

Relativistic Doppler-Shift Sense and Nonsense of Relative Motion

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Mai 2011

2 Current Physics:

**1. Lightspeed is constantly = c
independent of:**

- motion of observer**
- motion of light source**
- direction of light**

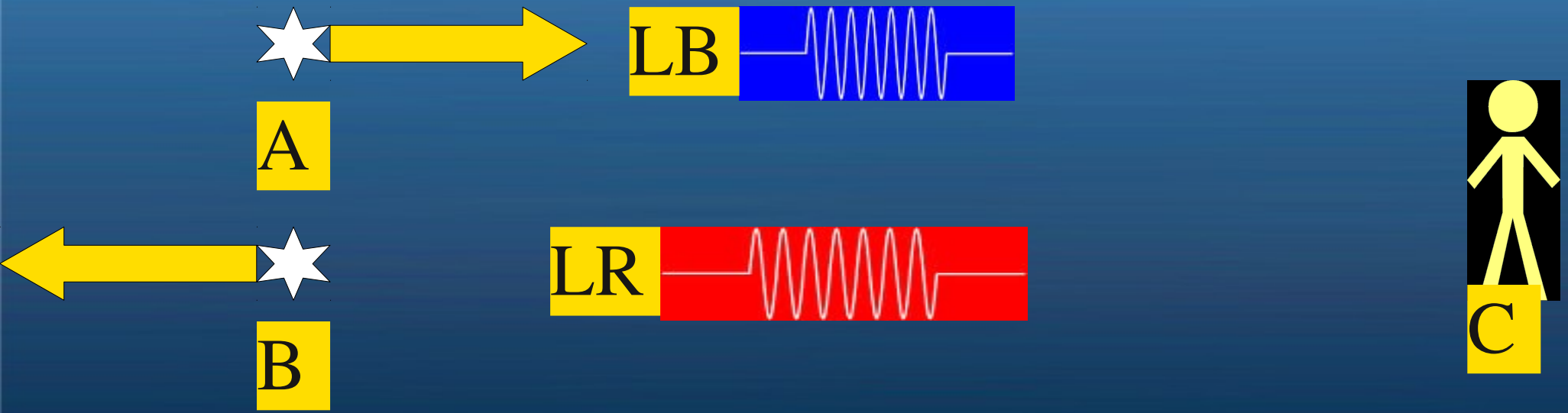
2. If source and observer

- move away: red-shift**
 - move towards: blue-shift**
- of light frequency.**

**This depends on the RELATIVE Motion
of source/observer only**

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- Sources A and B send simultaneously similar light (from their own view) when they meet
- A moves to the right towards C
- B moves to the left away from C
- Observer C will view LB blue shifted, LR red shifted at some time later

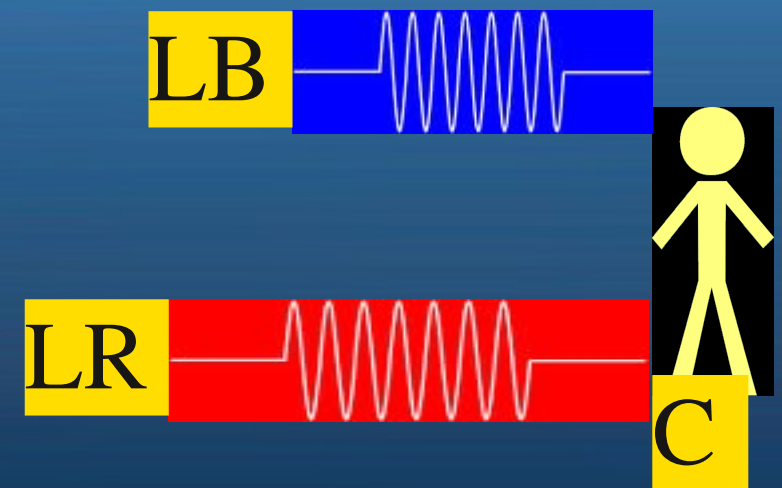


- A and B do no longer exist after LB and LR left them and before these will reach C



