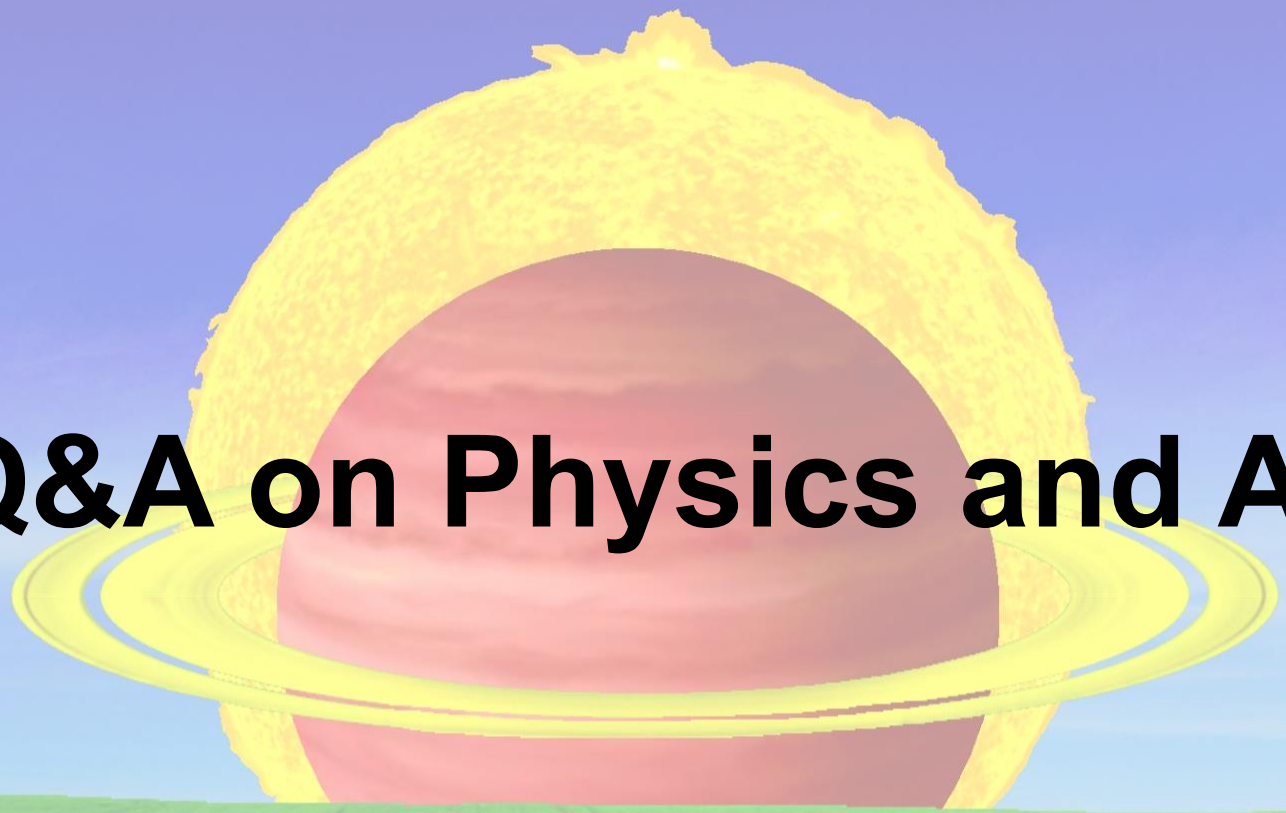


Q&A on Physics and AI

Presented by: Terry Bollinger (Apabistia Press)

Presented at: **Washington DC Quantum Computing Meetup (on OrionX YouTube)**

July 18, 2026

Overview

I. Einstein's Loading Principle

II. The Loading Principle in Cosmology

III. The Loading Principle in Quantum Mechanics

IV. Quick Comments on LLM Technologies

V. Summary

Objectives of Today's Talk

- Goal: List some topics in theoretical physics and artificial intelligence that have promise for future research
- Deep-dive starting topic that drives my assessment:
  - How **Einstein developed a novel method** to predict the Twins Paradox
  - How this **loading principle** converts many mathematical "paradoxes" in physics theory into extremely precise experimental predictions
  - How his loading principle allows existing highly successful mathematical models to take on new meanings by including loading constraints
  - Impacts of the loading principle on cosmology
  - Impacts of the loading principle on quantum mechanics
  - The curious issue of why Einstein's loading principle was lost
- For AI, the message is simple: Data compression is not cognition

Part I.
Einstein's Loading Principle

The Loading Principle: Einstein's Forgotten Insight

- Before 1911, everyone, including Einstein, assumed that since time dilation appears identical to all observers, clocks that traveled and returned should read the same as clocks that stayed home
- Einstein startled everyone, including himself, when he developed a new analytical approach that predicted clock differences
- His prediction was later verified by multiple experiments that showed fast-moving systems to have *testably* slower time

REF: A. Einstein, *The Theory of Relativity*. Naturforschende Gesellschaft, Zürich, Vierteljahresschrift **56**, 1–14, [Jan. 16] (1911)

Original German journal version:
https://archive.org/details/vierteljahrsschr56natu/page/1/mode/1up

English translation with added figures and Einstein's 1907 self-reference:
https://sarxiv.org/ref.1911-01-16.figs.pdf

