

Introduction to Sound (8-12)

SPS Outreach

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What is Sound?

Sound takes place in the form of waves called sound waves. Sounds are vibrations that travel through the air or other medium.

What are Waves?

Waves are curves that travel from one point to another. We can find waves in many places - sound waves, radio waves, electromagnetic field waves - but there are only two main types of waves: transverse and longitudinal.

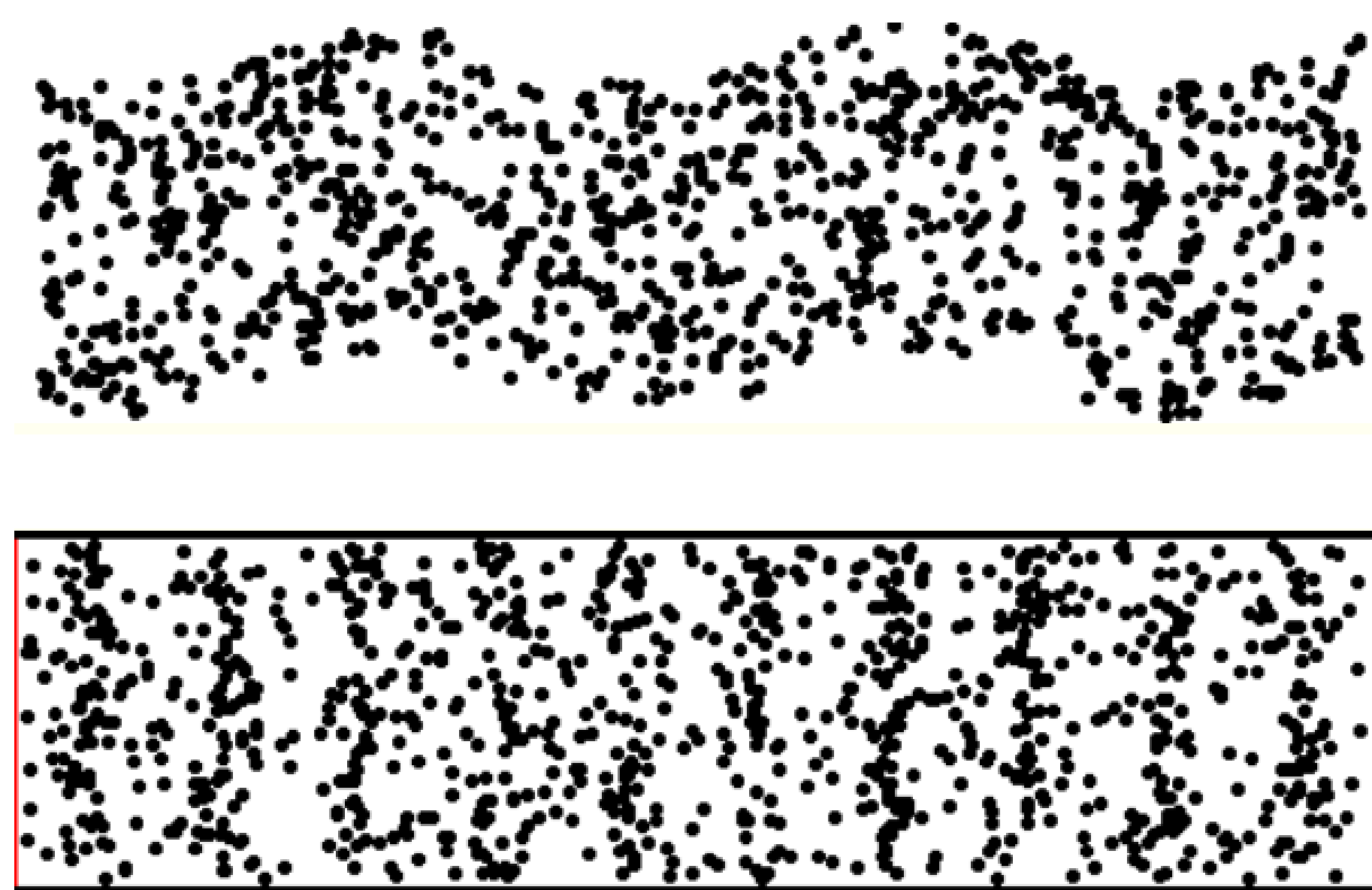


Figure 1. Comparison of the transverse wave (top) and longitudinal wave (bottom) (1)

How Does Sound Travel?

