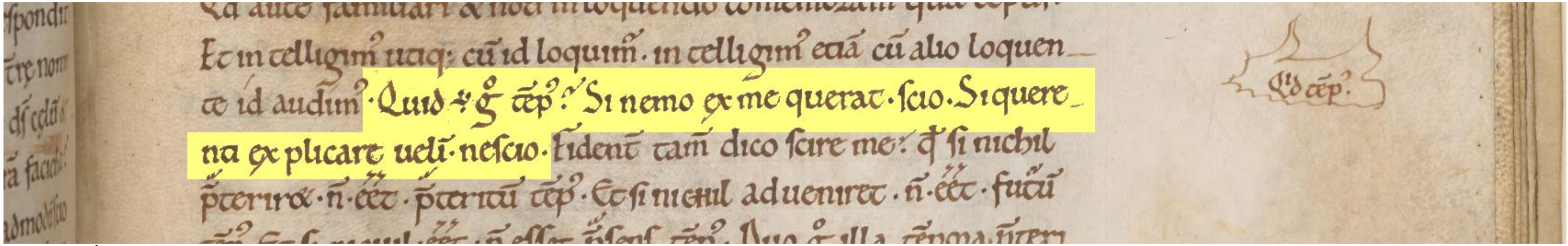
We cannot solve problems with the same way of thinking that created them.

Albert Einstein:

A new type of thinking is essential if mankind is to survive and move toward higher levels.

(New York Times - May 25 1946, p.13 - 'Atomic Education Urged by Einstein')

http://icarus-falling.blogspot.com/2009/06/einstein-enigma.html



11th century manuscript, http://www.bl.uk/manuscripts/Viewer.aspx?ref=harley_ms_3080_f094r

Quid est ergo tempus?
Si nemo ex me quærat, scio.
Si quærenti explicare velim, nescio.

Then what is time? When nobody asks me, I know. When I would like to explain it however, I do not know.

Aurelius Augustinus Hipponensis (CCCLIV – CDXXX)
Confessiones 11.14

Thou shalt not contrive concoctions.

Gij zult niets uit uw duim zuigen.

Fundamental propositions
should be deduced
from ascertained truths.

Thou shalt not take an inconsistency for granted.

Gij zult niet voor zoete koek slikken
wat niet te vreten is.

Do not accept any unclarity
if logic and common sense
say it is just impossible.

Please note:

First part of this presentation is in a perfectly Special Relativistic scenario (which in practice is unachievable), i.e. not a single experimental result can be used as a counterargument.

Paradox:

(in a physical sense)

OBSERVED phenomenon that *SEEMS impossible.*

E.g. *hydrostatic paradox* & *M87 jet*[1].

[1] See http://henk-reints.nl/astro/HR-Apparent-superluminality.pdf

Paradox:

something existing that you can't grasp.

YOUR insight is insufficient.

Not a paradox:

some *invention* that appears not to exist.

YOUR *brainchild* is JUNK!

E.g. the Fermi "paradox" is just a too simple-minded thought.

Twin ~~paradox~~ contradiction:

Impossible outcome of some reasoning:

$\therefore$ **this reasoning or at least one of its premises must be flawed.**

Not a paradox, but a contradiction;
can't be solved; must be rejected.

Calling it a paradox suggests it would be possible, obfuscating any mistake that might exist in the underlying reasoning.

Don't try to explain something impossible that has never been observed!

Premises: Einstein's postulates:

derived from facts of experience without excogitating anything.

He did not try to *explain* Michelson & Morley's experimental result, but he *drew a conclusion* from it.

Moreover:

constancy of speed of light does not need to be postulated[2]:

$$c = \frac{1}{\sqrt{\varepsilon_0 \mu_0}}$$

[2] Albert Einstein: "Ist die Trägheit eines Körpers von seinem Energieinhalt abhängig?", footnote 2 on 1st page. Annalen der Physik, Band 323, Nr. 13, 1905, 639–641.

Albert Einstein: Zur Elektrodynamik bewegter Körper.

On the electrodynamics of moving bodies. Annalen der Physik, 17 (1905, 891–921) @894:

Wir setzen noch der Erfahrung gemäß fest, daß die Größe

$$\frac{2\,\overline{AB}}{t'_A - t_A} = V$$

eine universelle Konstante (die Lichtgeschwindigkeit im leeren Raume) sei.

We further establish in agreement with experience, that the speed of light in empty space be a universal constant.

He did not think this up; he drew the most plausible CONCLUSION from a fact of experience, i.e. the result of the Michelson & Morley experiment;

"if we always measure the same value, then it must be a constant".

Einstein: Zur Elektrodynamik bewegter Körper.

On the electrodynamics of moving bodies.

Annalen der Physik 17 (1905) 891-921:

> 2. Jeder Lichtstrahl bewegt sich im „ruhenden“ Koordinatensystem mit der bestimmten Geschwindigkeit V, unabhängig davon, ob dieser Lichtstrahl von einem ruhenden oder bewegten Körper emittiert ist.

Each ray of light moves in the "stationary" system of coordinates with the determined velocity V, independent of whether this ray is emitted by a body at rest or in motion.

Einstein: Ist die Trägheit eines Körpers von seinem Energieinhalt abhängig?

Does the inertia of a body depend upon its energy-content?

Annalen der Physik 18 (1905) 639-641:

> 2) Das dort benutzte Prinzip der Konstanz der Lichtgeschwindigkeit ist natürlich in den Maxwellschen Gleichungen enthalten.

The there used principle of the constancy of the speed of light is of course contained in Maxwell's equations.

Einstein did *not come up* with *ideas*, but *concluded* from *facts* of experience:

0. we always measure the same *speed of light* in all directions, independent of Earth's motion around the sun, hence it apparently is a *universal constant*;
1. from his own perspective, each observer perceives the very same *laws of nature*, not affected by any relative movement of another entity;
2. for every observer, the *speed of light* equals the just mentioned *universal constant*, independent of any movement of the light source with respect to him (HR: *not any* wave velocity depends on that of the source); this is already contained in Maxwell's equations.

Therefore: *all observers* perceive the very *same speed of light* w.r.t. themselves, even if they measure the very same ray of light when passing one another at whatever velocity.

The *speed of sound* under water is about four times greater than in air, so it is not a property of the *sound itself*, but of the *medium* through which it propagates.

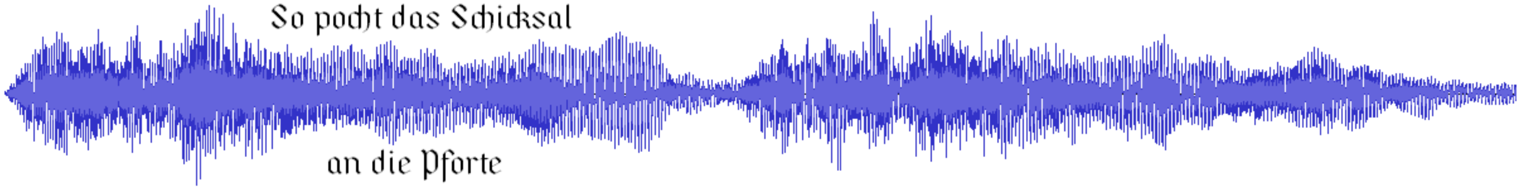
It also is not a property of the sound *source*, which can cause only a single point of the medium to oscillate and it is the medium itself that transports this oscillation.

Similarly, the **speed of light** is **not a property of light**, nor of the light source.

***Not any* wave velocity depends on the source's speed.**

It implies the motion of a sound or light ***source*** does not affect the speed of the sound or light ***itself***.

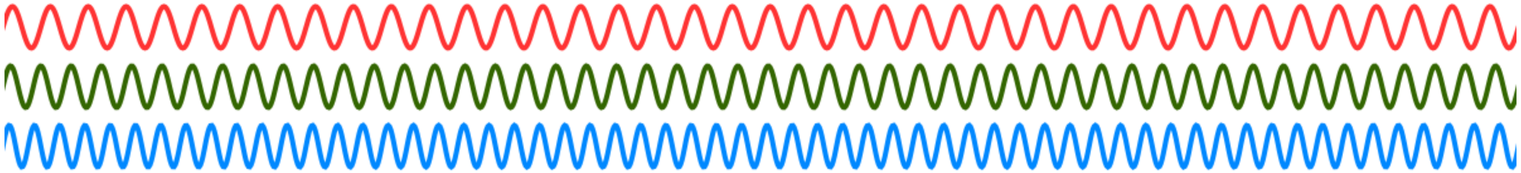
Speed (not pitch) of sound independent of velocity of sound source:

100 km/h
(in a car)

same speed of sound to each observer who does not move w.r.t. the medium through which the sound propagates.

Speed (not color) of light independent of velocity of light source:


1090 km/s
z = 0.003642
(redshift)

same speed of light to each observer who does not move w.r.t. the vacuum through which the light propagates.

Since NOTHING & NOBODY can move w.r.t. vacuum, the speed of light is identical to each & every observer.

It essentially is the ***vacuum*** (Latin for *emptyness*) **itself** that manifests identically to each & every observer.

It contains nothing by which it could reveal any difference.

It does not have any reference points,
so it cannot ***have*** any velocity (***not even zero***!);
it cannot manifest any motion w.r.t. whatever.
Only the ultimate observer
is a useful point of reference.

This simply implies the
same speed of light to all observers.

1) ***Any*** wave velocity is always with respect to medium, independent of any movement of source or observer.
2) If observers do not move w.r.t. medium, wave velocity is obviously same w.r.t. all observers.
3) Light has ability to propagate through vacuum, i.e. use empty space as a medium, ***no matter how and why it is able to do so.***
4) Not any observer can move w.r.t. vacuum, so all measure same *speed of light* in empty space.
5) The above suffices to explain M&M's result without ***any*** length contraction. As explanation of M&M, the latter is even inconsistent with a constant *speed of light*.

Please check:

"**The Speed of Light has Absolutely Nothing to Do With Light**"

video: https://www.youtube.com/watch?v=UHKZMGdj7cI (Premiered on 24 Sept 2023)

script: https://philosophyengineered.blogspot.com/2021/12/the-speed-of-light-has-nothing-to-do.html

It refers to:

Pelissetto, A. & Testa, M.:

"**Getting the Lorentz transformations without requiring an invariant speed**";

American Journal of Physics, 83, 338 (2015) 338-340:

https://aapt.scitation.org/doi/abs/10.1119/1.4901453

https://arxiv.org/pdf/1504.02423.pdf

As well as to the original:

W. von Ignatowsky: "**Das Relativitatsprinzip**";

Archiv der Mathematik und Physik 17, 1-24 (1911)

transcript: https://de.wikisource.org/wiki/Das_Relativit%C3%A4tsprinzip_(Ignatowski)

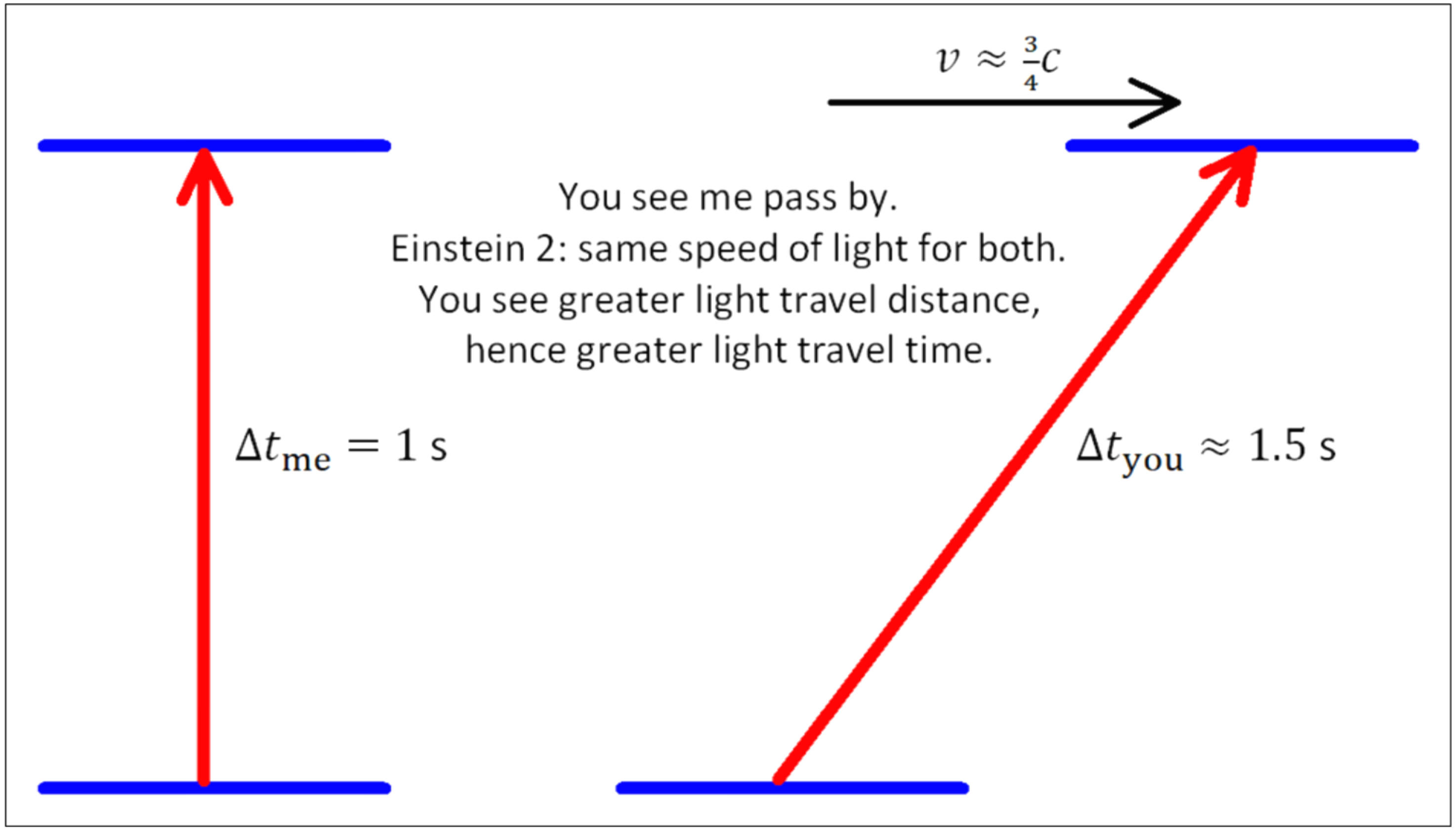
original: https://commons.wikimedia.org/wiki/File:IgnatowskiRelativ.djvu

pdf thereof: http://henk-reints.nl/IgnatowskiRelativ.pdf

(all in German, but you can use Google Translate on the Wikisource transcript)

WHY ISN'T THIS TAUGHT EVERYWHERE?

