

## The Stuver-Tyson Reconciliation (STR) Paradox

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<https://youtu.be/Iur1BAXpDyI&lc=Ugx6LY8ifD5i7raoqAJ4AaABAq>

A Comment on the [KNOWLEDGE 101](#) (Neil deGrasse Tyson) YouTube post:  
*THE TWIN PARADOX | TIME DILATION* (Nov 19, 2022)

<https://youtu.be/Iur1BAXpDyI>

**Abstract:** Popular explanations of the special relativity Twins Paradox, such as those of YouTube videos in mid-2023, try but mostly fail to address why the time dilation applies to one twin. The most common problem is subtly assuming asymmetric time dilation by focusing on the wrong issue, such as the proper time integral that merely breaks the hidden time dilations into smaller segments. Neil deGrasse Tyson's compact and pragmatic 2022 video avoids this problem by explicitly pointing out that time dilation applies always and only to the velocities of the twin who accelerates. In a very different approach, astrophysicist Amber Stuver explicitly derives the asymmetry by abandoning Lorentz time dilation and replacing it with a relativistic Doppler time model applied to once-per-year pulse frequencies. What is not clear is how Stuver's Doppler time method transforms into Tyson's seeming violation of the Lorentz symmetries without violating the extremely well-verified experimental fact that diverse inertial frames always see precisely the same physics. The problem of reconciling Stuver's Doppler method with Tyson's apparent breaking of the Lorentz symmetry thus provides the potential to understand special relativity in new ways.

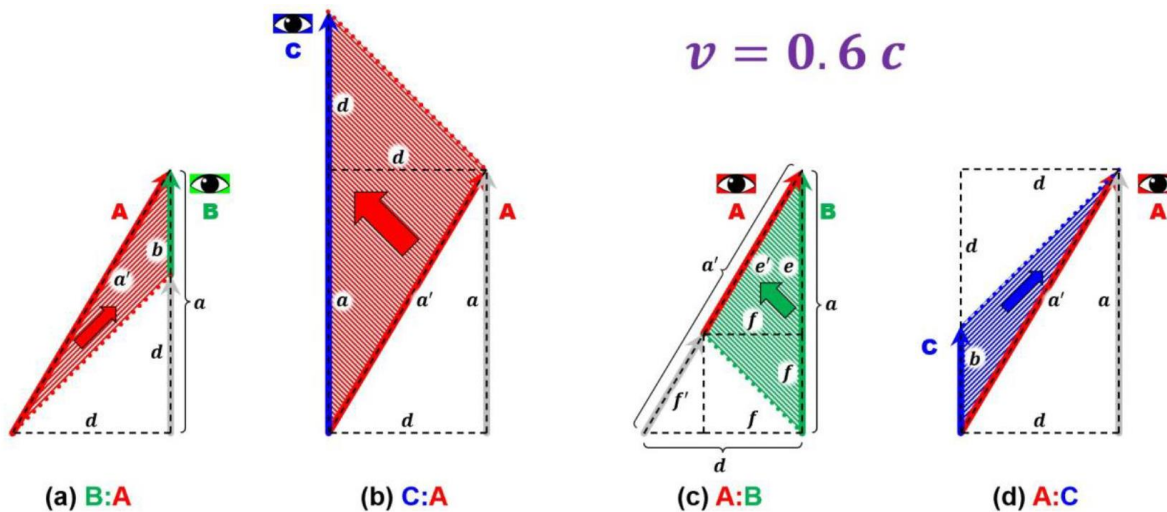
### The Neil deGrasse Tyson Twins Paradox Solution: Lorentzian and Correct

Of the far-too-many YouTube posts I've uncovered on the Twins Paradox, only a 2022 one by Neil deGrasse Tyson [1] and a 2019 TED-Ed one by astrophysicist Amber Stuver [2] avoid the trap of inadvertently presuming the very asymmetry they are trying to prove. For example, YouTube videos that invoke "proper time" hide their presumption of the asymmetry by breaking it up into short pieces hidden in the math noise of an integral that has nothing to do with how the asymmetry arises. Kudos to Neil deGrasse Tyson for avoiding the trap by *explicitly* stating the asymmetry as actual, continuous, and applicable only to the accelerated twin. That is why his simple method works so well. It is also the method used by folks who deal with real-world time dilation, such as in GPS satellites.

