Not possible to synchronize clocks assuming light is anisotropic

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Introduction

The method described below shows it is impossible to synchronize two clocks in an inertial frame, assuming the one-way speed of light is anisotropic.

Given:

1. The *round-trip* (2-way) *speed of light* (2WSOL) between two points spatially separated by a fixed distance L is a constant, c. The time duration to make the round-trip is a constant 2L/c for all inertial observers.
2. Two observers A and B have identical clocks that are positioned in the same inertial frame, stationary relative to each other, and a fixed distance L apart. Time passes at the same rate for both.
3. Information from one clock to another must be transmitted by light signal. Both clocks are able to write/read clock times in the signals; the time duration to write/read is a constant value μ, the same for both clocks. (A simple reflected signal has μ = 0.)
4. The *one-way speed of light* (1WSOL) between two space points may not be the same in all directions (anisotropic). Where the speed in the positive direction is c(+), and the speed in the negative direction c(-), the transit time: t(+)=L/c(+) and t(-)=L/c(-). The relationship to the 2WSOL is: 2L/c = L/c(+) + L/c(-).

Notation:

1. A(t0) "time t0 on clock A" , and B(t0) "time t0 on clock B", lie on the *X-axis* on a spacetime diagram. All other clock times: t1, t2, etc., lie on lines parallel to the *X-axis.*
2. Δt is the difference in time display of the two clocks. The goal is to determine the *initial* Δt and then adjust one clock so that both are synchronized: Δt = 0.

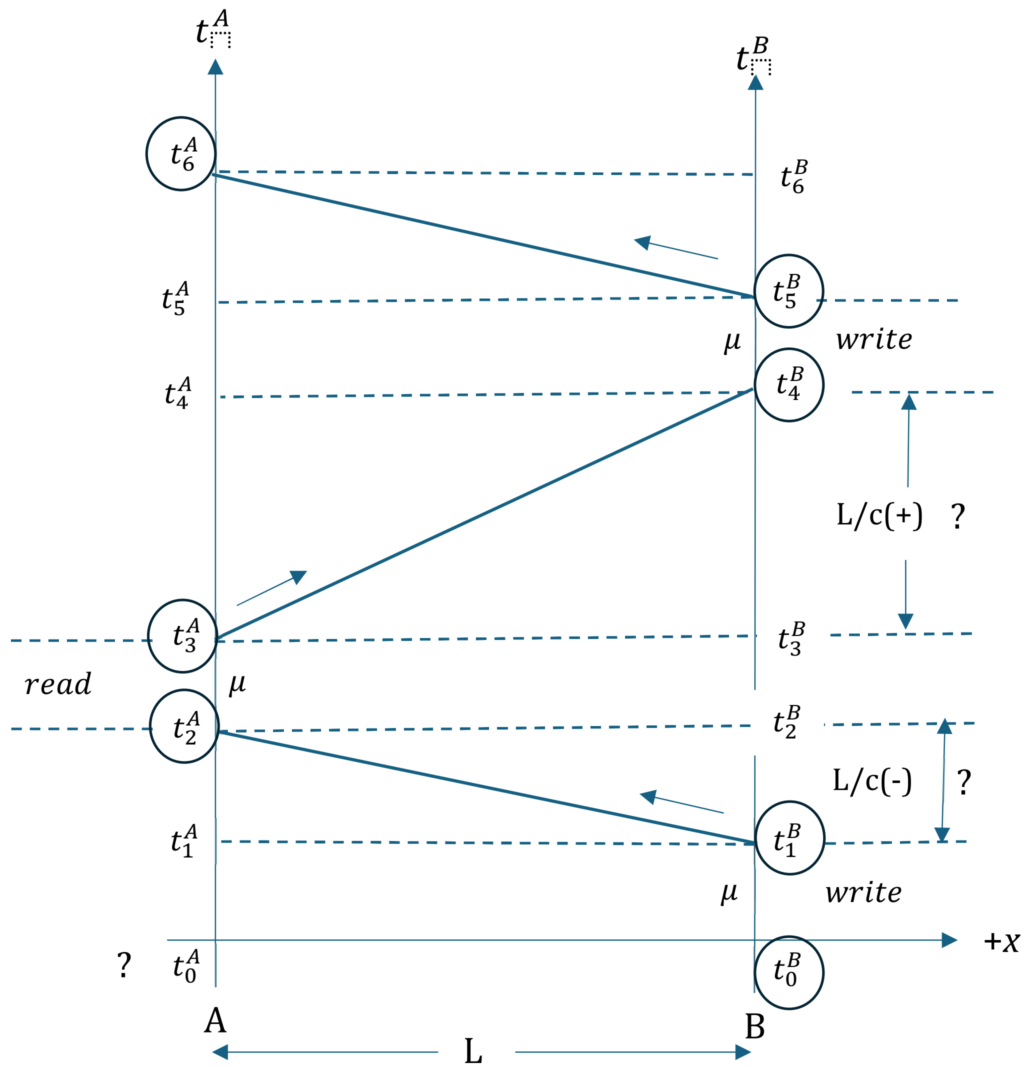
Synchronization Steps

(See the Spacetime Diagram.)

1. Beginning at time B(t0), clock B encodes "sent at B(t1)" into a light signal, and at time B(t1)=B(t0)+μ, sends the signal to A. Clock A receives the signal from B at time A(t2) and reads the information, and at time A(t3)=A(t2)+μ, sends a light signal to B.
2. Clock B receives the signal from A at time B(t4). Clock B then encodes "received at B(t4)" into a light signal and at time B(t5)=B(t4)+μ, sends the signal to A. Clock A receives the signal from B at time A(t6).

Spacetime Diagram

In the diagram: $t_1^A = A(t1)$, "time t1 on clock A", etc. Known clock times are circled.



3. Then given for 2WSOL: B(t4) - B(t1) = 2L/c + μ. From Step 1 : B(t1) = B(t0) + μ. So that : B(t4) - [B(t0) + μ] = 2L/c + μ. Then : B(t0) = B(t4) - 2L/c - 2μ. We also have: A(t6) - A(t3) = 2L/c + μ.

4. **CONCLUSION**: Note that for all of the known time values (circled) for any given clock, the corresponding time values on the other clock are unknown. Critical values L/c(+) and L/c(-) cannot be calculated *before* clocks A and B are synchronized. Without knowing these critical values, it is not possible to determine the initial value of Δt = B(t0) – A(t0). And therefore, it is not possible to synchronize the clocks.