Photon travels perpendicular distance of 1 light second at *universal speed of light*:



My point of view: you move, I am stationary;
your point of view: I move, you are stationary.
Departure and arrival are my events, you see them pass by.

Time dilation/stretching:

The speed of light being fundamentally
identical to each & every observer
independent of their mutual velocity yields:

time spans of fast passerby
appear
longer to stationary observer.

THE quintessense of relativity:

Due to the *speed of light* being a *universal constant*, i.e. identical to each and every observer,

YOU and I do not measure the same *timespan* between two events if we are in relative motion (passing each other)**.**

Each has own perception of time, i.e. ***THE time*** does not exist.

Frequently made **BIG** mistake:

time would go slower if you are moving very fast.

No! No! No!

Correct[3]:

Time of fast passerby goes slower for stationary observer, but ***not*** for passerby hirself[4].

[3] Although this very presentation will reveal it is not really correct.

[4] "hir" = her/him/his ("i" pronounced as in *Kick this slick brick, Jim Smith, hit it!*)

Reconsider concept of moving & stationary observer:

someone moves relative to you;
you move relative to hir:

time spans between ***your*** events appear longer to *hir* than to *you*;

time spans between ***hir*** events appear longer to *you* than to *hir*.

Depends on *where* events occur!

YOUR time spans: time spans between YOUR events, as perceived by YOU;

MY time spans: time spans between MY events, as perceived by ME.

YOUR time spans appear longer to ME than to YOURself,
MY time spans appear longer to YOU than to MYself.

IFF YOUR time spans identical to MINE then:
YOUR time spans appear longer to ME than MY own,
MY time spans appear longer to YOU than YOUR own.

IFF we have identical clocks, then:
tick rate ***I*** see on ***my*** clock ≡ what ***you*** see on ***yours***.

Time stretching also applies
to time spans between
consecutive clock ticks,
so for a stationary observer,
a fast moving clock
ticks slower.

The faster
the clock goes,
the slower
the clock goes.

From A's perspective:

A stationary, B moving;

$\Rightarrow$

to A, B's clock is slower.

From B's perspective:

B stationary, A moving;

$\Rightarrow$

to B, A's clock is slower.

From both perspectives:

other clock ticking slower, so when brought back together, then, urh...?

Paradox? Something *observed*?

Contradiction! Unless

YOU  explain it to a child,

but without relying on your authority as an adult!

Observed:

one clock behind other,

e.g. *uni*lateral GPS correction:

time dilation due to orbital velocity of satellites:

clocks in satellites actually tick *faster* (7 µs/day).

Never observed:

both behind one another

(of course not).

Twin "paradox":

antisymmetrical asymmetry
in perfectly symmetrical scenario.

$$a < b \wedge b < a \Rightarrow \text{NOPE}$$

$$a \leq b \wedge b \leq a \Rightarrow a = b$$

Observed:

$$a < b \wedge b > a \Rightarrow \text{fine.}$$

Special Relativity:

perfectly symmetrical scenario:
both observers persistently agree
on mutual ***velocity***:

$$v_{BA} = v_{AB}$$

v_{BA} = *velocity* of B as seen by A,
v_{AB} = *velocity* of A as seen by B.

Disagree? Then

YOU  explain it to a child.

Special Relativity:

perfectly symmetrical scenario:
both observers persistently agree
on mutual ***distance***:

$$d_{BA} = d_{AB}$$

d_{BA} = *distance* to B as seen by A,
d_{AB} = *distance* to A as seen by B.

Disagree? Then

YOU  explain it to a child.

Elapsed since passage:

$$\Delta t_A = \frac{d_{BA}}{v_{BA}} \;\&\; \Delta t_B = \frac{d_{AB}}{v_{AB}}$$

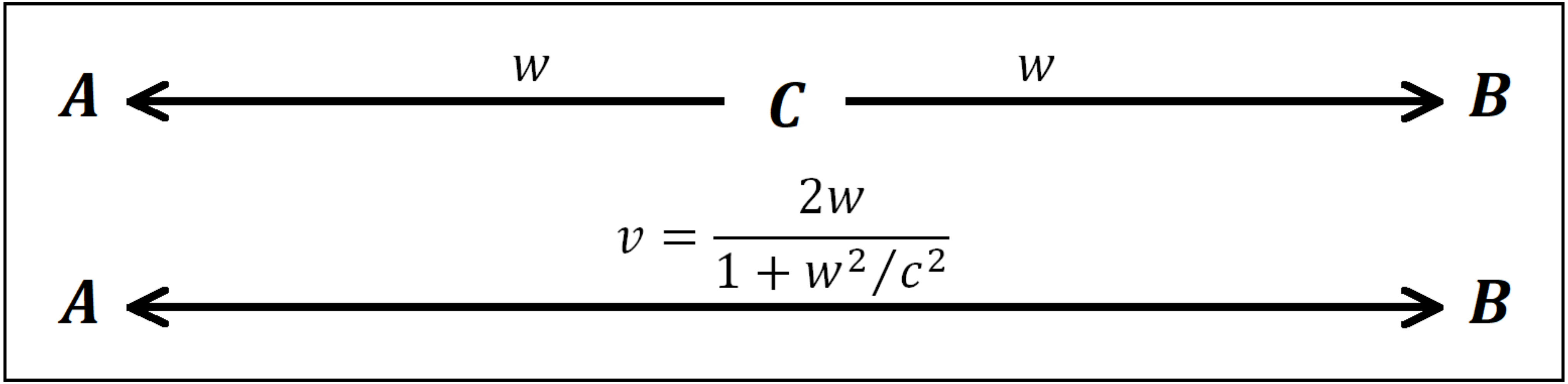
$$v_{BA} = v_{AB} \;\&\; d_{BA} = d_{AB}$$

$$\Rightarrow \Delta t_A \equiv \Delta t_B$$

Disagree? Then

YOU  explain it to a child.

One and same central clock C:



$$v = \frac{2w}{1 + w^2/c^2}$$

Both A and B read it,

both see identical redshift (slowdown)

by (relativistic) Doppler effect.

Puzzle:

will they, in this
perfectly symmetrical scenario,
perpetually read
exactly the very same value
on one and the very same clock?

If not, then

YOU  explain it to a child.

Only possible conclusion:

both measure exactly
same time since passage;

respective clock ticks
MUST *coincide* every time,

i.e. our clocks continually
tick at very same rate.

"Throwing" *periods of coherent light*
from identical light sources; each period = a clock tick.
A and *B* emit exactly same no. of periods;
A receives everything *B* emits;
B receives everything *A* emits;
A counts on *B*'s clock what *B* counts on *B*'s clock;
B counts on *A*'s clock what *A* counts on *A*'s clock.
⇒ ultimately: **both *A* and *B* count very same no. of ticks on both clocks.**

Disagree? Then

YOU  explain it to a child.

Proper local frame:

spans entire universe;

only reference points & directions determined locally;

YOU  are stuck in origin,

where all coordinates are zero.

NOW you started to read this very sentence and precisely ***NOW*** you're halfway through but you'll stop reading it right ***NOW***.

It's always

NOW.

Semper nunc.

On your own time line you're stuck in ***NOW***.

On your own time line
you're stuck in ***NOW***.

Already found:
stuck in proper origin,
where all coordinates are zero.

NOW **=** fixed to origin of proper frame.

NOW means: $\boldsymbol{t = 0}$;

$\boldsymbol{t = 0}$ means: ***NOW.***

ONLY

valid origin of proper frame:

HERE & *NOW*

Origin of spacetime!

The past cannot be *observed;*
only pondered *retro*spectively
(or *calculated*).

The future cannot be *observed;*
only pondered *pro*spectively
(or *calculated*).

George Berkeley (1685-1753):

Esse est percipi.

To be is to be perceived.

HR: ***exist*** ≔ being observable,

able to interact.

∴ the past does not *exist*;

the future does not *exist*;

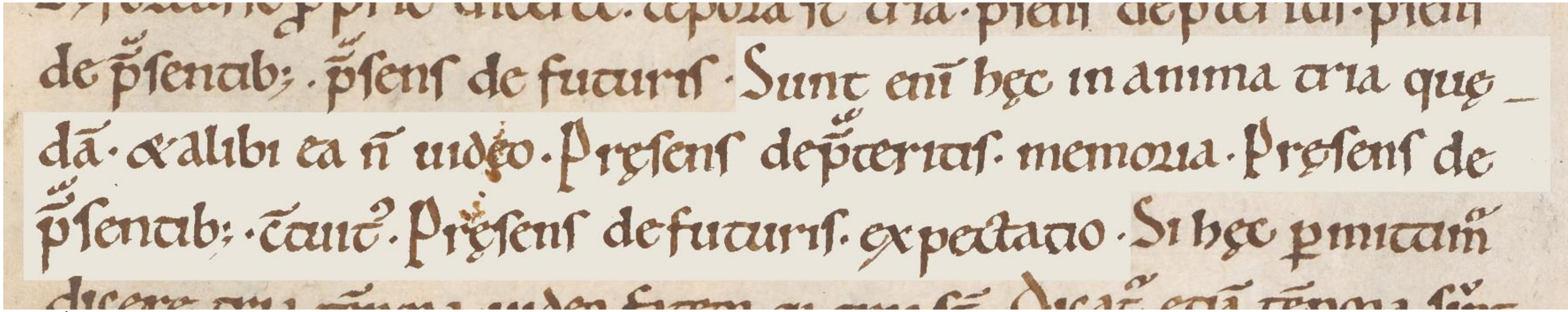
NOW = only point in time that *exists*

(we observe/experience it).

The only meaningful reference point in time is ***NOW.***

NOW is the only meaningful reference point in time.

It's stuck in the origin &
the only *exist*ing point in time.



11th century manuscript, http://www.bl.uk/manuscripts/Viewer.aspx?ref=harley_ms_3080_f096r

Sunt enim haec in anima tria quaedam et alibi ea non video. Praesens de praeteritis memoria. Praesens de praesentibus contuitus. Praesens de futuris expectatio.

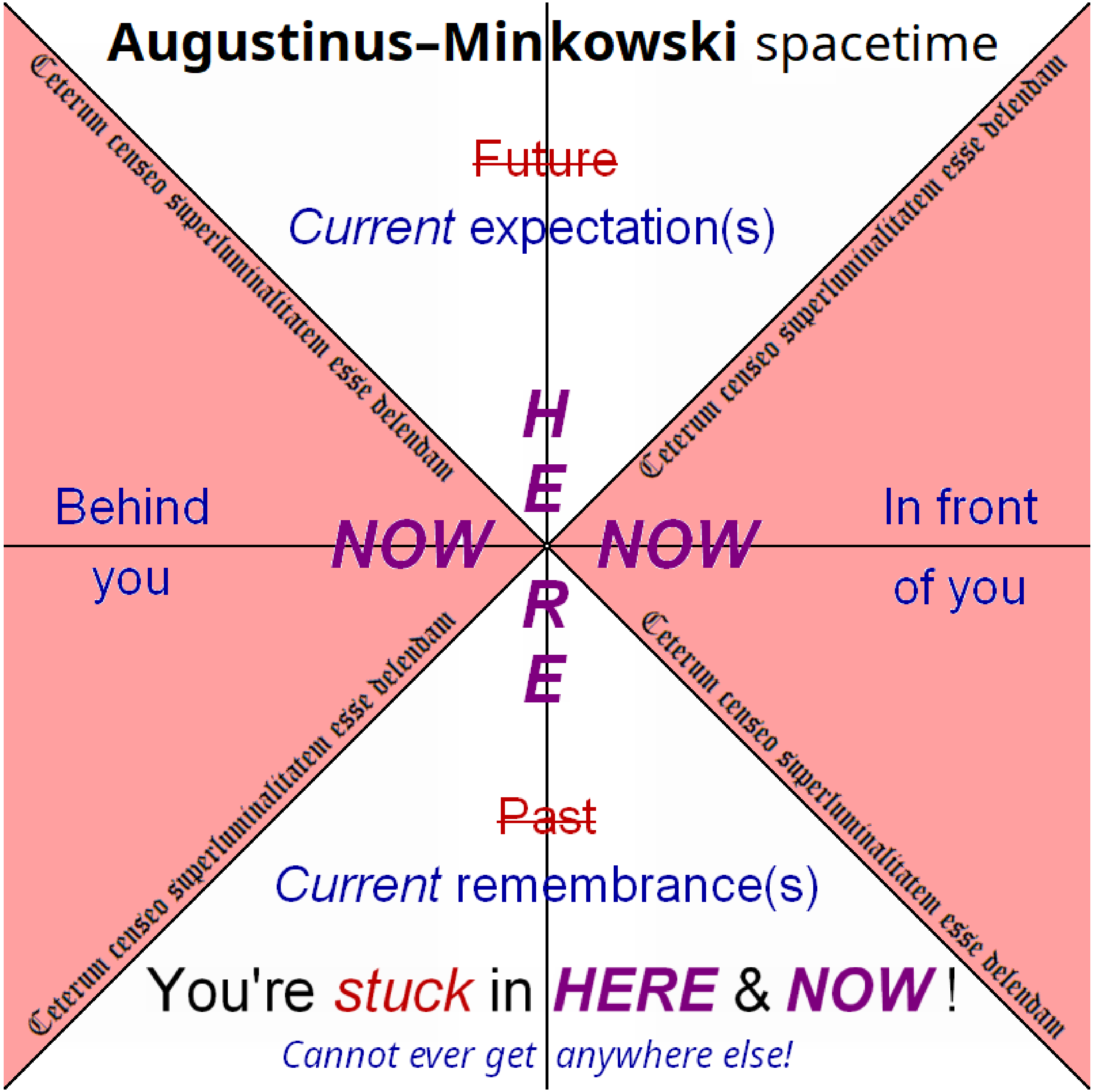
For there are three things in the soul and elsewhere I do not see them: current memory of the past, current perception of the present, current expectation of the future.

