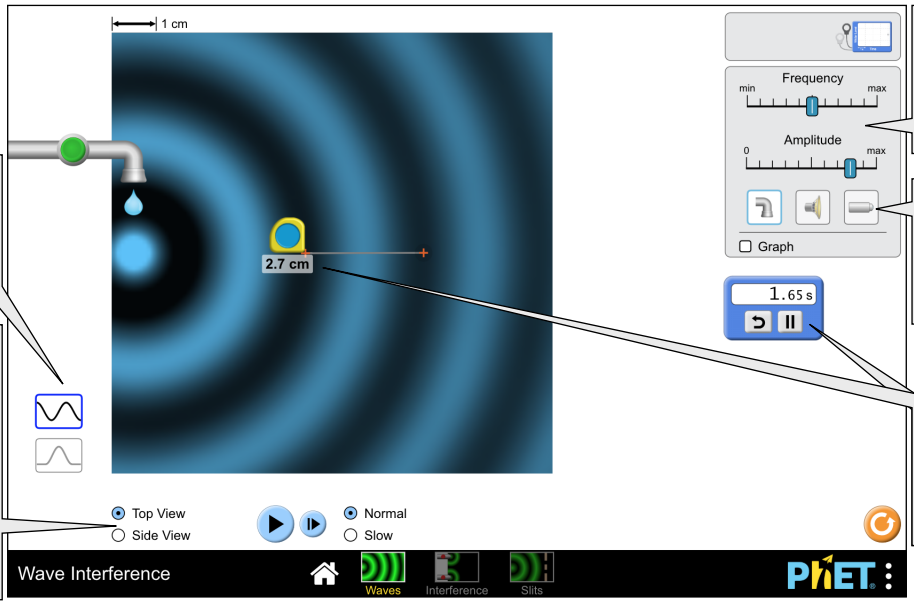
PhET Tips for Teachers

Wave Interference

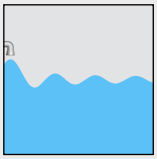
Waves Screen

Make waves with a dripping faucet, speaker, or laser. Adjust the frequency and amplitude, and observe the changes in the wave.



GENERATE continuous wave or pulse

VIEW top or side view



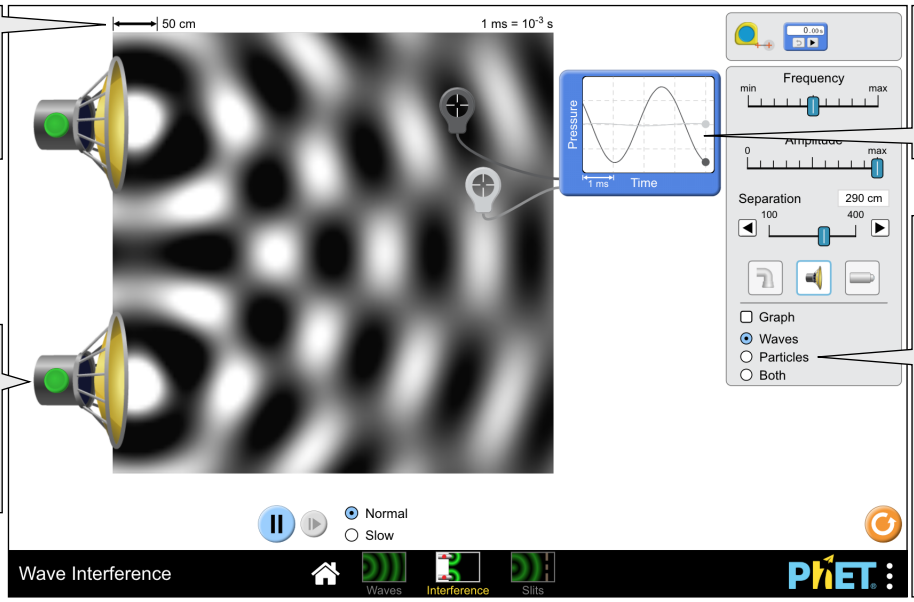
ADJUST frequency and amplitude

EXPLORE water, sound, or light waves

MEASURE wavelength or speed

Interference Screen

Explore how a pair of wave sources create an interference pattern. Find points of constructive and destructive interference by eye, and by using the detectors.

