# Smooth Spacetime is Only a First Approximation

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# A Small Omission with Broad Implications

The equation for translating time coordinates in special relativity…

$$\boldsymbol{t' = \gamma\left(t - \frac{v}{c^2}(x)\right)}$$

… needs one more parameter, $l = \text{length}$, to work in all situations:

$$\boldsymbol{t' = \gamma\left(t - \frac{v}{c^2}(x - l)\right)}$$

We don't notice because the *point approximation* of pretending moving objects are "mostly" point-like in time works well for most situations.

# 1 of 3 Root Problems in Special Relativity

## (1) Objects suffer no permanent changes from being set into motion and brought to rest.

Einstein realized the risk in this coordinate transformation assumption when he flagged it in a 1907 footnote:

> *1) This conclusion [that the coordinate transformation equations are symmetric from both frame views] is based on the physical assumption that the length of a ruler and the speed of a clock do not suffer any permanent change as a result of these objects being set in motion and brought to rest again."*
> — A. Einstein, 1907. Page 420, Section 3, Footnote 1), Coordinate-Time Transformation, in [1].

The assumption fails because Lorentz contraction and internal clock resynchronization are *physical* operations applied *only* to the accelerated system. When brought into motion and to rest again, the accelerated system is first squeezed and unsqueezed in historical events requiring time and energy. Meanwhile, the larger rest or parent frame is unchanged. Another irreversible change is that physics-time synchronization after acceleration introduces irreversible "lost time" gaps in the experienced (versus physics) definition of time in the accelerated system.

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[1] A. Einstein, *Coordinate-Time Transformation* [Sec. 3, pp. 418–420, in '*About the Principle of Relativity and the Conclusions Drawn from It*,' pp. 411–462], Jahrbuch der Radioaktivität und Elektronik **4** (4), 418–420 (1907). https://sarxiv.org/ref.1907-04-04.0418.engl.pdf

# 2 of 3 Root Problems in Special Relativity

## (2) Two inertial frames can share the same coordinate origin without creating paradoxes.

To derive his inertial frame coordinate transformation equations, Einstein assumed in 1907 that one can:

1) *"… choose as the starting point of time in both systems the moment at which the coordinate starting points* [$(t, x, y, z) = (0,0,0,0)$ *and* $(t', x', y', z') = (0,0,0,0)$] *coincide;"*
— A. Einstein, 1907. Page 418, Section 3, Coordinate-Time Transformation in [1].

This assumption fails for a curious reason. Even though Einstein found, identified, and quantified the different definitions of simultaneity across inertial frames — and, in his transformation equations, uncovered the "time slope" algebra needed to quantify these changes — he never applied his time-per-length math to predict times for clocks at the back and front of a moving (e.g., a train) system. Had he done so, he would have found that forcing the origin of a newly accelerated system to coincide with the origin its parent system requires physically resetting clocks to false-past times for which *no events exist*. Separating the parent and child frame origins removes false-past times, but cannot resolve the disparity between experienced time and physics time in accelerated systems.

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[1] A. Einstein, *Coordinate-Time Transformation* [Sec. 3, pp. 418–420, in '*About the Principle of Relativity and the Conclusions Drawn from It*,' pp. 411–462], Jahrbuch der Radioaktivität und Elektronik **4** (4), 418–420 (1907). https://sarxiv.org/ref.1907-04-04.0418.engl.pdf

# 3 of 3 Root Problems in Special Relativity

## (3) Declaring forward and backward lightspeeds to be identical causes no paradoxes.

After demolishing two arbitrary assumptions in a 1911 talk, Einstein ironically added one of his own making:

*1) "… since we now know that the lack of a preexisting universal time definition makes it fundamentally impossible to measure any speed, particularly the speed of light, without first applying an arbitrary determination, we are entitled to make just such an arbitrary stipulation regarding how light propagates. We stipulate only this: The speed of light propagation in a vacuum from A to B is the same as from B to A."*
— A. Einstein, 1911. Page 8 of *The Theory of Relativity* [2].

Einstein was keenly aware of the experimental difficulty in defining one-way lightspeeds, and so refused to define the speed of light using anything other than an out-and-back loop. However, since different lightspeeds in the forward and backward direction were part of Lorentz's earlier theory, Einstein used impossibility of such proofs as grounds to *declare* the two speeds equal. Unfortunately, his proof focused on lightspeed observability within a *single* inertial frame and overlooks the complexity of observing effective (causal) lightspeeds in other frames. For example, an oscillator vibrating in the direction of motion demonstrates different definitions of *time* in the forwards and backward directions, which are equivalent to diverse forward and backward lightspeeds.

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[2] A. Einstein, *The Theory of Relativity* [with Figures], Naturforschende Gesellschaft, Zürich, Vierteljahresschrift **56**, 1–14 [Jan.] (1911). https://sarxiv.org/ref.1911-01-16.figs.pdf

# Deriving the Non-Simultaneity Slope Alpha

One can find the non-simultaneity slope of how $S'$ time changes per unit of $S$ by looking at two points. First convert Einstein's equation:

$$t' = \gamma\left(t - \frac{v}{c^2}x\right) = \gamma\left(t - \frac{\beta x}{c}\right) = \gamma\left(\frac{ct - \beta x}{c}\right) = \frac{\gamma}{c}(ct - \beta x)$$

Using the above version for two $x$ points gives the slope:

$$\alpha = \frac{\Delta t'}{\Delta x} = \frac{t'_2 - t'_1}{x_2 - x_1} = \frac{\frac{\gamma}{c}(ct - \beta x_2) - \frac{\gamma}{c}(ct - \beta x_1)}{x_2 - x_1} = \frac{\gamma}{c}\left(\frac{-\beta x_2 + \beta x_1}{x_2 - x_1}\right) = \frac{\gamma}{c}\left(\frac{-\beta(x_2 - x_1)}{x_2 - x_1}\right) = -\frac{\beta\gamma}{c}$$

Summarizing:

$$\alpha = \frac{\Delta t'}{\Delta x} = -\frac{\beta\gamma}{c} = -\beta\gamma\, c^{-1}$$

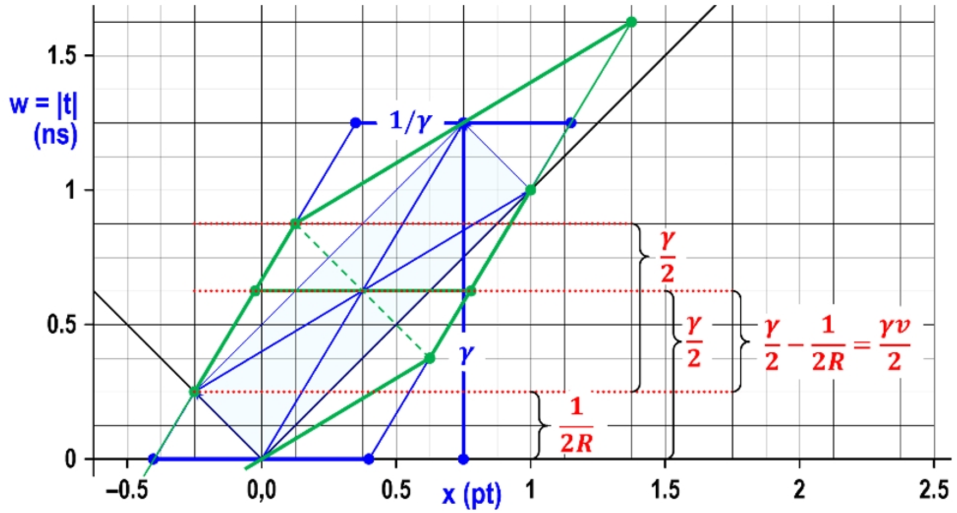
# My Derivation of Alpha Before Realizing Einstein Did It First

That's messy. Let's try velocity:

$$\frac{\gamma}{2} - \frac{1}{2R} = ½\left(1\Big/\sqrt{\frac{1+v}{1-v}}\right) = ½\left(\frac{1}{\sqrt{1-v^2}} - \frac{\sqrt{1-v}}{\sqrt{1+v}}\right) = ½\left(\frac{1}{\sqrt{1-v}\ \sqrt{1+v}} - \frac{\sqrt{1-v}}{\sqrt{1+v}}\right)$$

$$= ½\left(\frac{1-(1-v)}{\sqrt{1-v}\ \sqrt{1+v}}\right) = ½\frac{v}{\sqrt{1-v^2}} = ½\boldsymbol{\gamma v}$$

The final ratio in the figure is $(½\gamma v)/(½\gamma) = v$. So wow, yes, the time slope is $-v$.



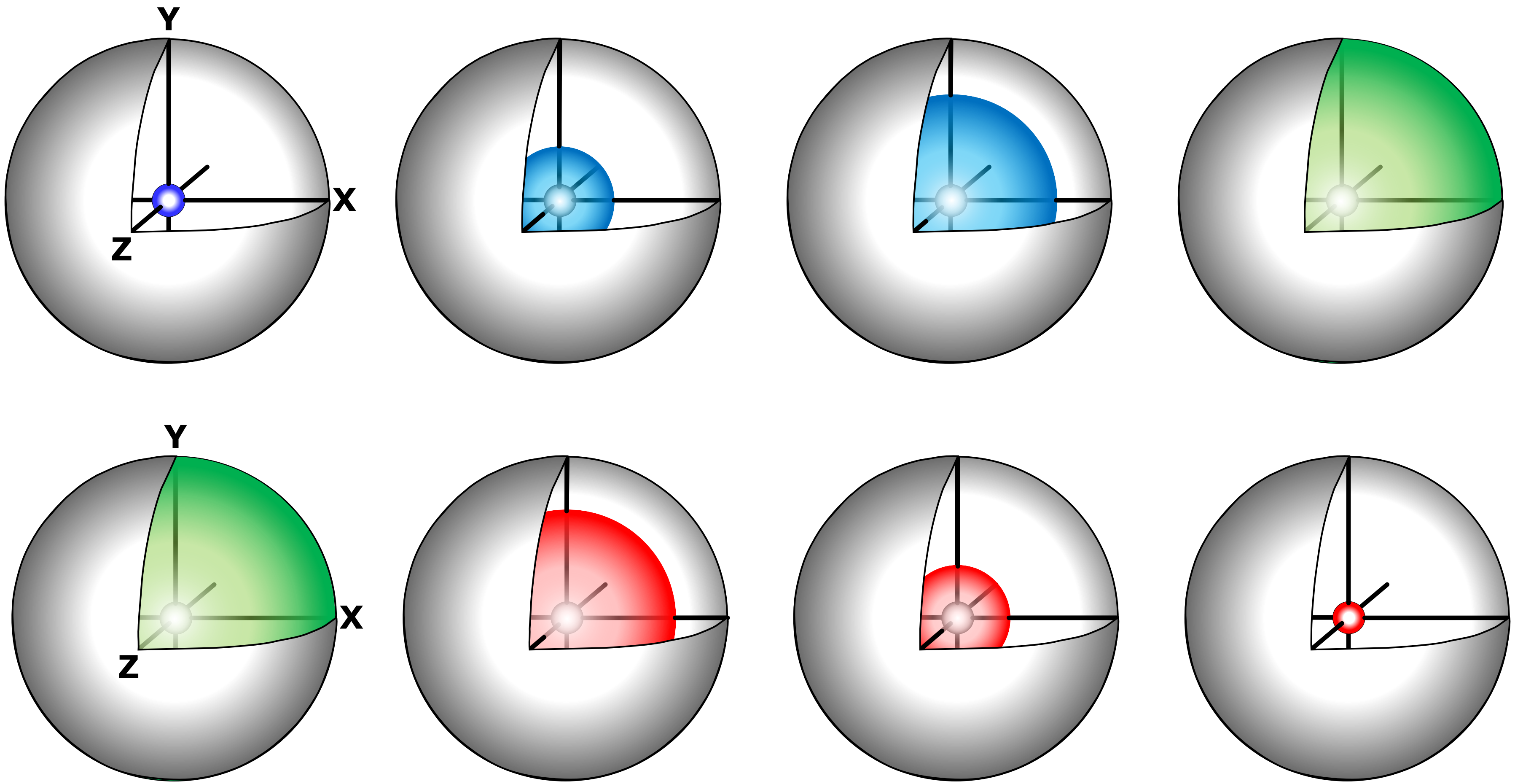

That's nice etc., etc., but it's also about as needlessly messy of a proof of it as I can think of, what with all of the odd roots popping up by projecting the various triangles onto $w$ vertical in the figure. So still, I wonder: What is the likely insanely simple point I keep missing that makes the age slope into minus the velocity?

[2022-07-01.17:03 Fri]

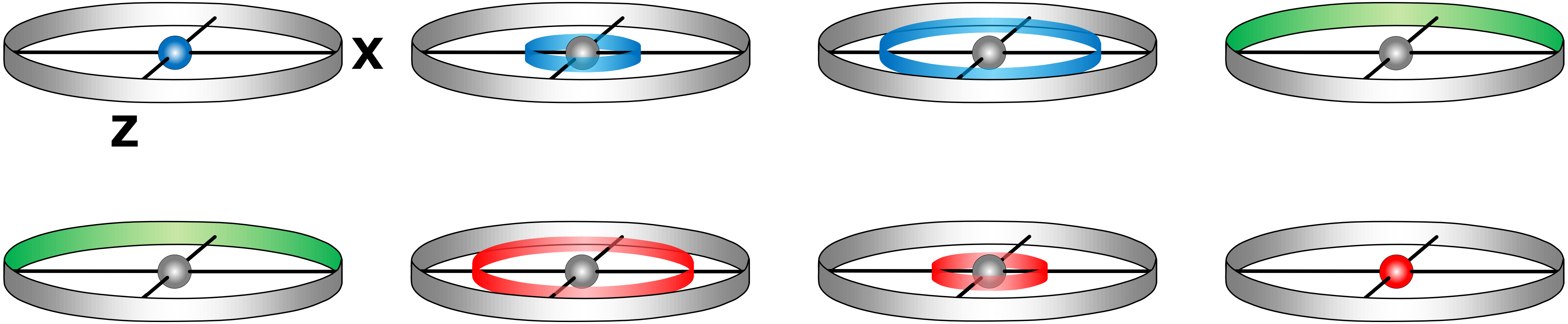
# Why the Mystery?

- Einstein made the non-simultaneous events issue famous with his lighting-and-train thought problem.
- Einstein also almost certainly *derived* the expression for clock change per meter since it is part of his time conversion math. That is why I could derive it easily from his time equation.
- Yet he never wrote his slope equation down or gave examples of how to use it to calculate non-simultaneity *precisely.*
- That's odd since he liked to stick clocks *everywhere,* e.g., to define measurable space in his 1911 paper.
- *Light pendulums* provide a mechanism to examine this issue more closely, and to identify how time works in more detail.