Aurelius Augustinus Hipponensis (CCCLIV – CDXXX)
Confessiones 11.20

<u>Upper white area:</u>
expected/future events
possibly caused by
NOW & ***HERE*** Event
(**NHE**);

<u>Pale red area:</u>
events having
NO causal connection
with **NHE**;
past events
cannot yet have
been observed;

<u>Lower white area:</u>
past events,
one of which
caused **NHE**.



~~2021~~ ~~2022~~ ~~2023~~

NOW is not **2024** past Christ; Christ was **2024** before ***NOW.***

By the way: right ***NOW***, we have $\boldsymbol{t = 0}$.

Itsy bitsy teeny weeny practical problem:
ALL (historical) documents
(like this very slideshow itself)
would require a yearly update...

A single event
(e.g. a flash of light)
can only be observed as it takes place.

Disagree? Then

YOU  explain it to a child.

⇒ ***ALL*** observers say it occurs ***NOW***

(each in their own frame);

⇒ applies to ***ANY*** event;

⇒ ***NOW***s in all frames persistently *coincide*.

⇒ ***The*** time ***does*** exist[5]!

De tijd bestaat wel dégelijk!

---

[5] *Exist* in the meaning of being present in the universe.

Suppose

some muon lives for: $10\Delta t_{\mathrm{life}} = 22\ \mu s$;

is born at altitude of: $h = 65.6\ \mathrm{km}$;

and travels down at: $\gamma \approx 10 \Rightarrow \beta \approx 0.995$;

observation from *our* perspective

occurs ***NOW*** in *our* proper time;

genesis was $h/\beta c =$

220 μs ago in *our* proper time;

Definition: betection $:=$ being detected;

Betection from *its* perspective
occurs ***NOW*** in *its* proper time;

our observation & *its betection*
are one single event
$\Rightarrow$ both ***NOW***s *coincide*.

genesis was 22 µs ago in *its* proper time;
with $\gamma = 10$ *we* perceive that as 220 µs;
it perceives $h' = h/10$.

The muon's genesis occurring either 220 or 22 μs ago whilst it must have been a single event is a

paradox in retrospection

due to backward time stretching.

Agree on: observation/betection: ***NOW***;

disagree on: how long ago produced.

Similarly:

moving observer's last clock tick
deeper in stationary's past
than in moving one's past,

but *CURRENT* clock ticks
perpetually coincide;

& afterwards there is disagreement.

Both of us will say:

the other one's last clock tick

occurred longer ago than my own,

although I saw them coincide

when they took place.

THAT is the twin paradox;

only in retrospection.

Page 38: on completion of journey, both $\boldsymbol{A}$ and $\boldsymbol{B}$ counted ***same*** N ticks on both clocks.

Doppler factor: $\zeta = \sqrt{\frac{1+\beta}{1-\beta}}$ Lorentz factor: $\gamma = \frac{1}{\sqrt{1-\beta^2}}$

way out: $\nu_{\text{obs1}} = \frac{1}{\zeta} \cdot \nu_{\text{em}}\,,\quad \tfrac{1}{2}N = \tfrac{1}{2}\Delta t_{\text{em}}\nu_{\text{em}}$

$$\Delta t_{\text{obs1}} = \tfrac{1}{2}N/\nu_{\text{obs1}} = \tfrac{1}{2}\Delta t_{\text{em}}\frac{\nu_{\text{em}}}{\nu_{\text{obs1}}} = \tfrac{1}{2}\Delta t_{\text{em}} \cdot \zeta$$

way back: $\nu_{\text{obs2}} = \zeta \cdot \nu_{\text{em}}\,,\quad \tfrac{1}{2}N = \tfrac{1}{2}\Delta t_{\text{em}}\nu_{\text{em}}$

$$\Delta t_{\text{obs2}} = \tfrac{1}{2}N/\nu_{\text{obs2}} = \frac{1}{2}\Delta t_{\text{em}}\frac{\nu_{\text{em}}}{\nu_{\text{obs2}}} = \frac{1}{2}\Delta t_{\text{em}}/\zeta$$

together: $\Delta t_{\text{obs}} = \Delta t_{\text{obs1}} + \Delta t_{\text{obs2}} = \tfrac{1}{2}\Delta t_{\text{em}}\left(\zeta + \frac{1}{\zeta}\right)$

$$\zeta + \frac{1}{\zeta} = \sqrt{\frac{1+\beta}{1-\beta}} + \sqrt{\frac{1-\beta}{1+\beta}} = \sqrt{\frac{(1+\beta)^2}{(1-\beta)(1+\beta)}} + \sqrt{\frac{(1-\beta)^2}{(1+\beta)(1-\beta)}} = \frac{1+\beta}{\sqrt{1-\beta^2}} + \frac{1-\beta}{\sqrt{1-\beta^2}} = \frac{2}{\sqrt{1-\beta^2}} = 2\gamma$$

hence: $\Delta t_{\text{obs}} = \gamma\,\Delta t_{\text{em}}$

On completion of journey,
both ***A*** and ***B*** say it's ***NOW*** &
both counted[6] same no. of ticks on both clocks,

but for ***A***, ***B***'s trip took[6] longer, so *on average*,
A saw[6] ***B***'s clock tick slower; it apparently started[6] earlier

and for ***B***, ***A***'s trip took[6] longer, so *on average*,
B saw[6] ***A***'s clock tick slower; it apparently started[6] earlier.

On completion of journey:
agreement on *NOW* as well as on clock readings
but disagreement on how long ago the other one departed.

THAT is the twin paradox;
NOT ***NOW*** BUT IN RETROSPECTION.

6: please note it's in the *past* tense!

Both twins *retro*spectively
perceive sibling to have been born
longer ago, but not earlier (sic)
and then have lived slower,
so ***NOW*** (i.e. at any moment of observation)
they are of the **same age**.

When a time span starts we call it: ***NOW***;
when a time span ends we call it: ***NOW***.

Time dilation: once time span elapsed,
observers in relative motion
retrospectively disagree on when it started.

But their mutual ***NOW***s *coincided*
at ***both*** start & end of interval.

THAT is the twin paradox.

Moving observer's *last* clock tick
deeper in stationary's past
than in moving one's past.

Moving observer's *next* clock tick
further in stationary's future
than in moving one's future.

Moving observer's past events
recede faster into stationary's history
than into moving one's own history.

Moving observer's forthcoming events
approach faster from stationary's future
than from moving one's own future.

Moving PAST time spans (ending ***NOW***)
become stretched AFTER observation,
⇒ clock *retro*spectively ticked slower,
cf. redshift.

Moving FUTURE time spans (starting ***NOW***)
undergo *contraction* BEFORE observation,
⇒ clock *pro*spectively ticks **faster**,
cf. blueshift.

Yes,

approaching from further in future means

clock *pro*spectively ticks **faster**:

NOW I think your next tick

will be in say 1½ second,

but once it occurs, it will

coincide with my own next tick,

so it'll ultimately have taken just 1 second.

Moving clock:

*retro*spectively slower
& *pro*spectively faster,

but *current* clock ticks
coincide right ***NOW***.

It's always ***NOW*** ⇒ ***all*** clock ticks
in ***all*** frames persistently ***coincide***.

The time ***does*** exist!

An expected moment in the future
is not a(n existing) point in time at all.

A remembered moment in the past
is not a(n existing) point in time at all.

Only ***NOW*** is
a(n existing) point in time
(we observe/experience it)
and it coincides for ALL observers.

Relativity of simultaneity:

894 *A. Einstein.*

(...) Die beiden Uhren laufen definitionsgemäß synchron, wenn

By definition, both clocks run synchronously if

$$t_B - t_A = t'_A - t_B.$$

896 *A. Einstein.*

(...) *Considering the constancy of the speed of light,* Unter Berücksichtigung des Prinzipes von der Konstanz der Lichtgeschwindigkeit finden wir:

we find:

$$t_B - t_A = \frac{r_{AB}}{V - v}$$

Zur Elektrodynamik bewegter Körper. 897

und

$$t'_A - t_B = \frac{r_{AB}}{V + v},$$

Relativity of simultaneity:

wobei r_{AB} die Länge des bewegten Stabes — im ruhenden System gemessen — bedeutet. Mit dem bewegten Stabe bewegte Beobachter würden also die beiden Uhren nicht synchron gehend finden, während im ruhenden System befindliche Beobachter die Uhren als synchron laufend erklären würden.

where rAB is the moving rod's length in the stationary system. Comoving observers would see the clocks running asynchronously, whilst stationary ones would declare them synchronous.

906 *A. Einstein.*

(...) Es folgt ferner, daß die Lichtgeschwindigkeit V durch Zusammensetzung mit einer „Unterlichtgeschwindigkeit“ nicht geändert werden kann. Man erhält für diesen Fall:

It further follows,that the speed of light V cannot be changed by combining it with a subluminal velocity. In this case, one obtains:

$$U = \frac{V + w}{1 + \frac{w}{V}} = V.$$

Relativity of simultaneity:

Taking the constancy of the speed of light into account Unter Berücksichtigung des Prinzipes von der Konstanz der Lichtgeschwindigkeit finden wir:

$$t_B - t_A = \frac{r_{AB}}{V - v}$$

He does NOT take it into account!

Zur Elektrodynamik bewegter Körper. 897

und

$$t'_A - t_B = \frac{r_{AB}}{V + v},$$

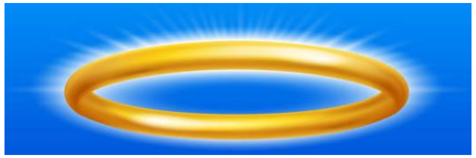
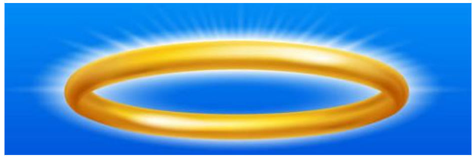
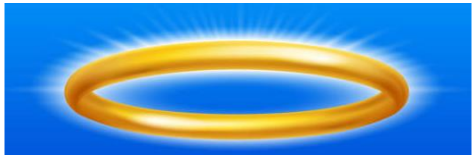
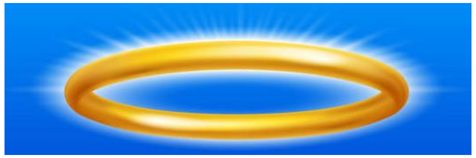
Once again he doesn't.

OOPS! What a terrible mistake!

$$V \pm v \Rightarrow V\,, \quad \textbf{hence:} \quad t_B - t_A = t'_A - t_B$$

Since then, everyone has haphazardly parroted him…

Autoritätsdusel…!

Albert Einstein

VOLL DANEBEN!

FALIEKANT DAARNEVEN!

***COMPLETELY MISSED* the point!**

What actually occurs:

on beforehand:

dis*agreement about when our clock ticks will be*;

when the ticks actually take place:

AGREEMENT *on both clocks ticking* ***NOW***

and showing the very ***same*** *time*;

afterwards:

dis*agreement on how long ago our clocks ticked,*

cf. retrospective disagreement about when the muon was born.

http://henk-reints.nl/u/HR-time-dilation-by-cars-animated.gif (right-click, new tab).

I buy something from a relativistically **travelling salesman.**

I pay him with my right hand at **very same moment** I take item with left hand, both my hands touching one another;

He gives item to me with right hand at **very same moment** he takes money with left hand, his hands touching each other;

"*Very same moment*" is in each one's proper frame.

We both feel all four hands are in physical contact, & to both of us, give and take are simultaneous actions.

Would it be a significant difference if his and my L & R hands are far apart (arms spread as wide as possible) **or close together** (touching one another) **?**

Don't tell me the simultaneity of give & take differs for him and me!

Both of us stretch both arms simultaneously in own frame!

Both *feel* both hands of the other at one single point in own time!

One single compound event

at **one single point** in both **my** and **his time** (***NOW***)

cannot **consist of non-simultaneous subevents**

(i.e. each hand's individual action).

Your current clock tick is one single event.
Both of us see it when it takes place and call it ***NOW***.

My current clock tick is one single event.
Both of us see it when it takes place and call it ***NOW***.

Both of us call it ***NOW*** when ***your*** tick occurs
& both of us call it ***NOW*** when ***my*** tick occurs,
hence: $NOW_{you} \equiv NOW_{me}$ applies to both ticks.

IF you see them simultaneously at NOW_{you} ,
then I must see them simultaneously at NOW_{me} .

IF I see them simultaneously at NOW_{me} ,
then you must see them simultaneously at NOW_{you} .

The same applies to *any* pair of events.

A single event can only be observed as it takes place & all say it occurs ***NOW***.

We observe 2 single events that are simultaneous to *me*:

NOW$_{me,1}$	=	***NOW***$_{me,2}$
=	⇑	=
Event 1	**IMPOSSIBLE!**	**Event 2**
=	⇓	=
NOW$_{you,1}$	≠	***NOW***$_{you,2}$

Same single events not simultaneous to *you*?

Euclid, common notions:

1: *things equal to the same thing are also equal to one another*;

4: *things which coincide with one another are equal to one another*.

If events are simultaneous to one observer, they are simultaneous to *all* observers.

(apart from differences in light travel time,
depending on their distances to both events).

As both simultaneous events occur, all agree about it, but in advance they disputed it & afterwards they disagree about how long ago the events took place.

Simultaneity of events
is frame independent
as the events take place.

Depending on each event's *velocity*
w.r.t. the observer, they undergo
different time dilation, yielding a bias
in how long ago each event occurred.

