The Doppler Effect

• How does light tell us the speed of a distant object?

Definition: “The change in wavelength of radiation due to relative radial motion between the source and the observer.”

Real Life Example of Doppler Effect

The change in the pitch of a siren on a police car, fire truck, or ambulance as it zooms past (sound waves)

Astronomers deal with the Doppler Effect of light waves

Doppler Effect

• When something which is giving off light moves towards or away from you, the wavelength of the emitted light is changed or shifted

$\text{Star} \rightarrow V \rightarrow \text{Redshift}$

Light Wave

Doppler Effect

• When the source of light is moving away from the observer the wavelength of the emitted light will increase. We call this a “redshift”.

$\text{Star} \rightarrow \text{Redshift}$
Doppler Effect

- When the source of light is moving towards the observer the wavelength of the emitted light will appear to decrease. We call this a "blueshift".

Doppler Effect

- "Radial" means "along line of sight"
- Doppler Effect happens only if the light source is moving towards you or away from you.

Doppler Shifts

- Redshift (to longer wavelengths): The source is moving away from the observer
- Blueshift (to shorter wavelengths): The source is moving towards the observer

\[
\frac{\Delta \lambda}{\lambda_0} = \frac{v}{c}
\]

\(\Delta \lambda\) = shift in wavelength
\(\lambda_0\) = wavelength if source is not moving
\(v\) = velocity of source
\(c\) = speed of light
Doppler Effect Lecture
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• Work with a partner or two
• Read directions and answer all questions carefully. Take time to understand it now!
• Come to a consensus answer you all agree on before moving on to the next question.
• If you get stuck, ask another group for help.
• If you get really stuck, raise your hand and I will come around.