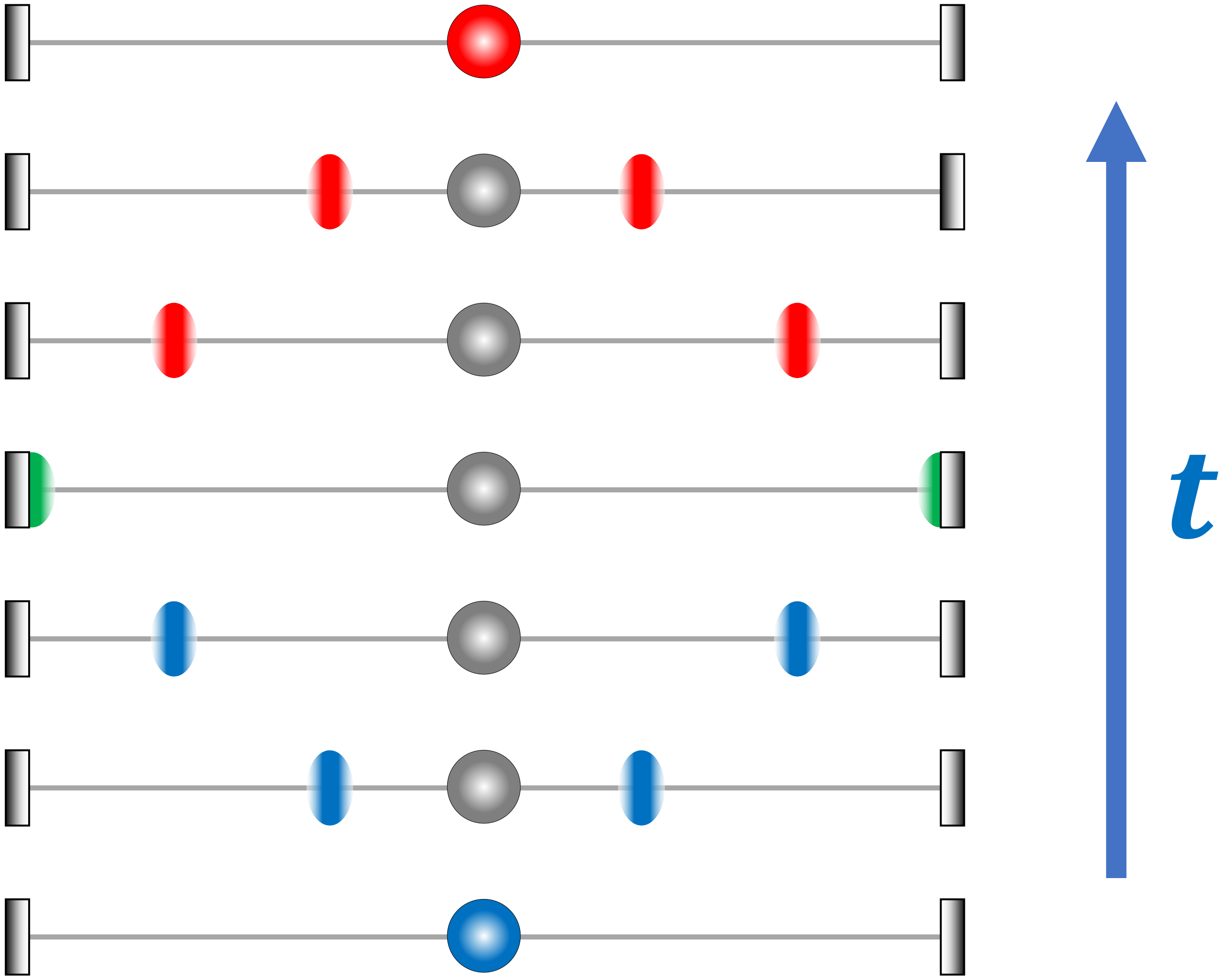
# 3D Light Pendulum: One full cycle



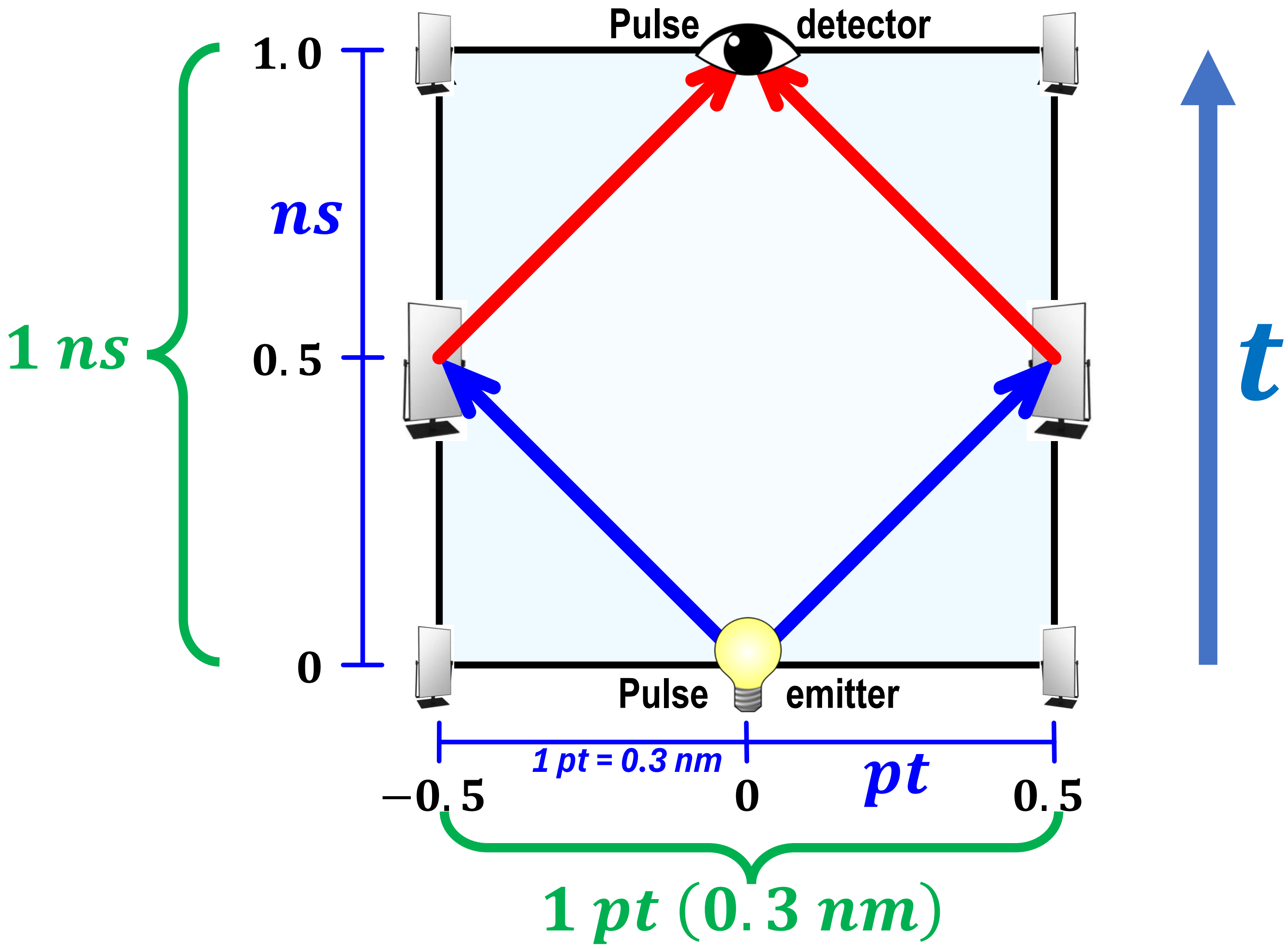
# 2D Light Pendulum: One full cycle



# 1D Light Pendulum: One full cycle

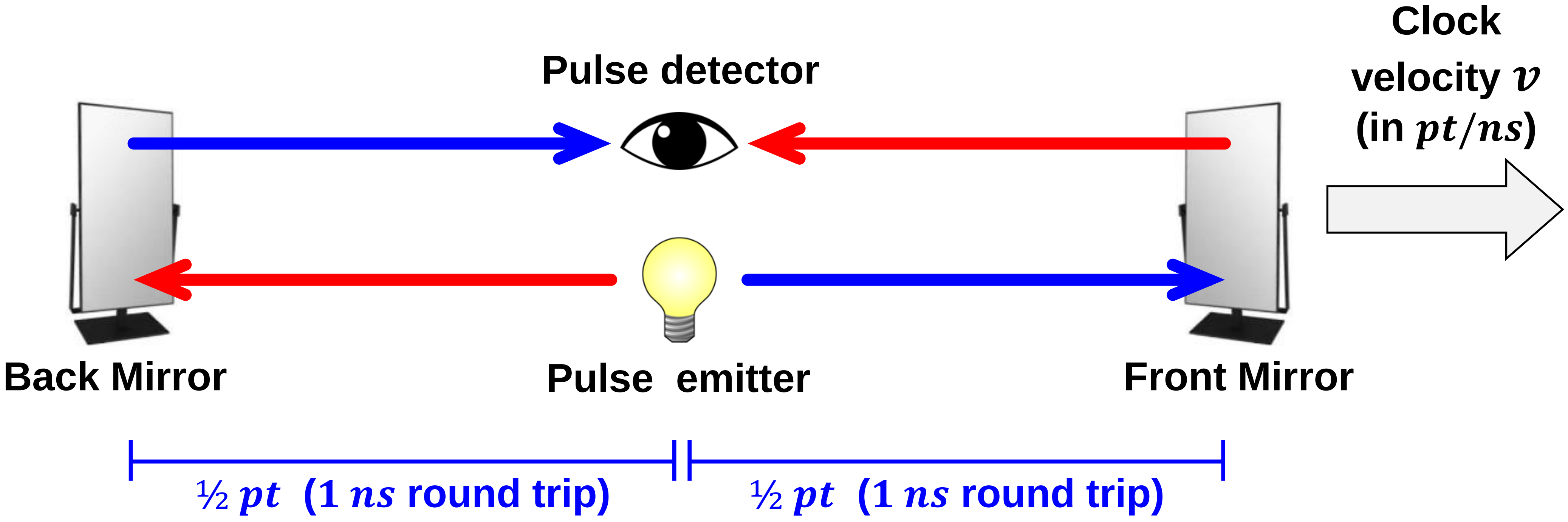


# 1D Light Pendulums as Clock-Rulers



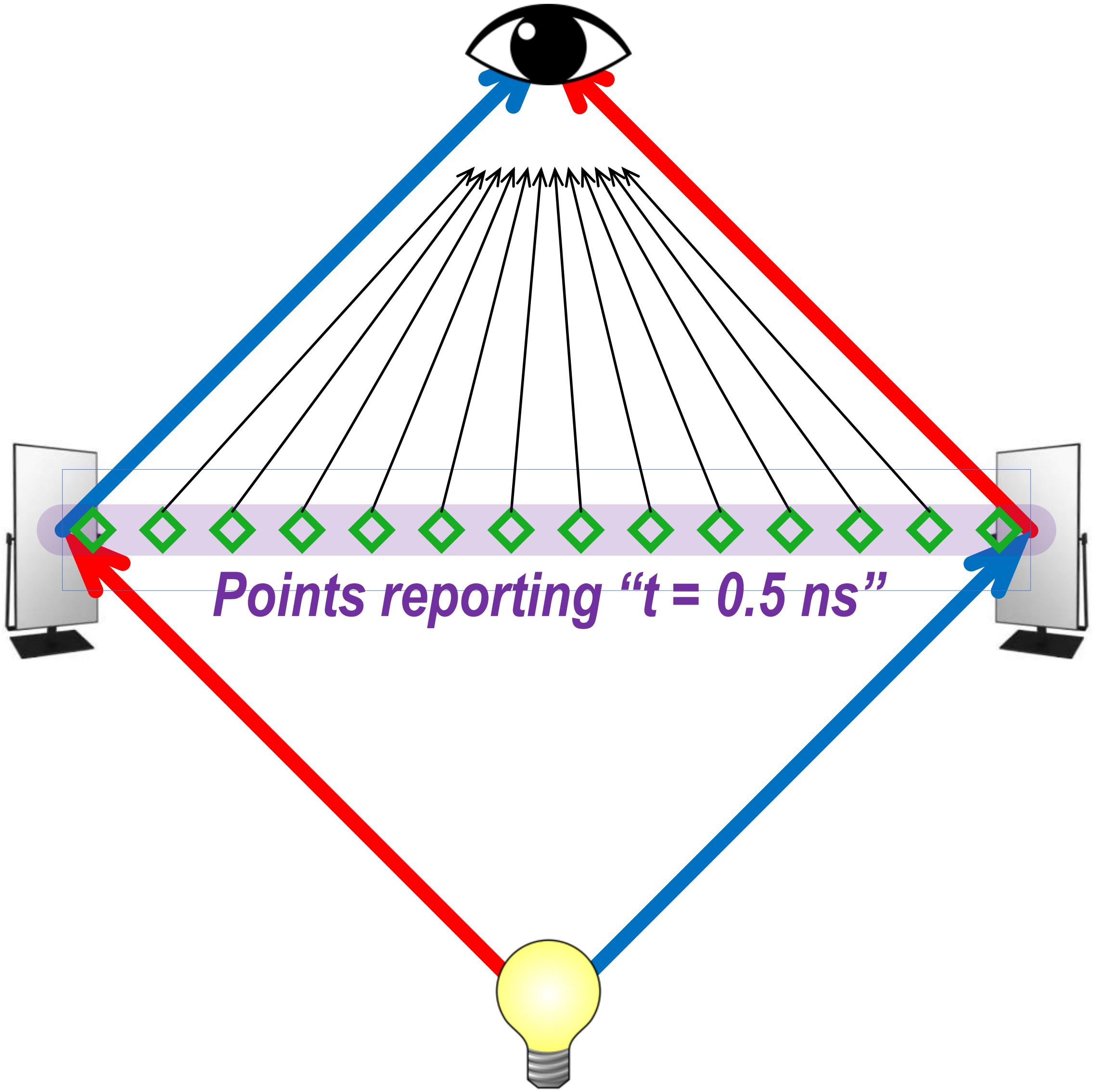
# Clock-Rulers in Motion: *Javelin Clocks*

