Answer on Question #51218, Physics, Other

Task: Two spaceships approach each other, each moving with the same speed as measured by a stationary observer on the Earth. Their relative speed is 0.8c. Determine the velocities of each spaceship as measured by the stationary observer on Earth.

Answer:

Let S be the earth reference frame and S' be that of the ship traveling east (positive x direction). Then in the reference frame S', the velocity of S is directed west, i.e., $V = -u_x$.

$$u'_x = \frac{u_x - V}{1 - \frac{Vu_x}{c^2}} = \frac{2u_x}{1 + \frac{u_x^2}{c^2}};$$

$$u'_x = 0.8c \Rightarrow u'_x(1 + \frac{u_x^2}{c^2}) - 2u_x = 0 \Rightarrow$$

$$u_x = \frac{2 - \sqrt{4 - 4 \cdot 0.8^2}}{2\frac{0.8}{c}} = \frac{2 - 1.2}{2\frac{0.8}{c}} = 0.5c$$

The velocities of each spaceship as measured by the stationary observer on Earth $u_x = 0.5c$

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