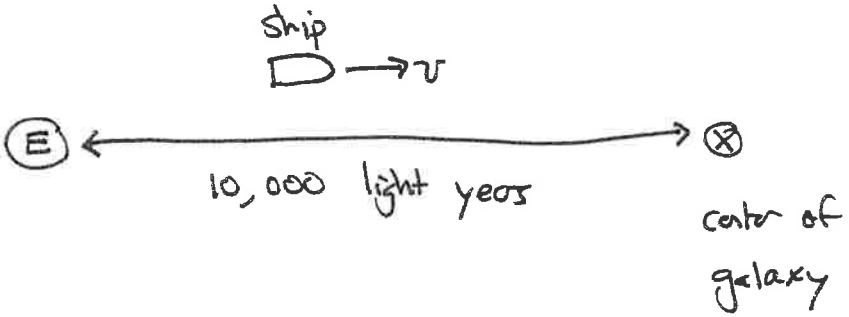
Ex 31.6 (Galactic travel)



In principle, one could make the trip in one lifetime if he or she travelled fast enough. This is because, according to the person on the ship, the distance travelled is length contracted to (potentially) much less than 10,000 light years. To make the trip in 40 years, the speed would have to be

$$\boxed{v = 0.999992\,c}$$

This was found as follows.

$$\Delta t_0 = 40 \text{ yrs} = \frac{\Delta t}{\gamma}$$

$$\Delta t = L_0 / v = \frac{(10{,}000 \text{ yrs})(c)}{v}$$

$$40 \text{ yrs} = \frac{(10{,}000 \text{ yrs})(c)}{v}\sqrt{1-\left(\frac{v}{c}\right)^2}$$

$$\frac{40^2}{(10{,}000)^2} = \frac{c^2}{v^2}\left(1-\frac{v^2}{c^2}\right)$$

$$1+\left(\frac{40}{10{,}000}\right)^2 = \frac{c^2}{v^2} \Longrightarrow \frac{v}{c} = \sqrt{\frac{1}{1+\left(\frac{40}{10{,}000}\right)^2}}$$