***This clock measures 1 $ns$ and 1 $pt$ per cycle***

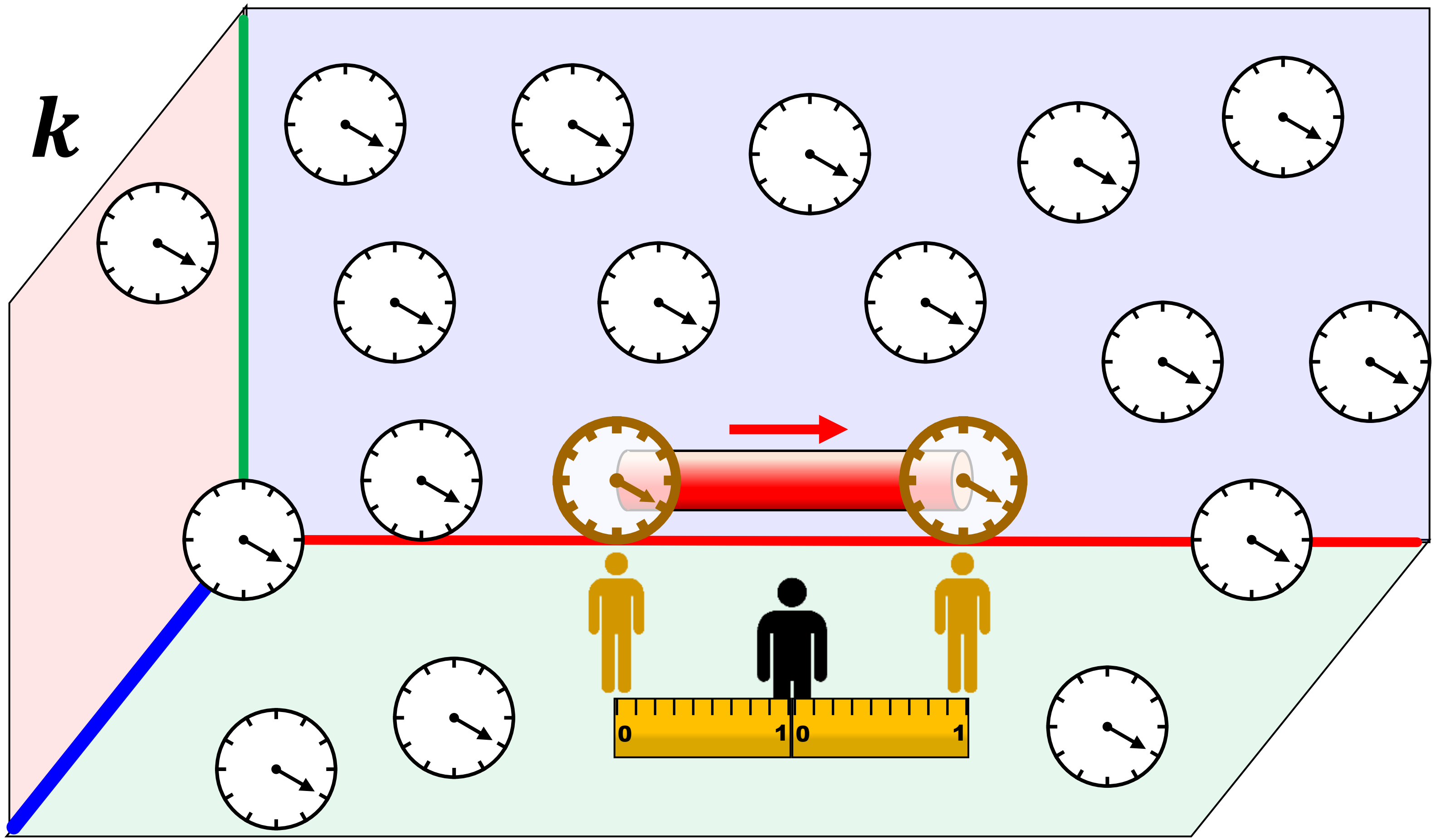



***1 pt = 1 photon foot = 1 light-ns = 0.983571 foot = 0.2998 m ≅ 0.3 m***

# Light Clocks *Define* "Space" Via Shared Times

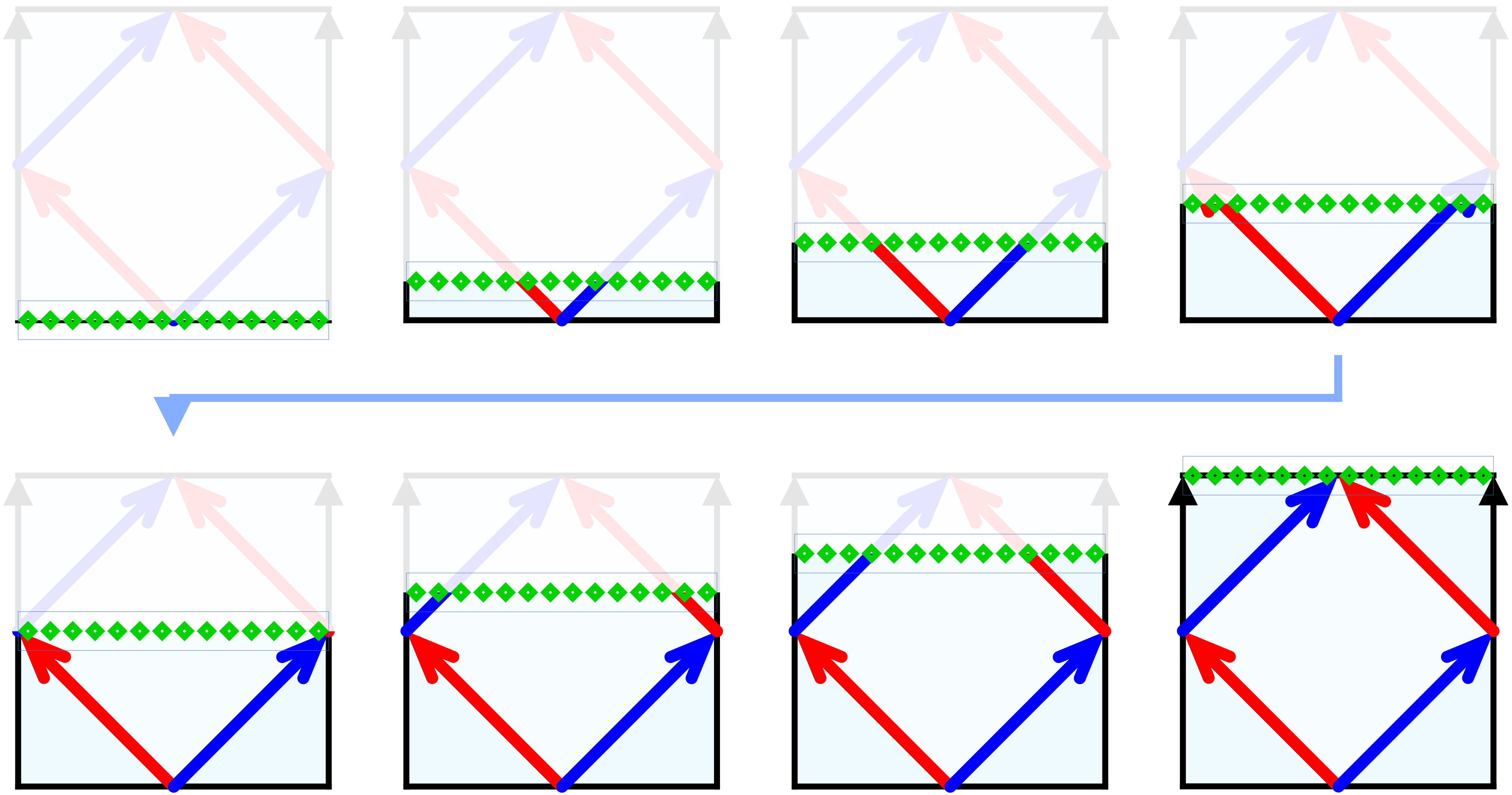


# Einstein Defined Space with Clocks to Find Lorentz Contraction

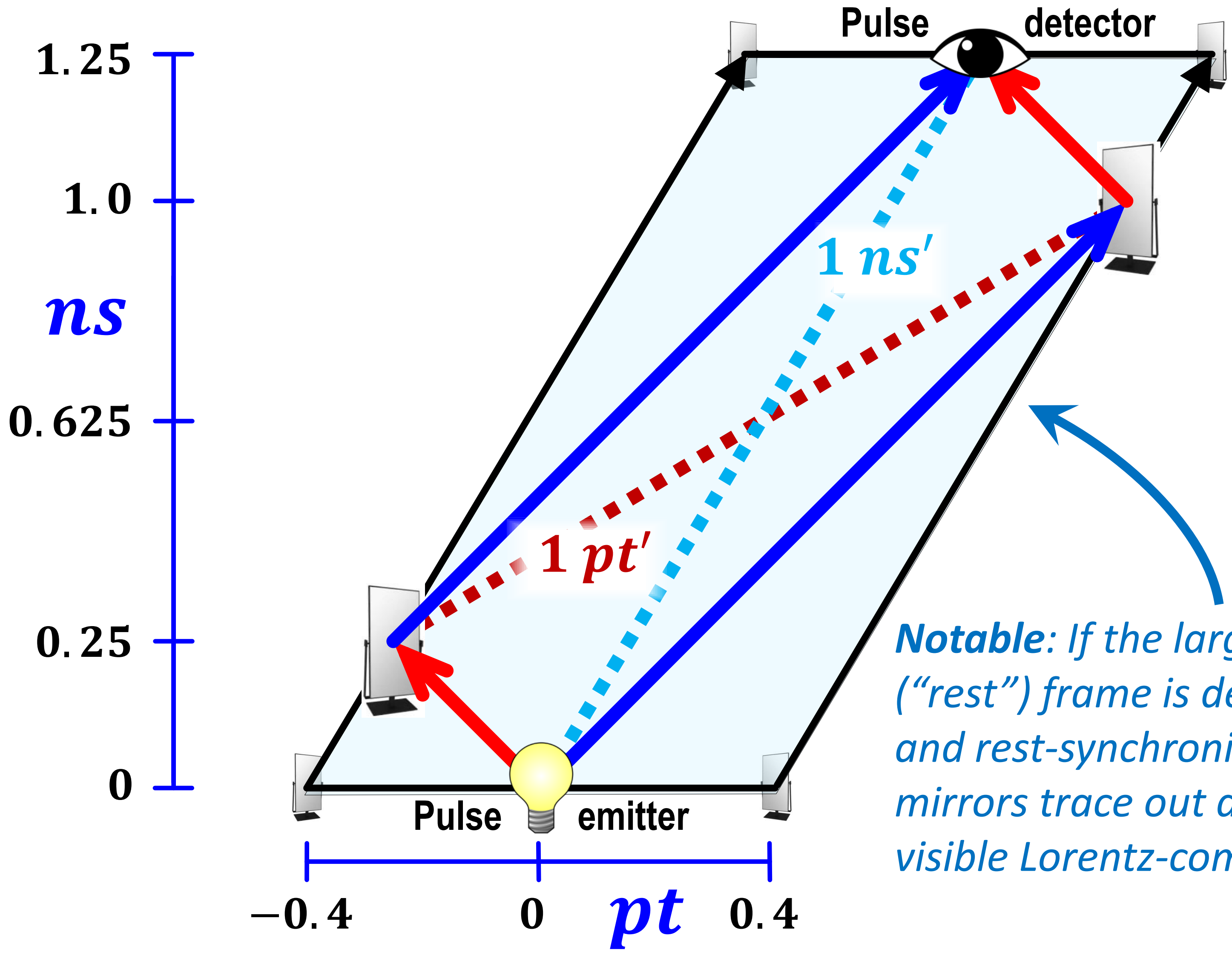



A. Einstein, *The Theory of Relativity* [with Figures]," *Naturforschende Gesellschaft, Zürich, Vierteljahresschrift* **56**, 1–14 [Jan. 16] (1911). See Figure 8. https://sarxiv.org/ref.1911-01-16.figs.pdf

# Larger Frames Can Observe Light Clock Internals in Detail



# A 1-ns, 1-pt Javelin Clock Moving at $0.6\,c$




***Notable**: If the larger, unaccelerated ("rest") frame is dense with detectors and rest-synchronized clocks, the mirrors trace out an experimentally visible Lorentz-compressed trapezoid.*

# Light-Clock Trapezoids in Minkowski's 1908 Spacetime Figure

$$c^2t^2 - x^2 - y^2 - z^2 = 1.$$

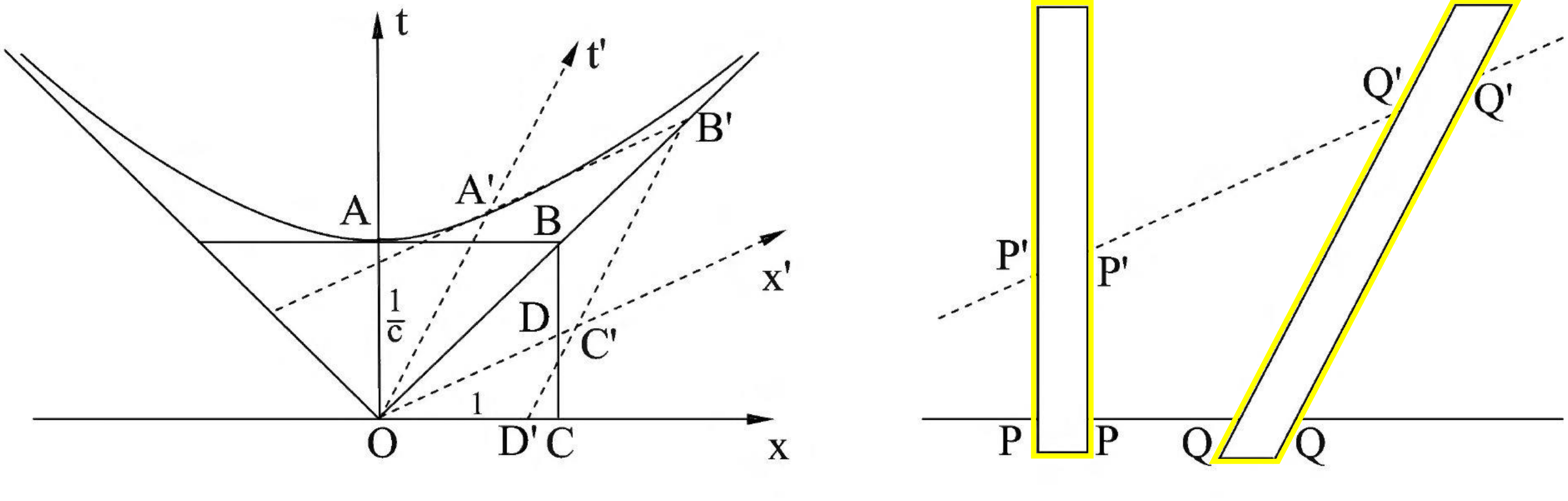
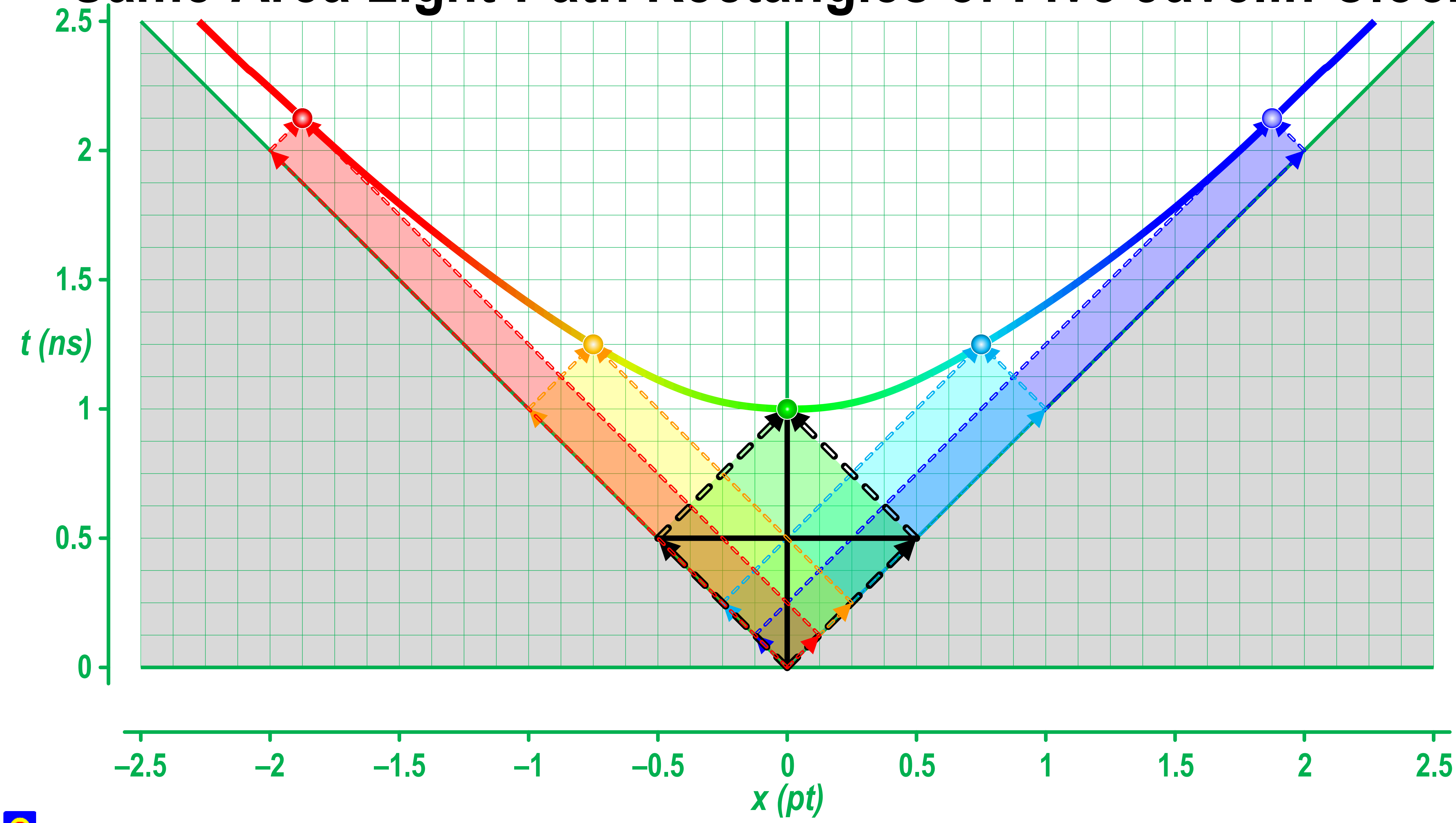


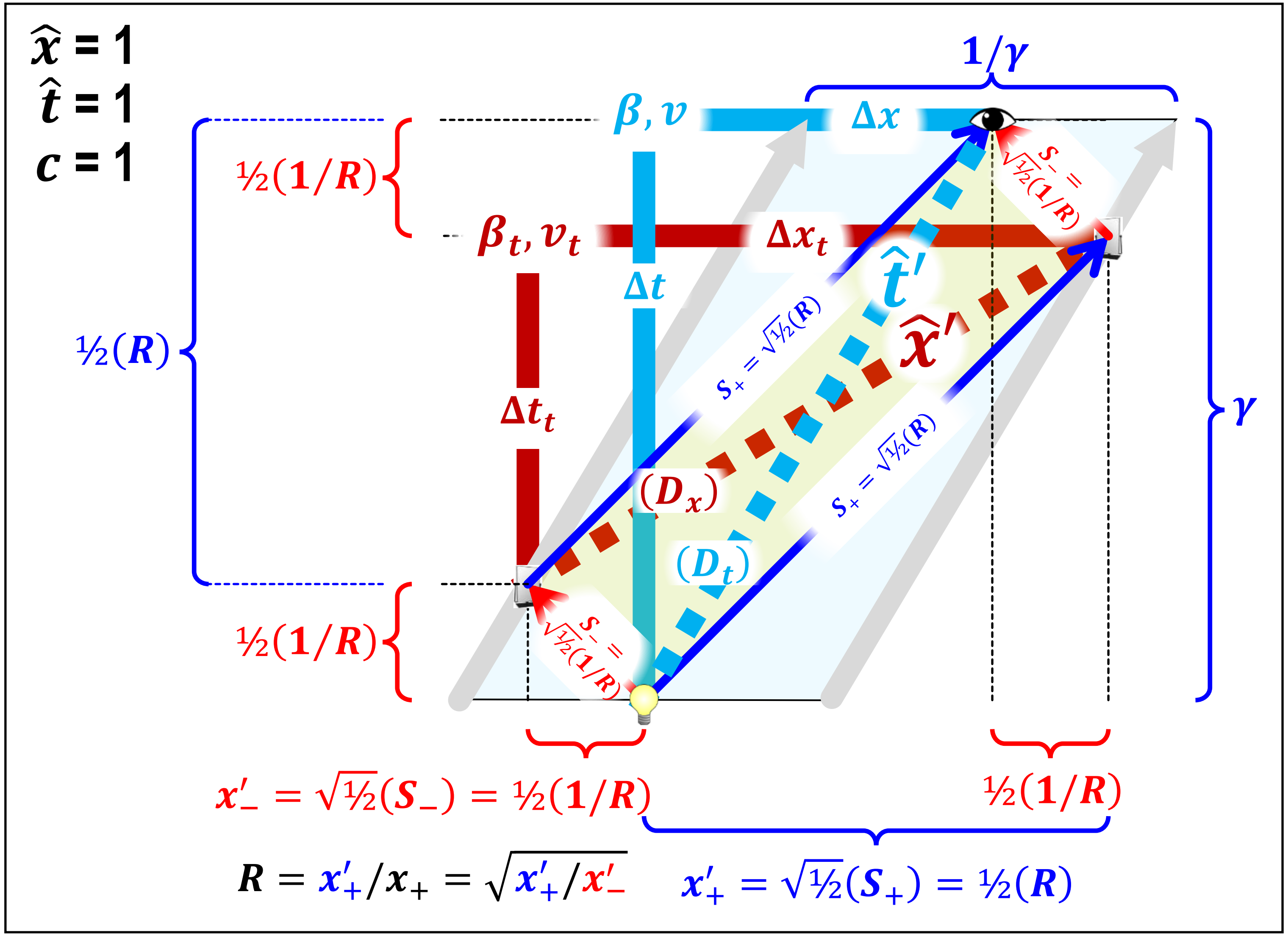

Fig. 1

H. Minkowski, *Space and Time*, 80th Assembly of German Natural Scientists and Physicians (1908).
http://www.minkowskiinstitute.org/mip/books/minkowski.html

