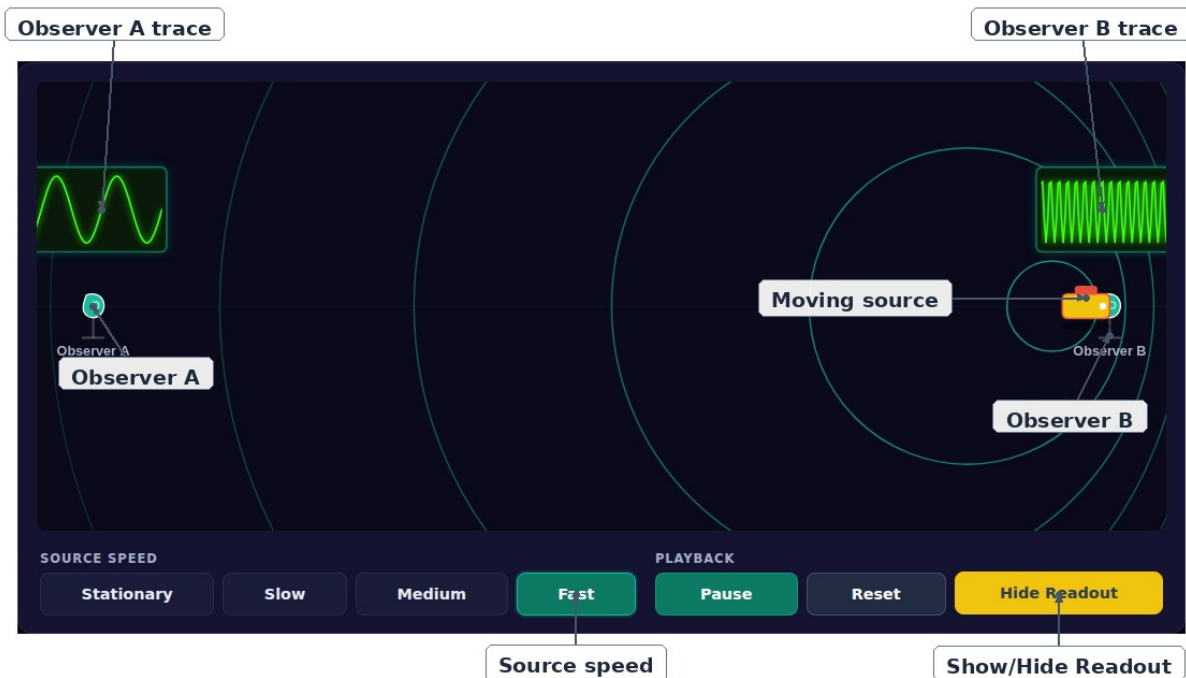


Investigating the Doppler Effect

Source Motion and Wavefront Spacing

Aim:

You are investigating whether the motion of a wave source affects the wavefront pattern and the frequency detected by two fixed observers, A and B.



Prediction:

Before setting the source moving: do you predict the wavefronts in front of a moving source will be spaced more closely together or further apart than when the source is stationary? What about behind the source?

Test this by setting the source speed to Medium in the sim.

Method:

1. Set Source speed to Stationary. Sketch the wavefront pattern around the source in the first box below, marking the positions of Observer A and Observer B.
2. Set Source speed to Medium. Sketch the wavefront pattern you see in front of and behind the moving source in the second box.
3. Set Source speed to Fast. Sketch the wavefront pattern again in the third box, and compare it with your Medium sketch.
4. Keep Source speed set to Fast and turn on Show Readout. Sketch the two oscilloscope traces for Observer A and Observer B in the boxes below.

Results:

Stationary	Medium	Fast
Observer A trace		Observer B trace

Analysis:

Compare your three wavefront sketches. How does the spacing of the wavefronts in front of the source change as source speed increases? How does the spacing behind the source change?

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Observer B is in the path of the approaching source. Describe how the wavefronts reach Observer B compared to Observer A when the source is moving.

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Describe the difference between the two oscilloscope traces. What does this suggest about the frequency each observer detects?

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Explaining why:

The Doppler effect also applies to light. A star moving away from Earth shows a red shift — a decrease in the frequency of its light. Using what you have observed about a receding wave source, explain why a receding source produces a lower-frequency (longer-wavelength) signal.

Use your sketches to explain why an ambulance siren sounds higher-pitched as it approaches you and lower-pitched as it passes and moves away.
