

Relativistic Doppler Shift

recall regular expressions:

$$\frac{\lambda_{\text{obs}}}{\lambda_{\text{rest}}} = 1 + \frac{\Delta\lambda}{\lambda} = 1 + z = 1 + \frac{v}{c}$$

valid ONLY when $\frac{v}{c} \ll 1$

otherwise:

$$\frac{\lambda_{\text{obs}}}{\lambda_{\text{rest}}} = \left(\frac{1 + \frac{v}{c}}{1 - \frac{v}{c}} \right)^{1/2} = 1 + z$$
$$z = \left(\frac{1 + \frac{v}{c}}{1 - \frac{v}{c}} \right)^{1/2} - 1$$

z can get as big as you want
with $\frac{v}{c}$ always < 1

e.g. let $\frac{v}{c} = .99$

$$z = \left(\frac{1 + .99}{1 - .99} \right)^{1/2} - 1 = \left(\frac{1.99}{0.01} \right)^{1/2} - 1 = 14.1 - 1$$
$$= \underline{\underline{13.1 !!}}$$