

Monday, February 17, 2025

Example: Doppler ~~sub~~ shift

A tie fighter attacks you at $v = 0.1c$ with its green $\lambda = 530 \text{ nm}$ laser canon.

Q: what color do you see for the lasers?

↳ blue shifted

$$\begin{aligned} -\frac{\Delta\lambda}{\lambda} &= \frac{v}{c} \Leftrightarrow \Delta\lambda = \underbrace{-\frac{v}{c}}_{\substack{0.1c \\ c} = 0.1} \lambda \\ &= -0.1 \times 530 \\ &= -53 \text{ nm} \end{aligned}$$

$$\begin{aligned} \Rightarrow \lambda' &= \lambda + \Delta\lambda = 530 + (-53) \\ &= 477 \text{ nm} \rightarrow \text{blue} \end{aligned}$$

↑
wavelength seen
by observer

\Rightarrow You see the laser's light as blue at $\lambda' = 477 \text{ nm}$