Einstein's Loading of Clock Settings into $x'y'z'$

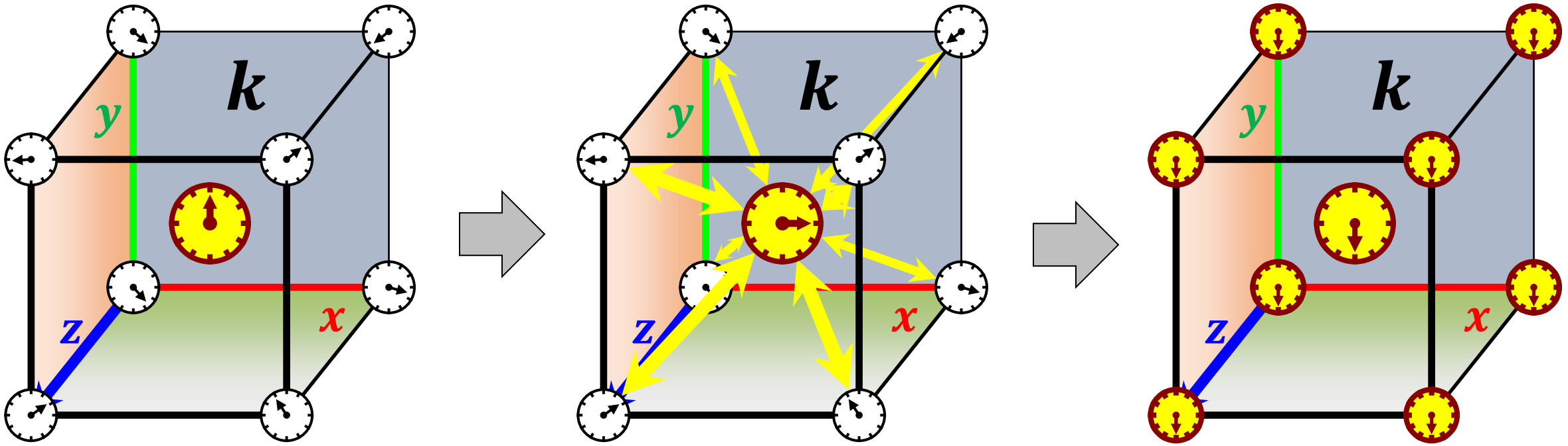
Einstein's insight: Until you load a well-defined local volume of the infinite abstract space $x'y'z'$ with co-moving synchronized physical clocks, t' cannot be measured:

Page 8: … "We stipulate only this: The speed of light propagation in a vacuum from A to B is the same as from B to A. Thanks to this stipulation, we can now add more clocks of the same type at various locations, all at rest relative to the system k. … By enforcing this constraint, we obtain a way of determining time that a physicist can apply practically: The time of an event is equal to the time given by whichever previously adjusted coordinate clock is closest to the event. … To give event times a very specific meaning, one must apply the rule of setting clocks by assuming equal light propagation times in both directions between any two clocks to a large number of clocks that are all at rest relative to a very specific coordinate system k. That is, we have not obtained a definition of time *per se*, but only a definition of time relative to the coordinate system k — or, more precisely, with reference to the clocks arranged at rest relative to the coordinate system k."

"We can, of course, perform precisely the same operations if we have a second coordinate system k' that is in uniform motion relative to k. We can distribute another clock system over space relative to this coordinate system k', but in such a way that the clocks move with k' and are at rest relative to it. We can then adjust these clocks at rest relative to k' using the same rule given above. If we do this, we get a new definition of time with respect to the system k'."

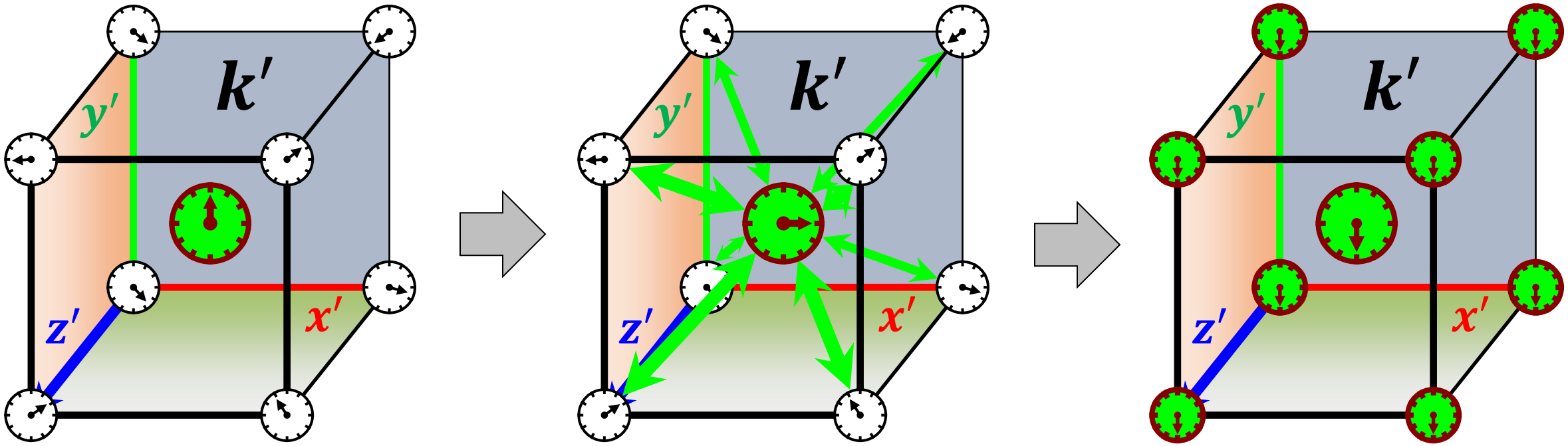
Einstein Clock Loading of the Observer Frame

- Einstein loading of the finite inertial-frame volume k=[x,y,z] with an experimentally testable definition of space-like simultaneity for any moment on the t' axis:

