Doppler Effect

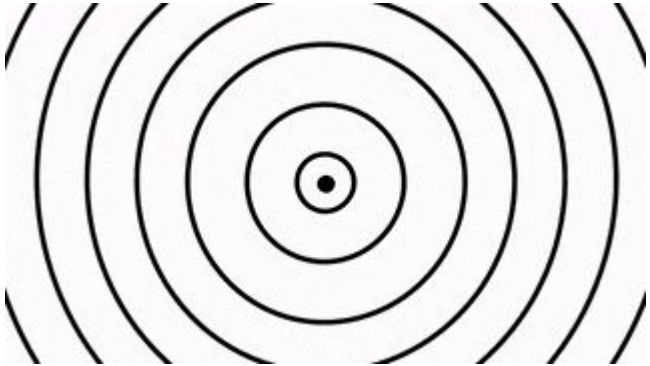
Joseph Chou, Yasmine Hejazi, Vanessa Hsu

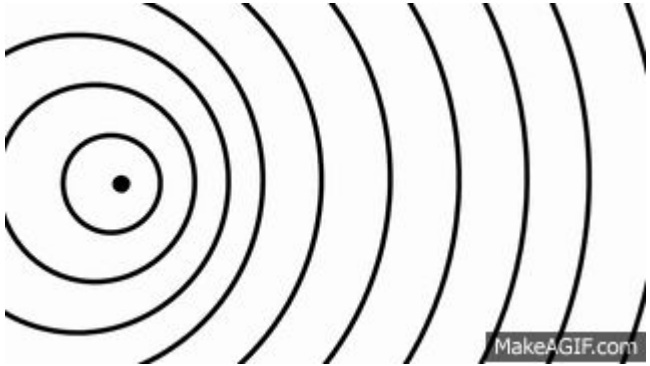
Why the Doppler effect?

- Explaining an interesting phenomenon most of us have experienced
- Applications in astronomy
  - Measure the Doppler shift of a radio signal sent from a spacecraft to earth to track positions of objects in space
  - Measure the velocity of stars and galaxies with redshift and blueshift
- Applications in medicine
  - Measure the direction and speed of blood flow
- Radar
  - Police radars for speeding cars
  - Wind speed and intensity for weather stations

Related Work

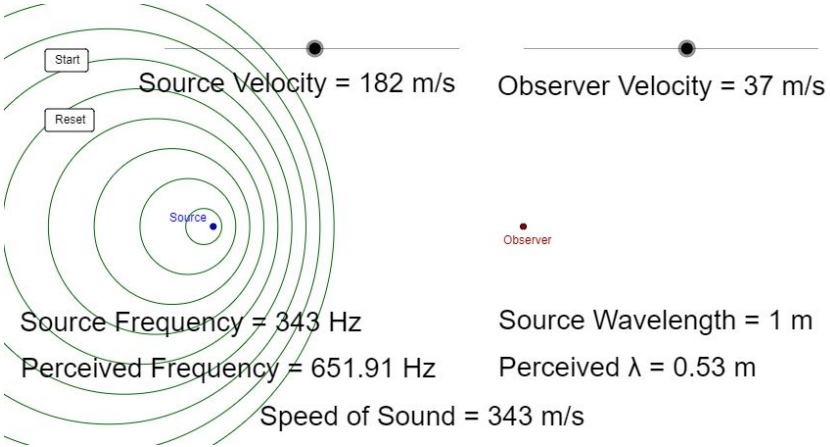
- Previous work includes animated/static visuals of sound waves shifting when the source of the sound moves

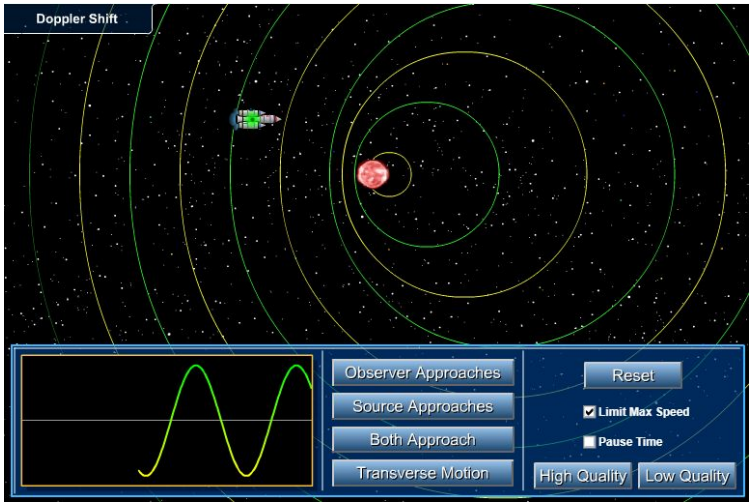




Related Work

- Some interactive simulations, but with fairly limited interactivity
- Most focus only on the classical Doppler effect and not redshift/blueshift

