

Friday, April 25, 2025

Example : High red shift velocity

Consider a quasar with a red shift of $z=5$.

Q: How fast is it travelling away from the Milky Way?

velocity

$$\frac{v}{c} \approx z \quad (\text{non-relativistic formula})$$

speed of light

$$\frac{v}{c} = 5 \Rightarrow v = 5c$$

↳ 5 times the speed of light!!

→ Impossible!

→ wrong formula.

relativistic formula
(works in all cases)

$$\frac{v}{c} = \frac{(z+1)^2 - 1}{(z+1)^2 + 1} = \frac{(5+1)^2 - 1}{(5+1)^2 + 1} = \frac{6^2 - 1}{6^2 + 1}$$
$$= \frac{36 - 1}{36 + 1} = \frac{35}{37} \approx 0.95$$

$$\Rightarrow v \approx 0.95c$$

The quasar is travelling away from us at 95% of the speed of light.