$$\Delta s^2 = c^2\Delta t^2 - \Delta x^2 = \left(3\times 10^8 \tfrac{m}{s} \times 10^{-7}\,\text{sec}\right)^2 - 3600\,m^2$$

$\downarrow$

Doesn't change with frame

$$(30)^2\,m^2 - 3600\,m^2 < 0$$

S $\qquad$ S' $\rightarrow v$

$\Delta s^2 > 0$ time separated events $\rightarrow \Delta x' = 0$

< 0 space " " $\rightarrow \Delta t' = 0$

$\Delta s^2 = 0$ light like events

$$\left.\begin{matrix}210\\150\end{matrix}\right\}\ \begin{matrix}\Delta x = 60\,m\\ \Delta t = 0.1\,\mu s\end{matrix}$$

$$\Delta x' = \frac{\Delta x - v\Delta t}{\sqrt{\quad}} \qquad \Delta t' \neq \Delta t$$

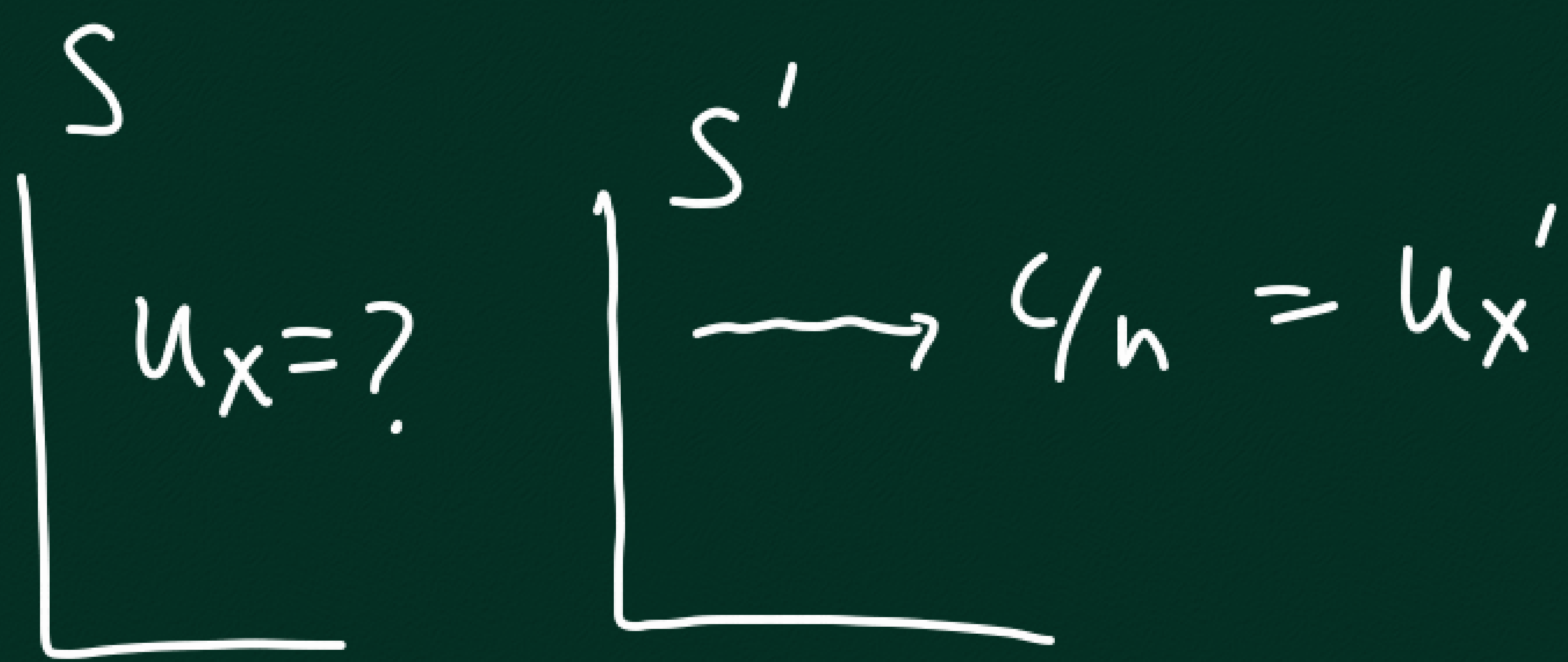
Can choose a v $(< c)$

s.t. $\Delta x' = 0$

$\Delta x = v\Delta t$

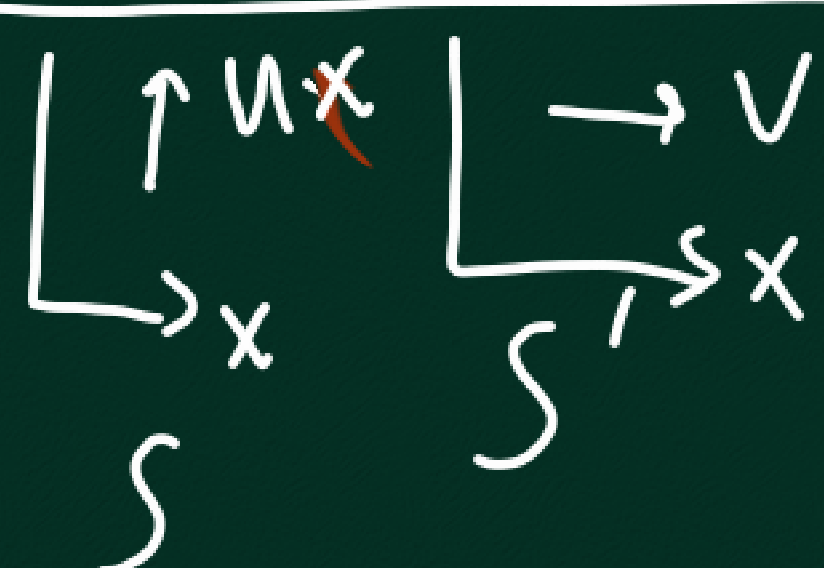
$\Delta x < c\Delta t$

$0 < \Delta s^2$



moving water

$$u_x = \frac{u_x' + V}{1 + \frac{u_x' V}{c^2}}$$



$$x' = \frac{x - vt}{\sqrt{}}$$

$$y' = y$$

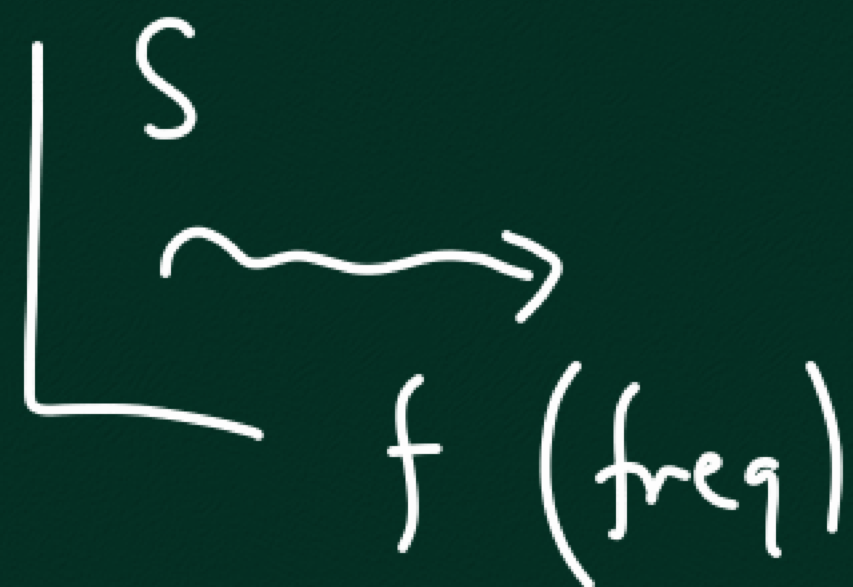
$$t' = \sim -$$

$$u_x' = \frac{u_x - V}{1 - u_x V/c^2}, \quad \Delta t' = \frac{\Delta t - \frac{V}{c^2}\Delta x}{\sqrt{1-\beta^2}}$$

$$u_x' = \frac{\Delta x'}{\Delta t'} = \frac{\Delta x - V\Delta t}{\Delta t - \frac{V}{c^2}\Delta x}$$

