

PHYS 3740 In Class Group Exercise

Name: _____ Date: _____

Momentum conservation in a collision, after Harris 2-76.

Two particles collide head on and bounce back elastically in one dimension, each of them just reversing their velocities but preserving their original masses, as shown.

- (a) Is energy conserved?
- (b) What is their relativistic momentum before and after the collision?
- (c) Is momentum conserved?
- (d) An observer moves to the right with speed $0.6c$. Draw the collision from her point of view, showing all the velocities. Be careful! We are adding relativistic velocities.
- (e) Using (d), calculate the energy and momentum of each particle before and after the collision in her frame. Are energy and momentum conserved from her point of view?
- (f) Instead of relativistic velocity addition, use the Lorentz transformation of energy and momentum to obtain the energies and momenta of both particles before and after the collision. Are your results the same as in (e)?