

Physics 113 -Lecture 8

Special Relativity(Continued)

x,y,z,t all relative to inertial reference frame

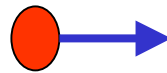
Mass Effect - moving mass gets heavier

m=5kg



at rest

m=10kg



0.87 c

m_0 is rest mass

$$m = \frac{m_0}{\sqrt{1 - \frac{v^2}{c^2}}}$$



It is impossible to accelerate a massive particle to speed c!

Momentum:

$$p = \frac{m_0 v}{\sqrt{1 - \frac{v^2}{c^2}}}$$

Energy:

$$E_{\text{total}} = m_0 c^2 \frac{1}{\sqrt{1 - \frac{v^2}{c^2}}}$$

$$E_{\text{total}} = \text{KE} + E_0$$

$$\text{KE} = m_0 c^2 \left(1 - \frac{1}{\sqrt{1 - \frac{v^2}{c^2}}} \right) \approx \frac{m_0 v^2}{2} \text{ for } v \ll c$$

Rest Energy:

$$E_0 = m_0 c^2$$

Energy and Mass are Equivalent

{ energy } can be { mass }
{ mass } converted to { energy }

$$1 \text{ MeV} = 1.6 \times 10^{-13} \text{ J}$$

Particle masses (n,p,e,...) are quoted in MeV