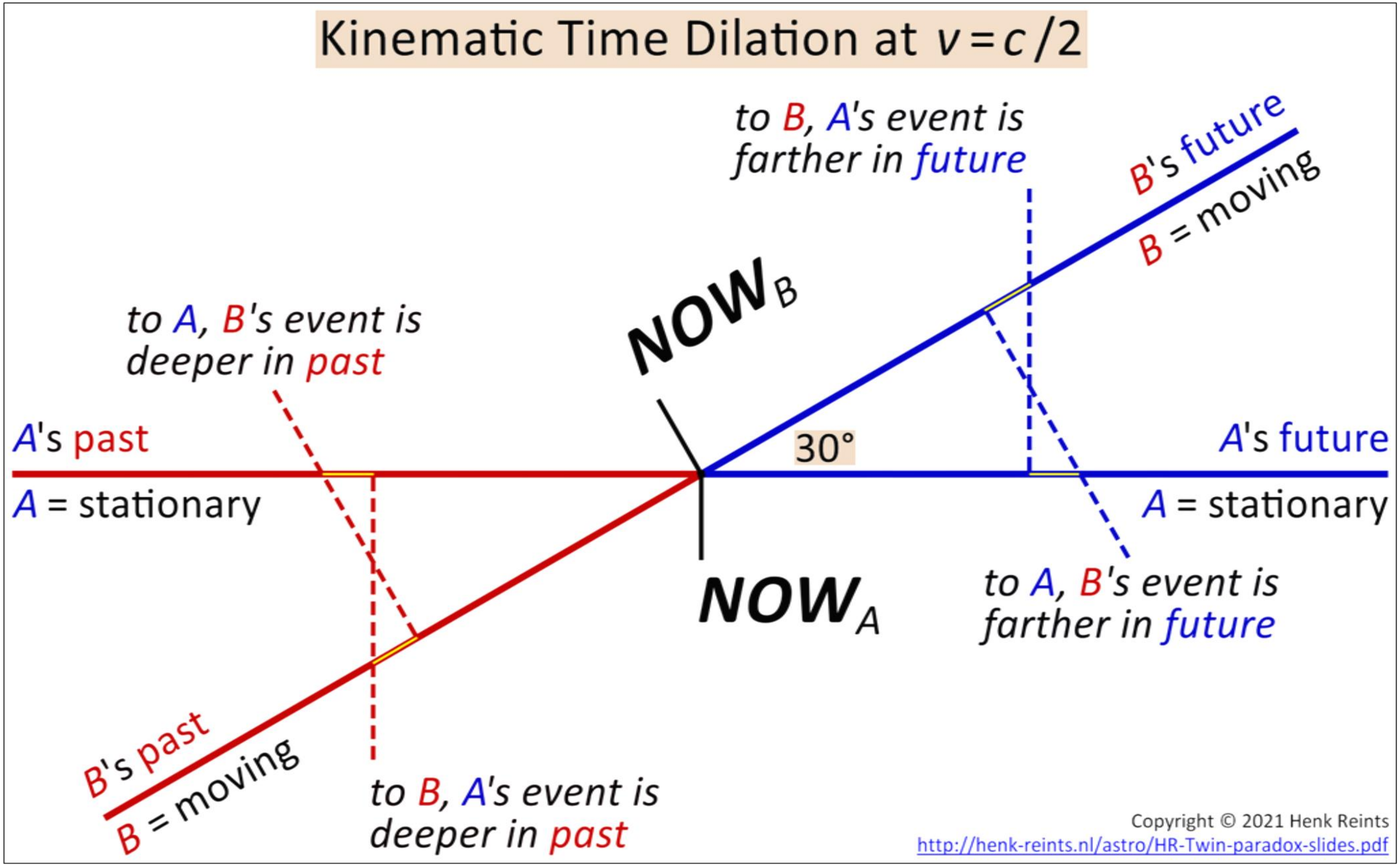
That is the twin paradox.

Both of us perceive future & past
from own perspective.

You see my events approach faster
from your future then you expected &
you see them retreat faster into your past.

I see your events approach faster
from my future then I expected &
I see them retreat faster into my past.

But our ***NOW***s perpetually coincide &
our clocks perpetually show the same time.


Kinematic Time Dilation at v = c / 2
to B, A's event is
farther in future
B's future
B = moving
NOW B
to A, B's event is
deeper in past
A's past
A = stationary
30°
A's future
A = stationary
NOW A
to A, B's event is
farther in future
B's past
B = moving
to B, A's event is
deeper in past
Copyright © 2021 Henk Reints
http://henk-reints.nl/astro/HR-Twin-paradox-slides.pdf

Predictions mutually **disagree;**

observations mutually **agree,**
but disagree with *predictions*, so
the latter are considered a mistake;

postdictions mutually **disagree,**
as well as with *observations*,
thus yielding a **paradox**.

I see your next clock ticks approach *faster* from *further* future than mine.

Your clock tick you call ***NOW*** always coincides with my clock tick I call ***NOW***.

I see your past clock ticks disappear *faster* into *deeper* history than mine.

& vice versa (regarding you & me).

http://henk-reints.nl/u/HR-time-dilation-by-cars-animated.gif (right-click, new tab).

Time span

from somewhere in future

until somewhere in past

(in two days, *tomorrow* will be *yesterday*, so the future precedes the past)

is ~~dilated~~ stretched

and ≠ *elapsed* time!

The latter = no. of clock ticks actually counted on both clocks.

In your own time (P&F), your own events are nearer by than passerby's events that actually take place simultaneously with yours.

You think your own events are the most important? Bloody egoist…

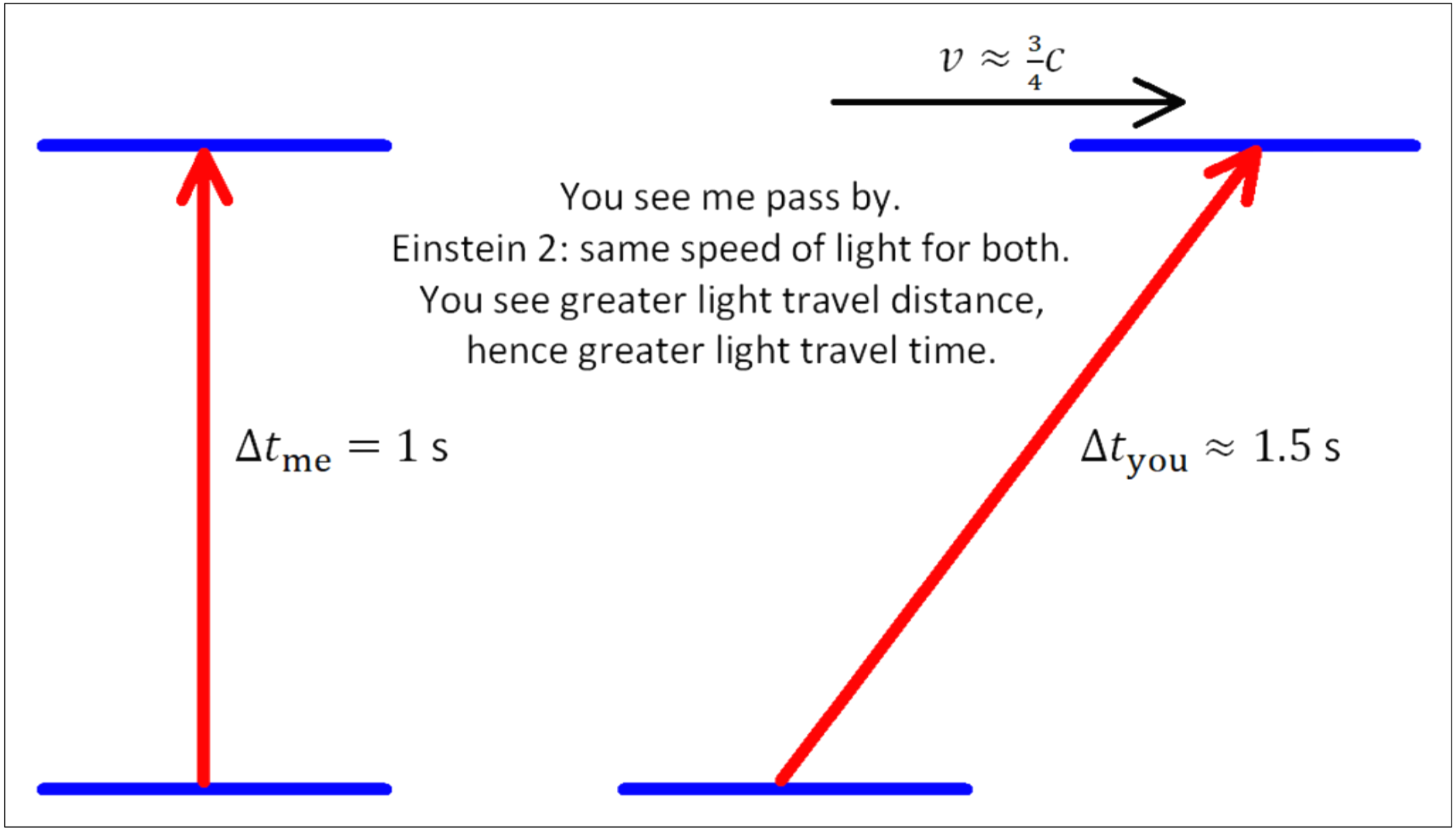
Time dilation as far as *observed* phenomena are concerned:

Time stretching is *retrospective,* i.e. from ***NOW*** backwards in time towards a past event. This applies to any passerby's time span ending ***NOW***. Your and hir ***NOW*** perpetually coincide.

It renders a paradox that pretends retrospective asynchronicity of events that actually took place simultaneously.

Time dilation (stretching)
is w.r.t. ***NOW***,
both towards past & future.
Hir bygone events are
deeper in your than in hir past
& hir upcoming events are
further in your than in hir future.
As an event actually takes place,
both say it occurs ***NOW***.

Photon travels perpendicular distance of 1 light second at *universal speed of light*:



Departure of light = single event, so we agree it occurs ***NOW***.

Me: ***it'll take* 1 s**;   **you:** ***it'll take* 1.5 s.**

You expect arrival further in future.

We prospectively disagree on expected arrival.

Arrival of light = single event, so we agree it occurs ***NOW***.

Me: ***it took* 1 s, *like I said***;   **you:** ***it took* 1.5 s, *like I said*.**

You remember departure deeper in past.

We retrospectively disagree on remembered departure.

Discrepancy between expectation and observation;

Discrepancy between observation and remembrance.

But when a departure or arrival event takes place,

we both agree it occurs ***NOW***.

Passerby's last clock tick appears longer ago than own last tick[7], yielding more time per tick, so in the *past*, the other clock apparently ticked *slower*.

In the *past*, the other *time* seems *slower*.

*Our current clock ticks coincide right **NOW**.*

Passerby's next clock tick will arrive earlier than expected, yielding less time per tick, so in the *future*, the other clock apparently ticks *faster*.

In the *future*, the other *time* seems *faster*.

[7] Although they took place simultaneously. *That* is the twin paradox.

Facts:

time stretching actually measured;

(GPS orbital velocity → 7 μs/day, walking speed → 3 ^{133}Cs ticks per year)

observed clock ticks *don't* coincide;

clocks deviate *asymmetrically*;

New paradox:

observed asymmetry

in perfectly symmetrical

Special Relativistic scenario?

General Relativity:

ASYMMETRY:

A is inert, *NO* force is exerted;

B accelerates, a force *IS* exerted.

No matter if the source of the force is Mr. Morse's Norsk horse that's of course off course, eating gorse in the courts of coarse lords who divorced without remorse on the Azores, or a lift or rocket engine that exhorts with roars in chords of fourths; and who ignores we can endorse gravitation in all sorts of astronomical ports?

Gravitational time dilation/stretching:

in *A*'s frame, *B*'s acceleration lasts longer than in *B*'s frame.

During B's acceleration,

A's time advances more,

B's time advances less;

result:

BIAS in their ***NOW***s:

$$\Delta t_{NOW} = t_A - t_B = \Delta t_A (1 - \gamma^{-1}) = \Delta t_B (\gamma - 1)$$

depends only on

duration of *acceleration* & resulting *velocity*.

Gravitational time dilation:

$$\Delta t_{\text{dist}} = \Delta t_{\text{grav}}/\sqrt{1 - 2GM/rc^2}$$

Equivalence Principle ≡ conservation of energy:

$$\sqrt{1 - 2GM/rc^2} = \sqrt{1 - v^2/c^2}$$

$$GMm/r = \tfrac{1}{2}mv^2$$

Accelerational time dilation:

$$\Delta t_{\text{inert}} = \Delta t_{\text{accel}}/\sqrt{1 - v^2/c^2} \therefore \Delta t_{\text{accel}} = \Delta t_{\text{inert}}/\gamma$$

BIAS in the ***NOW***s:

$$\Delta t_{NOW} = \Delta t_{\text{inert}} - \Delta t_{\text{accel}} = \Delta t_{\text{inert}}(1 - 1/\gamma) = \Delta t_{\text{accel}}(\gamma - 1)$$

BIAS in ***NOW***s

is not the best name, since our ***NOW***s perpetually coincide;
when observing a single event, we both say it occurs ***NOW***;
it actually is the acquired *age difference*,

persists

after end of acceleration;

if ***BIAS*** $\neq 0$

(no matter how infinitesimally small as long as it is nonzero)

then:

Kinematic time dilation has become ***asymmetrical***:

B shifted into A's past;	A shifted into B's future;
⇒ A *retrospectively* observes B;	⇒ B *prospectively* observes A;
⇒ A sees B's heart beat **slower**.	⇒ B sees A's heart beat **faster**.

Clock that underwent acceleration persistently ticks γ times slower than clock that remained inert.

Both experience proper time as normal.

http://3.bp.blogspot.com/-AfjVnR_AIv8/VRkGyJb1gxI/AAAAAAAABvI/OymtWdcZ0BI/s1600/Bingo.jpg

https://www.fundcalibre.com/wp-content/uploads/2019/07/AdobeStock_85284311.jpeg

After B's acceleration ended (engine turned off):

Asymmetric kinematic time dilation:

A sees B's clock tick slower (by γ);

B sees A's clock tick faster (by γ).

Just how it is indeed observed (GPS!).

https://www.spacecentre.nz/resources/faq/spaceflight/how-long-to-reach-space.html:

Space shuttle reached orbit in: 8½ minutes (Soyuz = similar);

orbital velocity: 27600 km/h:

$$\Delta t_{NOW} = (8\tfrac{1}{2}\ \text{min})(1 - \gamma^{-1}) \approx 0.17\ \mu\text{s}.$$

This nonzero ***BIAS*** in the ***NOW***s

is barely part of final age difference,

but causes kinematic time dilation

to be asymmetrical during inert

orbital motion for half a year in ISS:

$$\Delta age = (180\ \text{days})(1 - \gamma^{-1}) \approx 5\ \text{ms}.$$

The clock that underwent the greatest acceleration (i.e. on which **greatest *force* was exerted**) runs slower than the other one.

