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A Particular Property of the Lorentz Equations

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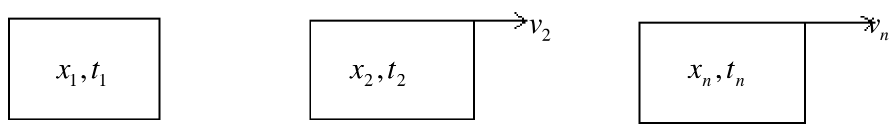
From the Lorentz's equations:

$$\begin{cases} x = \dfrac{x_0 + vt_0}{\sqrt{1 - v^2/c^2}} \\ t = \dfrac{t_0 + vx_0/c^2}{\sqrt{1 - v^2/c^2}} \end{cases} \quad \Leftrightarrow \quad c^2t^2 - x^2 = c^2{t_0}^2 - {x_0}^2$$

For n relative frames with v_n relative speeds:



$$\begin{cases} x_2 = \dfrac{x_1 + v_2t_1}{\sqrt{1 - {v_2}^2/c^2}} \\ t_2 = \dfrac{t_1 + v_2x_1/c^2}{\sqrt{1 - {v_2}^2/c^2}} \end{cases} \quad \Leftrightarrow \quad c^2{t_2}^2 - {x_2}^2 = c^2{t_1}^2 - {x_1}^2$$

$$\begin{cases} x_n = \dfrac{x_1 + v_nt_1}{\sqrt{1 - {v_n}^2/c^2}} \\ t_n = \dfrac{t_1 + v_nx_1/c^2}{\sqrt{1 - {v_n}^2/c^2}} \end{cases} \quad \Leftrightarrow \quad c^2{t_n}^2 - {x_n}^2 = c^2{t_1}^2 - {x_1}^2$$

$$v_x = c^2 \frac{v_n - v_2}{c^2 - v_nv_2}$$

$$\begin{cases} x_n = \dfrac{x_2 + v_x t_2}{\sqrt{1 - {v_x}^2 / c^2}} \\ t_n = \dfrac{t_2 + v_x x_2 / c^2}{\sqrt{1 - {v_x}^2 / c^2}} \end{cases} \Leftrightarrow \quad c^2 {t_n}^2 - {x_n}^2 = c^2 {t_2}^2 - {x_2}^2$$

So:

$$c^2 {t_1}^2 - {x_1}^2 = c^2 {t_2}^2 - {x_2}^2 = \cdots = c^2 {t_n}^2 - {x_n}^2 \quad \Leftrightarrow$$

$$c^2 {t_n}^2 - {x_n}^2 = k \quad \text{(Constant)}$$

And if k is different than zero?

In any case x and t are not independent coordinates. x and t must be wavelength and period.

In relativity theory this value k is a variable (it can be = 0 , >0 or <0) but as we have demonstrated it is a constant.