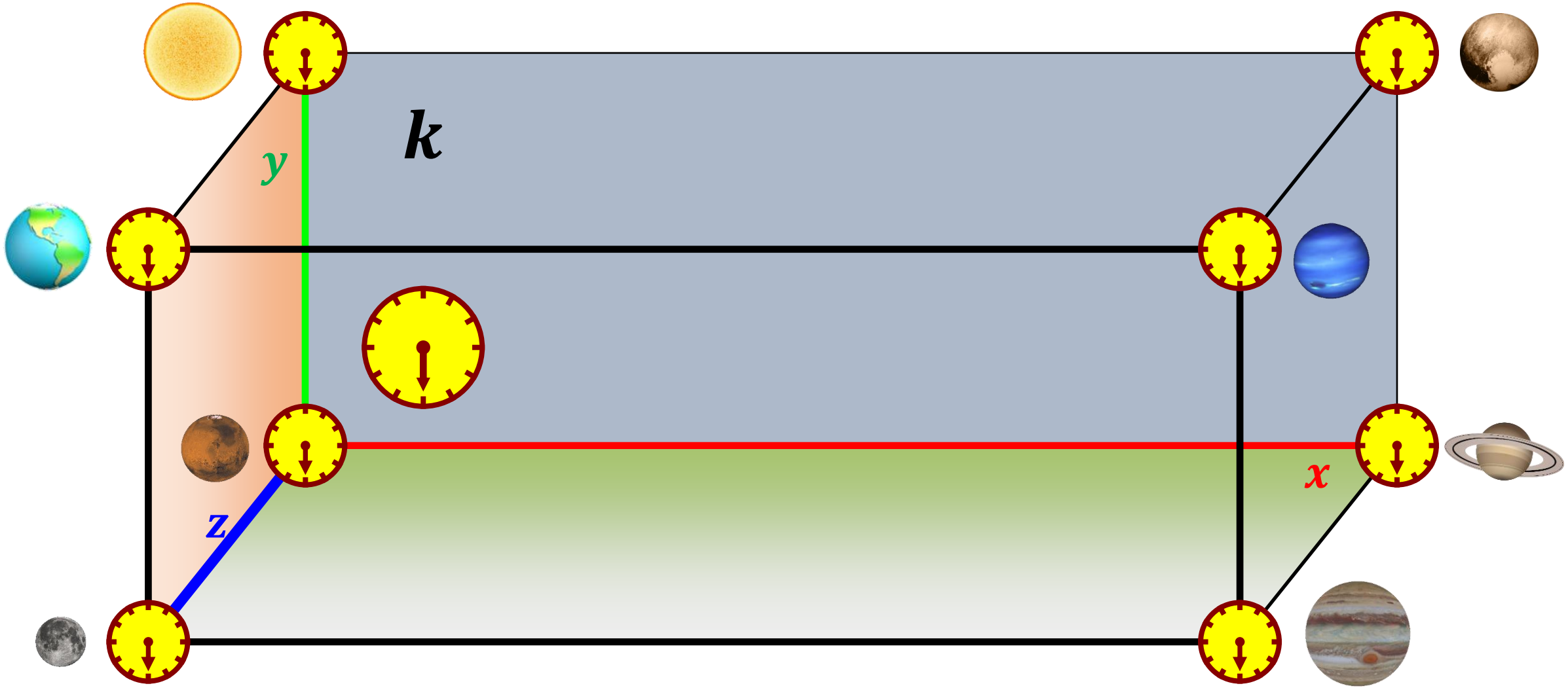


Einstein Clock Loading of an Accelerated Frame

- Einstein loading of a new inertial-frame volume $k'=[x', y', z']$ with an experimentally testable definition of space-like simultaneity for any moment on the t' axis:

