Doppler effect

Classical Doppler effect:

$$f = f_0 \frac{c \pm v_o}{c \mp v_s}$$

c : speed of sound (330-340 m/s)
v_o : observer speed
v_s : source speed
f_0 : emitted frequency
f : observed frequency

Air is the carrier medium of sound. The source and the observer move in this carrier medium.

Relativistic Doppler effect:

up: $f_\uparrow = f_0 \sqrt{\frac{c+v}{c-v}} = f_0 \sqrt{\frac{1+\beta}{1-\beta}}$ } blue shift ($\beta = v/c$)

down: $f_\downarrow = f_0 \sqrt{\frac{c-v}{c+v}} = f_0 \sqrt{\frac{1-\beta}{1+\beta}}$ } red shift

c : speed of light ($c = 3 \cdot 10^8$ m/s)
v : speed of the source and the observer with respect to each other.

There is NO carrier medium!

Doppler effect 2.

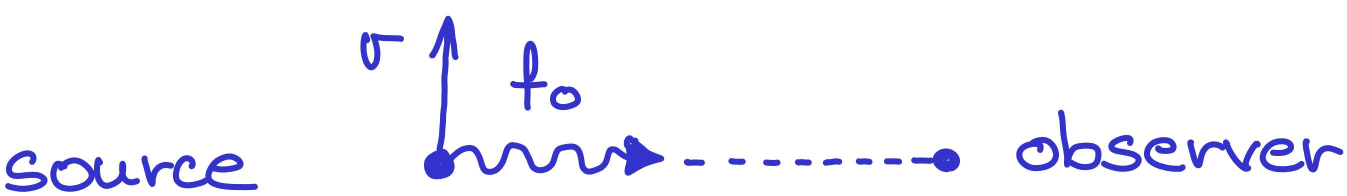
Longitudinal Doppler effect:

$$f_\uparrow = f_0 \cdot \sqrt{\frac{1+\beta}{1-\beta}} \quad \text{or} \quad f_\downarrow = f_0 \sqrt{\frac{1-\beta}{1+\beta}}$$

blue shift — red shift

$$c = \lambda f \Rightarrow \lambda = \frac{c}{f}$$

Transverse Doppler effect



$$f = \frac{f_0}{\gamma} = \sqrt{1-\beta^2} \cdot f_0$$

The source's clock is time dilated, the light is redshifted.

The transverse Doppler effect is a pure relativistic effect!