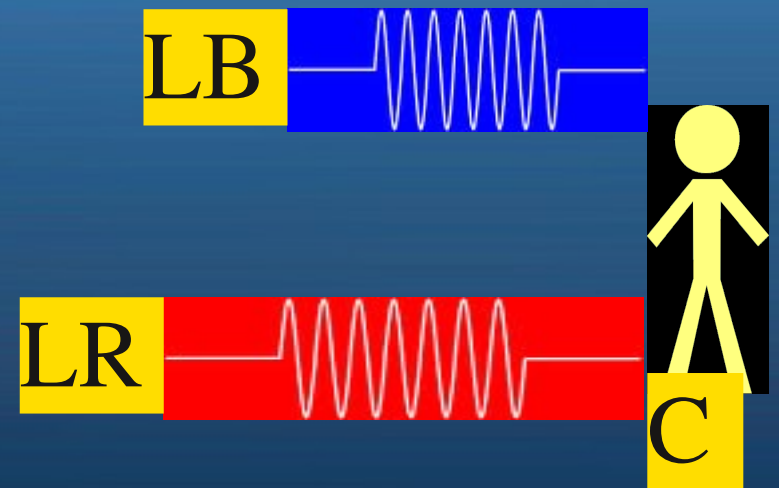
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- The heads of LB and LR reach C at the same time
- The tail of LB reaches C earlier than the tail of LR



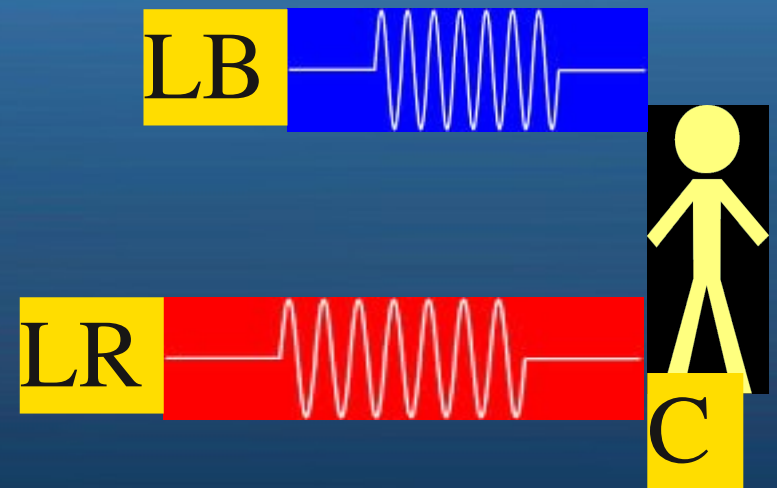
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- LB and LR contain the same number of waves
- What is different in LB and LR ?

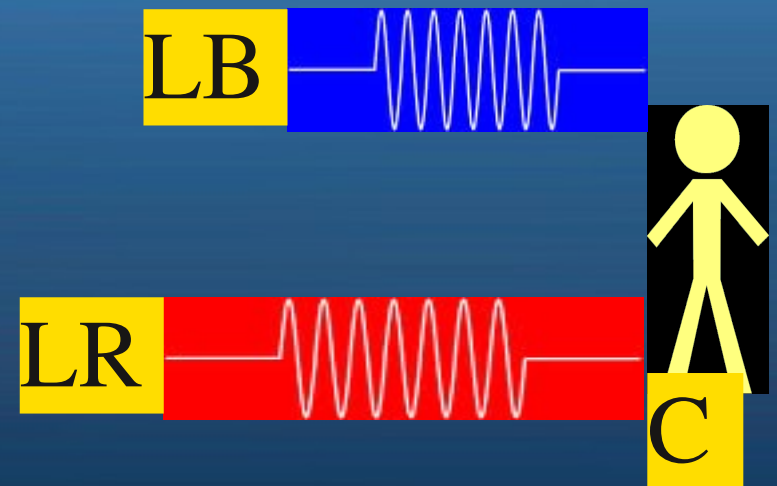


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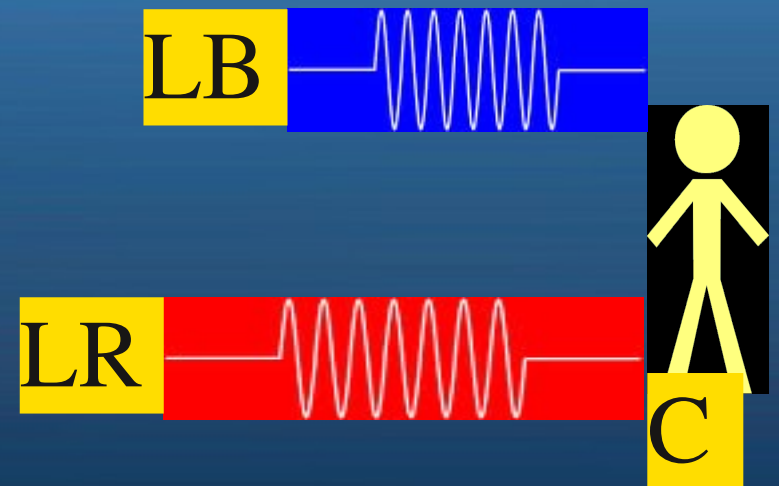
- Their length and thus (because of $c = \text{constant}$) the time they need to pass C
- The difference blue/red is the **SOLE** property of LB and LR, not of C , however