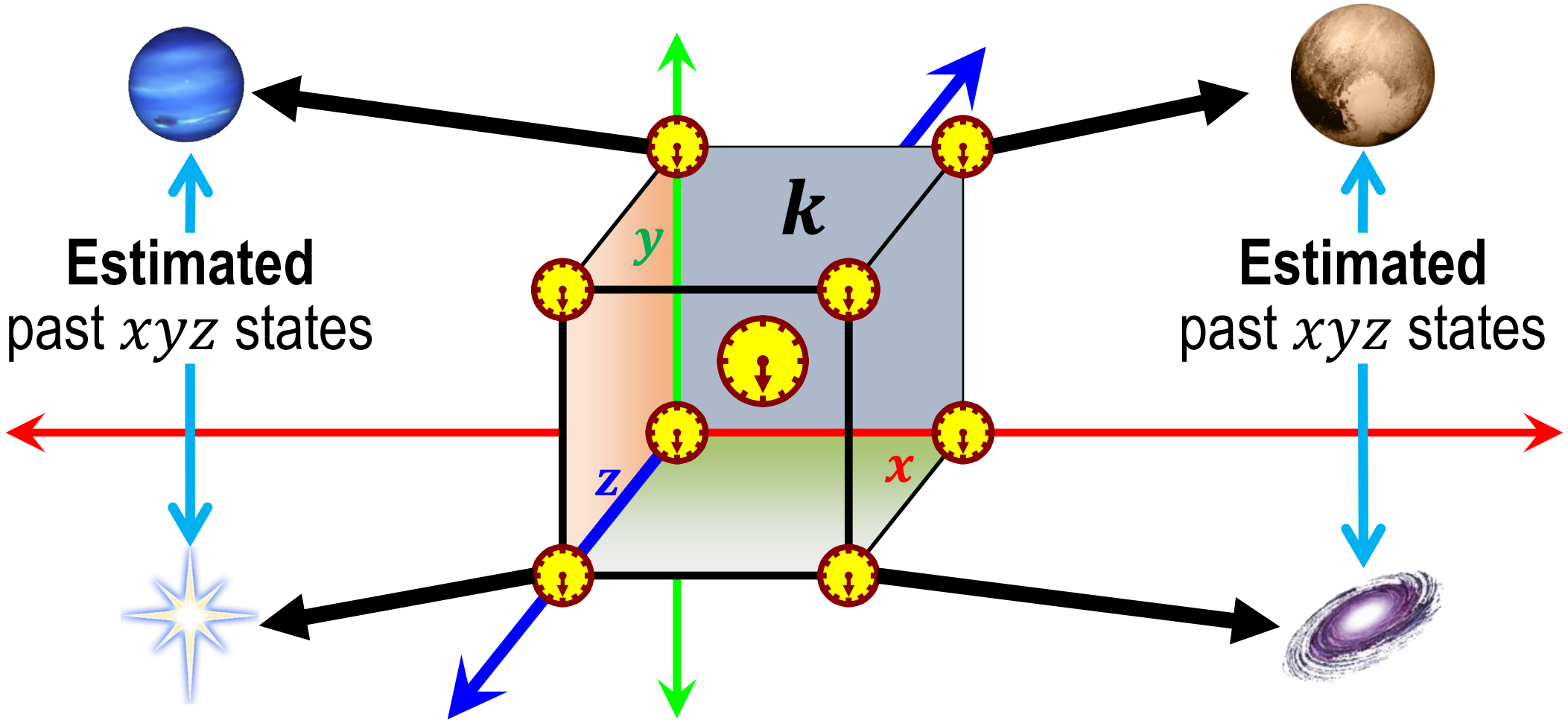


Example of a Very Large Pre-Loaded Observer Frame



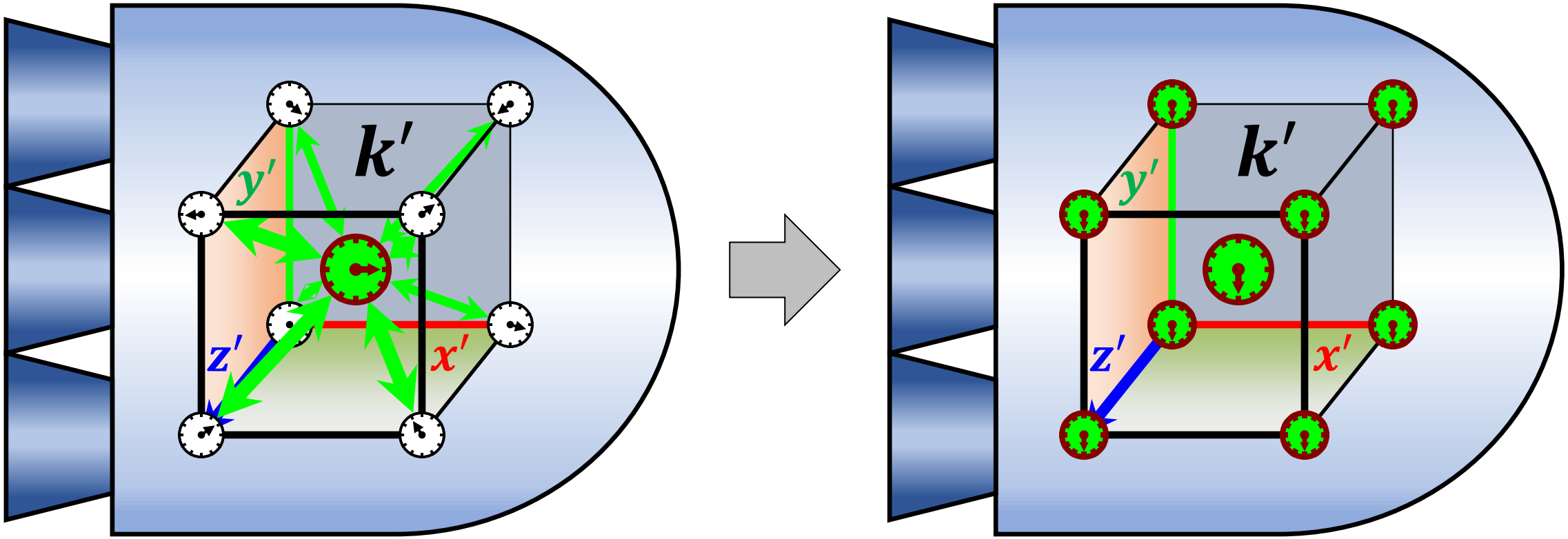
Proxy Loading for Distant But Predictable States

