

Formulas:

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

Lorentz transformation :

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

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

$$y' = y, \quad z' = z$$

$$\gamma = \frac{1}{\sqrt{1 - v^2/c^2}}$$

$$y = y', \quad z = z'$$

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

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

Velocity transformation :

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

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

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

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

Spacetime interval: $(\Delta s)^2 = (c\Delta t)^2 - [\Delta x^2 + \Delta y^2 + \Delta z^2]$

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

Momentum : $\vec{p} = \gamma m \vec{u}$; Energy : $E = \gamma mc^2$; Kinetic energy : $K = (\gamma - 1)mc^2$

Rest energy : $E_0 = mc^2$; $E = \sqrt{p^2 c^2 + m^2 c^4}$

Electron : $m_e = 0.511 \text{ MeV}/c^2$ Proton : $m_p = 938.26 \text{ MeV}/c^2$ Neutron : $m_n = 939.55 \text{ MeV}/c^2$

Atomic mass unit : $1 u = 931.5 \text{ MeV}/c^2$; electron volt : $1 \text{ eV} = 1.6 \times 10^{-19} \text{ J}$