# Same-Area Light-Path Rectangles of Five Javelin Clocks



# Detailed Mathematical Structure of a Javelin Clock

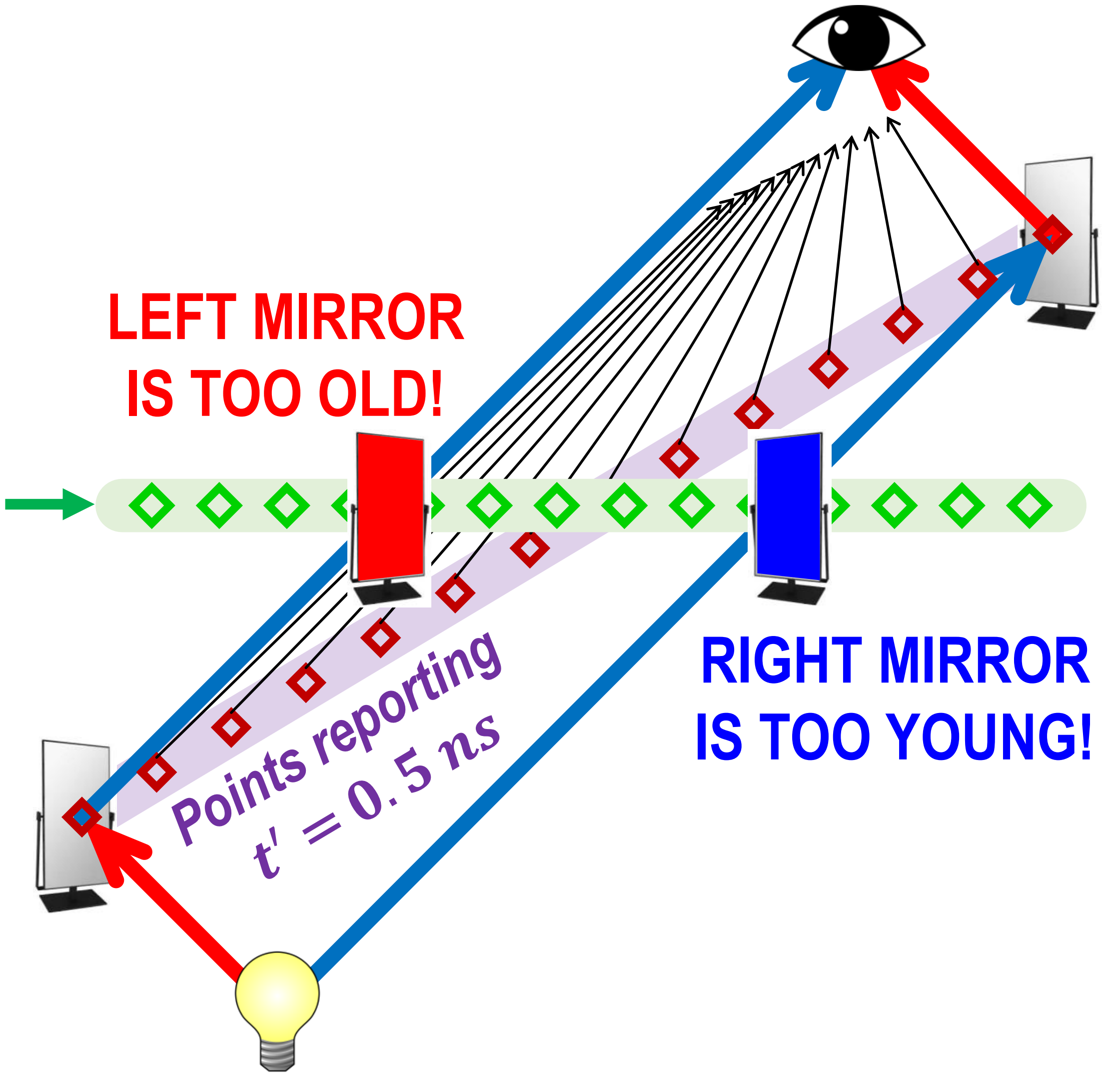


# Special Relativity Conversions [Bollinger]

| | Velocity | Unitless Velocity | Forward Light Paths Ratio (Relativistic Doppler Factor) | Rapidity | Binary Rapidity | Lorentz Factor | Diagonal Factor | Age Gradient | Traveler's Gradient | In-Frame Gradient |
|---|---|---|---|---|---|---|---|---|---|---|
| | $v =$ | $\beta =$ | $R =$ | $w =$ | $\rho =$ | $\gamma =$ | $D =$ | $\alpha =$ | $\alpha_+ =$ | $\alpha' =$ |
| Best→ | $v$ | $\frac{v}{c}$ | $\sqrt{\frac{1+\beta}{1-\beta}}$ | $\ln R$ | $\log_2 R$ | $\frac{R+R^{-1}}{2}$ | $\sqrt{2\gamma^2-1}$ | $-\frac{\beta\gamma}{c}$ | $-\alpha$ | $-\frac{v}{c^2}$ |
| Given↓ $v$ | $v$ | $\frac{v}{c}$ | $\sqrt{\frac{c+v}{c-v}}$ | $\ln\sqrt{\frac{c+v}{c-v}}$ | $\log_2\sqrt{\frac{c+v}{c-v}}$ | $\frac{1}{\sqrt{1-\frac{v^2}{c^2}}}$ | $\sqrt{\frac{c^2+v^2}{c^2-v^2}}$ | $-\frac{v}{c\sqrt{c^2-v^2}}$ | $\frac{v}{c\sqrt{c^2-v^2}}$ | $-\frac{v}{c^2}$ |
| $\beta$ | $c\beta$ | $\beta$ | $\sqrt{\frac{1+\beta}{1-\beta}}$ | $\ln\sqrt{\frac{1+\beta}{1-\beta}}$ | $\log_2\sqrt{\frac{1+\beta}{1-\beta}}$ | $\frac{1}{\sqrt{1-\beta^2}}$ | $\sqrt{\frac{1+\beta^2}{1-\beta^2}}$ | $-\frac{\beta}{c\sqrt{1-\beta^2}}$ | $\frac{\beta}{c\sqrt{1-\beta^2}}$ | $-\frac{\beta}{c}$ |
| $R$ | $c\frac{R-R^{-1}}{R+R^{-1}}$ | $\frac{R-R^{-1}}{R+R^{-1}}$ | $R$ | $\ln R$ | $\log_2 R$ | $\frac{R+R^{-1}}{2}$ | $\sqrt{\frac{R^2+R^{-2}}{2}}$ | $-\frac{R-R^{-1}}{2c}$ | $\frac{R-R^{-1}}{2c}$ | $-\frac{R-R^{-1}}{2c}$ |
| $w$ | $c\frac{e^w-e^{-w}}{e^w+e^{-w}}$ | $\frac{e^w-e^{-w}}{e^w+e^{-w}}$ | $e^w$ | $w$ | $\frac{w}{\ln 2}$ | $\frac{e^w+e^{-w}}{2}$ | $\sqrt{\frac{e^{2w}+e^{-2w}}{2}}$ | $-\frac{e^w-e^{-w}}{2c}$ | $\frac{e^w-e^{-w}}{2c}$ | $-\frac{e^w-e^{-w}}{2c}$ |
| $\rho$ | $c\frac{2^\rho-2^{-\rho}}{2^\rho+2^{-\rho}}$ | $\frac{2^\rho-2^{-\rho}}{2^\rho+2^{-\rho}}$ | $2^\rho$ | $\rho\ln 2$ | $\rho$ | $\frac{2^\rho+2^{-\rho}}{2}$ | $\sqrt{\frac{2^{2\rho}+2^{-2\rho}}{2}}$ | $-\frac{2^\rho-2^{-\rho}}{2c}$ | $\frac{2^\rho-2^{-\rho}}{2c}$ | $-\frac{2^\rho-2^{-\rho}}{2c}$ |
| $\gamma$ | $c\sqrt{1-\frac{1}{\gamma^2}}$ | $\sqrt{1-\frac{1}{\gamma^2}}$ | $\sqrt{\frac{\gamma+\sqrt{\gamma^2-1}}{\gamma-\sqrt{\gamma^2-1}}}$ | $\ln\sqrt{\frac{\gamma+\sqrt{\gamma^2-1}}{\gamma-\sqrt{\gamma^2-1}}}$ | $\log_2\sqrt{\frac{\gamma+\sqrt{\gamma^2-1}}{\gamma-\sqrt{\gamma^2-1}}}$ | $\gamma$ | $\sqrt{2\gamma^2-1}$ | $-\frac{\sqrt{\gamma^2-1}}{c}$ | $\frac{\sqrt{\gamma^2-1}}{c}$ | $-\frac{\sqrt{\gamma^2-1}}{c}$ |
| $D$ | $c\sqrt{\frac{D^2-1}{D^2+1}}$ | $\sqrt{\frac{D^2-1}{D^2+1}}$ | $\sqrt{\frac{1+\sqrt{\frac{D^2-1}{D^2+1}}}{1-\sqrt{\frac{D^2-1}{D^2+1}}}}$ | $\ln\sqrt{\frac{1+\sqrt{\frac{D^2-1}{D^2+1}}}{1-\sqrt{\frac{D^2-1}{D^2+1}}}}$ | $\log_2\sqrt{\frac{1+\sqrt{\frac{D^2-1}{D^2+1}}}{1-\sqrt{\frac{D^2-1}{D^2+1}}}}$ | $\sqrt{\frac{D^2+1}{2}}$ | $D$ | $-\sqrt{\frac{D^2-1}{2c^2}}$ | $\sqrt{\frac{D^2-1}{2c^2}}$ | $-\sqrt{\frac{D^2-1}{2c^2}}$ |
| $\alpha$ | $-\frac{\alpha c^2}{\sqrt{1+\alpha^2c^2}}$ | $-\frac{\alpha c}{\sqrt{1+\alpha^2c^2}}$ | $\sqrt{\frac{\sqrt{1+\frac{1}{\alpha^2c^2}}+1}{\sqrt{1+\frac{1}{\alpha^2c^2}}-1}}$ | $\ln\sqrt{\frac{\sqrt{1+\frac{1}{\alpha^2c^2}}+1}{\sqrt{1+\frac{1}{\alpha^2c^2}}-1}}$ | $\log_2\sqrt{\frac{\sqrt{1+\frac{1}{\alpha^2c^2}}+1}{\sqrt{1+\frac{1}{\alpha^2c^2}}-1}}$ | $\sqrt{1+\alpha^2c^2}$ | $\sqrt{1+2\alpha^2c^2}$ | $\alpha$ | $-\alpha$ | $\frac{\alpha}{\sqrt{1+\alpha^2c^2}}$ |
| $\alpha_+$ | $\frac{\alpha_+c^2}{\sqrt{1+\alpha_+^2c^2}}$ | $\frac{\alpha_+c}{\sqrt{1+\alpha_+^2c^2}}$ | $\sqrt{\frac{\sqrt{1+\frac{1}{\alpha_+^2c^2}}+1}{\sqrt{1+\frac{1}{\alpha_+^2c^2}}-1}}$ | $\ln\sqrt{\frac{\sqrt{1+\frac{1}{\alpha_+^2c^2}}+1}{\sqrt{1+\frac{1}{\alpha_+^2c^2}}-1}}$ | $\log_2\sqrt{\frac{\sqrt{1+\frac{1}{\alpha_+^2c^2}}+1}{\sqrt{1+\frac{1}{\alpha_+^2c^2}}-1}}$ | $\sqrt{1+\alpha_+^2c^2}$ | $\sqrt{1+2\alpha_+^2c^2}$ | $-\alpha_+$ | $\alpha_+$ | $-\frac{\alpha_+}{\sqrt{1+\alpha_+^2c^2}}$ |
| $\alpha'$ | $-\alpha'c^2$ | $-\alpha'c$ | $\sqrt{\frac{1-\alpha'c}{1+\alpha'c}}$ | $\ln\sqrt{\frac{1-\alpha'c}{1+\alpha'c}}$ | $\log_2\sqrt{\frac{1-\alpha'c}{1+\alpha'c}}$ | $\frac{1}{\sqrt{1+\alpha'^2c^2}}$ | $\sqrt{\frac{1+\alpha'^2c^2}{1-\alpha'^2c^2}}$ | $\frac{\alpha'}{\sqrt{1-\alpha'^2}}$ | $-\frac{\alpha'}{\sqrt{1-\alpha'^2}}$ | $\alpha'$ |

# Moving Objects are *Internally Asynchronous*

*How an unmoving observer “slices” the moving object in time as it passes by at $t = \sim 1.5\,ns$.*



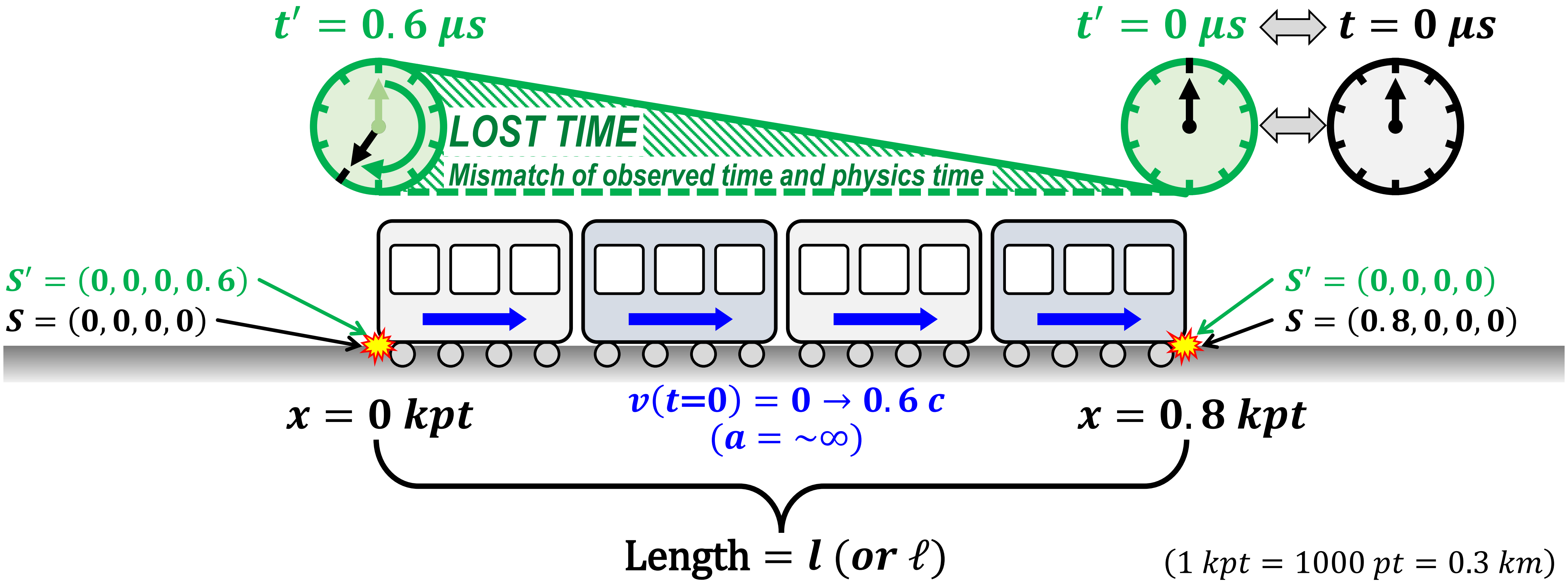
# Why Does Internal Asynchrony Matter?

- The moving system *cannot detect any difference* internally.
- The difficulty: All systems *originate* in some other frame.
- When a system transitions from one frame to another, it *keeps* the historical constraints of its Parent (origin) system.
- For example, the new system *cannot* create a past that extends beyond events recorded earlier by its Parent system.
- The Poincaré symmetries alone cannot track such issues.