- Proxy loading creates local-only clock models for distant systems

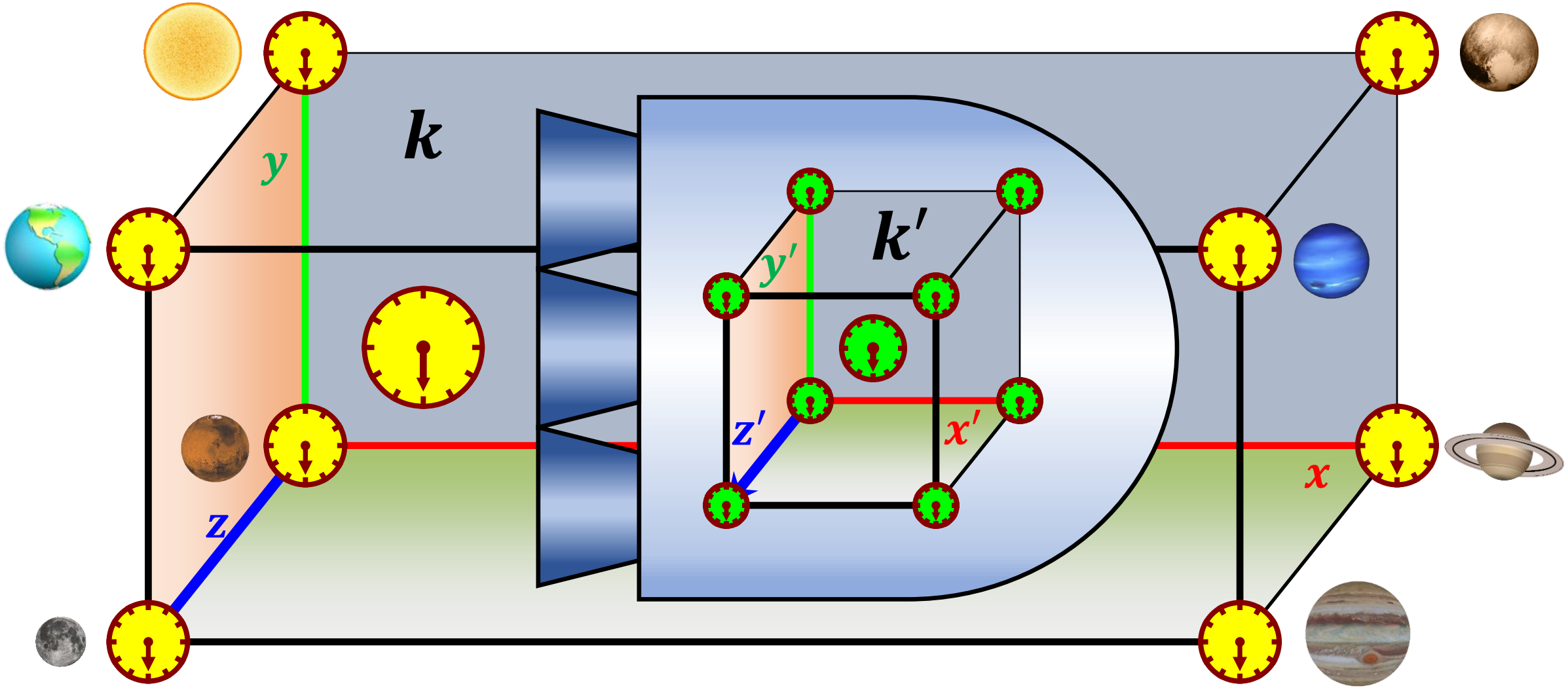


Acceleration *Always* Requires Clock Reloading

- The act of acceleration creates time gradients across earlier clocks

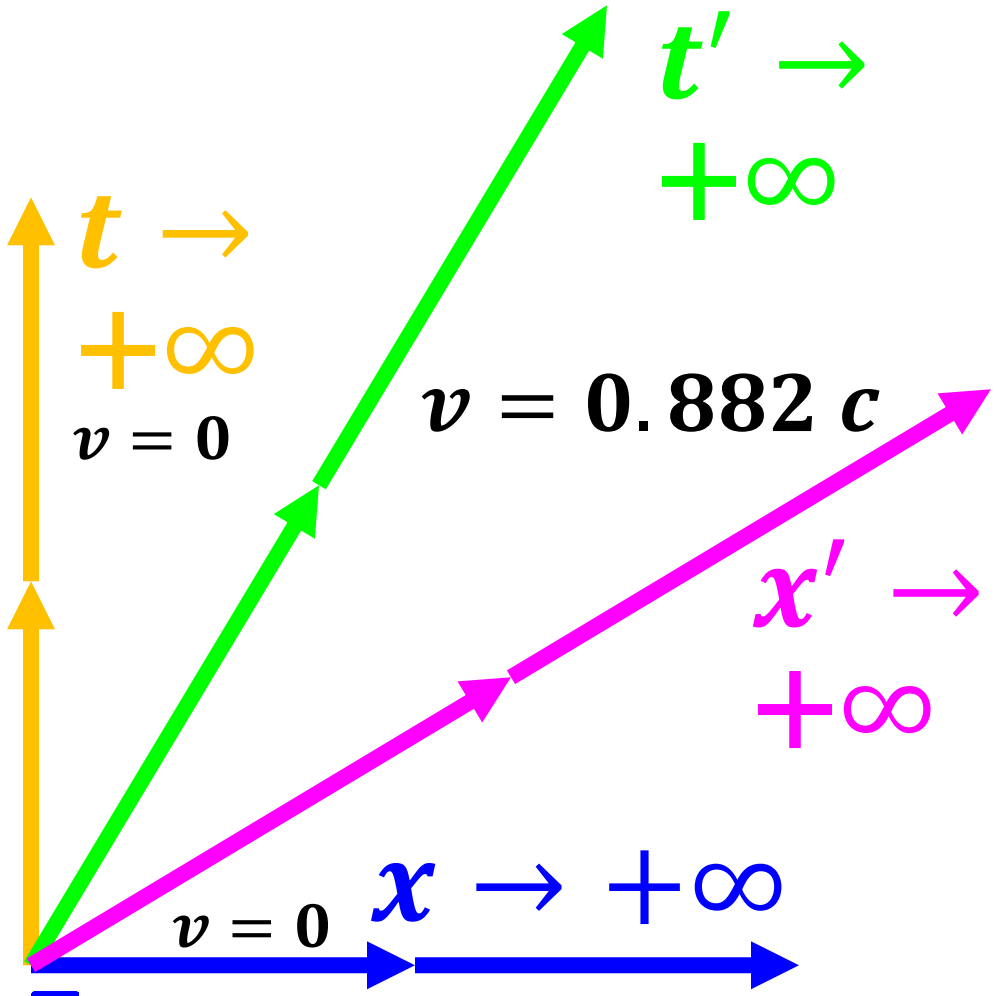


The Meaningful t' Volume of a Rocket is Very Small

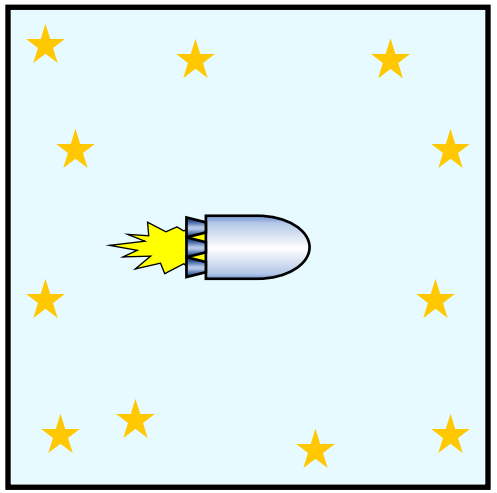


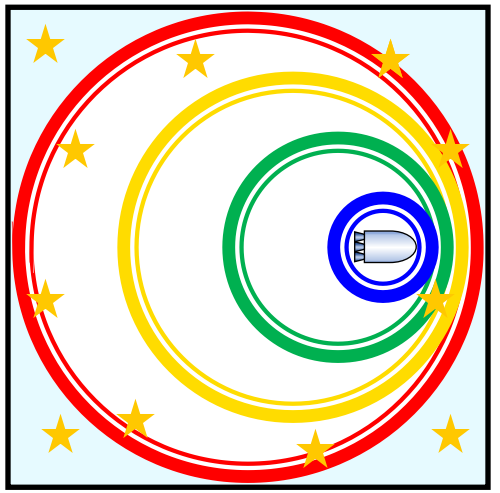
Frame Realism: The First Frame Always Dominates

