Answer on Question #73095-Physics-Other

Two events happen simultaneously in the frame S at a distance of 3.0 light years apart. In the frame S', which is moving with a speed v relative to S, the distance between these events is 3.5 light years. Calculate (i) v and (ii) the time interval between these events in the frame S'.

Solution

(i) $l = 3.0\ light\ years$

$l_0 = 3.5\ light\ years$

$$l = l_o\sqrt{1 - \frac{v^2}{c^2}}$$

$$\sqrt{1 - \frac{v^2}{c^2}} = \frac{l}{l_0} = \frac{3}{3.5}.$$

$$1 - \frac{v^2}{c^2} = \left(\frac{3}{3.5}\right)^2$$

$$\frac{v^2}{c^2} = 1 - \left(\frac{3}{3.5}\right)^2.$$

$$v = c\sqrt{1 - \left(\frac{3}{3.5}\right)^2} = 0.515c.$$

(ii)

$$t' = \frac{3.5}{0.515} = 6.8\ years.$$