# Acceleration Is Complicated

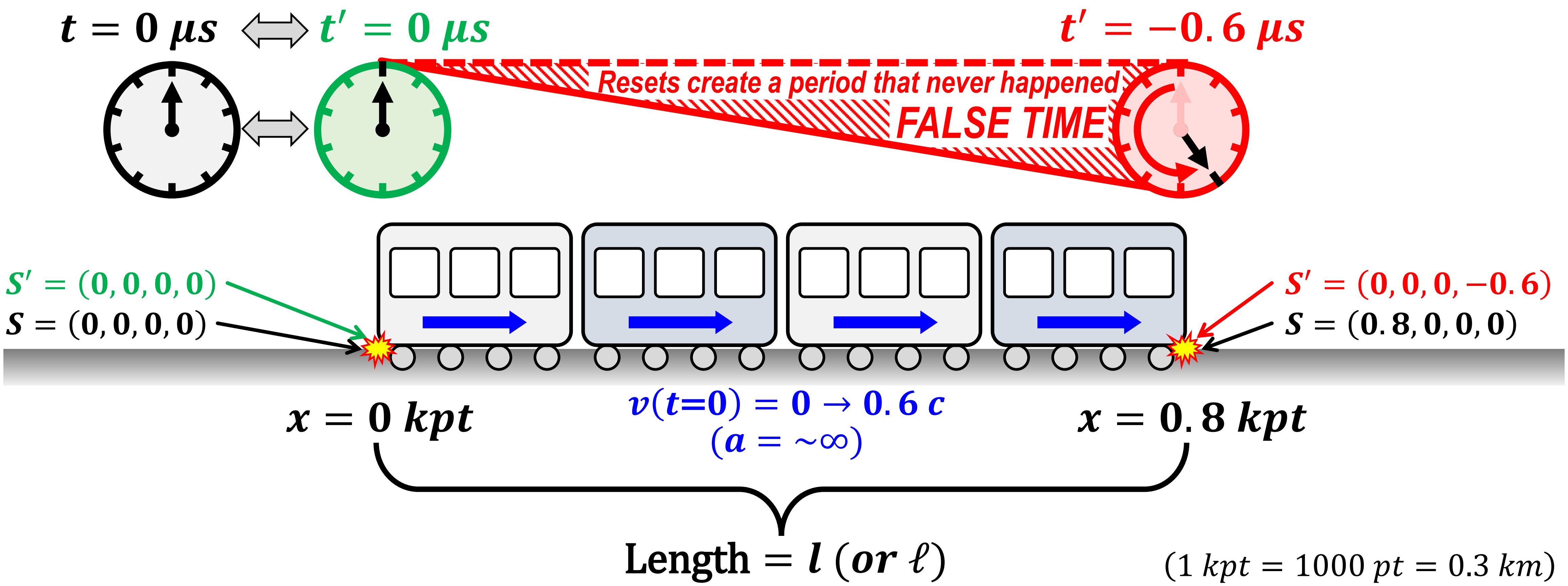
- Einstein co-located the origins of two inertial frames.
- Applying origin co-location when creating (accelerating) a Child frame from a Parent *necessarily* creates “false stories”.
- Even worse, every such Child origination (acceleration) brings two fundamental definitions of time into direct conflict:
  - *Experienced time* is time witnessed continually by an observer, even if it passes at differing rates.
  - *Physics time* is the time required to replicate the full range of physics, from particle physics up.
  - Ironically, it is the *physics time* that can never be restored immediately after an acceleration (!)

# Setting $t' = 0$ at $x = 0.8$ (Keeping $t'$ Positive)

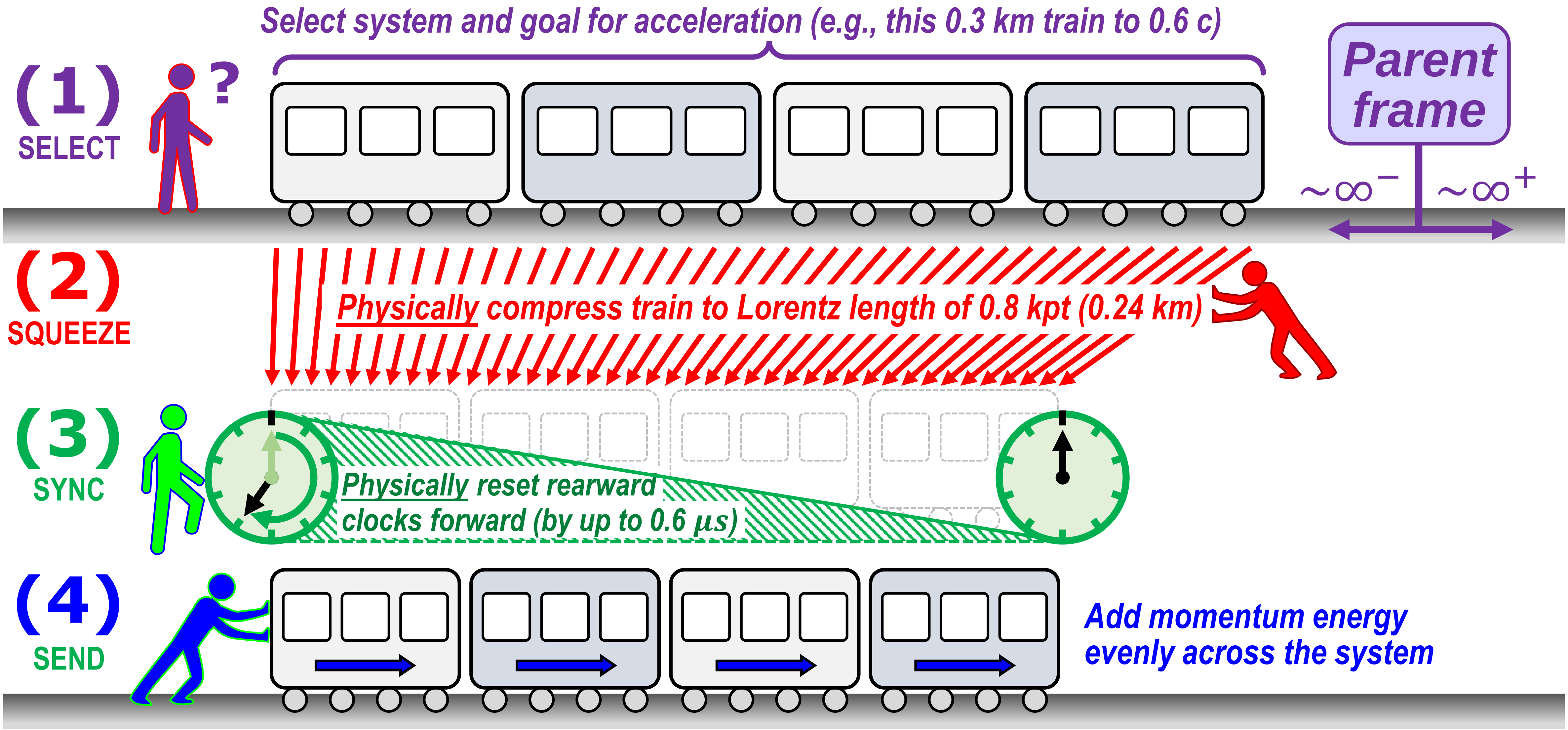



$(1\ kpt = 1000\ pt = 0.3\ km)$

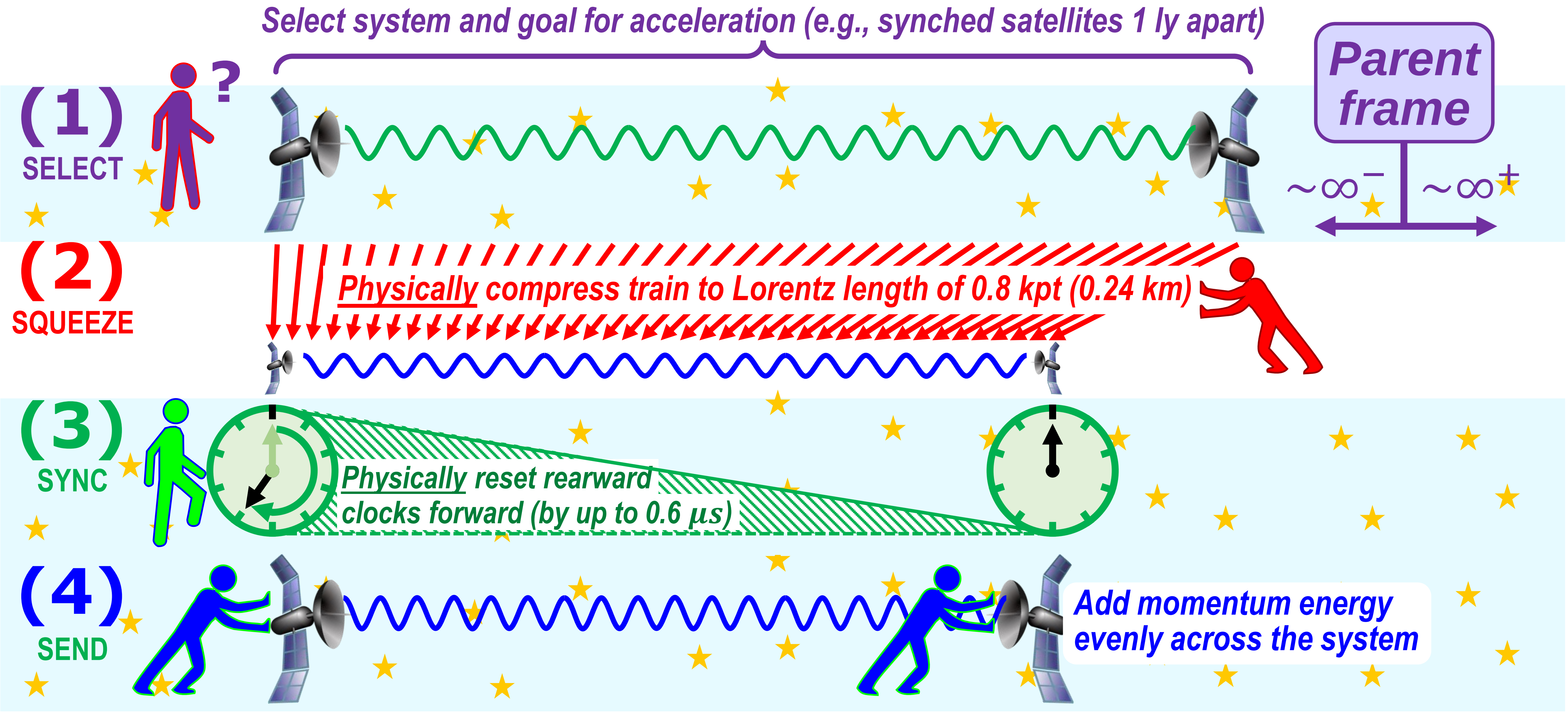
# Setting $t' = 0$ at $x = 0$ (Einstein's Collocation of Origins)



# Four Steps in Creating a Metrics-Capable Spacetime Instance



# Accelerating a Time-Synchronized Interstellar Satellite Network



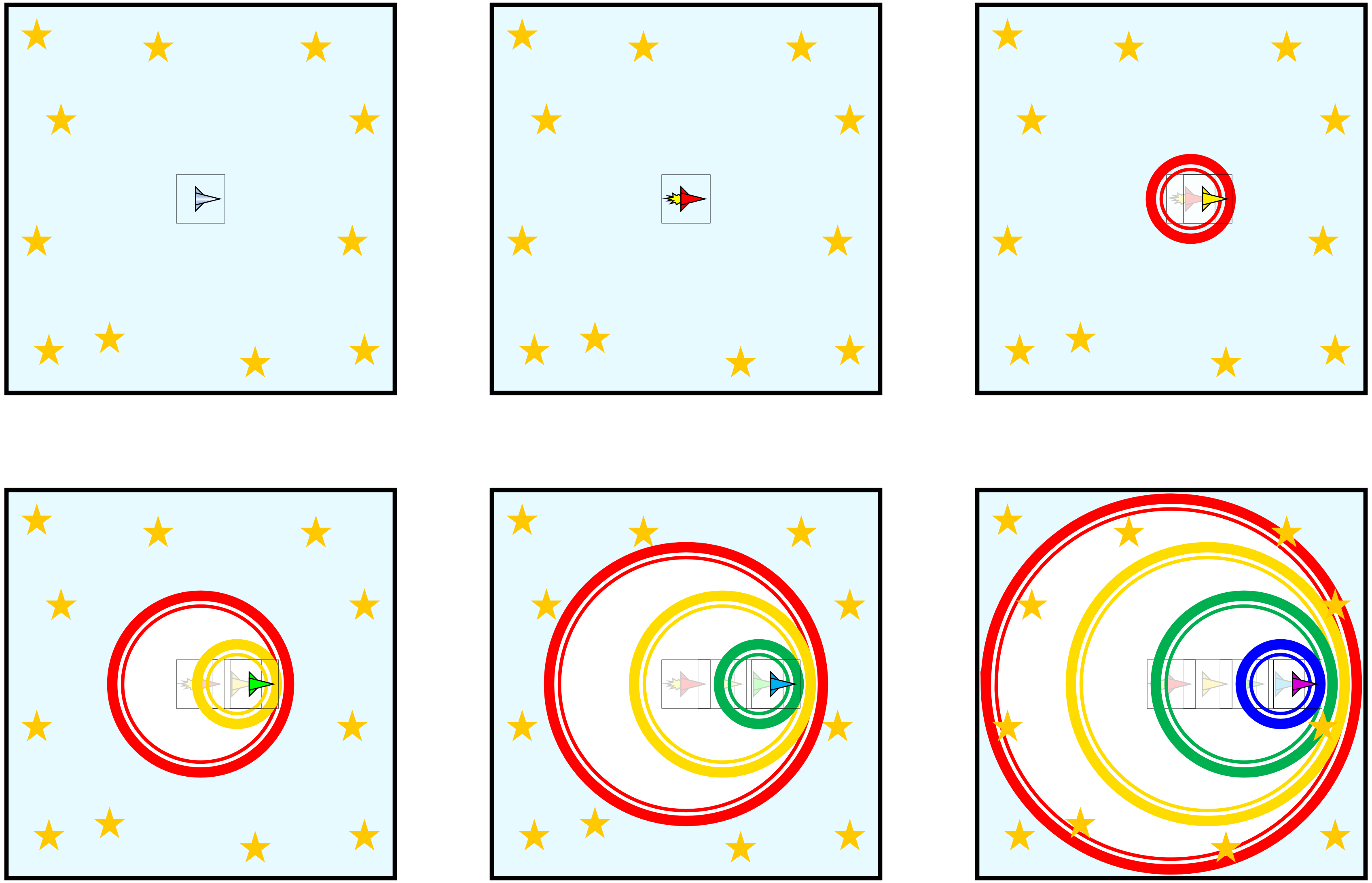
# But Terry! Lorentz Contraction is Symmetric!

- Correct statement:

**Length contraction is symmetric only for lengths passing through your *local* definition of spacetime.**

- Lengths forward of your region *shorten* (multiply) by the inverse relativistic Doppler factor: $1/R = \sqrt{(c-v)/(c+v)}$
- Lengths behind your region *stretch* (multiply) by the relativistic Doppler factor: $R = \sqrt{(c+v)/(c-v)}$
- Lengths passing through your region divide by the *average* of the two: $\big((1/R) + R\big)/2 = 1/\sqrt{1 - v^2/c^2} = \gamma$

# Forward Compression and Backward Dilation



# But Terry! Time Dilation is *Also* Symmetric!

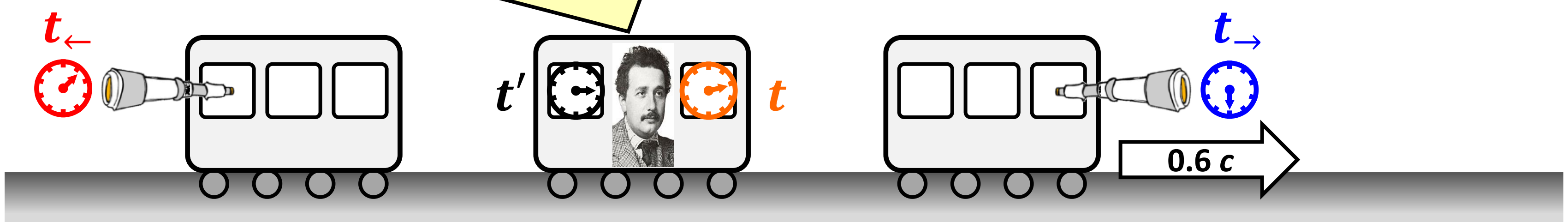
- Correct statement:

**Time dilation is symmetric only for durations passing through your *local* definition of spacetime.**

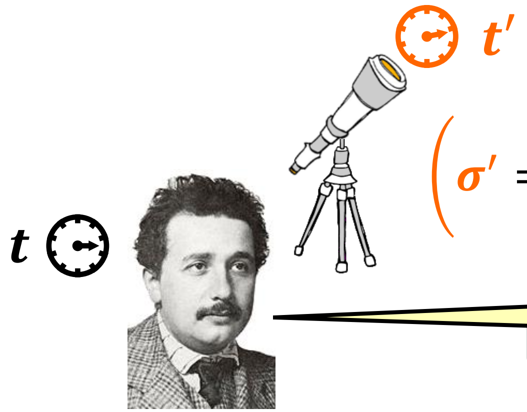
- Durations forward of your region *shorten* (multiply) by the inverse relativistic Doppler factor: $1/R = \sqrt{(c-v)/(c+v)}$
- Durations behind your region *stretch* (multiply) by the relativistic Doppler factor: $R = \sqrt{(c+v)/(c-v)}$
- Durations passing through your region multiply by the *average* of the two: $\big((1/R) + R\big)/2 = 1/\sqrt{1 - v^2/c^2} = \gamma$