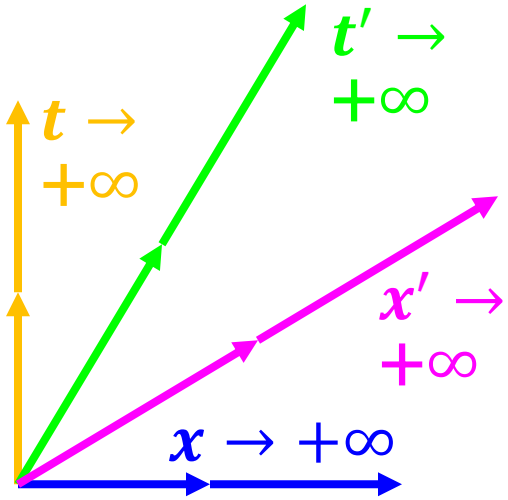
$k' = [x', y', z', t']$ (infinite)



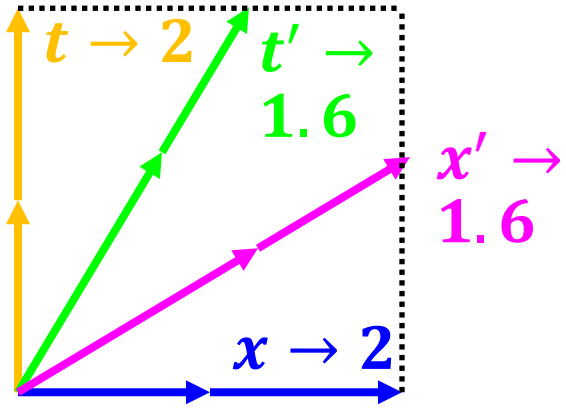
k light cones *limit* loading of k'





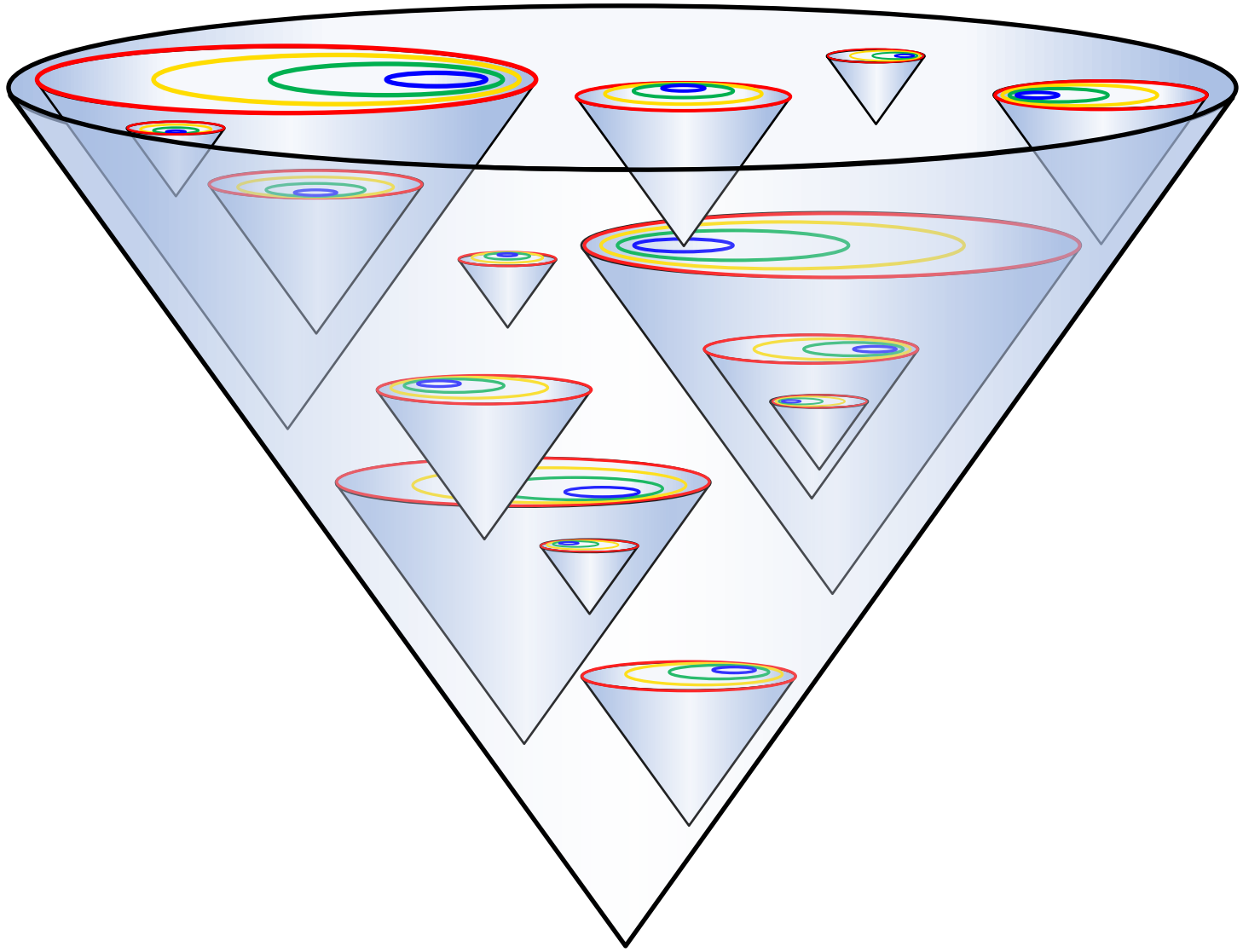


Oops! All k' metrics encounter k cut-offs!

