

Symmetry Experiment to the Lorentz Transformation

Deysenroth H*

Holzgasse 28, 79539 Loerrach, Germany

Abstract

The result of the Lorentz Transformation on a classical formula is that an observer in reference frame A observes the same phenomena in reference frame B like an observer in reference frame B observing the phenomena in reference frame A. Is that true? In this article I demonstrate at the Doppler effect that this is valid even for 'absolute' velocities belonging to a reference frame outside of A and B. I suggest to test whether the geometric means of frequencies belong to the frames A and B or to a reference frame outside of A and B by an experiment at CERN. In the latter case this would have significant implications in space-time modelling.

Keywords: Lorentz-transformation; Doppler effect; Frequency; Galilean transformation

Introduction

The Relativistic Doppler Effect as a Geometric Mean

The Lorentz Transformation (LT) applied to the classical Doppler Effect at a Lorentz boost provides the formula for the Relativistic Doppler Effect (RDE), e.g. if sender and receiver move to each other in x-direction [1]:

$$f = f_0 \sqrt{(1+\beta)/(1-\beta)} = f_0(1/\gamma)(1-\beta) = f_0\gamma(1+\beta) \quad (1)$$

with $\beta = v/c$ and $\gamma = 1/\sqrt{1-\beta^2}$

The observer in A gets the same frequency as the observer in B.

The RDE is a symmetric formula concerning the observations of A and B. But one can see at one glance that the formula of RDE is a geometric mean of the two classical Doppler Effect formulas for the observer A in rest and B moving to A [2]

$$f_B = f_0/(1-\beta) \quad (2)$$

and the system B in rest and A moving to B

$$f_A = f_0(1+\beta) \quad (3)$$

where f_B and f_A

are not symmetric to each other.

This is no accident. In my former paper I demonstrated the deduction of Lorentz-transformation by three completely different methods, each having the same result: The transformed variable is a geometric mean as a result of simultaneous movement of frames A and B in opposite directions [3].

The geometric mean might be useful if the observers in A and B cannot measure their own velocities related to a fixed point but only the relative velocity between A and B. However, in this case formula (1) gets another meaning because the velocities v_A and v_B referring to an outside reference frame of A and B (e.g. the air for sound) determine the results of (2) and (3). One can get the relative velocity v in all variations of

$$v = v_A - v_B \quad (4)$$

e.g. $v = 900 - (-100) = 1000$, or $v = 800 - (-200)$ or $v = 500 - (-500) = 1000$ km/h.

Therefore, there is no classical formula of Doppler effect with the relative velocity between A and B.

If $|v_A| \neq |v_B|$ there is no more symmetry in observations though v has the same value in all cases and the physical meaning is different as well, because (2) can only be derived from a rest frame C outside of A and B, where the light propagates isotropically with constant speed c (also valid without a medium). An observer in A or B cannot derive the classical Doppler effect formulas from their own system because he/she cannot see the changed wavelength by the velocity of the sender. This is possible only for an observer in C outside of A and B where the velocities v_A and v_B to a common fixed point in this frame can be measured and only such a person can anticipate which frequencies can be measured in the systems A and B.

But there is a problem: To which system should the reference frame C belong to? To the surface of Earth, to the center of Earth, to the space over the sun, to the space over our galaxy or galaxy clusters, or to the space of the Universe?

From experiments we know that atomic clocks go slower in a system that moves with high speed. If e.g. $v_A = 1000$ km/h and $v_B = -100$ km/h, an atomic clock in A goes slower than in B. This was detected in the Hafele-Keating experiment (by the way: without symmetry between the times of clocks in the aircrafts and the ground clock), where the reference frame was the center of Earth and not the clock on the ground [4]. But the formulas of the STR determine the time to go slower by the same factor γ in the observed system that moves with the relative speed v to the own system. An experiment could perhaps reveal which interpretation of formula (1) is correct.

Let's regard the situation with an example where A and B move to each other at the same altitude and take aim with a laser beam at each other. If an observer in B measures the frequency shift he/she will get in the first step by the classical Doppler-formula

$$f_B = f_0(1+\beta_B)/(1-\beta_A), \text{ and an observer in A: } f_A = f_0(1+\beta_A)/(1-\beta_B) \quad (5)$$

It is evident, that these formulas are not symmetric, except for $|v_A| = |v_B|$. On the other hand, we should take account of the Hafele Keating experiment. The results show that the time $t = N/f$ and

*Corresponding author: Deysenroth H, Senior Researcher, Holzgasse 28, 79539 Loerrach, Germany, Tel: 49-762187175; E-mail: deysenroth@t-online.de

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and quantum phenomena by physical mechanisms (which also can be described mathematically) rather than to describe them mathematically in space-time. In this case the implications on physics and philosophy would be eminent.

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