Relativity of Simultaneity [mln51]

Light signal sent out to synchronized, equidistant clocks in frame S'.

Arrival times observed in S': $ct'_1 = ct'_2 = \ell_0/2 \quad \Rightarrow \ \Delta t' = 0.$

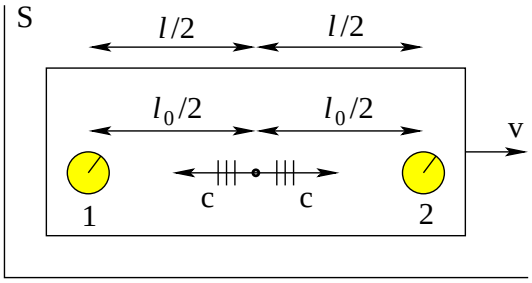
Arrival times observed in S: $ct_1 = \ell/2 - vt_1, \quad ct_2 = \ell/2 + vt_2.$

$$\Rightarrow \ \Delta t = t_2 - t_1 = \frac{\ell/2}{c-v} - \frac{\ell/2}{c+v} = \frac{\ell v/c^2}{1 - v^2/c^2} = \frac{\ell_0 v/c^2}{\sqrt{1 - v^2/c^2}}.$$

Time difference translated from S to S': $\Delta t' = \Delta t\sqrt{1 - v^2/c^2} = \dfrac{\ell_0 v}{c^2}.$

Result in conflict with actual observation $\Delta t' = 0$ made in S'.

Resolution of paradox:
When viewed from S, clock 1 was set ahead of clock 2 by $\ell_o v/c^2$.



Consider two arrays of synchronized clocks in relative motion as shown.

When an observer in frame S asks about the time t' in frame S', the answer depends on the position x'... and vice versa.