# What Einstein Sees from an Actual Train

Your clocks are *weird*: They match my theory *inside* this train, but they're too slow behind me and too fast in front of me!




$$\left(\sigma_{\leftarrow} = \frac{s_{\leftarrow}}{s'} = 2\right) \left(\sigma = \frac{\sigma_{\leftarrow} + \sigma_{\rightarrow}}{2} = \frac{2 + 0.5}{2} = 1.25\right) \left(\sigma_{\rightarrow} = \frac{s_{\rightarrow}}{s'} = 0.5\right)$$

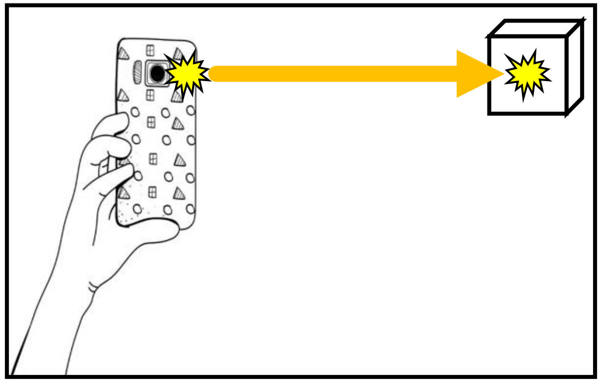



$$\left(\sigma' = \frac{\sigma'_{\leftarrow} + \sigma'_{\rightarrow}}{2} = \frac{2 + 0.5}{2} = 1.25\right)$$

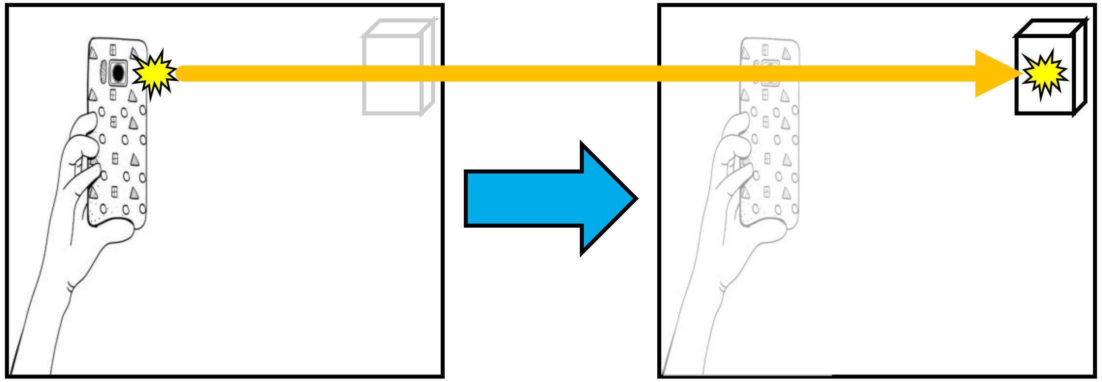
But… *your* clocks *always* match my theory!

# Short Version: Acceleration *Always* Time-Dilates

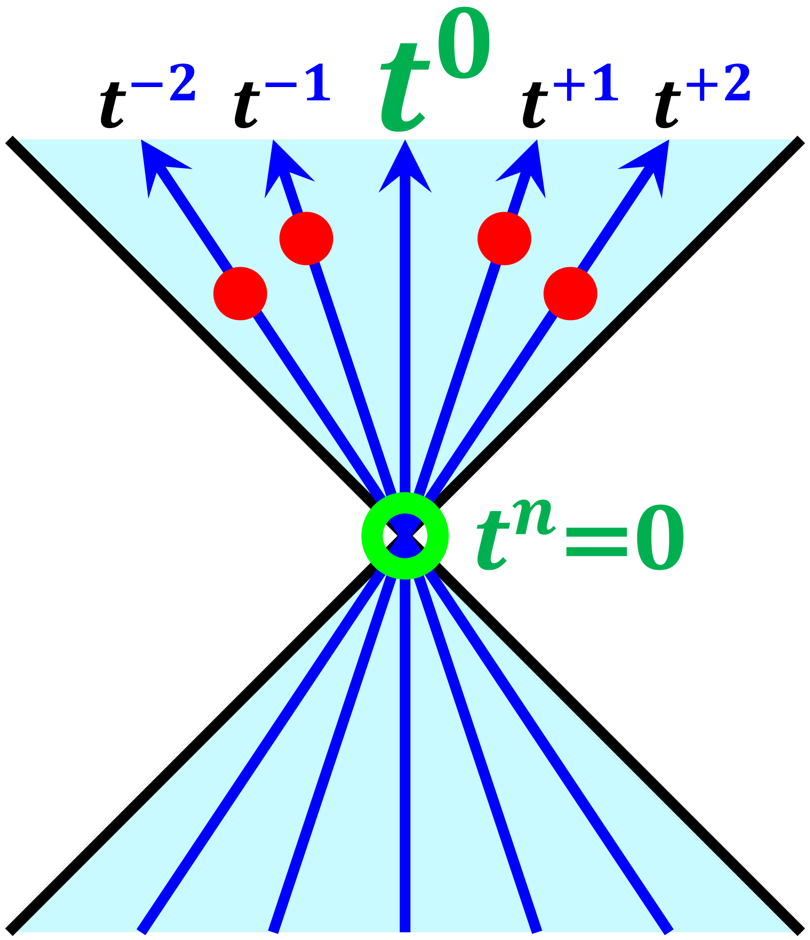
## Light delay when the phone and box are at rest



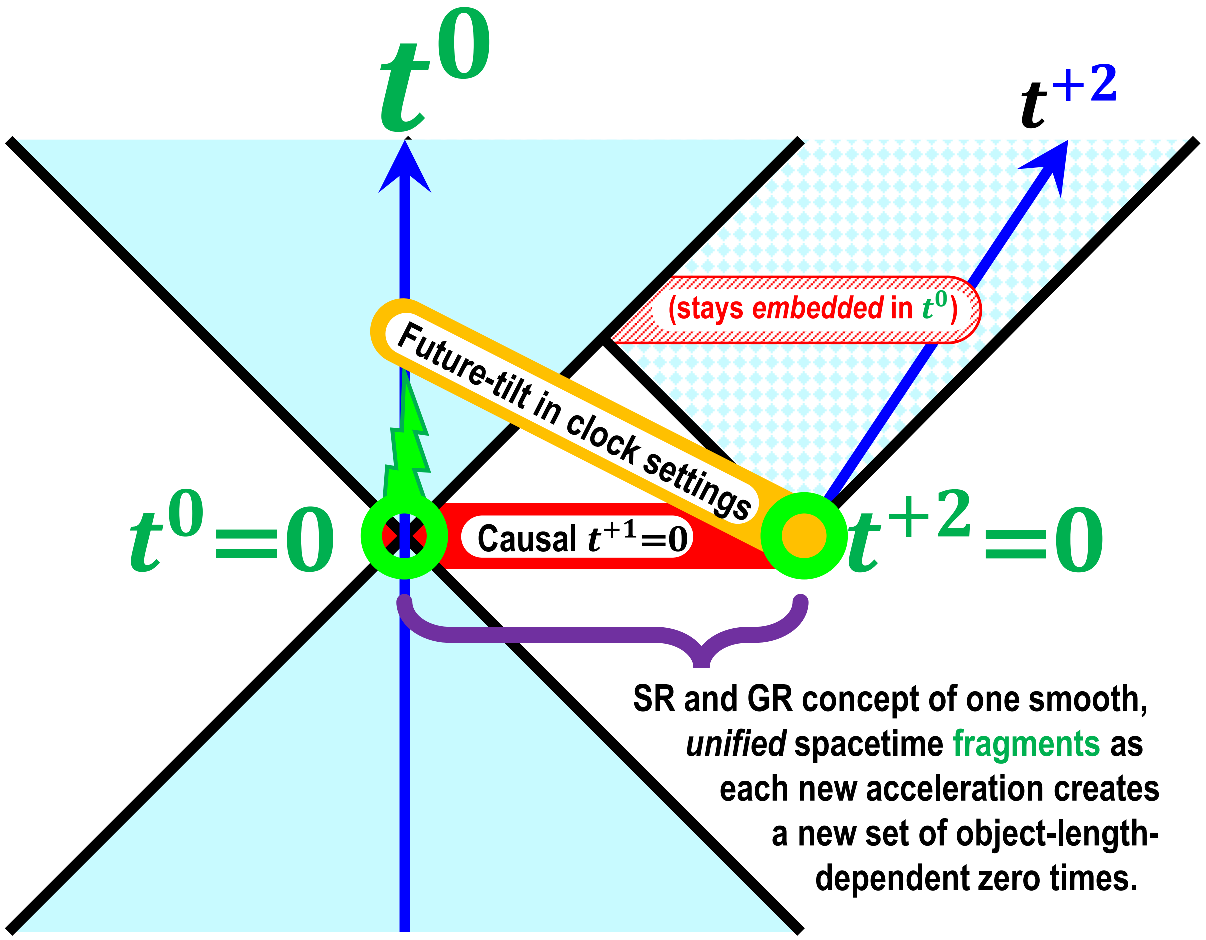
## Light delay when the phone and box are in motion



# Acceleration Creates *Small, Unique* Physics Regions

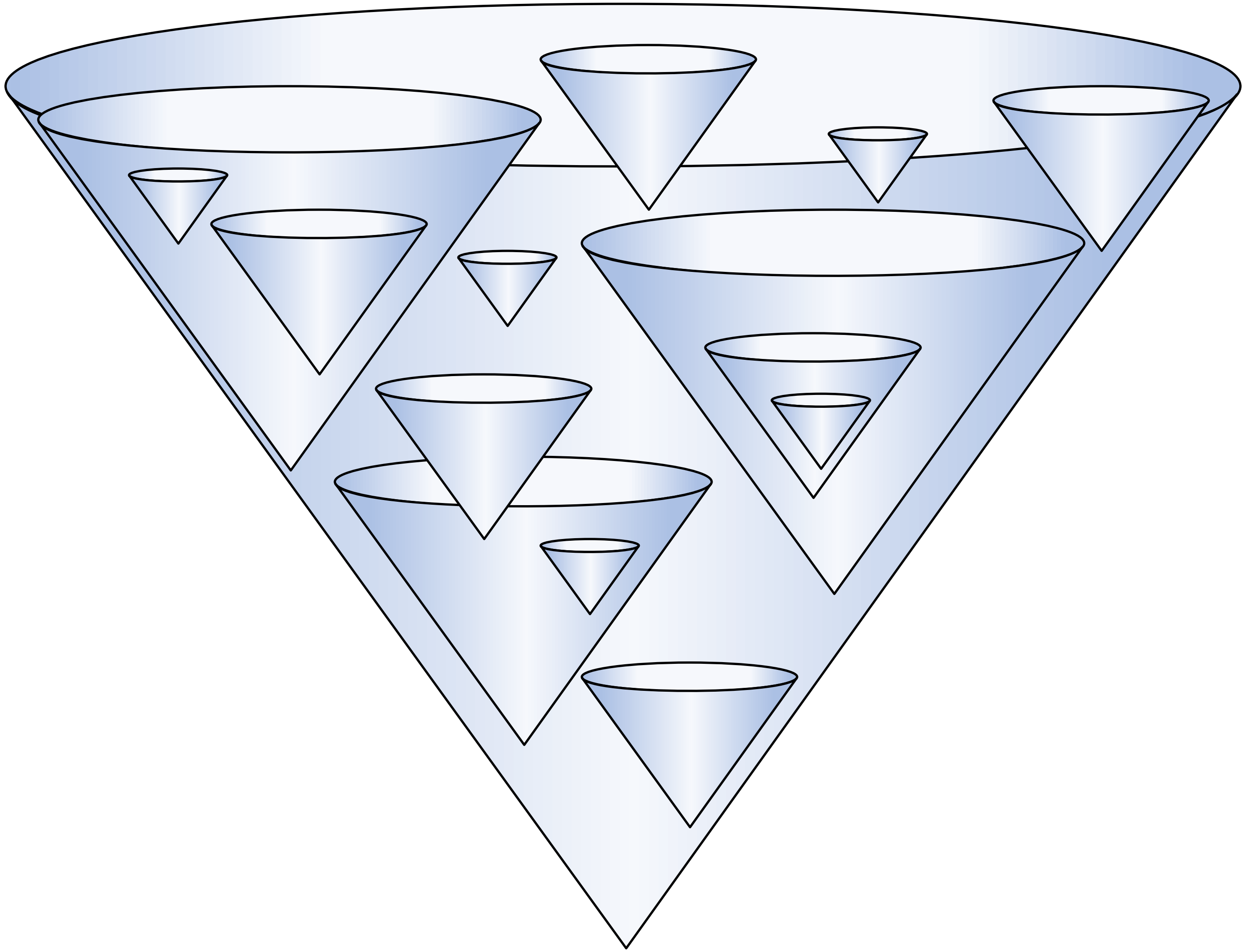



Einstein-Minkowski-Poincaré spacetime
($t^{n\neq 0}$ objects must be **exact points**)




Experimentally accessible spacetime
($t^{n\neq 0}$ objects can have **length**)

# Cones Within Cones: Fractal, Matter-Centered Spacetime



# Bringing in the Sparse Interpretation

- A *sparse interpretation* interprets subatomic mathematical complexity as mostly *chaos bits*. A smaller set of *persistent bits,* associated solely with matter, generates the chaos bits.
- The idea that accelerated systems *create* unique instances of spacetime is trivially consistent with a sparse interpretation.
- Combining the sparse interpretation with bottom-up, particles-first spacetime creation suggests a radical view:
  - Most of quantum physics emerges from *incomplete* early stages in the emergence of “classical” spacetime.
  - This view pushes the Standard Model to the top of physics.

# Żenczykowski on Spacetime Emerging from Matter

Piotr Żenczykowski,
*Quarks, Hadrons, and Emergent Spacetime*,
*Foundations of Science* **24** (2), 287–305 (2019).
https://arxiv.org/abs/1809.05402

*"… with space viewed as an attribute of matter … one should start not from discrete (or quantized) space but from discrete (or quantized) matter. Hadrons seem particularly relevant … as the hadronic mass scale is much farther from the classical realm than the Planck mass scale, which is essentially of classical size."*

*"… the hadronic spectrum parameter [justifies] emergence of internal quantum numbers of weak isospin, hypercharge and color [from a phase-space]. This picture is … unique in its parsimony [and thus] very attractive. It suggests an extension of the concept of mass [and] questions the idea of ordinary divisibility of space … and suggests that standard ideas on intra-baryonic space [only] approximate reality."*

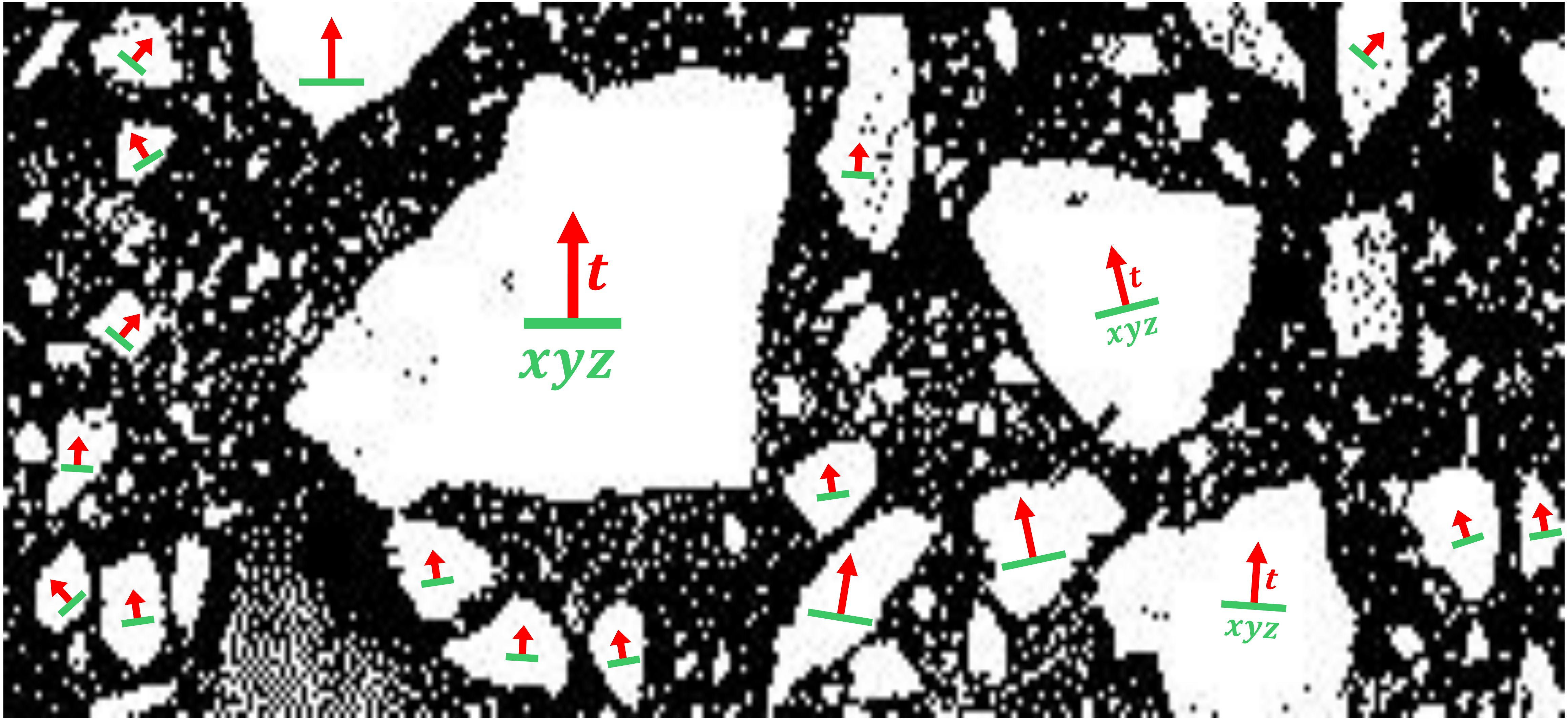
# What is “Spacetime”?