Acceleration using Special Relativity (violating E's original 1st postulate):

<u>I am stationary/inert:</u>

your kinetics in ***my*** frame:

$$s\ ,\ \ t\ ,\ \ v = \frac{ds}{dt},\ \ a = \frac{d^2 s}{dt^2}$$

<u>*YOU* accelerate:</u>

your kinetics in ***your*** frame:

$$s'\ ,\ \ t'\ ,\ \ v' = \frac{ds'}{dt'},\ \ a' = \frac{d^2 s'}{dt'^2}$$

symmetry premise: $v = \frac{ds}{dt} = v' = \frac{ds'}{dt'}$ ∴ same mutual β & γ for both

time stretching: $dt = \gamma dt'$

length contraction: $ds = \gamma^{-1} ds'$

velocity change: $dv = d\frac{ds}{dt} = d\frac{\gamma^{-1}ds'}{\gamma dt'} = \gamma^{-2} dv'$

we perpetually agree on mutual velocity, but not on its change... (different time spans!)

(relativistic velocity addition: $v + \Delta v = \frac{v+\Delta v'}{1+v\Delta v'/c^2}$ where $\Delta v' \to dv' \approx 0$ yields very same)

acceleration: $a = \frac{dv}{dt} = \frac{\gamma^{-2}dv'}{\gamma dt'} = \gamma^{-3} a'$

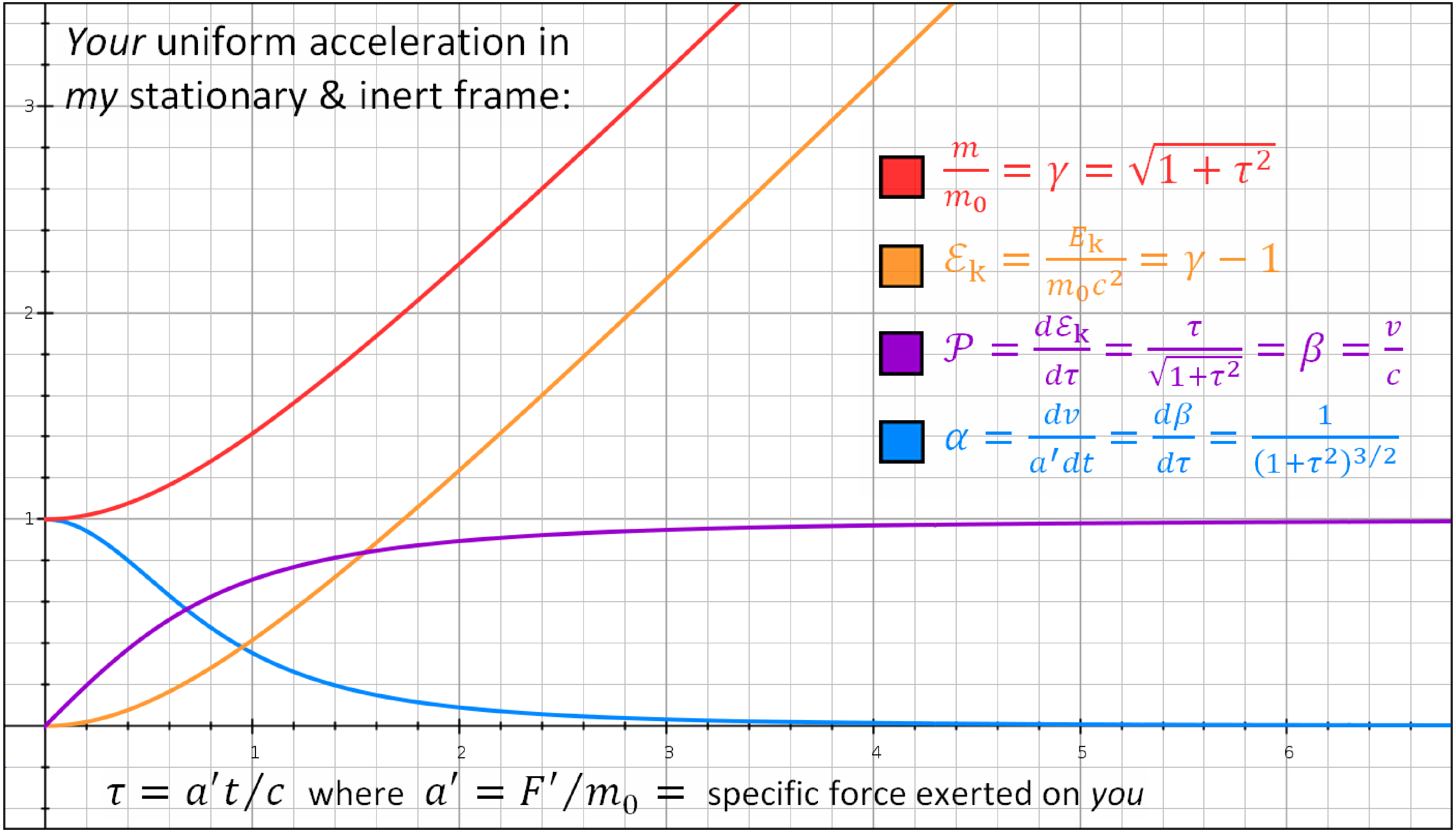
yielding: $(1-\beta^2)^{-3/2} dv = a' dt$

i.e.: $(a'/c)dt = (1-\beta^2)^{-3/2} d\beta$

integration yields: $\boldsymbol{\tau} \coloneqq \boldsymbol{a' t/c} = \beta/\sqrt{1-\beta^2}$

please don't see a' as a kinematic quantity but as the (constant) *specific force* you feel

which renders: $\boldsymbol{\beta = \tau/\sqrt{1+\tau^2}}$ ∴ $\boldsymbol{\gamma = \sqrt{1+\tau^2}}$



Series of: $\mathcal{E}_\mathrm{k} = \sqrt{1+\tau^2} - 1$:

Taylor $@\tau = 0$: $\boldsymbol{\frac{\tau^2}{2}} - \frac{\tau^4}{8} + \frac{\tau^6}{16} + \mathcal{O}(\tau^8)$ (cf. $\frac{1}{2} m v^2 \propto t^2$)

Laurent $@\tau = \infty$: $\boldsymbol{\tau - 1} + \frac{1}{2\tau} - \frac{1}{8\tau^3} + \frac{1}{16\tau^5} + \mathcal{O}\left(\frac{1}{\tau^7}\right)$

$$(P = Fv) \Rightarrow (\mathcal{P} = \mathcal{F}\beta) \text{ (dim.less).}$$

Just found: $\mathcal{P} = \beta$, yielding: $\boldsymbol{\mathcal{F} = 1}$

Using: $\mu := \frac{m}{m_0}$, we can write N's 2nd law (dim.less) as:

$$\mathcal{F} = \mu\alpha = \frac{\sqrt{1+\tau^2}}{(1+\tau^2)^{3/2}} = \frac{1}{1+\tau^2} = \frac{1}{\gamma^2} \Rightarrow \lim_{\tau\to\infty} \boldsymbol{\mathcal{F} = 0}$$

To avoid this 0, we could have defined: $\mathcal{F} := \gamma^2\mu\alpha$

and we obviously have: $\mu = \gamma$, hence: $\mathcal{F} = \gamma^3\alpha$

Just derived (@p.100): $a = \gamma^{-3}a'$ ☺

When defining: $F := ma'$ *as perceived by moving obs.*

the latter renders: $\boldsymbol{F = \gamma^3 ma}$ *as observed by stationary obs.*

so indeed: $\mathcal{F} = \gamma^3\alpha$ without using $\mu = \gamma$ (*was not yet*

hence: $\mu = \gamma$ *derived from anything, but now it is*).

Zur Elektrodynamik bewegter Körper. 919

des bewegten Elektrons. Wir schreiben die Gleichungen (A) in der Form

$$\mu \beta^3 \frac{d^2 x}{d t^2} = \varepsilon X = \varepsilon X',$$

(...)

und bemerken zunächst, daß $\varepsilon X'$, $\varepsilon Y'$, $\varepsilon Z'$ die Komponenten der auf das Elektron wirkenden ponderomotorischen Kraft sind,

(*He used μ for the mass and β for the Lorentz factor*).

It renders: $F = \gamma^3 ma = m\gamma^3 \frac{d^2x}{dt^2} = m\gamma^3 \frac{dv}{dt}$

which is the same as what we just found.

Kinetic energy:

$$E_k(x) = \int_0^x F dx' = \int_0^x m\gamma^3 \frac{d^2x'}{dt^2} dx' = m \int \gamma^3 \frac{dv}{dt} dx$$

$$v = \frac{dx}{dt} \;\Rightarrow\; dx = vdt$$

$$E_k(t) = m \int_0^t \gamma^3 \frac{dv'}{dt'} v' dt' \;\Rightarrow\; E_k(v) = m \int_0^v \gamma^3 v' dv'$$

$$v = c\beta \;\Rightarrow\; E_k(\beta) = m \int_0^\beta \gamma^3 c\beta' \cdot c d\beta' = mc^2 \int_0^\beta \gamma^3 \beta' d\beta'$$

$$[u \coloneqq \beta'] \;\Rightarrow\; \frac{E_k(\beta)}{mc^2} = \int_0^\beta (1-u^2)^{-3/2} u du = \left.\frac{1}{\sqrt{1-u^2}}\right]_0^\beta$$

$$\frac{E_k(\beta)}{mc^2} = \frac{1}{\sqrt{1-\beta^2}} - \frac{1}{\sqrt{1-0^2}} = \gamma - 1$$

$$E_k(\gamma) = mc^2(\gamma - 1)$$

$$E_{\mathrm{k}}(\gamma) = mc^2(\gamma - 1)$$

920 *A. Einstein.*

(...)

$$W = \int \varepsilon X \, dx = \int_0^v \beta^3 v \, dv = \mu V^2 \left\{ \frac{1}{\sqrt{1 - \left(\frac{v}{V}\right)^2}} - 1 \right\}.$$

W wird also für $v = V$ unendlich groß. Überlichtgeschwindigkeiten haben — wie bei unseren früheren Resultaten — keine Existenzmöglichkeit.

Oops... he omitted μ after the second equals sign: $\boldsymbol{\mu} \int_0^v \beta^3 v dv$

To *you*, your environment will eventually not further speed up (ceterum censeo superluminalitatem esse delendam), whilst you should keep experiencing the force, since your engine keeps running. It will more and more behave like pure gravitation.

If *you* are the only one undergoing a force, your acceleration is with respect to everything else in the entire cosmos, including very fast distant galaxies. Relativistic velocity addition will eventually yield nearly the same speed ($\sim c$) with respect to each and every object, hence your velocity gradually becomes absolute, relative to *all* inert bodies in the universe.

The entire cosmos will ultimately become Lorentz contracted to Sweet Fanny Adams & you'll smack against the "edge of the universe" at or extremely close to the very speed of light.

Hasta la vista, baby, you'll not be back...

From: $\Delta t_{NOW} = t(1 - 1/\gamma)$ we obtain: $\Delta\tau_{NOW} = \tau - \tau/\gamma$

so your proper time: $\tau' = \tau - \Delta\tau_{NOW} = \tau/\gamma = \tau/\sqrt{1+\tau^2} = \beta$

Now your engine makes you accelerate at $a' = g$ as if you're on Earth.

Then: $\beta = \frac{gt}{c} / \sqrt{1 + \left(\frac{gt}{c}\right)^2} = \frac{gt}{\sqrt{c^2+g^2t^2}}$ and: $\gamma = \sqrt{1 + \frac{g^2t^2}{c^2}} = \sqrt{\frac{c^2+g^2t^2}{c^2}}$

hence: $\Delta t_{NOW} = t(1 - 1/\gamma) = t - \frac{ct}{\sqrt{c^2+g^2t^2}} = t - \frac{c}{g} \cdot \sqrt{\frac{(gt)^2}{(gt)^2+c^2}}$

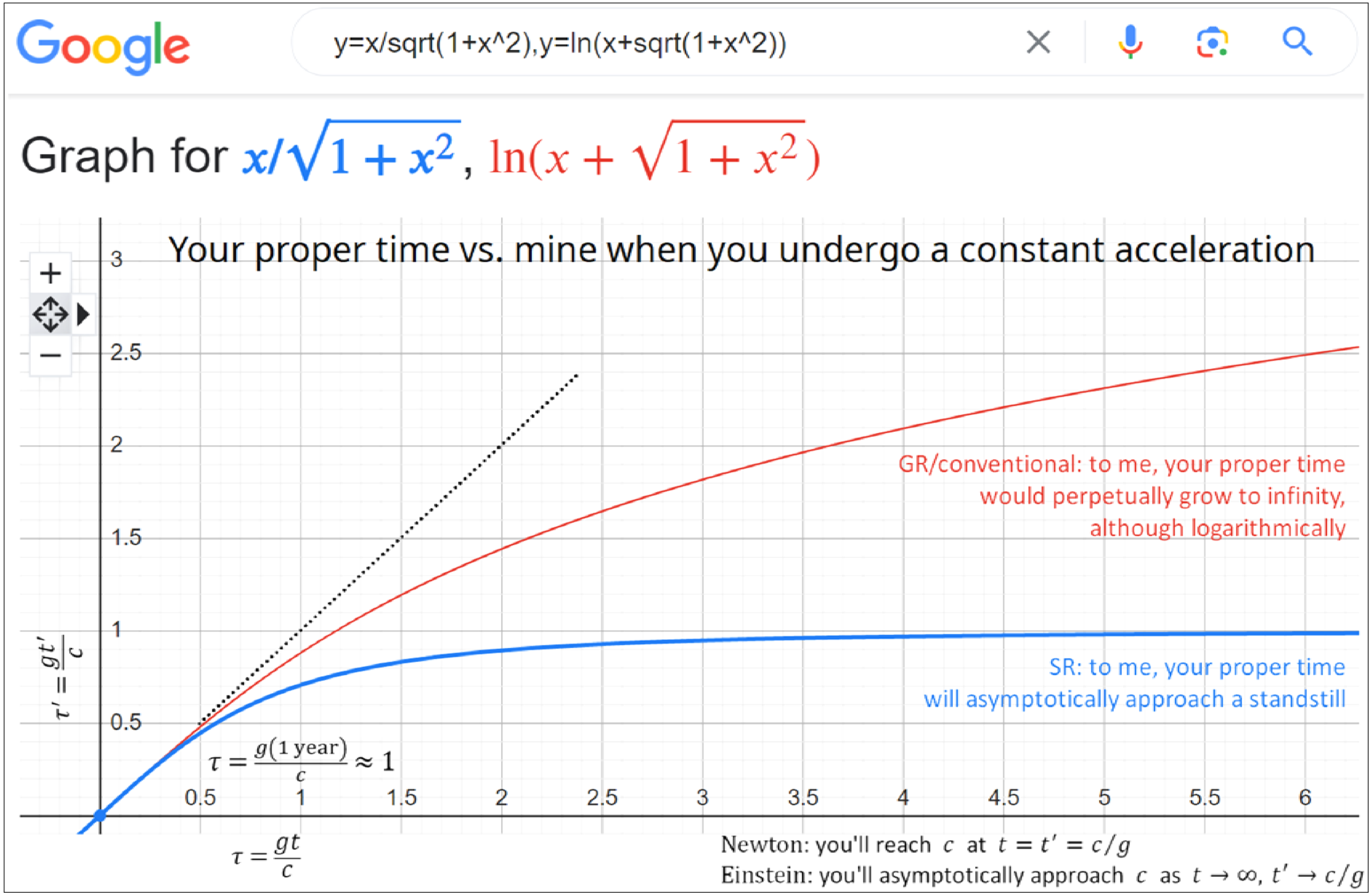
Long duration: $t \to \infty \Rightarrow \Delta t_{NOW} \approx t - \frac{c}{g}$ your pr. time

Subtracting Δt_{NOW} from *my* proper aging t yields *your* proper aging $t' = t - \Delta t_{NOW} \approx c/g \approx$ 30 570 323 s ≈ 353d19:45:23 (≈ 1 lunar year, i.e. 12 moons, *how nice!*) after a (very) long (in *my* proper time) acceleration.

