

Relative and Absolute [mln59]

Lorentz invariant:

Consider frames S and S' in relative motion with velocity v .
A clock at rest in S signals a proper time interval $\Delta\tau$.

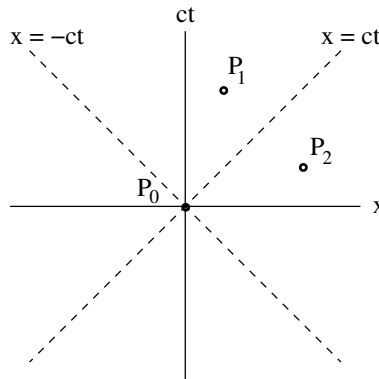
Time interval measured in S' : $\Delta t' = \frac{\Delta\tau}{\sqrt{1 - v^2/c^2}}$.

Displacement of clock measured in S' : $\Delta x' = -v\Delta t' = -\frac{v\Delta\tau}{\sqrt{1 - v^2/c^2}}$.

$\Rightarrow (c\Delta t')^2 - (\Delta x')^2 = (c\Delta\tau)^2$ independent of v .

Invariant quantity: $(\Delta s)^2 \doteq (c\Delta t)^2 - (\Delta x)^2$.

Light cone:



Events P_0 and P_1 :

- time-like relation,
- causally related,
- at the same position in some frame.

Events P_0 and P_2 :

- space-like relation,
- not causally related,
- simultaneous in some frame.