- Spacetime is a set of *relationships* between entities that are:
  - Persistent (highly conserved, not easily destroyed).
  - Devoid of spacetime shape (*nirakar*, निराकार, Sanskrit for “unformed”).
  - *Neither* point-like *nor* wave-like. Points and waves are short-term transient views (chaos bits) created solely by interactions with frames.
  - Capable of mutual exclusion (Pauli exclusion).
  - In large numbers, capable of shaping exclusion into *orthogonalities.*
  - Capable of stability, that is, of forming new persistent relationships.
  - Capable of change, which can organize into an orthogonal *time* axis.
- Spacetime is *hierarchical* with *fractal* self-symmetry.
- Spacetime *does not exist* without matter (matter’s “address book”).

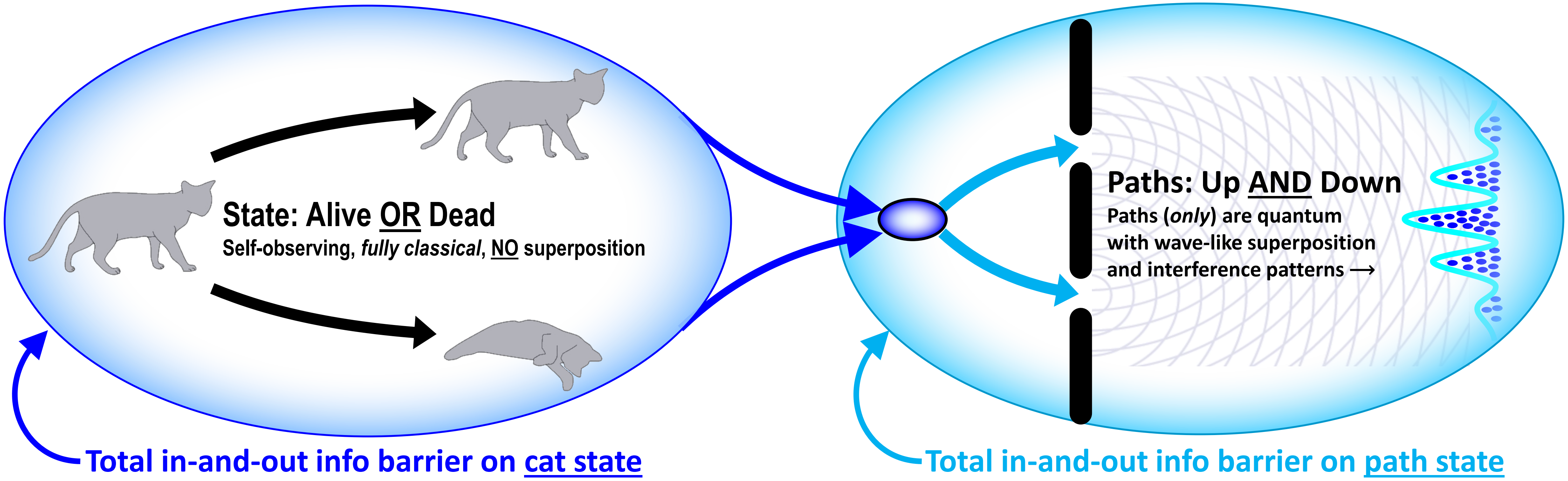
# The Quantum-to-Gravity Continuum

- If creating spacetime instances is a *bottom-up* process…
  - Spacetime *begins* with the Standard Model of particle physics.
  - Pauli exclusion and bonding make *rulers* possible.
  - Cyclic phenomena (looping) make *clocks* possible.
  - *Acceleration* (“observation”) causes entities to share scale definitions.
  - *Continual* self-observation (spin) enables “particle” persistence.
  - Hierarchies of external observation enable the point-particle illusion.
- Spacetime smoothness depends on how entities interact:
  - “Very few entities participating” = Small-scale quantum uncertainty
  - “Many-but-distant entities” = Spacetime alignment variability (GR).

# The Brecciated Universe: Competing Spacetimes



# The Role of Local Spacetime in Quantum Superposition

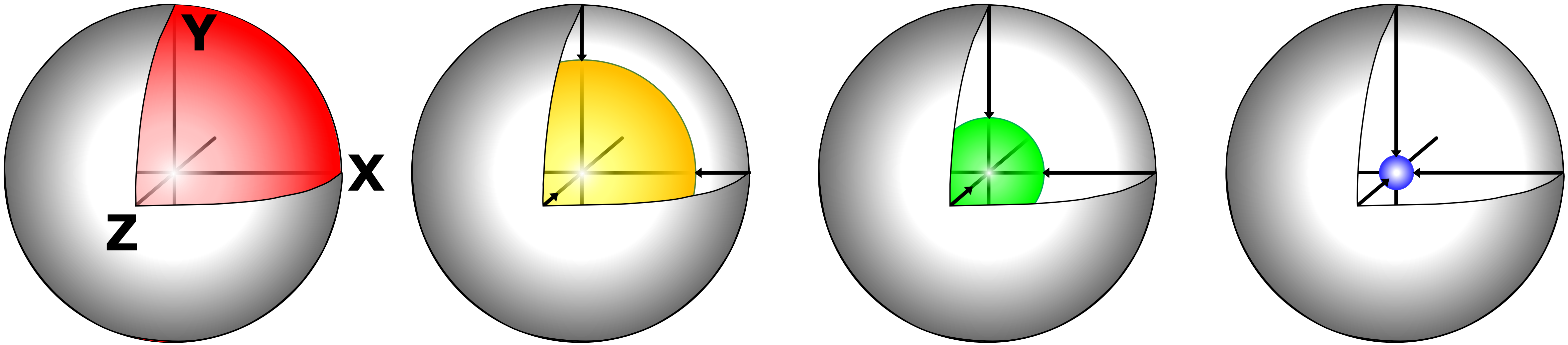


# Euclid's First Definition: "A point is that which has no part."

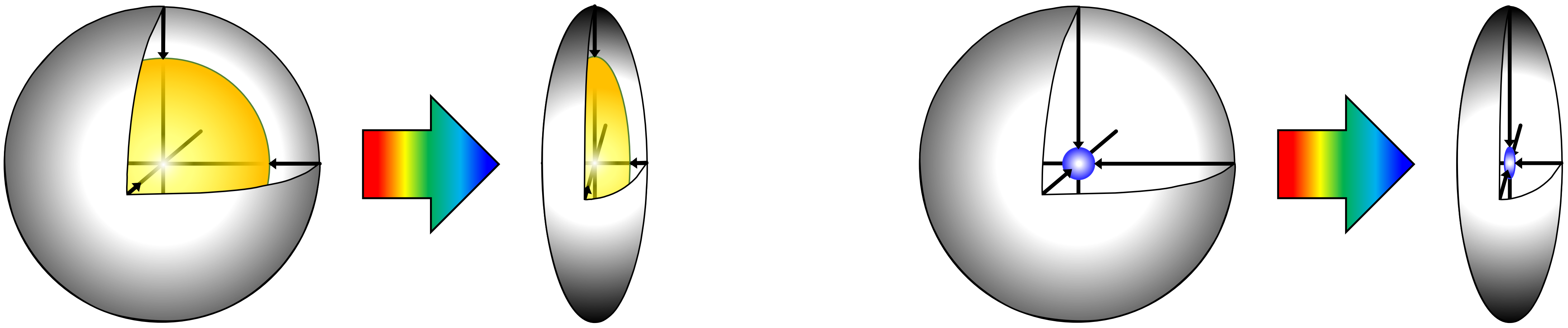
***What does it mean to "have" a part? … What is a "part"? … What does it mean to* not *have a part?"***

Euclid's intuition in his first definition is easy to discern. He's thinking of a point as what you get if you shrink a ball until it has no detectable volume — a ball being the only geometric shape without any unique "parts," since it has spherical symmetry. A cube or any shape other than a sphere has discernable parts, such as corners and faces, that give them unique orientations. However, points should never have orientations since they capture only *location*.

In modern terminology, Euclid implicitly proposed that the best definition of a point was a round, three-dimensional ball scaled down to infinitesimal size. This is complicated definition that implies calculus-level algorithms.

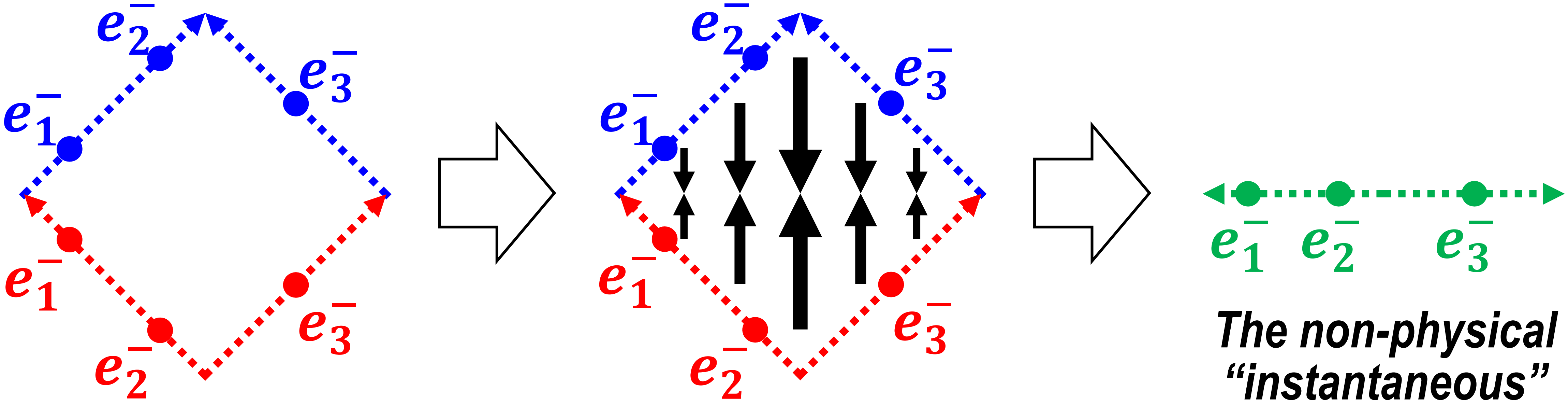


# A *Moving* Point Is *Not* a Euclidean Point



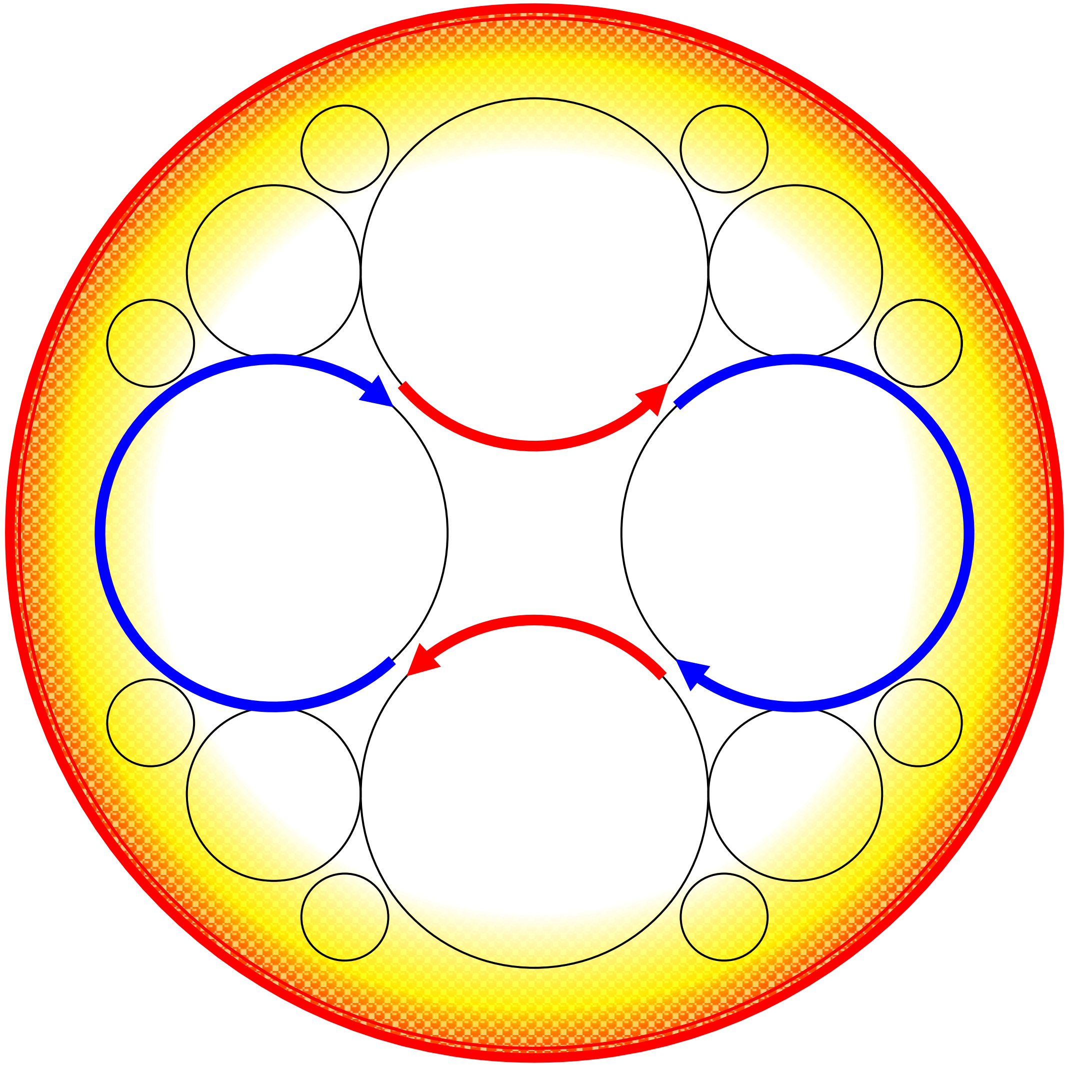
- A *moving*, Lorentz-compressed point loses its spherical shape.
- For any given scale, it has *parts* relative to a spherical point.
- The two cases remain unique *even at their infinitesimal limits.*