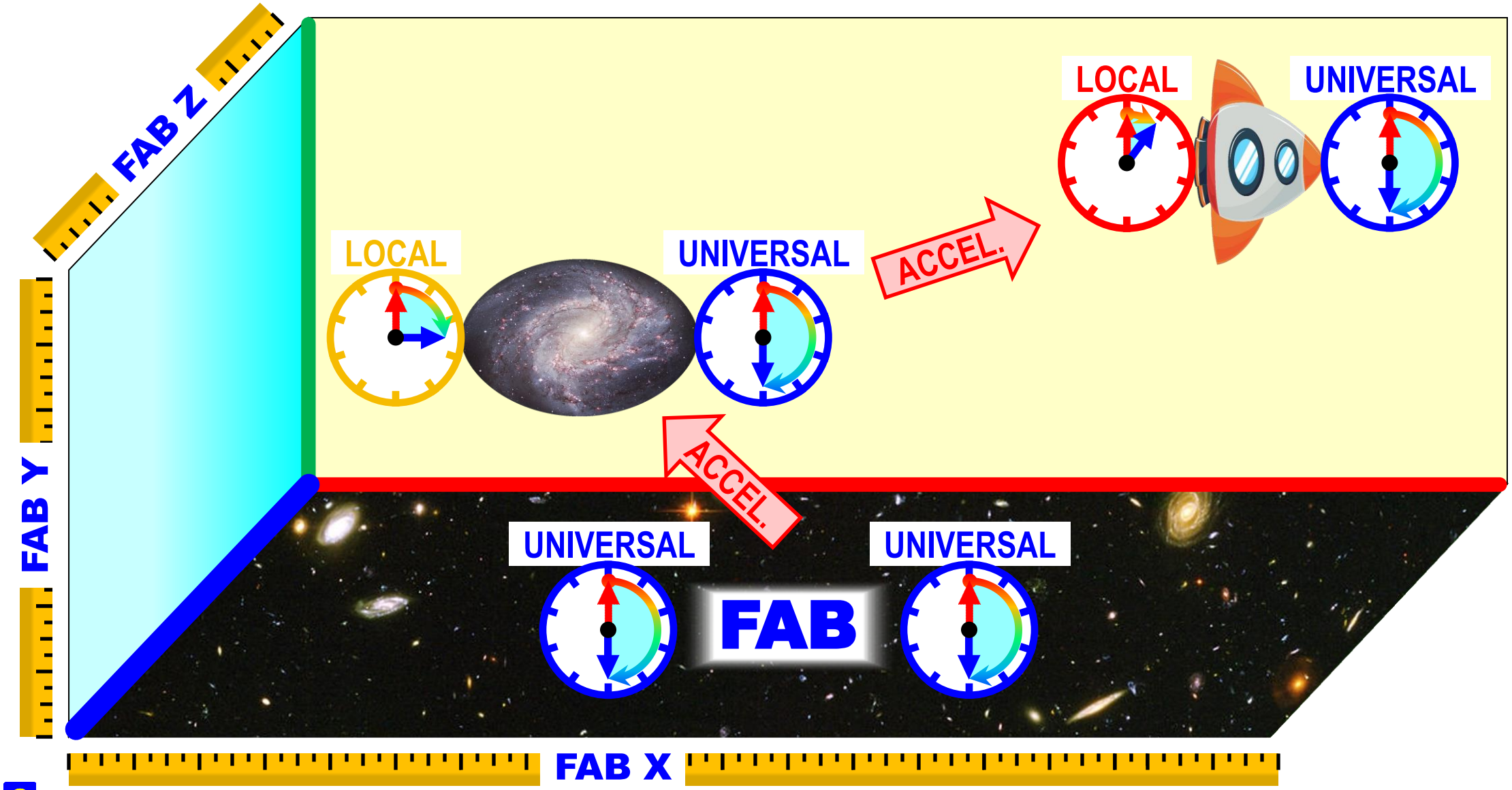


Part II.
The Loading Principle in Cosmology

Cones Within Cones: Fractal, Matter-Centered Spacetime

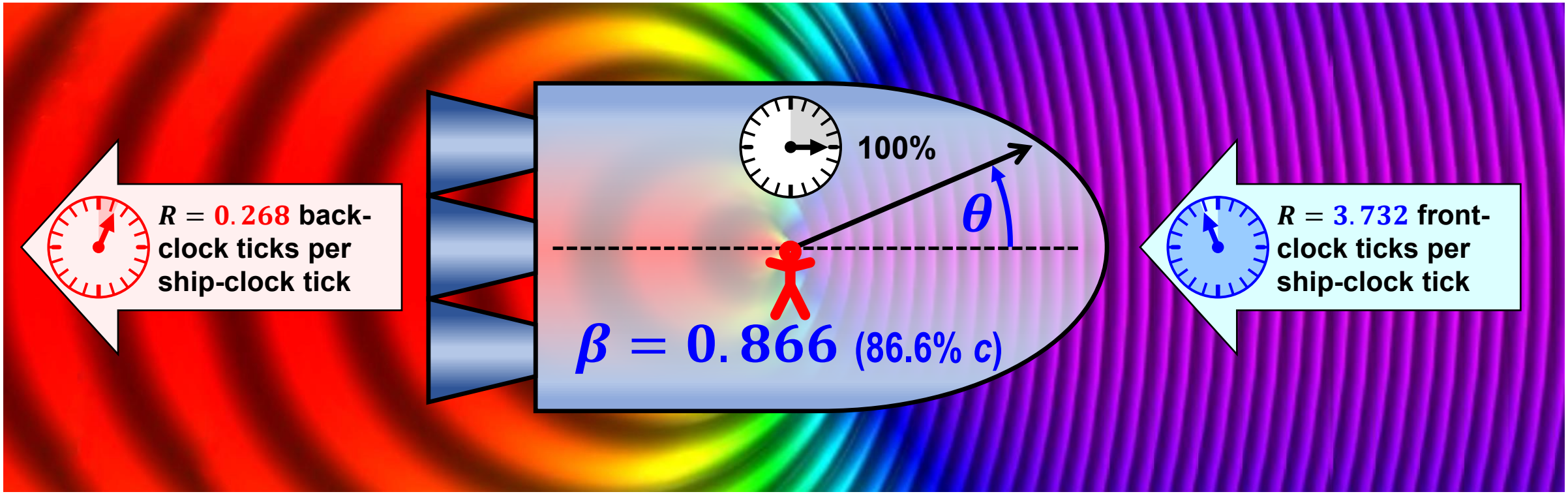


Universal First Ancestral Bubble (FAB) Coordinates



Locally Loaded Inertial Frames are Never Symmetric

- Outside the ship, time follows **Relativistic Doppler rules**
- The full equation is: $\boldsymbol{R(\beta,\theta) = \sqrt{1-\beta^2}/(1-\beta\cos\theta)}$