Conventional calculation: $t(t') = \frac{c}{g}\sinh\left(\frac{g}{c}t'\right) \quad \therefore \quad t' = \frac{c}{g}\operatorname{arsinh}\left(\frac{g}{c}t\right)$

yields: $\Delta t_{NOW} = t - t' \approx t - \frac{c}{g}\ln\left(\frac{gt}{c} + \sqrt{\frac{(gt)^2+c^2}{c^2}}\right)$

Long duration: $t \to \infty \Rightarrow \Delta t_{NOW} \approx t - \frac{c}{g}\ln\frac{2gt}{c}$ **?**factor $\ln\frac{2gt}{c}$**?**



Standstill of *your* proper time: time necessary for remaining distance approaches nought as $v \to c$, cf. light not experiencing any time interval.
Blue curve is identical to mutual velocity $\beta < 1$ as function of *my* proper time.

Uniform acceleration
in classical mechanics: $v = at$

dimensionless: $\beta = \tau$

To you, your environment
would become SUPERLUMINAL if: $\tau' > 1$

Can conventional equation: $t(t') = \frac{c}{g}\sinh\left(\frac{g}{c}t'\right)$

or: $t'(t) = \frac{c}{g}\operatorname{arsinh}\left(\frac{g}{c}t\right)$

be correct?

It's always ***NOW***, so both t & t' are
lookback times to begin of acceleration!

Above graph does not show progress of time,
but lookback from NOW to start of acceleration!

SHOULD have used *delta* notation:

$$\Delta t' = \frac{c}{g}\operatorname{arsinh}\left(\frac{g}{c}\Delta t\right) \quad \text{or:} \quad \Delta\tau' = \operatorname{arsinh}(\Delta\tau)$$

YOU$_0$ $:=$ your prior self,
when acceleration was still zero.
Acceleration renders a mutual velocity
between ***YOU***$_{NOW}$ & ***YOU***$_0$, hence ***time dilation***!

Looking back in time from ***NOW*** to when acceleration started:

Your* proper aging** (**E.G.** accel. started 0.97 years ago): $\Delta\tau'_{\text{prop}} = \Delta\tau/\sqrt{1+\Delta\tau^2} \nearrow 1$ sum of all of your proper clock tick durations that ***NOW are in the past;

built up en route (acceleration started 2.1 years ago): $\Delta\tau'_{\text{trav}} = \int_0^{\Delta\tau} \frac{d\tau^*}{\gamma(\tau^*)} = \int_0^{\Delta\tau} \frac{d\tau^*}{\sqrt{1+(\tau^*)^2}} = \text{arsinh}(\Delta\tau) \to \infty$ my ticks ***gradually*** shortened to you; nobody's proper aging; ***senseless*** *quantity*?

My* proper aging** (your accel. started 4.0 years ago): $\Delta\tau = \gamma_{NOW}\Delta\tau'_{\text{prop}} \to \infty$ all of your ticks ***NOW it's stretched by γ_{NOW}; = *my* & ***YOU₀***'s proper aging.

Arsinh not measured at single point in time, nor at single point in space!

But ***NOW*** we ***retrospectively*** disagree on when your acceleration started.

Your proper age has grown by 1 year & I may have aged to near infinity.

You won't need more time since $v \to c$, cf. light not experiencing time.

In spite of our (large) age difference, our ***NOW***s still coincide!

When observing a single event, we both say it occurs ***NOW***.

Your travelled distance as perceived by *me*:

with: $v = \frac{cgt}{\sqrt{c^2+g^2t^2}}$

we get: $s(\Delta t) = \int_0^{\Delta t} v dt = \int_0^{\Delta t} \frac{cgt}{\sqrt{c^2+g^2t^2}} dt = \frac{c}{g}\sqrt{c^2+g^2t^2}\Big]_0^{\Delta t}$

$= \frac{c}{g}\left(\sqrt{c^2+g^2\Delta t^2} - c\right)$

hence: $\boldsymbol{s(t) = \frac{c^2}{g}\left(\sqrt{1+\left(\frac{gt}{c}\right)^2} - 1\right)}$

$c^2/g \approx 0.97$ ly;
so at g, you travelled ~1 ly
after $\sqrt{3}$ years (in my frame).
($\tau = \sqrt{3} \to \beta = \sqrt{3}/2 \to \gamma = 2$)

Conventional[8]: $s(t') = \frac{c^2}{g}\left(\cosh\frac{gt'}{c} - 1\right)$ (integrated over journey so far)

which equals: $s(t) = \frac{c^2}{g}\left(\cosh\left(\operatorname{arsinh}\frac{gt}{c}\right) - 1\right)$ $(t' = \frac{c}{g}\operatorname{arsinh}\frac{gt}{c})$

therefore: $\boldsymbol{s(t) = \frac{c^2}{g}\left(\sqrt{1+\left(\frac{gt}{c}\right)^2} - 1\right)}$ ☺ 👍

Seen by you: $s'_{NOW} = s_{NOW} / \gamma_{NOW}$ (at 1 single point in time)

you approach $v = c$, so entire universe Lorentz contracted to practically zero!

8 https://en.wikipedia.org/wiki/Space_travel_under_constant_acceleration

WHO invented

to mix frames and express
my stationary observations in the
observed moving body's *proper time*?

Is that because it's mathematically simpler?
Wrong target!

It ***should*** be about
physical comprehensibility!

A spatial measurement must be done
at a single point in time
&
a temporal measurement must be done
at a single point in space.

The *senseless* **sinh** and **cosh**
resulting from integration
should be abandoned.

Resubstituting: $g = a'$

yields: $s(t) = \frac{c^2}{a'}\left(\sqrt{1 + \left(\frac{a't}{c}\right)^2} - 1\right)$

With a' in the denominator,
it ***MUST*** be that: $\boldsymbol{a' \neq 0}$ (note: we started at $v_0 = 0$)

Modus Tollens would yield: $(a' = 0) \rightarrow (v_0 \neq 0)$.

Might it be a universal truth
that: zero velocity requires non-zero acceleration
and: **zero acceleration *requires* non-zero velocity**?

Isn't the latter exactly what the expanding universe is actually doing?

Please forget about *accelerated expansion* of the cosmos, which is falsified in http://henk-reints.nl/astro/HR-Geometry-of-universe-slideshow.pdf by **derivation from observed/measured values**, i.e. ***FACTS***.

Classical mechanics: $\Delta s = v_0 t + \frac{1}{2} a t^2$

$a \neq 0 \Rightarrow$ quadratic equation yielding t;

$a = 0 \land v_0 \neq 0 \Rightarrow$ linear equation yielding t;

$a = 0 \land v_0 = 0 \Rightarrow$ **time is indeterminate**.

Without anything changing, time would not "exist".

Might it be a universal truth

that: zero velocity requires non-zero acceleration

and: **zero acceleration *requires* non-zero velocity**?

Isn't the latter exactly what the expanding universe is actually doing?

Please forget about *accelerated expansion* of the cosmos, which is falsified in http://henk-reints.nl/astro/HR-Geometry-of-universe-slideshow.pdf by **derivation from observed/measured values**, i.e. ***FACTS***.

https://en.wikipedia.org/wiki/Space_travel_under_constant_acceleration#Ship_reference_frame:

TOTALLY WRONG: **QUOTE:** At a constant acceleration of 1 g, a rocket could travel the diameter of our galaxy in about 12 years ship time, and about 113,000 years planetary time. If the last half of the trip involves deceleration at 1 g, the trip would take about 24 years. **UNQUOTE.**

WikipediA refers to: **Baez**, UCR, "The Relativistic Rocket" (which gives 113242 ly in 12 years):
https://math.ucr.edu/home/baez/physics/Relativity/SR/Rocket/rocket.html

Inverse of: $\sigma \coloneqq gs/c^2 = \sqrt{1+\tau^2} - 1 = \mathcal{E}_\mathrm{k}$ (cf. $W = F.s$)

is: $\tau = \sqrt{\sigma}\sqrt{\sigma + 2}$

IF: $s = 113\,242$ ly $\approx 1.07 \times 10^{21}$ m

then: $\sigma \approx 116\,899.2$

hence: $\tau \approx 116\,899.7$

and: $\tau' = \tau/\sqrt{1+\tau^2} \approx 1 - 3.66 \times 10^{-11}$

yielding: $t = c\tau/g \approx 113\,243$ years (***my*** proper aging, matches Baez)

and: $t' = c\tau'/g \approx$ **354 days** (***your*** proper aging $\ll$ 12 years).

With a uniform acceleration of $1\,g$, ***ANY*** large **distance** can be travelled in **barely 1 year** of shiptime. After $t \approx 10$ years in my proper time, you will have reached $\beta \approx 0.995$ and hardly need any more time, cf. light not experiencing its proper time. If you travel far, I will age by about s/c .

Had you started accelerating at the big bang, you would by ***NOW*** have reached a *proper age of just 1 lunar year* during which you travelled:

$$s(t_{\mathrm{H}}) = \frac{c^2}{g}\left(\sqrt{1+\frac{g^2 t_{\mathrm{H}}^2}{c^2}} - 1\right) = \sqrt{\frac{c^4}{g^2} + D_{\mathrm{H}}^2} - \frac{c^2}{g}$$

with: $\frac{c^2}{g} \approx 0.07 D_{\mathrm{H}}$: $s \approx \sqrt{(0.07)^2 D_{\mathrm{H}}^2 + D_{\mathrm{H}}^2} - 0.07 D_{\mathrm{H}}$

$$s \approx \left(\sqrt{1.0049} - 0.07\right) D_{\mathrm{H}} \approx 0.93 D_{\mathrm{H}}$$

as measured by a stationary & inert observer

& barely 1 ly (you nearly fare at c) from your own persp. right ***NOW***.

Expanding universe: $D_{\mathrm{H}} = c t_{\mathrm{H}}$

hence: $$\boldsymbol{\sigma(t_{\mathrm{H}}) = \frac{s(t_{\mathrm{H}})}{D_{\mathrm{H}}}} = \frac{s(t_{\mathrm{H}})}{c t_{\mathrm{H}}} = \frac{c}{g}\sqrt{\frac{1}{t_{\mathrm{H}}^2} + \frac{g^2}{c^2}} - \frac{c}{g t_{\mathrm{H}}} = \boldsymbol{\sqrt{1 + \left(\frac{c}{g t_{\mathrm{H}}}\right)^2} - \frac{c}{g t_{\mathrm{H}}} < 1}$$

$$\lim_{t_{\mathrm{H}} \to \infty} \sigma(t_{\mathrm{H}}) = 1$$

THE flaw in the standard interpretation:

Time dilation also applies to time spans between consecutive clock ticks,
so for a stationary observer,
a fast moving clock ticks slower.

NO, IT DOESN'T!

It was Einstein himself who introduced this flawed interpretation:
http://henk-reints.nl/astro/EinsteinTwinParadox/Einstein-Twin-Paradox.html
(right-click & open in new tab).

Time span between *moving ticks*
is extended for stat. obs. because

next tick is further in future
(and approaching faster)

& last one is deeper in past
(retreating more quickly).

In stationary observer's time,
a fast moving clock's tick
comes from further in the future
and goes to deeper in the past.

This single tick passes this elongated
time span during stationary's normal
time, hence it "travels" faster!

Greater tick distance + greater tick velocity
$\Rightarrow$ identical tick rate & simultaneous ticks;
moving clock does *not* tick slower.

http://henk-reints.nl/u/HR-time-dilation-by-cars-animated.gif (right-click, new tab).

Passerby's time spans

are s t r e t c h e d

to stationary observer,

but do *NOT* last longer;

instead, they pass by faster.

Clock Hypothesis:

difference in clock rates would be
due to kinematic time dilation only
& not gravitational/accelerational.

Contradictio in terminis:
asymmetry not caused by only possible cause...

Not a *hypothesis*, but an ***assumption***, a ***concoction***, not deduced from any ascertained truth (cf. phlogiston),

hence **to be firmly rejected.**

*(**ALL** assumptions arise from nescience = not knowing, so they have nothing to do with science = knowledge).*

Virtual time span
between past & future
points in time

is not the same quantity
as *elapsed time span*!