# Distance as Stability-Dependent Approximation

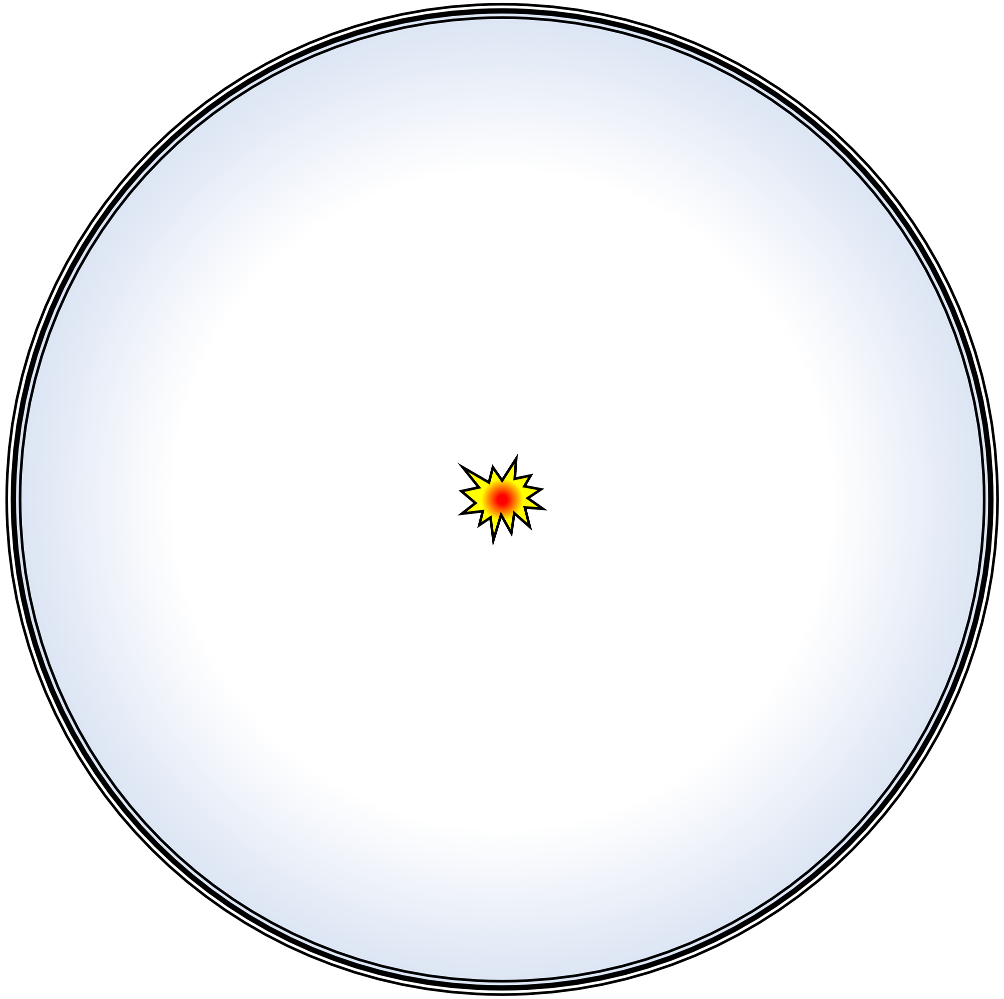


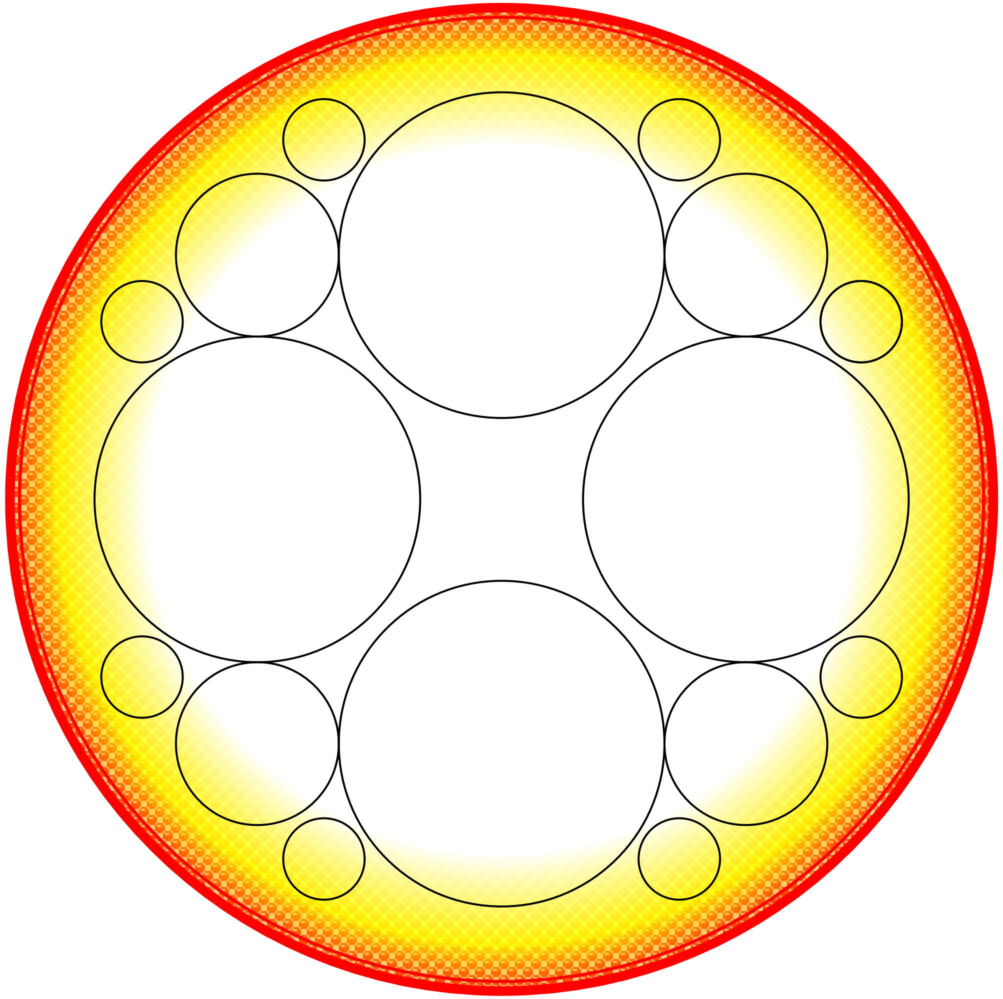

***The non-physical "instantaneous" number-line approximation***

# The Quantum Momentum State Interpretation of Black Holes

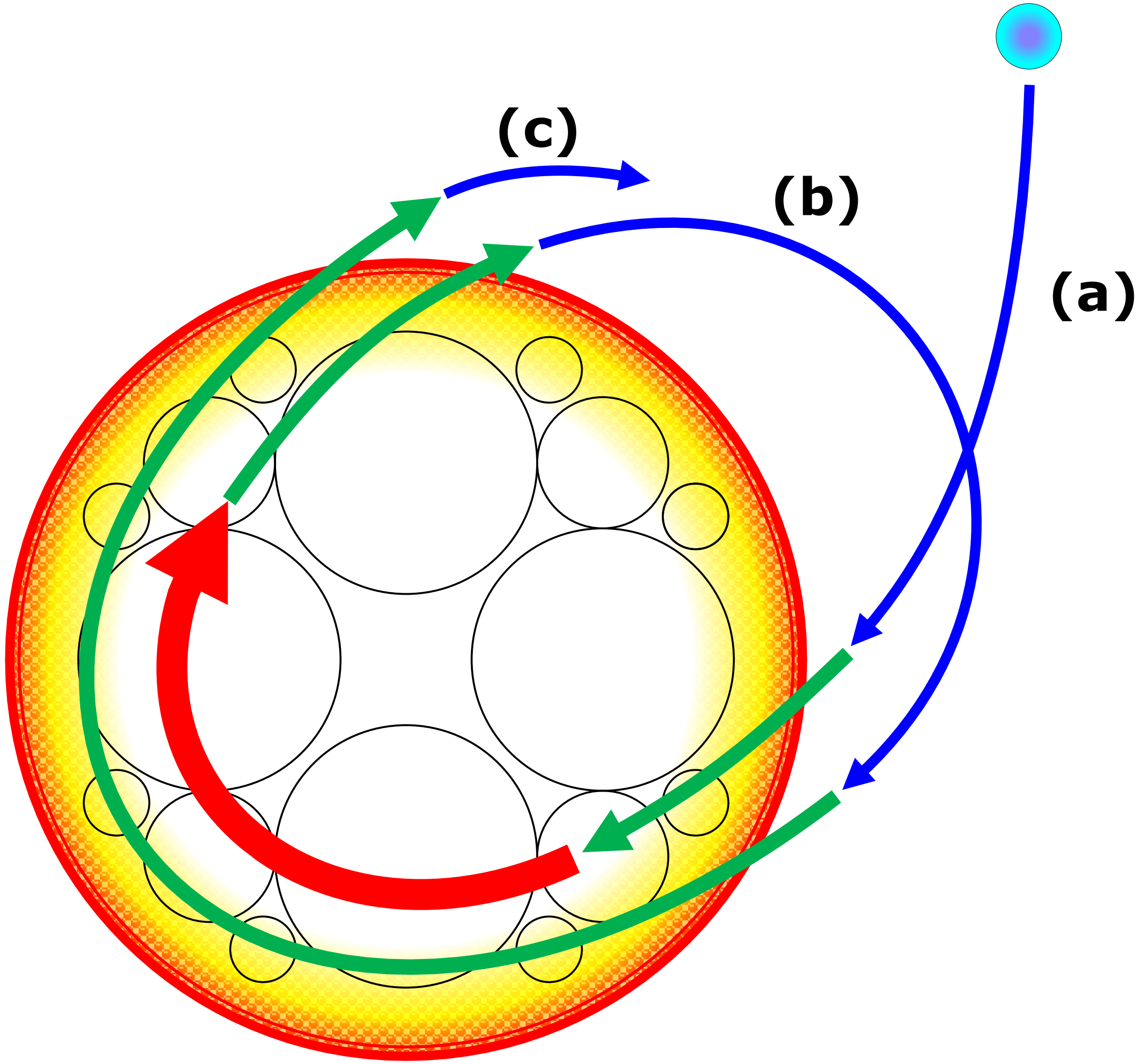


# Conventional vs. *Asymmetric Orbital Scale* (AOS) Black Holes



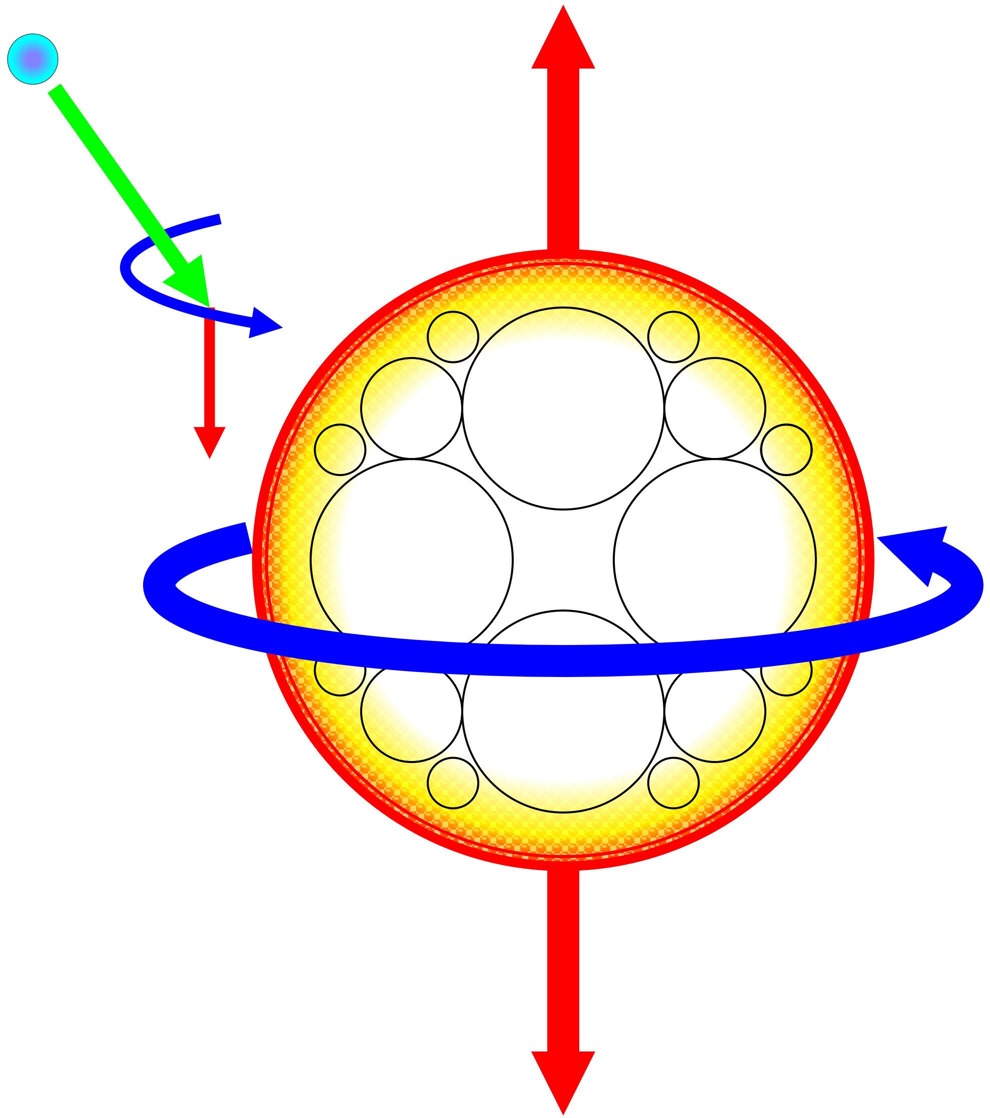


# Decaying Elliptical AOS Orbits

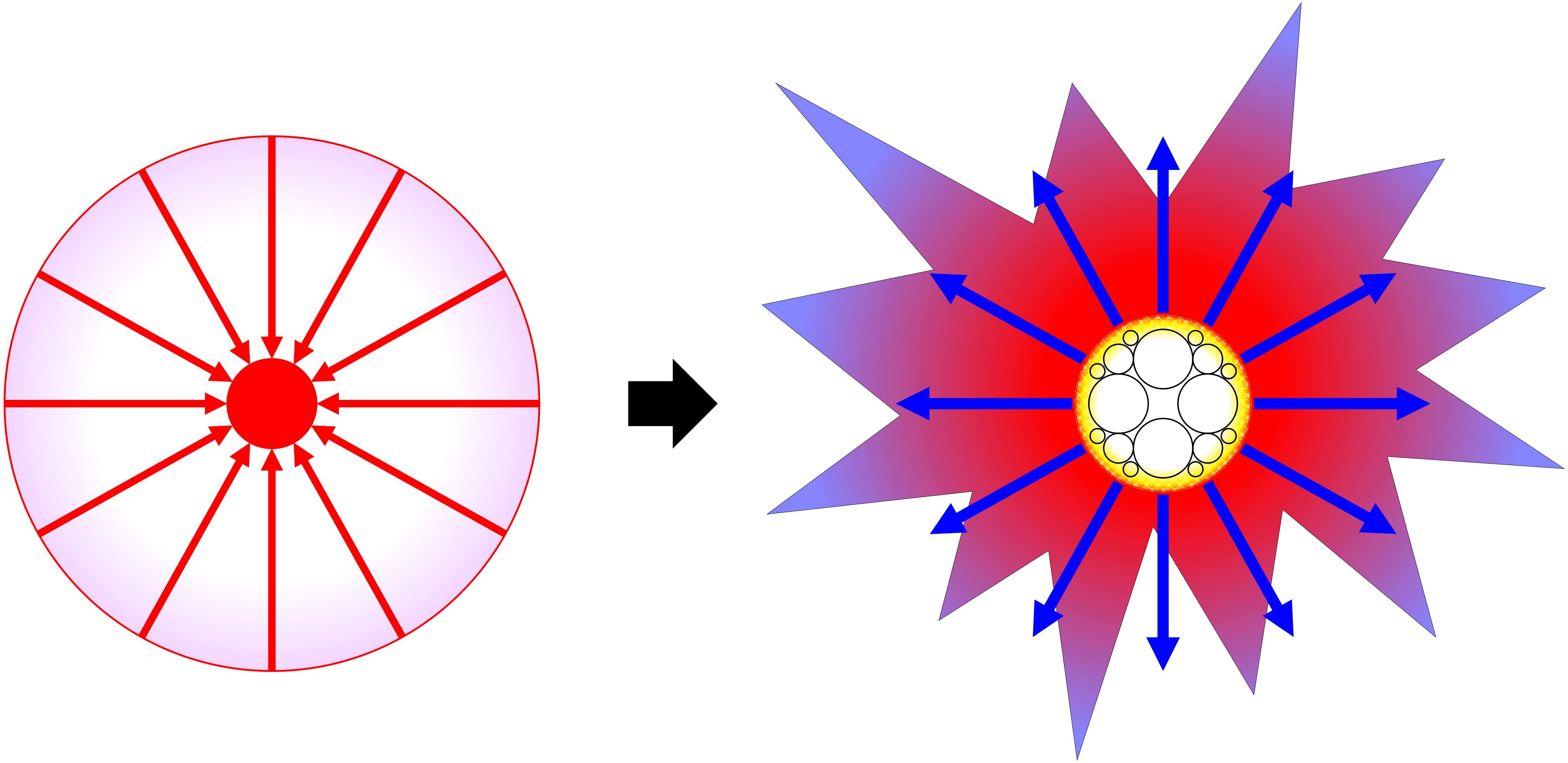



**Y. Cendes et al.,** ***Ubiquitous Late Radio Emission from Tidal Disruption Events, arXiv preprint arXiv:2308.13595*****, [Aug.] (2023).**
**https://arxiv.org/abs/2308.13595**

# Cosmic Jets as AOS Momentum Factoring



# Supernova Type II Core Rebound as an AOS Effect



# Summary

- There is danger in math models that are too beautiful!
  - Beauty too often means *oversimplification*
  - Math itself has a deep relationship to classical physics, borrowing many of its “simple” concepts such as metrical space from physics.
  - Example: The Poincaré symmetries work fantastically well, but do *not* tell a sufficiently detailed story of what a “boost” truly means.
- A new path: If particles and fields are nothing more than creations of inertial frame instances, *what is hiding deeper?*
  - What are the precise rules that govern the deeper, enduring, nirakar entities that disregard spacetime and only pose as particles or waves?
  - What are the rules that *precede* the emergence of space and time?