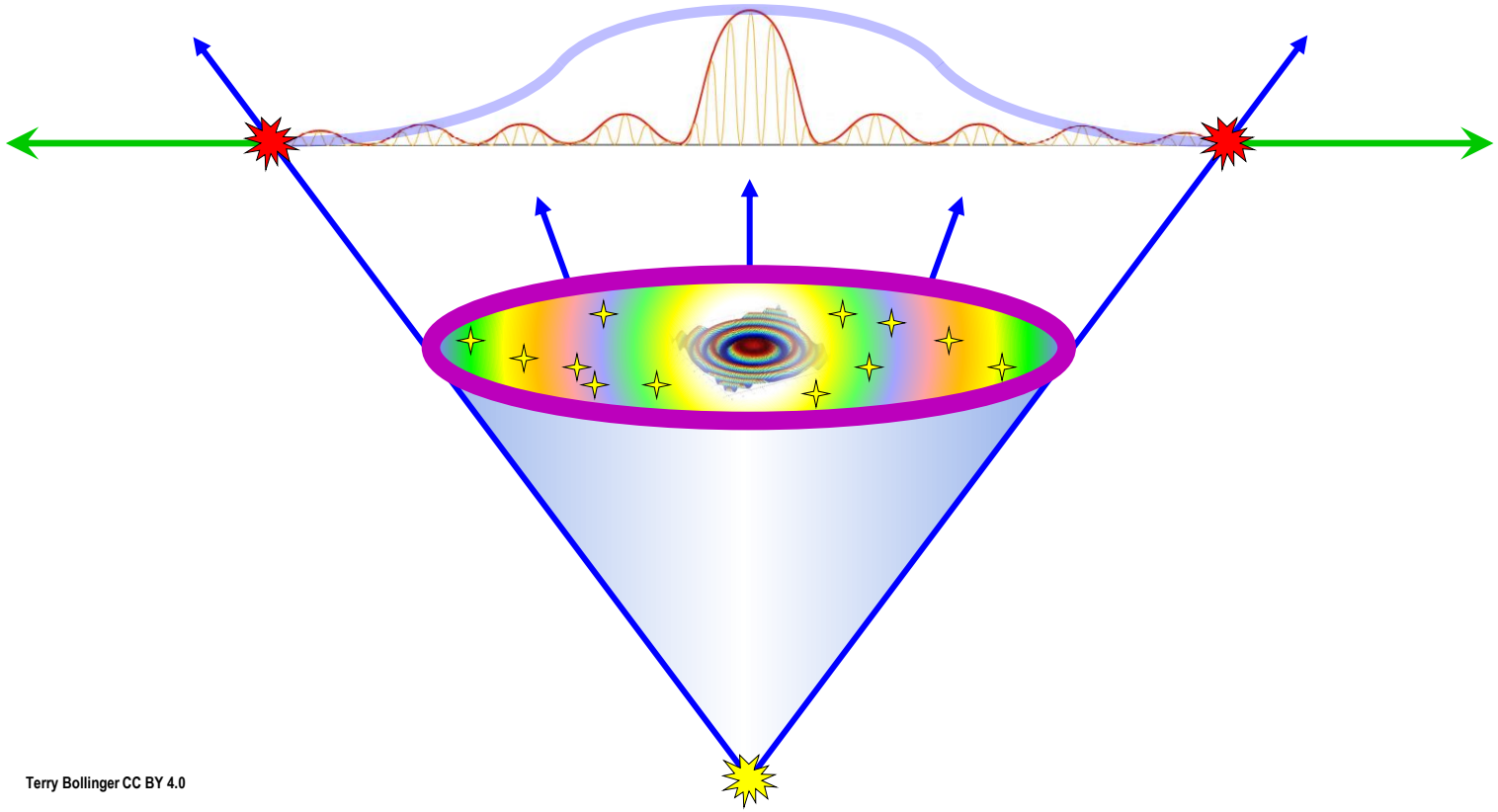


Relativistic Doppler background by TxAlien, CC BY-SA 3.0 (Wikimedia Commons)

Part III.
The Loading Principle in Quantum Mechanics

Light Cones Are Natural Quantum-Wave Boundaries

- Loading applies equally to the energy contents of wave functions
- Using infinite-volume “pure” states conflicts with light-speed limits



Loading in Quantum Mechanics: Large Disruptions

- Constraining the loading of mathematical data structures to within the light cone is devastatingly restrictive to many models
- Example: Many-Words Interpretation must allow propagation time
  - Saying that "one event" splits the universe invokes finite propagation times
  - An event-triggered split would need to propagate throughout the universe
  - MWI ends up as an experimentally meaningless concept before it begins
- Hilbert spaces
  - Hilbert spaces of quantum states are necessarily *no longer* fundamental
  - 3D light cone propagation instead limits access to Hilbert space
- Universal wave functions are no longer meaningful

Part IV.
Quick Comments on LLM Technologies

Large Language Models are Data Compressions

- They treat conversational data as the objects for compression
- The result can be incredibly convincing conversations
- The problem is that the conversations are no more real than TV images of ducks are identical to ducks: It's always superficial
- The effective reuse is where the real power resides, but…
- … LLM always inserts noise and ends up undermining good reuse
- If you want to make LLMs faster and cheaper:
  - Abandon the Transformer path and focus on compression
  - Quality of axes is always critical
  - Fourier math is likely to be unbelievably more efficient
  - Hand-held optical databases are likely possible (but how useful?)
- **We do not understand the physics of low-energy cognition**

Part V. Summary

Summary

- **Einstein's powerful loading principle** opens up new ways to expand existing physics math theories by adding new limits, and provides a powerful tool for eliminating a variety of paradoxes
- Scary: We need to abandon length and duration as fundamental, and instead treat them as consistent dynamic behaviors of matter
  - Our reverence for distance and duration is rooted not only in their high value in classical physics, but because they are hard-wired into our neural systems as extremely efficient short-cuts for navigating the physical world
  - Alas: Since it is impossible to measure length or duration without matter (Einstein's clocks), the argument for deprecating their primacy is simple
- **Artificial Intelligence**: LLMs can be made far more efficient, but…

  … we **must** stop confusing powerful data compression with intelligence
- New priority: Explore low-energy physics to understand cognition