<u>Formulas:</u>

Time dilation; Length contraction : $\Delta t = \gamma \Delta t' \equiv \gamma \Delta t_p$; $L = L_p / \gamma$; $c = 3 \times 10^8 m/s$

Lorentz transformation :

$$x' = \gamma(x - vt) \qquad\qquad\qquad x = \gamma(x' + vt')$$

$$y' = y , \quad z' = z \qquad \gamma = \frac{1}{\sqrt{1 - v^2/c^2}} \qquad y = y', \quad z = z'$$

$$t' = \gamma(t - vx/c^2) \qquad\qquad\qquad t = \gamma(t' + vx'/c^2)$$

Velocity transformation :

$$u_x' = \frac{u_x - v}{1 - u_x v/c^2} \qquad\qquad u_x = \frac{u_x' + v}{1 + u_x' v/c^2}$$

$$u_y' = \frac{u_y}{\gamma(1 - u_x v/c^2)} \qquad\qquad u_y = \frac{u_y'}{\gamma(1 + u_x' v/c^2)}$$

Relativistic Doppler shift : $f_{obs} = f_{source} \sqrt{1 + v/c} \ / \ \sqrt{1 - v/c}$