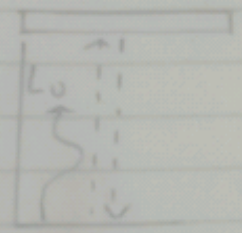
Selasa,

Fismod :

Dilatasi waktu

kerangka O (diam) dan sebuah cermin berada pada jarak L_0 dari sumber cahaya diam sehingga waktu yang di butuhkan cahaya untuk pulang pergi adalah $\Delta t_0 = t_1 + t_2$ dengan $t_1 = t_2 = \frac{L_0}{c}$

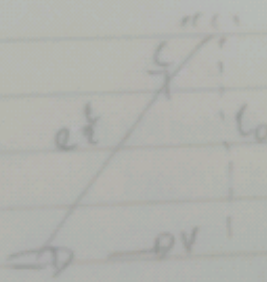


sehingga di dapatkan

$\Delta t_0 = 2t_1 = 2t_2 = \frac{2L}{c^0}$

dengan $t = \Delta t_0$

$L_0 = \left(\frac{c\Delta t_0}{2}\right)$



$c_0^2 = (c\frac{t}{2})^2 - (v\frac{t}{2})^2$

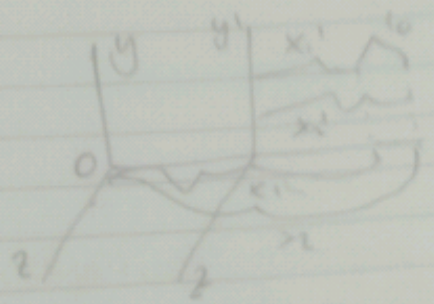
$= \frac{t^2}{4}(c^2 - v^2)$

$t^2 = \frac{4L_0^2}{c^2 - v^2} = \frac{4L_0^2}{c^2(1 - \frac{v^2}{c^2})}$

$= \frac{4L_0^2/c^2}{(1 - \frac{v^2}{c^2})}$

Penyusutan Panjang

Benda yang bergerak dengan kec. v akan nampak lebih pendek dari panjang mula-mula (l_0)



$l_0 = x_2' - x_1'$

$l = x_2 - x_1$

$x_1' = \frac{x_1 - v.t}{\sqrt{1-\frac{v^2}{c^2}}}$, $x_2' = \frac{x_2 - v.t}{\sqrt{1-\frac{v^2}{c^2}}}$

$x_1 = v.t + x_1' \sqrt{1-\frac{v^2}{c^2}}$

$x_2 = v.t + x_2' \sqrt{1-\frac{v^2}{c^2}}$

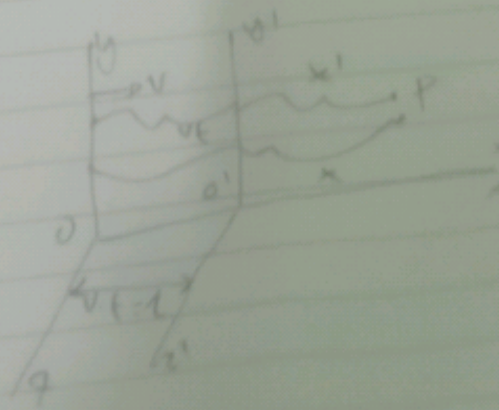
$x_2 = vt + x_2' \sqrt{1-v^2/c^2}$

$x_1 = vt + x_1' \sqrt{1-v^2/c^2}$

$x_2 - x_1 = (x_2' - x_1') \sqrt{2-\frac{v^2}{c^2}}$

$l = l_0 = \sqrt{1-v^2/c^2}$

Kontraksi lorentz



$x = x' + v t$

Secara relativistik

$x = \frac{x' + vt}{\sqrt{1 - v^2/c^2}}$

Selanjutnya $t_0 = \frac{t_0' + \frac{v x'}{c^2}}{\sqrt{1 - \frac{v^2}{c^2}}}$

Posisi P dilihat dari x

$x = x' + v \cdot t \quad \cdots (1)$

$= x' + l$

atau pembuktian dengan penyusutan panjang. (kontraksi panjang)

Dalam relativitas klasik kita memperoleh

$x = x' + v \cdot t \rightarrow x = \frac{x' + v \cdot t}{\sqrt{1 - v^2/c^2}}$

$t = t_0 \rightarrow t = \frac{t_0}{\sqrt{1 - v^2/c^2}}$

$t = t' + \frac{x'}{c^2} \cdot v \rightarrow t = \frac{t' + \frac{x'}{c^2} \cdot v}{\sqrt{1 - v^2/c^2}}$

$v = v + v_1 \rightarrow v = \frac{v_1 + v_1}{1 (\frac{v_1 + v_1}{c})}$

3. $l_0 = 1\ m$ $\quad v = 0,95$

$\theta_0 = 60^\circ$

$l_x = l_0 \cos 60^\circ = 1 \times 0,5 = 0,5\ m$

$l_0 = l_0 \sin 60^\circ = 1 \times 0,866 = 0,866\ m$

$$l_x' = l_x \sqrt{1 - \frac{v^2}{c^2}}$$
$$= 0,5 \sqrt{1 - 0,81}$$
$$= 0,5 \times 0,435$$

$$l' = \sqrt{l_x'^2 + l_y^2}$$
$$= \sqrt{0,047 + 0,75}$$
$$= 0,892\ m$$

$$\tan \theta' = \frac{l_y}{l_x'}$$

$$\tan \theta' = 3,05$$

$$\theta' = 75,9^\circ$$

4. a. $u = u' + v = 2\ m/s + 0,1\ c$

b. $$v = \frac{2\ m/s + 0,1\ c}{1 + \frac{2\ m/s\ (0,1\ c)}{c^2}}$$

$$v = 0,1\ c + 2\ m/s$$

5. $$v' = \frac{0,8\ c + 0,6\ c}{1 + \frac{0,8\ (0,6)}{c^2}} = 0,946\ c$$

1. Dik panjang : 2 %
Panjang terukur : $l = 0,98 l_0$
$l = l_0 \sqrt{1 - \frac{v^2}{c^2}}$

$l = l_0 \sqrt{1 - \frac{v^2}{c^2}}$
$0,98\, l_0 = l_0 \sqrt{1 - v^2/c^2}$
$0,98^2 = 1 - \frac{v^2}{c^2}$

$\frac{v^2}{c^2} = 1 - 0,98 \Rightarrow v = 0,199\, c.$

2. $l_0 = 12.740$ km $= 1,274 \times 10^7$ m.
$v = 3 \times 10^4$ m/s
$c = 3 \times 10^8$ m/s
$l = l_0 \sqrt{1 - \frac{v^2}{c^2}}$

$l = (1,274 \times 10^7) \times \sqrt{1 - \left(\frac{3 \times 10^4}{3 \times 10^7}\right)^2}$

$l = 1,274 \times 10^7 \times \sqrt{1 - 10^7}$
$l = 1,274 \times 10^7 - 6,37$ cm.