Formula Sheet 1

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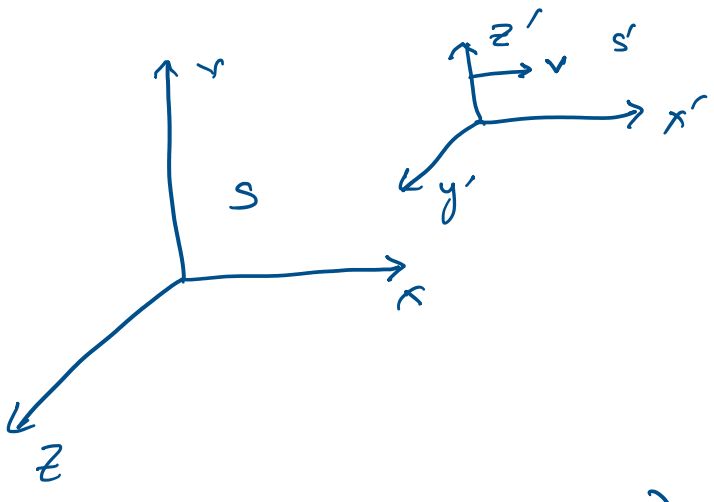
* $\Delta t = \gamma \Delta t'$ ← time dilation
  - Δt: time as measured in rest frame
  - $\Delta t'$: time in frame where the rest frame is in relative motion.

* Leading clocks lag.
  In a frame where clocks are moving, the leading clocks lag by $L'v/c^2$ where L' is the distance between the clocks in their rest frame

* $l = l'/\gamma$ ← length contraction

* There is no transverse contraction

*



$$c\Delta t' = \gamma(c\Delta t - \beta \Delta x) \qquad c\Delta t = \gamma(c\Delta t' + \beta \Delta x')$$
$$\Delta x' = \gamma(\Delta x - \beta c \Delta t) \qquad \Delta x = \gamma(\Delta x' + \beta c \Delta t')$$

* Velocity Addition

$$W = \frac{v + u}{1 + uv/c^2}$$

(v: relative velocity of frames; u: velocity in S' frame)

* $\tilde{A} \cdot \tilde{B} = A_0 B_0 - A_1 B_1 - A_2 B_2 - A_3 B_3$

* $\Delta \tilde{x} = (c\Delta t, \Delta x, \Delta y, \Delta z)$

  $\Delta \tilde{v} = (\gamma c, \gamma v_x, \gamma v_y, \gamma v_z)$

  $\Delta \tilde{p} = (\gamma m c, \gamma m v_x, \gamma m v_y, \gamma m v_z)$

where

$|\Delta \tilde{x}|^2$, $|\Delta \tilde{v}|^2$, $|\Delta \tilde{p}|^2$ are all invariants

* $E = \gamma m c^2$

  $\vec{p} = \gamma m \vec{v}$

* $E^2 = m^2 c^4 + |\vec{p}|^2 c^2$

* $E/c = \gamma(E'/c + \beta p'_x) \qquad E'/c = \gamma(E/c - \beta p_x)$

  $p_x = \gamma(p'_x + \beta E'/c) \qquad p'_x = \gamma(p_x - \beta E/c)$

* $\cos\theta = \dfrac{\cos\theta' + \beta}{1 + \beta\cos\theta'}$ ← Stellar aberration

* $\dfrac{\nu}{\nu'} = \dfrac{\sqrt{1-\beta^2}}{1-\beta\cos\theta}$ ← doppler effect