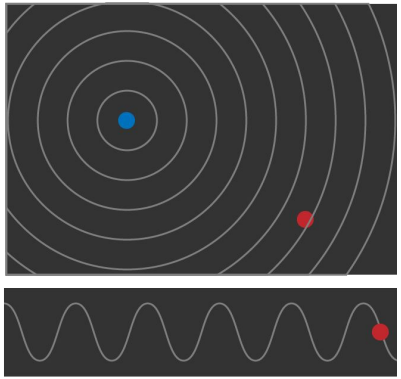




Our Project

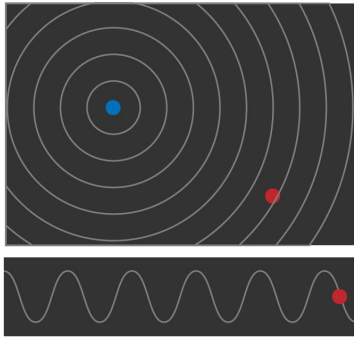
- Idyll document with explanations of the Doppler effect and how it creates redshift/blueshift, accompanied with interactive visualizations

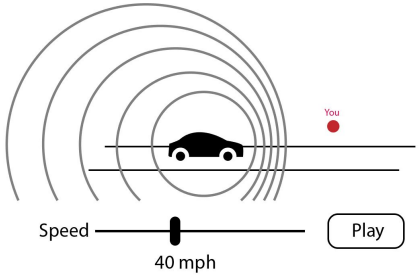
Drag source to modify velocity



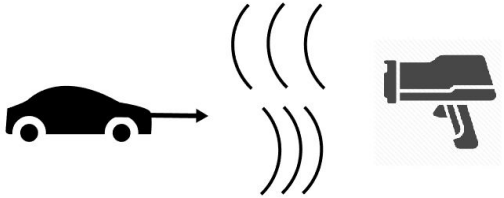
Drag source and receiver to see how their relative velocity affects perceived frequency; could also emit sound

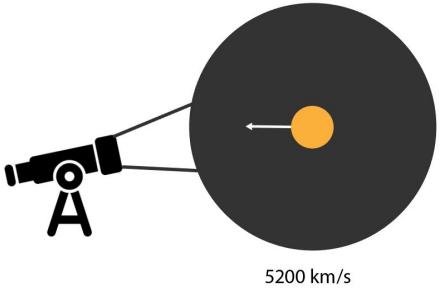
Outline





- Introduction
  - Car horn audio clip
- Explanation of Doppler effect
  - Abstract examples
  - Effects on sounds (frequency/pitch)
  - Interactive mathematical formulas?
  - Interactive car horn example
- Applications
  - Ultrasonography - measuring blood velocity
  - Doppler radars
- Relativistic Doppler effect
  - Abstract redshift/blueshift example
  - Astronomy applications

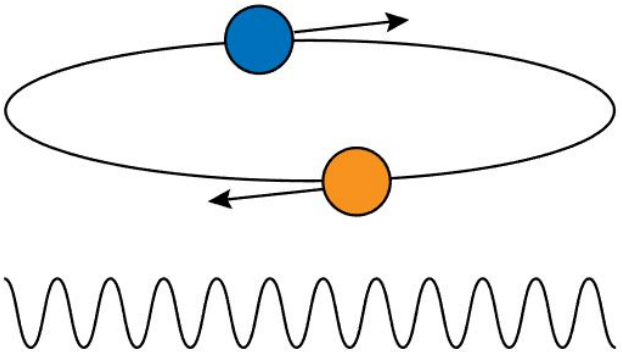




Demo

Features

- Animation: star on elliptical path around observation point, color circle representing perceived color changes
- Animation: wavelengths of objects moving closer/further



Features

- Include color spectrum to demonstrate:
  - Low frequency = red
  - High frequency = blue
- Basic hover quiz showing color transitioning before/after, question if it's moving closer, further away, or standing still

Feedback?

- How in-depth should we go? Should we discuss the math behind it?
- What other visualizations could help illustrate the concept?
- Narrow scope to just astronomy concept (redshift/blueshift)?