

1

$$\begin{aligned} f &= f_0 \frac{1}{1 \pm \frac{v}{c}} \\ \frac{v}{c} &\ll 1 \\ \Rightarrow f &\approx f_0 (1 \mp \frac{v}{c}) \end{aligned}$$

2

$$\sigma_c = \sigma_v = 0.1$$