$$= \frac{u_x - V}{1 - \frac{V}{c^2}u_x}$$

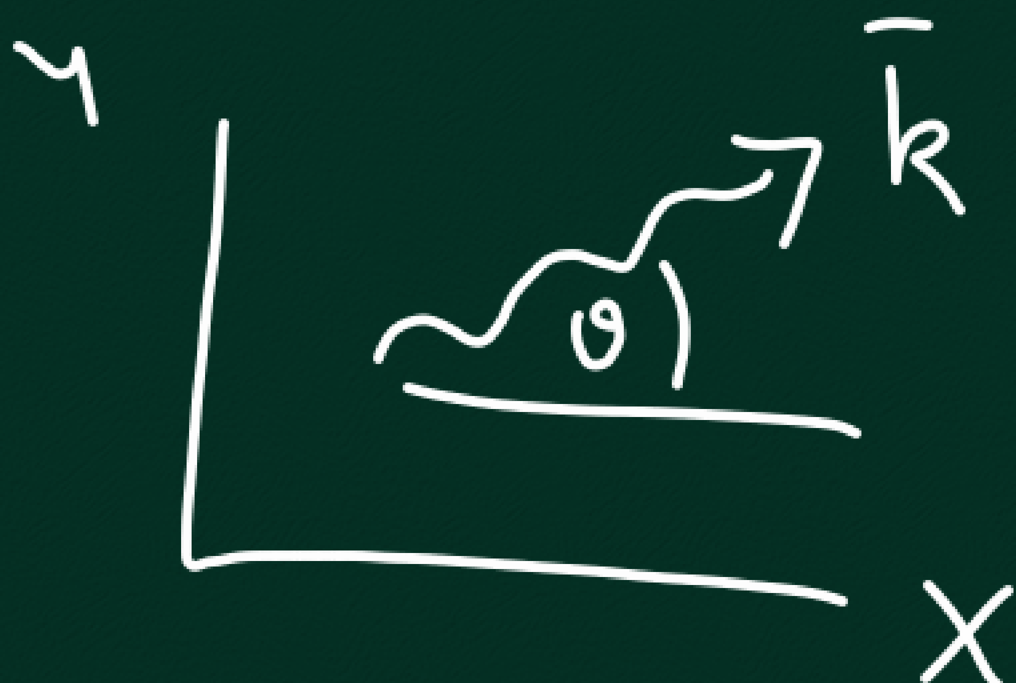
$$u_y' = \frac{\Delta y'}{\Delta t'} = \frac{\Delta y}{\frac{\Delta t - \frac{V}{c^2}\Delta x}{\sqrt{1-\beta^2}}} = \frac{u_y\sqrt{1-\beta^2}}{1 - \frac{V u_x}{c^2}}$$

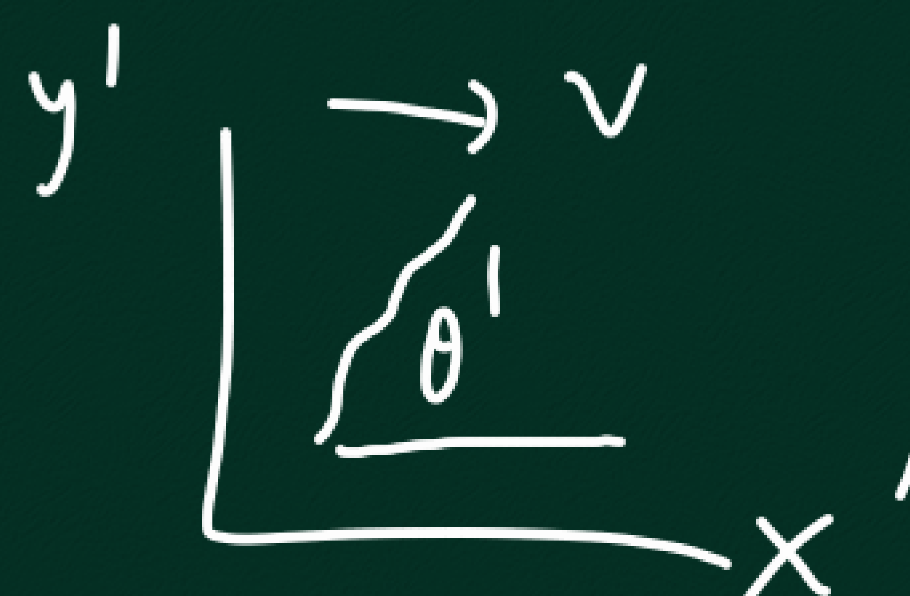


$S' = 0$

$f' < f$

$\lambda' > \lambda$





$$\bar{k} = \frac{2\pi}{\lambda}\left(\cos\theta\,\hat{i} + \sin\theta\,\hat{j}\right)$$

