

Switching Frames

How do things look from a different reference frame?

Useful equation

The relativistic relative velocity equation: $\vec{v}_{AC} = \frac{\vec{v}_{AB} - \vec{v}_{CB}}{1 - \frac{\vec{v}_{AB} \vec{v}_{CB}}{c^2}}$.

Now let's analyze the same collision, but from a new reference frame.

In your reference frame an object with a mass of 3 mass units is traveling in the positive x-direction at a speed of 0.8c. It collides with a second object that has a mass of 8 units and that is traveling in the negative x-direction at a speed of 0.6c.

In Isabelle's frame of reference the first object is stationary. Now let's look at everything from Isabelle's perspective.

First, how fast is particle 2 traveling, according to Isabelle?

What is the energy of the second object, according to Isabelle?

What is the momentum of the second object, according to Isabelle?

Sketch the momentum vectors for the first object, the second object, and the system of two objects, before the collision.

The total energy in this system is: _____

The total momentum in this system is: _____

The total momentum in this system is: _____

The objects stick together after the collision.

What is the velocity of the combined object after the collision?

What is the mass of the combined object after the collision?