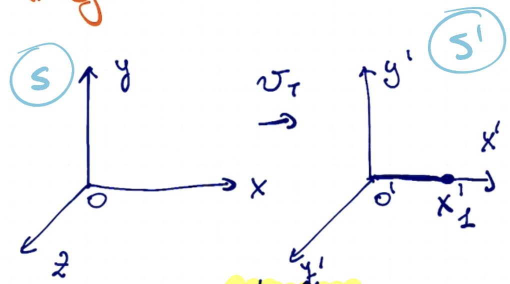
Relatività

11 mar '21

T. Galileo



$\overline{OO'} = v_T t$

$$\begin{cases} x'_1 = x - v_t t \\ y' = y \\ z' = z \\ t' = t \end{cases}$$

un solo orologio

$\Downarrow$

$v'_x = v_x - v_t$

$a' = a$

x moto unidirezionale

T. Lorentz

$$\underbrace{\begin{cases} x' = \gamma(x - v_T t) \\ y' = y \\ z' = z \\ t' = \gamma\left(t - \dfrac{xv}{c^2}\right) \end{cases}}$$

$\rightarrow$ sono necessari 2 orologi

$$\begin{cases} \boxed{x = \gamma(x' + v_t \cdot t)} \\ y = y' \\ z = z' \\ t = \gamma\left(t' + \dfrac{xv}{c^2}\right) \end{cases}$$

Why?

ricavate sul libro

$$\begin{cases} x = \gamma(x' + v_t \cdot t) \\ t = \gamma\left(t' + \dfrac{x v_t}{c^2}\right) \end{cases} \qquad \gamma = \frac{1}{\sqrt{1 - \frac{v_T^2}{c^2}}}$$

$$v_x = \frac{\Delta x}{\Delta t} = \frac{\Delta x' + v_T \Delta t'}{\underbrace{\sqrt{1 - \frac{v_T^2}{c^2}}}_{\gamma}} \cdot \left(\frac{\sqrt{1 - v_T^2/c^2}}{\Delta t' + \frac{\Delta x' v_T}{c^2}}\right) \rightsquigarrow \frac{1}{\Delta t}$$

dividendo per $\Delta t'$

$$v_x = \frac{\frac{\Delta x'}{\Delta t'} + v_b \cancel{\frac{\Delta t'}{\Delta t'}}1}{\cancel{\sqrt{1 - \frac{v_T^2}{c^2}}}} \cdot \frac{\cancel{\sqrt{1 - v_T^2/c^2}}}{\cancel{\frac{\Delta t'}{\Delta t'}}1 + \frac{\Delta x'}{\Delta t'} \cdot \frac{v_T}{c^2}} = \frac{v_x' + v_T}{1 + \frac{v_x' v_T}{c^2}}$$

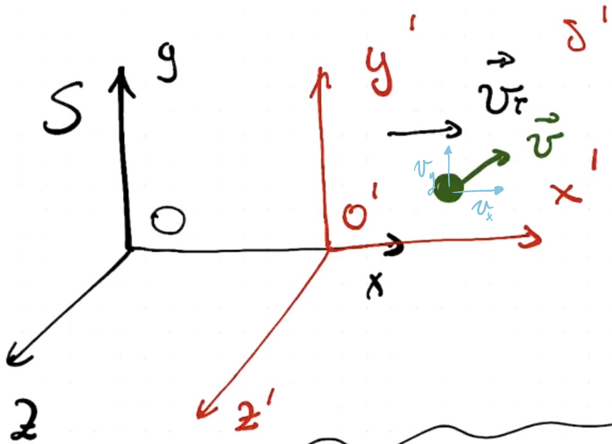
$$v_y = \frac{v'_y \cdot \sqrt{1 - v_T^2/c^2}}{1 + \frac{v_T v'_x}{c^2}}$$

$$v_z = \frac{v'_z \cdot \sqrt{1 - v_T^2/c^2}}{1 + \frac{v_T v'_x}{c^2}}$$

→ il moto avviene lungo l'asse delle x

La contrazione avviene solo sull'asse x

$O' \Rightarrow S'$ si muove lungo l'asse $x \equiv x'$ con v costante rispetto a O collegato a S



$$v'_x = \frac{v_x - v_T}{1 - \frac{v_t v_x}{c^2}}$$

$$v'_y = \frac{v_y \sqrt{1 - v^2/c^2}}{1 - v_T \frac{v_x}{c^2}}$$

$$v'_z = \frac{v_z \sqrt{1 - v^2/c^2}}{1 - \frac{v_t x_x}{c^2}}$$

P. 167-170; 182-184

esercizi

① $L = 0{,}500\ m$ $\qquad v = ?$

$L_0 = 1\,m$

v

$$L = \frac{L_0}{\gamma} \rightsquigarrow 1 - \frac{v^2}{c^2} = \left(\frac{L}{L_0}\right)^2$$

$$\frac{v^2}{c^2} = 1 - \left(\frac{L}{L_0}\right)^2 \rightsquigarrow v = \sqrt{1 - \frac{L^2}{L_0^2}} \cdot c$$

$$v = \frac{\sqrt{3}}{2} c$$

② $v = 0{,}995\,c$ $\qquad T_0 = 2{,}2 \cdot 10^{-6}\ s$

$h = 5\ Km$

$$T = \gamma T_0 = \frac{1}{\sqrt{1 - 0{,}995^2}} \cdot 2{,}2 \cdot 10^{-6}\ s =$$

$$= 2{,}2 \cdot 10^{-5}\ s$$

$$d = 2{,}2 \cdot 10^{-7}\ s \cdot 0{,}995\ c = 6570\ m$$

https://www.youtube.com/watch?v=AZ2TTMLBWw8 $\rightarrow$ guardare

3

$v = 0$

80,5 m

124 m

$v \longrightarrow$

$$\sqrt{1 - \frac{v^2}{c^2}} = \frac{L}{L_0} \quad \leadsto \quad v = \sqrt{1 - \frac{L^2}{L_0^2}} \cdot c$$

$$v = \sqrt{1 - \frac{(80{,}5\ m)^2}{(124\ m)^2}} \cdot c$$

$$= 0{,}7606\ c$$