$$\left.\begin{matrix} f \\ \lambda \end{matrix}\right\} \quad f\lambda = c = f'\lambda'$$

$$\omega = 2\pi f$$

$$S: \quad A\cos\left(\bar{k}\cdot\bar{r} - \omega t\right)$$

$$A\cos\left[\frac{2\pi}{\lambda}\left(\cos\theta\, x + \sin\theta\, y\right) - \omega t\right]$$

$$(\cdot)\, x + (\cdot)\, y + (\cdot)\, t$$

1) $\rightsquigarrow$ along x in S

$\theta = 0$

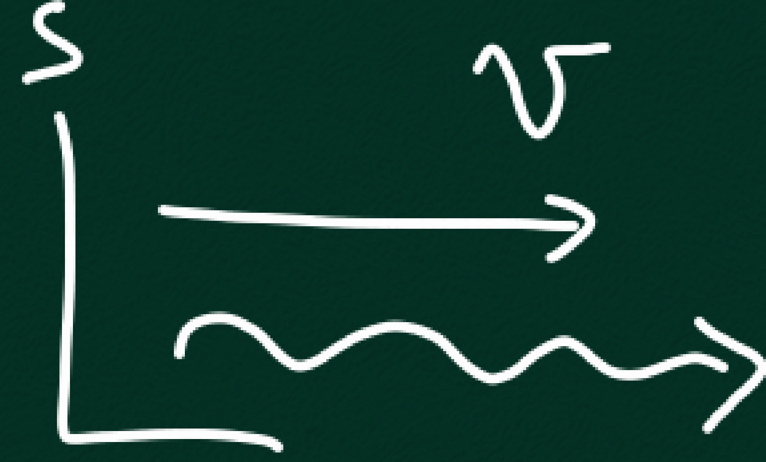
$\Rightarrow \theta' = 0$ same in S'

2) $$f = \frac{1+\beta}{\sqrt{1-\beta^2}}\, f' = \sqrt{\frac{1+\beta}{1-\beta}}\, f'$$

$\theta' = 0$

$f' < f$

Newtonian



Obsv

Source moving towards Stationary observer

$$f_{obs} = \frac{f}{1 - v/c}$$

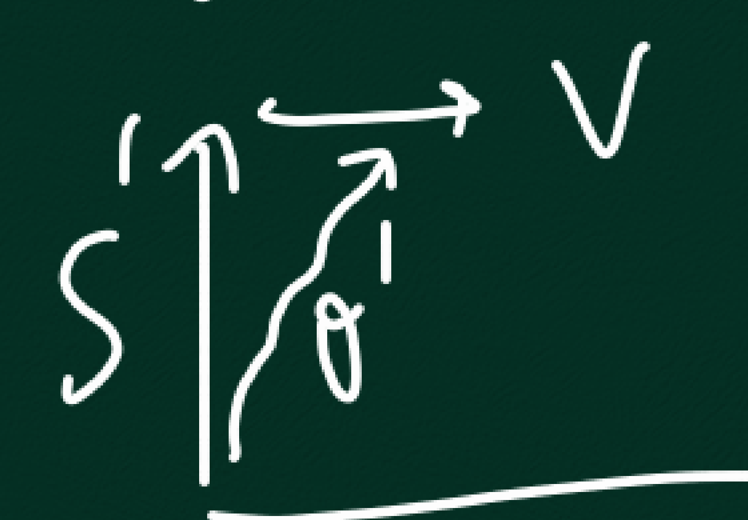
$\rightarrow$ could be sound spd.