### The Amber Stuver Twins Paradox Solution: Non-Lorentzian and Correct

Professor Stuver goes in the opposite direction of a decidedly non-intuitive analysis that avoids the hidden asymmetry assumption by correctly invoking relativistic Doppler effects instead of Lorentz, though she never mentions Doppler. But frequencies are frequencies, however slow, so her once-a-year light pulses in both directions are just as subject to Doppler red and blue shifts as light itself. Using the more fundamental Doppler math allows her to avoid the Lorentz asymmetry entirely. Doppler time can go slower *or* faster, providing the math chops required to make time dilation asymmetric. (Fig 1)

In contrast, slower-only Lorentz time dilation mostly makes a mess of things. However, it works, after a fashion, if you follow Tyson's rule of applying it only to the part of the system that undergoes acceleration.



**Figure 1.** Relativistic Doppler geometries for the four main observation scenarios. [3] The relativistic Doppler time factor  $R = (1 + \beta) / (1 - \beta)$  emerges in the first (a) and third (c) cases of converging blue-shift observation, while the inverse relativistic Doppler factor  $1/R$  emerges in the second (b) and fourth (d) cases of diverging red-shift observation. In Amber Stuver's video, terrestrial Terra observing star-traveling Stella's trip corresponds to figure (b) followed by (mirror-image) figure (a), while Stella observing Terra corresponds to (d) followed by (mirror-image) figure (c).

## The Stuver-Tyson Resolution (STR) Paradox

Here's the deeper problem: Why do *both* of these methods work?

I use YouTube mostly to publicly record progress in my ongoing analysis of such issues, as opposed to focusing on convincing people of the correctness of any one part of my analysis. What I like about this pair of videos is that the Stuver-Tyson Reconciliation (STR) Paradox, combined with event-first, bottom-up singular reality, provides a better thought problem than any I've encountered so far for figuring out what's needed: A new deep-universe math model in which special relativity holds absolutely with each localized, per-inertial-frame xyzt frame, yet is insufficient to explain the observed asymmetry in the Twins Paradox. In their zeal for simplicity, current Lorentz-only maths discard too many critical details.

## The Need to Focus on Recordable Events

Hints? Well, at the very least, a model of the Twins Paradox in which "some space" (not necessarily xyzt) contains a set of individual localized events in which a clock synched with one frame touches a clock synched with a second frame, with both exchanging information and generating irreversible historical records of what happened. Doing nothing more than that — that is, saying that frame interactions consist of many small, independent, history-generating interactions between components from both frames — plunges you into a different style of thinking about how the Poincaré symmetries work.

These symmetries require closer examination than is possible with the too-smooth, too-simple models currently in use.

I'll post more later as I develop additional specifics. I may even post a video myself! Incorrect resolutions of the Twins Paradox have plagued special relativity for over a century. It's time to get a model that stops pretending there is no problem and instead predicts time dilation asymmetries in a cohesive, fully formalized fashion.

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## References

- [1] N. d. Tyson, *The Twin Paradox | Time Dilation*, Knowledge 101 (YouTube) (2022-11-19), <https://youtu.be/Iur1BAXpDyI>
- [2] A. Stuver, *Einstein's Twin Paradox Explained*, TED-Ed (YouTube) (2019-09-26), <https://youtu.be/h8GqaAp3cGs>
- [3] T. Bollinger, *The Four Observable Time Ratios for A Launched to B at Velocity  $v$* , Apabistia Notes (2023-01-21), <https://sarxiv.org/apa.2023-01-21.2102.pdf>