

Friday, April 24, 2026

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

speed of light

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

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

↳ 5 times the speed of light!!
→ Impossible
→ Wrong formula

Relativistic formula: $\frac{v}{c} = \frac{(z+1)^2 - 1}{(z+1)^2 + 1}$
(works in all cases)

$$= \frac{(5+1)^2 - 1}{(5+1)^2 + 1} = \frac{6^2 - 1}{6^2 + 1}$$

$$= \frac{36 - 1}{36 + 1} = \frac{35}{37} \approx 0.95$$

⇒ $v = 0.95c$

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