$u_y' \neq u_y$

Observer moving towards source

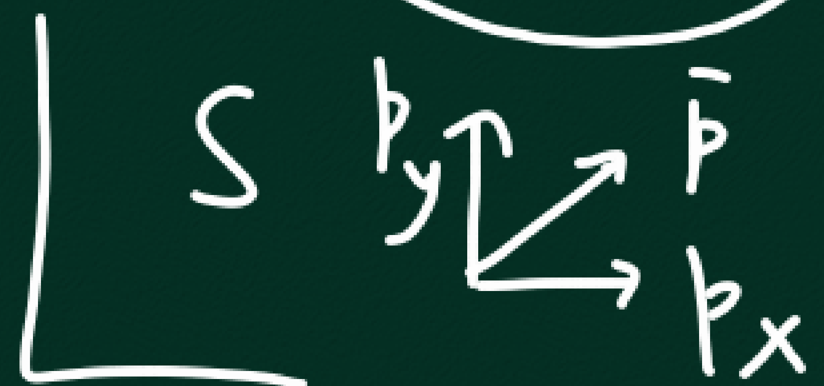
obsvr

$$f_{obsv} = f\left(1 + \frac{v}{c}\right)$$



$\tan\theta < \tan\theta'$

$$p_x = m u_x = \overbrace{\frac{m_0}{\sqrt{1-u^2/c^2}}}^{m} u_x$$



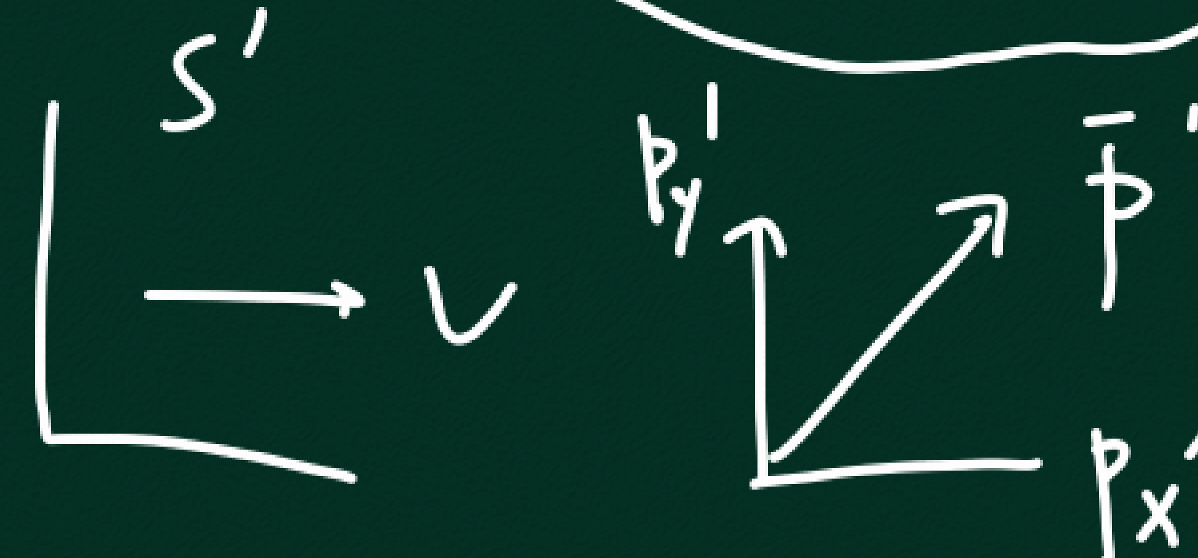
$$p_x' = \frac{\overset{\equiv x}{p_x} - v\,\overset{\equiv t}{E/c^2}}{\sqrt{1-\beta^2}}$$

$$p_y' = p_y$$

$$p_z' = p_z$$

$$\frac{E'}{c^2} = \frac{\overset{\equiv t}{E/c^2} - v\frac{p_x}{c^2}}{\sqrt{1-\beta^2}}$$

$$p_x' = \overbrace{\frac{m_0}{\sqrt{1-u'^2/c^2}}}^{m'} u_x'$$



$$x' = \frac{x - vt}{\sqrt{1-\beta^2}}$$

$$y' = y$$

$$z' = z$$

$$t' = \frac{t - vx/c^2}{\sqrt{1-\beta^2}}$$

$$\boxed{E = mc^2 = (m_0 + \Delta m)c^2}$$

$$= \frac{m_0}{\sqrt{1-u^2/c^2}} c^2$$

$$K = \left(\frac{1}{\sqrt{1-u^2/c^2}} - 1\right) m_0 c^2$$

$$= (m - m_0)c^2$$

$$K(u) = m u v$$

$$K = \frac{m}{2} u^2$$

$$f(u,v) = u' = \frac{u - v}{1 - vu/c^2}$$

$$\frac{\partial K}{\partial v} = mu$$

Galln: $f' = \frac{\partial f}{\partial v} = -1$

$$x' = x - vt$$

$$x =$$