

Homework 10:

Remember: In addition to this problem, you also have a “Mastering Physics” assignment Due April 17. Due at 10:00 A.M, Friday, April 17. Write up of the solution to this problem in a coherent fashion.

Suppose we have two particles each of mass M . One of the particles is at rest (in your rest frame) and the other is traveling with a speed of v_0 . Suppose the two particles crash and stick together to form a new particle.

- a. Show that the total energy of the systems (which is the sum of the

energies of the two particles) is
$$E = Mc^2 \left(1 + \frac{1}{\sqrt{1 - \frac{v_0^2}{c^2}}} \right).$$

- b. Show that the magnitude of the total momentum is
$$p = M \frac{v_0}{\sqrt{1 - \frac{v_0^2}{c^2}}}.$$

- c. Show that the mass of the new particle is
$$M_{new} = M \sqrt{2 \left(1 + \frac{1}{\sqrt{1 - \frac{v_0^2}{c^2}}} \right)}.$$

- d. Show that the speed of the new particle is
$$\frac{v_0}{\sqrt{1 - \frac{v_0^2}{c^2}} + 1}$$