

Week 77 (3/1/04)

Relativistic momentum paradox

Two equal masses are connected by a massless string with tension T . (By “massless”, we mean that it has no mass in its unstretched, zero-length state.) The masses are constrained to move with speed v along parallel lines, as shown below. The constraints are then removed, and the masses are drawn together. They collide and make one blob which continues to move to the right. Is the following reasoning correct? If your answer is “no”, then state what is invalid about whichever of the four sentences is/are invalid.

“The forces on the masses point in the y -direction. Therefore, there is no change in momentum in the x -direction. But the mass of the resulting blob is greater than the sum of the initial masses (because they collided with some relative speed). Therefore, the speed of the resulting blob must be less than v (to keep p_x constant), so the whole apparatus slows down in the x -direction.”

