

Audio Interference



Purpose: Demonstrates constructive and destructive interference of audio waves.

This demo uses two speakers to illustrate interference of sound waves. The speaker unit input plugs directly into our Pasco sine-wave generator. Run the generator at 440 Hz (concert A) - this frequency seems to be optimal for the demo. Keep the wire that connects the two speakers untangled from the rest.

With the speakers side-by-side on a demo cart, turn on the speaker-amplifier and the sine-wave generator. (Note: Because the speakers have a built-in amp, take care not to overdrive the speaker input by setting the generator output too high.)

The DPDT switch shown in the photo is now mounted in a plastic amber box. It controls the phase of the second speaker relative to the first. With the switch in the central position, the second speaker is off. Clicked to either side, it puts the second speaker either in or out of phase with the first.

Here is what seems to be the best sequence to present the demo:

- A) **Second speaker off:** The students can hear the normal volume due to a single speaker.
- B) **Second speaker in-phase:** The pair will sound louder, which will not surprise anyone. Then increase the speaker separation. As the condition for constructive interference degrades, the volume decreases - which should be a surprise.
- C) **Second speaker 180° out-of-phase:** The volume will decrease, and in fact is less than the volume due to just one speaker. You can switch back and forth to illustrate this point. Then increase the speaker separation. As the coherence is destroyed, the volume will increase.

Note: The interference effect is confined to an area in front of the speaker pair. For large classes, you will want to swivel the cart so that people on either side of the room can hear the full effect. Stress that the phase-changing switch is not doing anything mysterious, simply switching the way the wires of the second speaker are connected.

The wavelength of 440 Hz sound waves is about 77 cm ... the speakers will separate to about a meter. However, trying to explain the observed interference with $n\lambda = 2d \sin \theta$ is risky.

Extra Equipment Needed: Pasco sine-wave generator (Shelf D2).

Location: Shelf D5