VIRTUAL TIME SPAN:

START $\neq$ ***NOW*** and/or ***END*** $\neq$ ***NOW***;

***conceived* at 1 *single* point in time.**

Elapsed or ***MEASURED TIME SPAN***:

counted no. of successively recurring identical elementary events

between ***NOW_X*** and ***NOW_Y*** ;

***measured* between 2 *separate* points in time.**

Elementary = not further subdivisable.

How much time elapses between two consecutive elementary events?

Similarly:

Lorentz contra(*di*)ction:

passed length = measured time span × speed

≠

physical length = no. of (elem.) things it consists of;

e.g. street length expressed in no. of roadside posts
does not change, whatever the velocity.

What is the distance between two adjacent elementary things (i.e. without any subdivision)?

http://henk-reints.nl/astro/HR-Lorentzcontractie-slides.pdf (in Dutch)

Fitzgerald-Lorentz, urh,
relativistic length contraction:

A witch is passing you. Her broom has head and tail lights that flash when they pass your nose. You know her *velocity* and you measure the *elapsed time* between these flashes, i.e. how long the broom takes to pass your nose, yielding:

$$L_{\text{you}} = \Delta t_{\text{you}} \cdot v$$

(suffix indicates observer).

Starting & stopping YOUR clock are YOUR events.

She sees *you* moving, so YOUR time span is stretched for HER and she measures:

$$\Delta t_{\text{she}} = \Delta t_{\text{you}} \cdot \gamma$$

implying: $\Delta t_{\text{you}} < \Delta t_{\text{she}}$

hence: $\boldsymbol{L}_{\textbf{you}} < \boldsymbol{L}_{\textbf{she}}$

This is *relativistic length contraction*.

HER broom's head and tail flashes are HER events.

When the tail flashes, *her* head flash is already Δt_{you} in *your* past. **Or is it?** Since this head flash is HER event, *you* observe time stretching, which yields:

$$\Delta t_{\text{retrospective}} = \Delta t_{\text{you}} \cdot \gamma = \Delta t_{\text{she}}$$

hence: $$\boldsymbol{L_{\text{retrospective}} = L_{\text{she}}}$$

The broom is **NOT physically contracted** at all, but the ***virtual length*** passing a single point in space (your nose) is shorter than the ***physical length***.

The train will NEVER fit in the tunnel.

Time dilation applies to ***time spans***
and ***not*** to ***points in time***.

When measuring the broom
at a ***single point in time***,

there is ***no time span,***
therefore no time stretching,
hence ***no length contraction***.

I measured the witch's velocity as:

*distance between two milestones that are stationary to **me**, using **my** rod, divided by timespan she needed to travel from one to the other in **my** frame, measured with **my** clock.*

But witch's broom's head & tail are ***HER*** milestones!

Measuring with double standards!

https://science.nasa.gov/mission/**mars-climate-orbiter/**

Measured a shorter broom passage duration,

but does this imply a shorter broom,

or a greater apparent velocity?

$$v = \Delta L / \Delta t \quad \therefore \quad \Delta \boldsymbol{t} = \boldsymbol{\Delta L} / \boldsymbol{v} \, .$$

Does a shorter $\Delta \boldsymbol{t}$ imply a

contracted $\boldsymbol{\Delta L}$ or an **enlarged** $\boldsymbol{v}$,

as seen by me?

YOU  **tell how to distinguish!**

But you are restricted to deduction from truths!

Did ~~we~~ you make an implicit assumption?

Why wouldn't an entity
having some spatial expanse,

but *observed* at a
single *point in space,*

seemingly have its velocity
multiplied by the Lorentz factor?

Does a muon experience a

contracted height difference passing by at same velocity as we see the muon moving,

or does it perceive the

original Δh with only itself as a ref. point, i.e. a single point in space at which Δh can't be assessed with only a rod, allowing it to show a velocity of γv ?

Aforementioned symmetry of SR:

I measure ***your*** speed in ***my*** frame

$\equiv$

you measure ***my*** speed in ***your*** frame.

Both using *own* ruler & clock, stationary in *own* frame.

But this time ***I*** want to measure
my own speed in ***your*** frame.

With a measuring rod stationary to *me*,
I assess *your* speed in *my* frame,
not *mine* in *yours* as *observed by myself*.

WE see ***ITS*** velocity w.r.t. ***US***

$$\equiv$$

IT sees ***OUR*** velocity w.r.t. ***IT***

$$= \boldsymbol{v} < \boldsymbol{c}$$

WE see ***OUR OWN*** velocity w.r.t. ***IT***

$$\equiv$$

IT sees ***ITS OWN*** velocity w.r.t. ***US***

$$? \ = \boldsymbol{\gamma v} \rightarrow \infty \ ?$$

$$\textbf{Celerity} := \frac{\text{distance, measured when stationary}}{\text{elapsed time, measured when moving}}$$

$$\eta := \gamma\beta$$

Celebrity:

https://www.youtube.com/watch?v=ux9ArSigpoA

Uniform acceleration, *urh*, ***constant force exerted*** (see p.100)**:**

$$\boldsymbol{\beta = \tau/\sqrt{1+\tau^2}}$$

$$\boldsymbol{\gamma = \sqrt{1+\tau^2}}$$

$$\therefore \boldsymbol{\eta = \tau}$$

Naah nah na naah naah!

Length contraction: $$\Delta L_{\mathrm{mov}} = \Delta L_{\mathrm{stat}}\sqrt{1-\beta^2}$$

Totally ***independent*** of ***where*** the length interval resides, be it behind, around, or before you. Must always multiply ***entire*** length interval by contraction factor how it is *when observation is made*.

Time contraction: $$\Delta t_{\mathrm{mov}} = \Delta t_{\mathrm{stat}}\sqrt{1-\beta^2}$$

Totally ***independent*** of ***when*** the time interval occurred, be it in the past, present, or future. Must always multiply ***entire*** time interval by contraction factor how it is *when observation is made*.

Aforementioned $sinh$ & $cosh$ to be abandoned for precisely the reason mentioned on last page.

Used Lorentz root that changed during a timespan instead of observing at a single point in time.

Travelled distance seen by stat. obs.: $$d\sigma = \beta_\tau d\tau = \frac{\tau}{\sqrt{1+\tau^2}} d\tau$$

hence: $$\Delta\sigma = \int_0^{\Delta\tau} \frac{\tau}{\sqrt{1+\tau^2}} d\tau = \sqrt{1+\Delta\tau^2} - 1 = \gamma - 1$$

Moving observer's proper travel time: $$\Delta\tau' = \frac{\boldsymbol{\Delta\tau}}{\boldsymbol{\gamma_\tau}} = \frac{\Delta\tau}{\sqrt{1+\Delta\tau^2}}$$ (apply *current* γ to *entire* travel time)

Perceived celerity: $$\frac{\boldsymbol{\Delta\sigma}}{\boldsymbol{\Delta\tau'}} = \frac{\Delta\sigma}{\Delta\tau}\sqrt{1+\Delta\tau^2} = \boldsymbol{\beta_\tau\gamma_\tau} = \boldsymbol{\eta_\tau}$$

ΟΕΔ = **ο**περ **ε**δει **δ**ειξαι (*oper edei deixai*) — 𝔔.𝔈.𝔇. = quod erat demonstrandum

Didn't we already encounter: $\boldsymbol{\tau} \coloneqq \boldsymbol{a'}\boldsymbol{t}/\boldsymbol{c} = \beta/\sqrt{1-\beta^2}$ on p.100?

Doesn't this equal $\eta \coloneqq \gamma\beta = \tau$?

Isaacus Newtonus:
Natura enim simplex est.

Celerity: $\boldsymbol{w := \gamma v = \frac{v}{\sqrt{1-v^2/c^2}}}$

hence: $v = \frac{w}{\sqrt{1+w^2/c^2}} \quad \therefore \quad \gamma = w/v = \sqrt{1 + w^2/c^2}$

Simply (naively?) **use classical mechanics:**

$s = s_0 + w_0 t + \frac{1}{2} a' t^2$ (s, t *in stationary frame*)

$w = w_0 + a' t$ ($a' = F/m =$ *specif. force felt by mov. obj.*)

$(s_0 = 0 \;\&\; w_0 = 0) \Rightarrow s = \frac{1}{2} a' t^2 \;\&\; w = a' t \;\&\; \gamma = \sqrt{1 + a'^2 t^2 / c^2}$

i.e.: $\boldsymbol{t} = \sqrt{\frac{2s}{a'}} \quad \therefore \quad \boldsymbol{t'} = t/\gamma = \frac{c}{a'} \sqrt{\frac{2a's}{c^2+2a's}}$

Equating: $a' = g$ & $s = D_{\mathrm{H}} = c/H$

and *ignoring cosmic expansion*

renders: $\Delta t_{\mathrm{stat,inert}} = \sqrt{2c/gH}$ $\approx$ **163 345 years** $\left(\tfrac{1}{2}g\Delta t^2 = D_{\mathrm{H}}\right)$

and: $\Delta t_{\mathrm{accel}} = \frac{c}{g}\sqrt{\frac{2g}{2g+cH}}$ $\approx$ **353d19:45:23** (cf. p.107)

$$\left(t^2 = \frac{2s}{a'} = \frac{2c}{gH}\right) \Rightarrow \left[\frac{c}{g}\cdot\sqrt{\frac{(gt)^2}{(gt)^2+c^2}}\right]_{\mathrm{p.107}} = \frac{c}{g}\cdot\sqrt{\frac{g^2\cdot 2c/gH}{g^2\cdot 2c/gH+c^2}} = \frac{c}{g}\cdot\sqrt{\frac{2g}{2g+cH}} \quad \text{Q.E.D.}$$

Also: $v_{\mathrm{fin}} = g\Delta t'$ $\approx c - 5.27$ mm/s

and: $w_{\mathrm{fin}} = g\Delta t$ $\approx 168\,621 \cdot c$

BUT...

You accelerated from $\mathbf{0}$ to $\boldsymbol{v}_{\mathbf{fin}} < \boldsymbol{c}$
with an average velocity of:
$\boldsymbol{D}_{\mathrm{H}}/\Delta\boldsymbol{t} \approx 13.77 \times 10^9$ ly / 163 345 years
$\approx \mathbf{81661}\boldsymbol{c} \gg c$ ... **HUH?**

Δt is timespan in my frame after which you actually arrive overthere, but I have not yet ***observed*** it!

In order to let me ***observe*** your arrival at D_{H},
light must yet travel all the way back, requiring t_{H},
yielding an ***observed*** average velocity of:

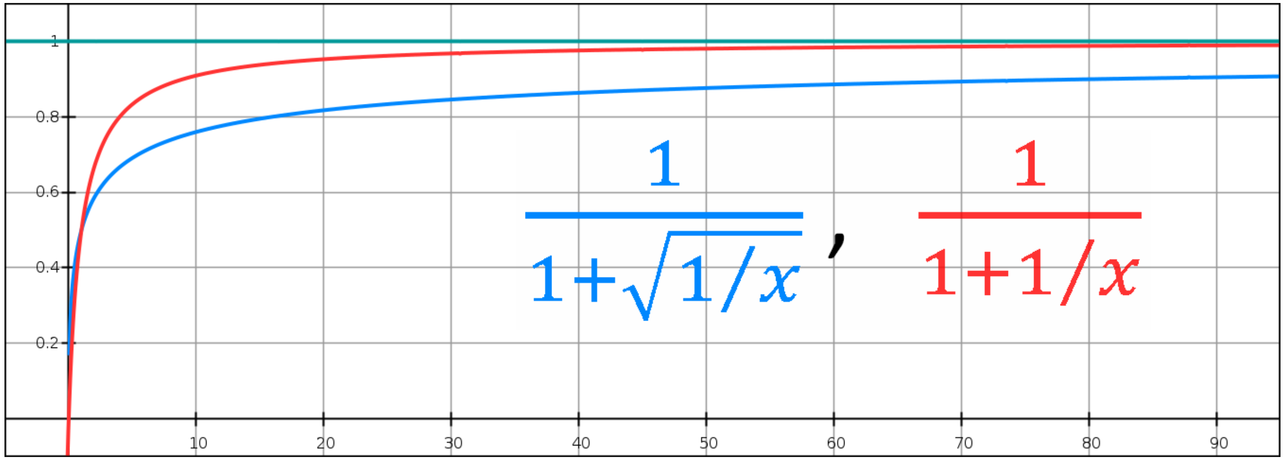
$$\frac{D_{\mathrm{H}}}{\Delta t + t_{\mathrm{H}}} = c\,\frac{t_{\mathrm{H}}}{t_{\mathrm{H}} + \Delta t} < c$$

She won't seriously **see** you seemingly exceed **c** in the seasonal scenery of the scenic cosmic sea, you see?

In general:

Average velocity of body feeling constant force, observed with stationary & inert instruments:

$$\langle v\rangle = \frac{\Delta s}{\Delta t_{\text{light}}+\Delta t_{\text{travel}}} = \frac{s(t)}{\frac{s(t)}{c}+t} = \frac{s}{\frac{s}{c}+\sqrt{\frac{2s}{a'}}}\left(\frac{c/s}{c/s}\right) = \frac{c}{1+c\cdot\sqrt{\frac{2}{a's}}} = \frac{c}{1+\frac{2c}{a't}}$$



GraphSketch.com

See also: http://henk-reints.nl/astro/HR-observed-velocity.pdf

which reveals that $\Delta t_{\text{light}} + \Delta t_{\text{travel}}$ should actually be $\sqrt{\Delta t_{\text{light}}^2 + \Delta t_{\text{travel}}^2}$.

Total travel distance gets
more and more contracted
as your own *velocity* increases.

Doesn't this imply the end point
is approaching you at a(n increasing)
rapidity on top of your own speed?

Celerity is the superposition of
this *rapidity* and your *velocity*.

Since *rapidity* & *celerity* are not ordinary *velocities*,
they may well exceed the speed of light.

See also: http://henk-reints.nl/astro/HR-velocity-celerity-rapidity.pdf

Does light,

from its own perspective,

perceive zero travel distance

or an infinite velocity?

Physical length of road:

no. of roadside posts is

totally independent of any velocity!

Light "sees" $\#posts > 0$ *passing by in zero time!*

Please rethink "spooky action at a distance"...

Doesn't the whole concept of ***length contraction*** sprout from what Einstein described as Fitzgerald's & Lorentz's ***ad hoc assumption that appeared only as an artificial means to save the theory***?[9]

Fabrications may render a
flawed but persistent concept,
restricting one's open-minded view
& independent lateral thinking!

