Relativistic Definitions of Momentum and Energy

Note that these must reduce to classical definitions at low speeds.

Once again γ (gamma) makes its appearance. Remember that this defined as:

$$\gamma = \frac{1}{\sqrt{1-v^2}}, \quad \text{where } v \text{ is expressed as a fraction of } c.$$

Energy is defined as:

$$E = m\gamma$$

If we set the speed to zero what do we get for the energy?

We can interpret the energy as $E = E_{rest} + K$, where $E_{rest} =$ ____________

The x-component of momentum is defined as:

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

If we set the speed to zero what do we get for the momentum?

We also have a nice simple relationship between speed, momentum, and energy:

$$v = \frac{p}{E}$$

Conservation Laws

The total momenergy of an isolated system of particles is conserved.

In addition, each component of the momenergy 4-vector is conserved. In other words, the energy of the system is conserved, and the momentum (in fact, each component of the momentum) of the system is conserved.