

# Physics 113 -Lecture 8

## Special Relativity(Continued)

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

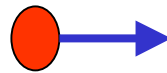
**Mass Effect - moving mass gets heavier**

$m=5\text{kg}$



at rest

$m=10\text{kg}$



$0.87 c$

$m_0$  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**