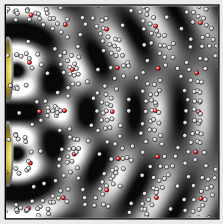


OBSERVE the distance and time scale

CREATE an interference pattern with two sources

COMPARE amplitude and phase

SEE particle or wave view of sound



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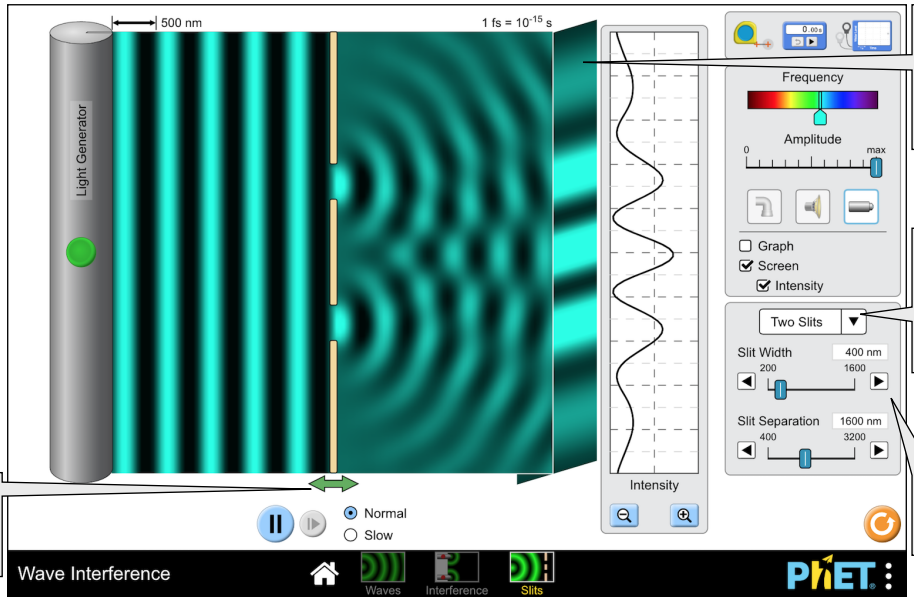
Slits Screen

Put up a barrier to see how the waves move through one or two slits, and discover the resulting interference pattern. Determine how to change the pattern by adjusting the slit width and separation.



OBSERVE the interference pattern

EXPERIMENT with single or double slit

ADJUST slit width, separation

ADJUST barrier position

Model Simplifications

- The color maps to the amplitude of the wave. To improve the appearance of the nodes, while maintaining balance between the apparent widths of the maxima and minima, this color-mapping is piecewise defined. Amplitudes greater than zero linearly map to color values of 40%-100%, while amplitudes less than zero linearly map to color values of 0%-40%.
- Before the laser is turned on, the wave viewing window is black, suggesting that the light propagates into vacuum. However, when the laser is running, black represents a trough.
- On the Waves and Interference screens, the wave amplitude is attenuated as it gets further from the source. For consistency, the light amplitude is also attenuated, though this wouldn't happen to light propagating in a vacuum.
- Due to the different time scales across the water, sound, and light scenes, the next frame button will advance time by a different amount in each scene.
- The boundaries of the wave viewing window are absorbing, but there are still some artifacts due to internal reflections. This can result in some noise in the Screen and Intensity curve, which is smoothed by displaying time-averaged data.
- The plane wave source on the Slits screen is generic. Due to the nature of the model, changing the amplitude will instantaneously change the amplitude for the entire plane wave to the left of the barrier.
- Certain changes will instantaneously clear (or partially clear) the wave viewing area — changing the source separation (Interference), moving the barrier (Slits), changing the frequency (light on all screens, all sources on Slits).

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Customization Options

To enable an overlay that displays the theoretical location of interference maxima (yellow lines) and minima (red lines) on the Slits screen, append `?theory` to the end of the URL:
https://phet.colorado.edu/sims/html/wave-interference/latest/wave-interference_en.html?theory

Suggestions for Use

Sample Challenge Prompts

- How does changing the frequency and amplitude affect the characteristics of the waves? How are the water droplet and speaker affected?
- Design an experiment to measure the speed of the wave. How does your measurement compare to the accepted value of the speed of sound or light? How can you explain the discrepancies between your calculated value and the accepted value?
- Create an interference pattern with two sources, and determine the ways to change the pattern.
- Identify points of constructive and destructive interference by eye, and by using the wave detector.
- Compare single-slit diffraction and double-slit interference. How are the patterns on the screen similar? Determine the ways to change this pattern.
- For two slits, use the equation $d \sin\theta = m\lambda$ to predict to where on the screen the maxima will appear. Use the tape measure to verify your predictions.

See all published activities for Wave Interference here.
For more tips on using PhET sims with your students, see Tips for Using PhET.

Rouinfar, January 2019