[9] A. Einstein: Über das Relativitätsprinzip und die aus demselben gezogenen Folgerungen. Jahrbuch für Radioaktivität und Elektronik, 4 (1907), 411-462.

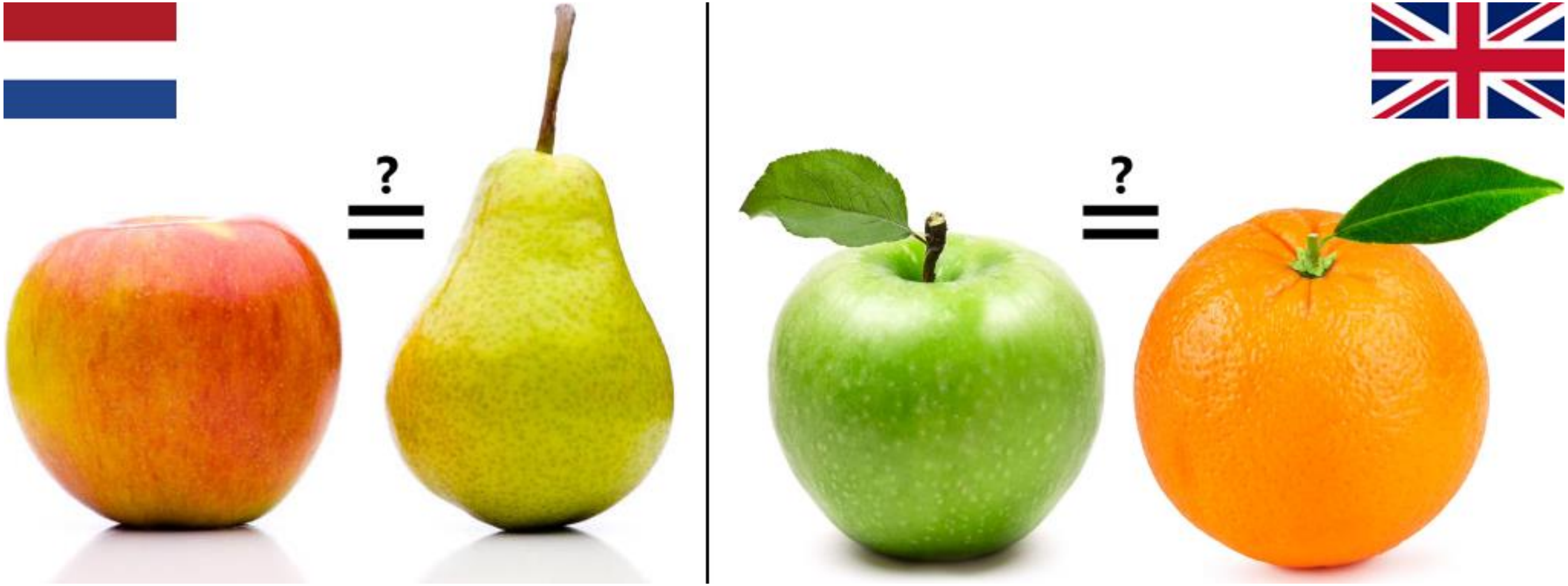
THE flaw regarding length contraction:

$L = v\Delta t$ between two events
at *two* different points in *time*
and ***one*** single ***point in space***

is not the same concept as:

distance between two things
at *two* different points in *space*
and ***one*** single ***point in time***.

Virtual time span ≠ elapsed time span = no. of events.



Virtual (passed) length ≠ physical length = no. of things.

Throughout history,
we have naively equated
two different concepts of time
as well as
two different concepts of length.

Virtual time span: indirect value; calculated.
Virtual length: indirect value; calculated.

Elapsed time span (*physical duration*)**:**
directly counted no. of
consecutive identical elementary events.

***Physical length*:**
directly counted no. of
adjacent identical elementary things.

Elementary event =
interaction between elementary things
(relates distance to time, so it *somehow* involves the *speed of light*).

EMPTY time span ≔

between consecutive elementary **events**;

EMPTY length ≔

between adjacent elementary **things**.

Conjecture:

time stretching & *length contraction*
apply only to EMPTY *time spans* or *lengths*
(the *tare* duration or distance).

Length contraction in Schwarzschild metrics

Distance from a thing to M as observed from infinity:

$\rho = \frac{r}{r_S} \therefore r = \rho r_S \therefore dr = r_S d\rho$; we'll consider only: $\rho > 1$

Distance from thing to M as perceived by thing: $\varrho = \frac{r^*}{r_S}$

a and b are distances to M as perceived from infinity;

proper length between a and b ($b > a$, $\alpha = \frac{a}{r_S}$, $\beta = \frac{b}{r_S}$) :

$\Delta r = b - a$	$\Delta r^* = \int_a^b \sqrt{1 - \frac{r_S}{r}} dr = r_S \int_\alpha^\beta \sqrt{\frac{\rho-1}{\rho}} d\rho$
$\Delta \rho = \beta - \alpha$	$\Delta \varrho = \int_\alpha^\beta \sqrt{\frac{\rho-1}{\rho}} d\rho$

https://www.integral-calculator.com/ yields:

$$\Delta\varrho = \int_\alpha^\beta \sqrt{\frac{\rho-1}{\rho}}\,d\rho = \left[\frac{2\sqrt{\frac{\rho-1}{\rho}}\rho-\ln\left(\sqrt{\frac{\rho-1}{\rho}}+1\right)+\ln\left(\left|\sqrt{\frac{\rho-1}{\rho}}-1\right|\right)}{2}\right]_\alpha^\beta$$

We have: $\rho > 1$ & $\sqrt{\frac{\rho-1}{\rho}} < 1$, hence: $\left|\sqrt{\frac{\rho-1}{\rho}}-1\right| = -\left(\sqrt{\frac{\rho-1}{\rho}}-1\right) = 1-\sqrt{\frac{\rho-1}{\rho}}$

so: $\Delta\varrho = \left[\sqrt{\rho^2-\rho}+\frac{1}{2}\ln\frac{1-\sqrt{\frac{\rho-1}{\rho}}}{1+\sqrt{\frac{\rho-1}{\rho}}}\right]_\alpha^\beta = \left[\sqrt{\rho^2-\rho}+\frac{1}{2}\ln\frac{\sqrt{\frac{\rho}{\rho}}-\sqrt{\frac{\rho-1}{\rho}}}{\sqrt{\frac{\rho}{\rho}}+\sqrt{\frac{\rho-1}{\rho}}}\right]_\alpha^\beta = \left[\sqrt{\rho^2-\rho}+\frac{1}{2}\ln\frac{\sqrt{\rho}-\sqrt{\rho-1}}{\sqrt{\rho}+\sqrt{\rho-1}}\right]_\alpha^\beta$

hence: $\Delta\varrho = \left[\sqrt{\rho^2-\rho}+\frac{1}{2}\ln\frac{(\sqrt{\rho}-\sqrt{\rho-1})(\sqrt{\rho}-\sqrt{\rho-1})}{(\sqrt{\rho}+\sqrt{\rho-1})(\sqrt{\rho}-\sqrt{\rho-1})}\right]_\alpha^\beta = \left[\sqrt{\rho^2-\rho}+\frac{1}{2}\ln\frac{(\sqrt{\rho}-\sqrt{\rho-1})^2}{\rho-(\rho-1)}\right]_\alpha^\beta$

$$\Delta\varrho = \left[\sqrt{\rho^2-\rho}+\ln\left(\sqrt{\rho}-\sqrt{\rho-1}\right)\right]_\alpha^\beta$$

Final result:

$$\Delta\varrho = \sqrt{\beta^2 - \beta} - \sqrt{\alpha^2 - \alpha} + \ln\left(\frac{\sqrt{\beta} - \sqrt{\beta - 1}}{\sqrt{\alpha} - \sqrt{\alpha - 1}}\right)$$

total of all gradually shrinking distances between successive roadside marker posts, measured individually when they pass your (accelerating) car at diff. moments.

But at any single point in time, *each and every* (longitudinal) **distance is Lorentz contracted** (you're in free fall) **to you by the *very same factor* corresp. to speed at *that moment*, including between ANY pair of successive marker posts!**

Entire street length as seen *at a single point in time* differs from total street length you see passing under your car while travelling *during some time span*.

$\ln\left(\frac{\sqrt{\beta}-\sqrt{\beta-1}}{\sqrt{\alpha}-\sqrt{\alpha-1}}\right)$ **is due to not measuring at a single point in time nor at a single point in space.**

As seen from b: $\Delta\rho_b = (\beta-\alpha)\sqrt{1 - 1/\beta} = \sqrt{\beta^2-\beta} - \sqrt{\alpha^2 - \alpha(\alpha/\beta)}$

as seen from a: $\Delta\rho_a = (\beta-\alpha)\sqrt{1 - 1/\alpha} = \sqrt{\beta^2 - \beta(\beta/\alpha)} - \sqrt{\alpha^2-\alpha}$

measured while travelling: $\Delta\rho_t = \sqrt{\beta^2-\beta} - \sqrt{\alpha^2-\alpha} + \ln\left(\frac{\sqrt{\beta}-\sqrt{\beta-1}}{\sqrt{\alpha}-\sqrt{\alpha-1}}\right)$

$$a < b \;\rightarrow\; \Delta\rho_a < \Delta\rho_t < \Delta\rho_b$$

TRUE street length: no. of marker posts

(but what is the distance between successive posts?)

As seen from position ρ at single point in time:

entire road appears contracted by: $\sqrt{1 - 1/\rho}$,

yielding: $\rho\sqrt{1 - 1/\rho}$;

distance to M as perceived by thing: $\boldsymbol{\varrho} = \sqrt{\boldsymbol{\rho}^2 - \boldsymbol{\rho}}$.

Another conufinsg thing:

"time" is a homonym

in many languages.

At a time I pondered time for some time;

a ***point in time*** *;* *time as such* *;* *a* ***time span*** *;*

solution: be explicit! (t vs. Δt)

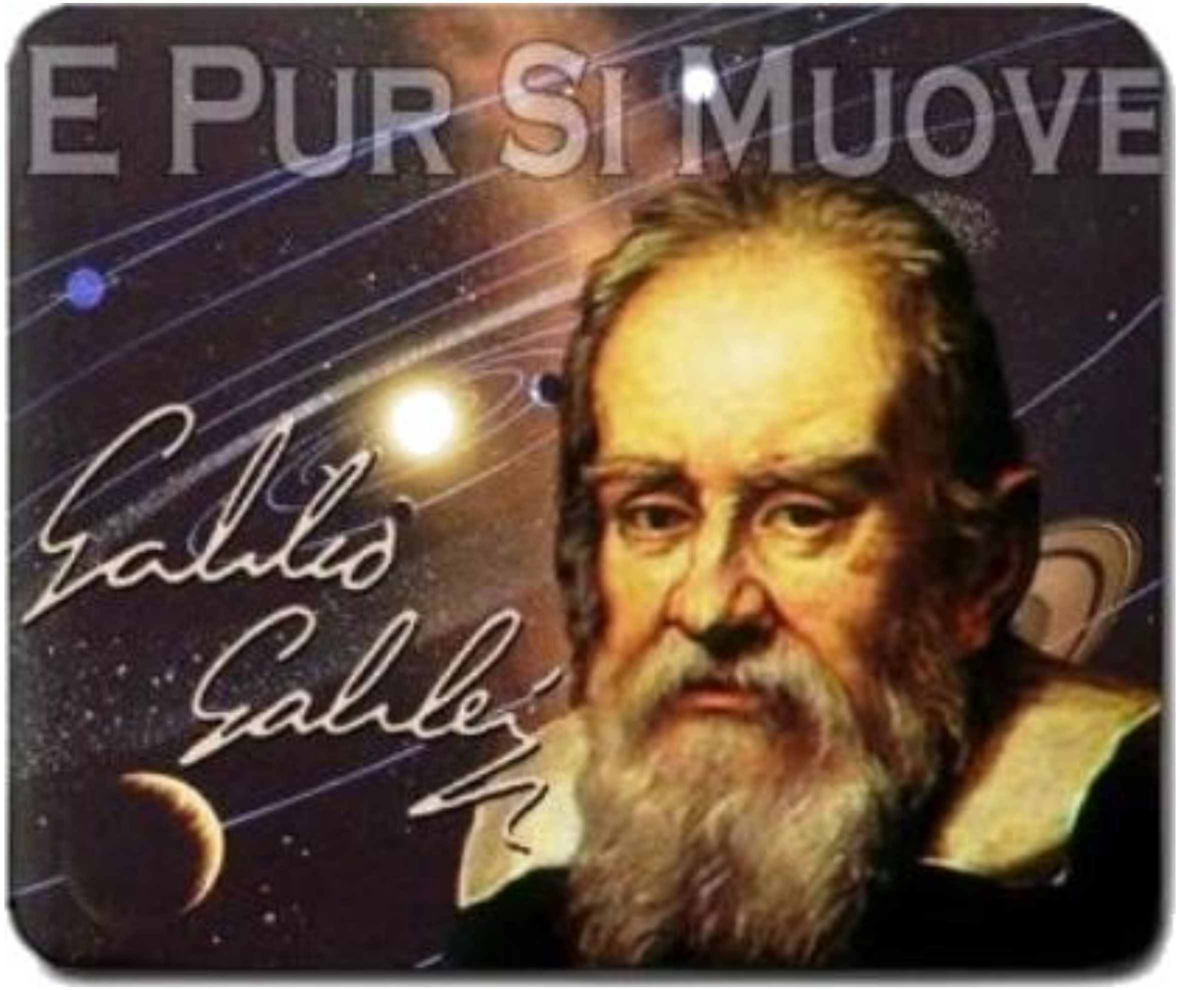
CONSISTENT;

STRAIGHT FORWARD REASONING;

NO IMPOSSIBILITIES;

NO FABRICATIONS;

IN AGREEMENT WITH OBSERVATIONS.



It is the fate of every truth to be an object of ridicule when it is first acclaimed.

— Albert Schweitzer —

See also:

http://henk-reints.nl/astro/HR-Lorentzcontractie-slides.pdf

(this presentation is in Dutch, sorry for that).

Henk Reints

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