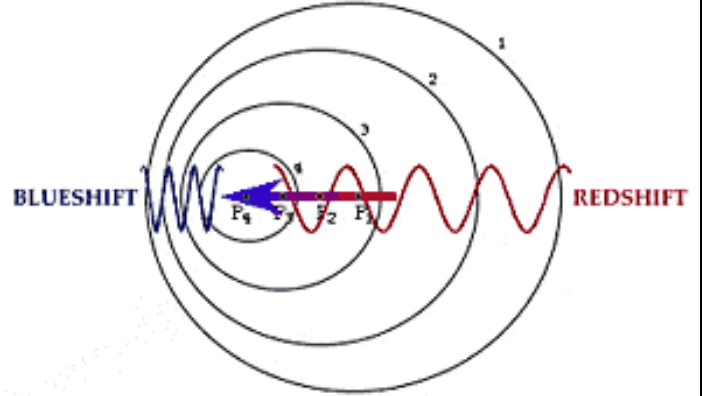
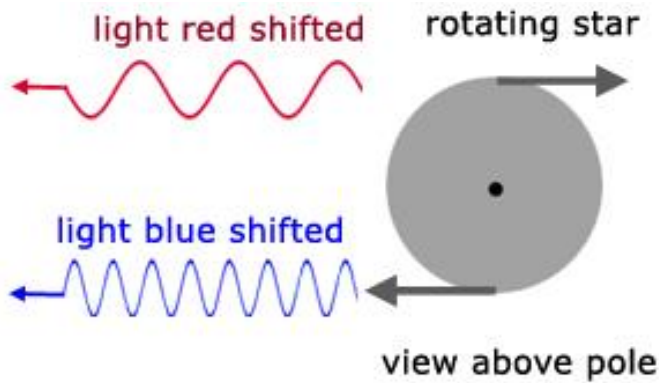


Harold's Physics Doppler Effect "Cheat Sheet"

19 April 2016

Doppler Effect – Sound			
Diagram	<div style="display: flex; justify-content: space-between; align-items: center;"> <div style="text-align: center;"> <p>Low Frequency</p> </div> </div>		
<p>f = frequency (pitch) of sound wave v = speed of sound in the medium [343.2 m/s; 1,126 ft/s; 1,236 km/h; 768 mph] v_s = speed of the sound source v_r = speed of the listener / receiver</p>	Source Velocity (v_s)	Receiver Velocity (v_r)	Observed Frequency Equation
Source and receiver are both stationary	•	•	$f_r = f_s$
Source moving away from the receiver	←	•	$f_r = f_s \left(\frac{v}{v + v_s} \right)$
Source moving towards the receiver	→	•	$f_r = f_s \left(\frac{v}{v - v_s} \right)$
Receiver moving towards the source	•	←	$f_r = f_s \left(\frac{v + v_r}{v} \right)$
Receiver moving away from the source	•	→	$f_r = f_s \left(\frac{v - v_r}{v} \right)$
General Equation	← →	← →	$f_r = f_s \left(\frac{v \pm v_r}{v \mp v_s} \right)$
<p>Tip: Towards use top sign, away use bottom sign Pick sign so observed frequency increases when towards (big numerator, small denominator)</p>			

Doppler Effect – Light



$f = \text{frequency of light wave at the source}$ $c = \text{speed of light}$ $v = \text{speed difference between two objects}$	Source Velocity Relative to Receiver (v)	Receiver Velocity (0)	Observed Frequency Equation
Both objects are moving at the same velocity	•	•	$f_r = f_s$
Redshift: Source object moving away from the earth	←	•	■ $f_{red} = f_s \left(\frac{c}{c + v} \right)$
Blueshift: Source object moving towards the earth	→	•	■ $f_{blue} = f_s \left(\frac{c}{c - v} \right)$
$f = \frac{c}{\lambda}$	$\lambda = \frac{c}{f}$		
$\lambda = \text{wavelength of light wave at the source}$ $c = \text{speed of light}$ $v = \text{speed difference between two objects}$	Source Velocity Relative to Receiver (v)	Receiver Velocity (0)	Observed Wavelength Equation
Both objects are moving at the same velocity	•	•	$\lambda_r = \lambda_s$
Redshift: Source object moving away from the earth	←	•	■ $\lambda_{red} = \lambda_s \left(\frac{c + v}{c} \right)$
Blueshift: Source object moving towards the earth	→	•	■ $\lambda_{blue} = \lambda_s \left(\frac{c - v}{c} \right)$