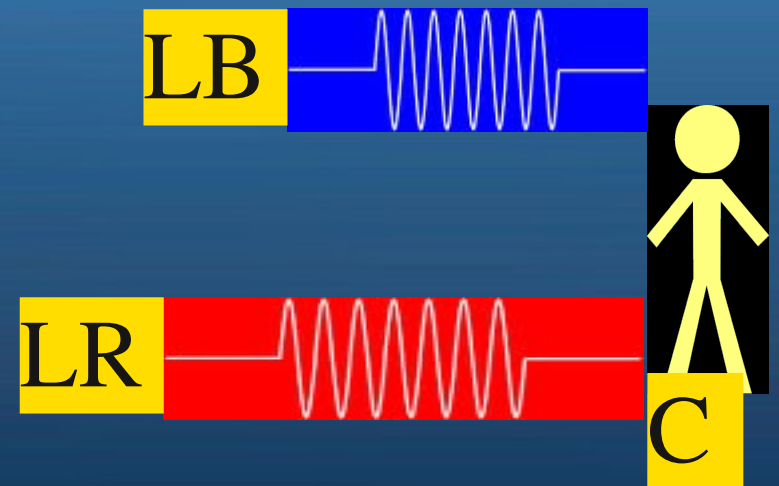
- C is not aware of A or B and does not know about any relative motion against those
- The difference between LB and LR does not arise from the perception by C but from the emission by A and B



- A and B did not interfere. C would see LB and LR exactly the same way, if A or B would have existed alone



- The difference between LB and LR would exist without C the same way
- It comes from the different motion of A und B
- But if C is missing: Motion against what ?

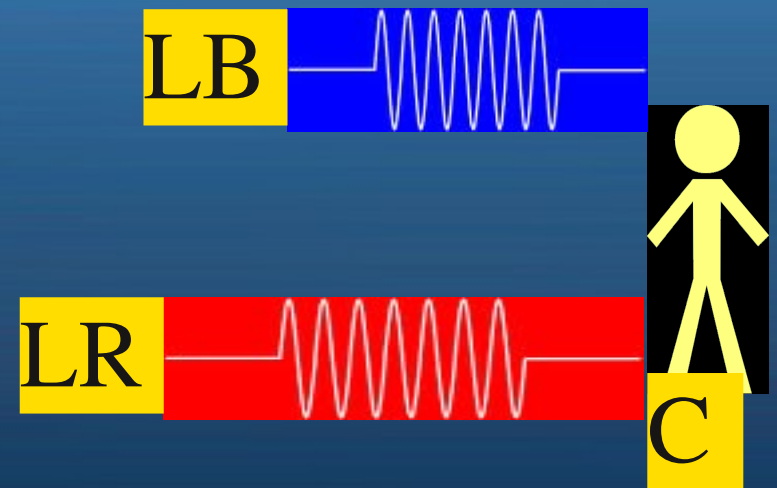


- It must be motion against something which was present at the location and time of emission
- As location and time of emission are arbitrary, this something must be omnipresent at any time
- Motion of C against this something would affect the absolute frequencies as seen by C but not the difference

- Conclusion:

A red/blue shift cannot be explained by a relative motion only

The light emitted “remembers” the motion of the source against an omnipresent medium



What is relative motion ?

- Motion is done with some speed
- Speed is defined by distance divided by time. This requires some time greater than zero
- This means: The definition of motion between two systems requires them to exist in parallel for some time $T > 0$

- Definition of motion requires further that during this time we can determine the relative position of two systems.

This means:

For each point P_a in A and any moment within T we can determine a point P_b in B which matches P_a

- It makes sense to talk about relative motion of a system A against a system B if the things said before can be achieved without another System C

Example:

- Two trains meet. It takes some time $T > 0$ for passing one another. For each moment within T we can match any point in the first train to some point in the second train and vice versa

Counter-Examples:

- A star at a large distance moves away from the earth. When its light reaches the earth it has vanished for a long time already.
- Jules Cesar drives a horse cart along the road. 2000 years later we pass the same location with our car. We know that we would overtake him, but would it make sense to call this relative motion ?

Why are these counter-examples ?

- Probably it is the only way to examine the spectral-shift in the light of the star. From the remarks above this depends on two speeds:

Star against something and observer against something. There is no way to define motion directly.

- **Cesar does not exist at the same time as ourselves. We know roughly his speed against the road and our own one, too. We consider the calculated difference as a relative speed. But there is no way to measure it. A definition without the road is not possible.**

- Conclusion:

The definition of a “relative speed” requires that two systems exist at the same time at the same location.

What this means depends on the problem under consideration.

The SRT uses relative motion without any restrictions of this kind. This makes it hard to understand its predictions based on relative motion.