Sound waves are vibrations of particles that travel from side to side in a longitudinal wave. Longitudinal waves travel without exhibiting any up or down motion as seen in figure 1 and 2. A slinky can be used to visualize a longitudinal wave by pulsing the springs like in figure 3.

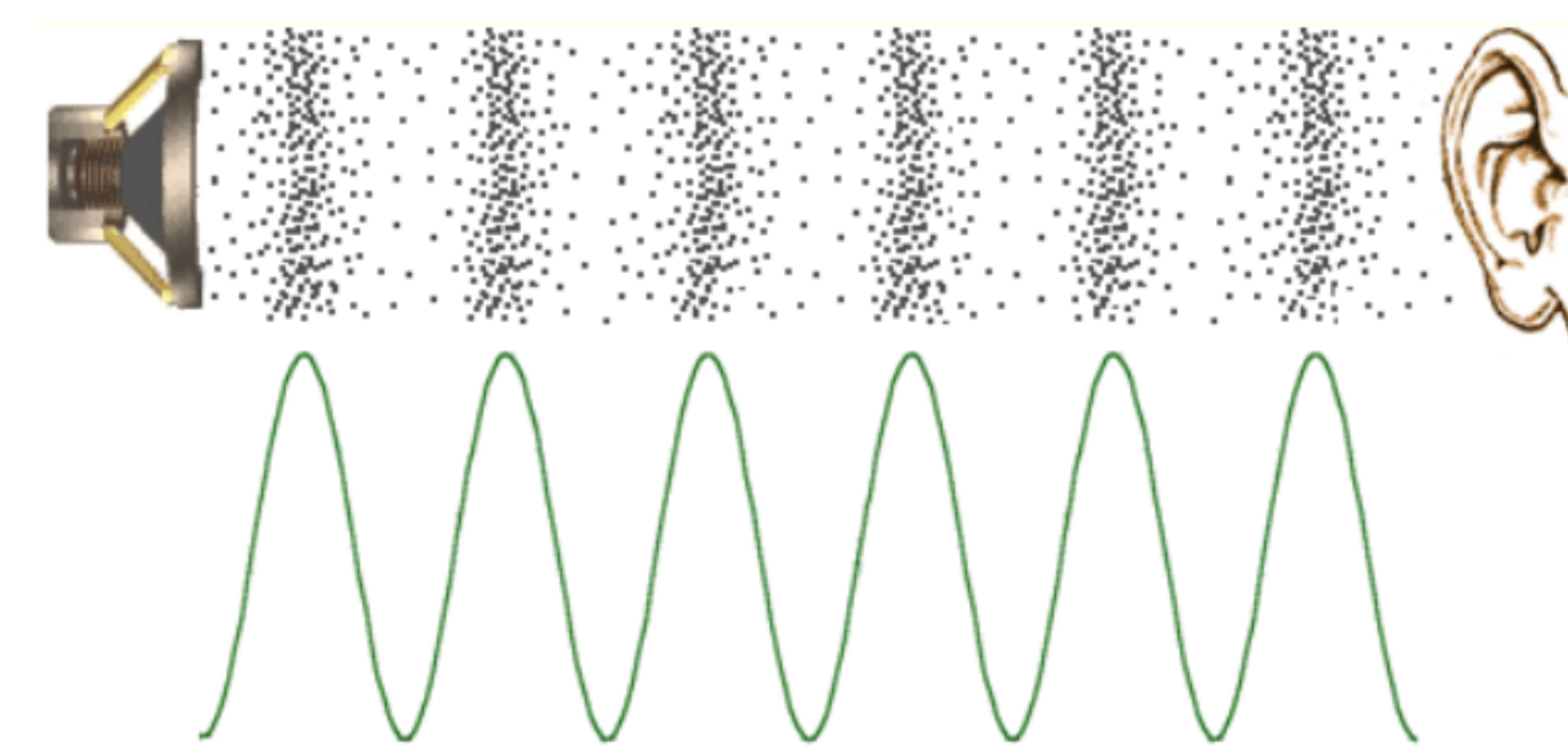


Figure 2. Sound Wave (2)

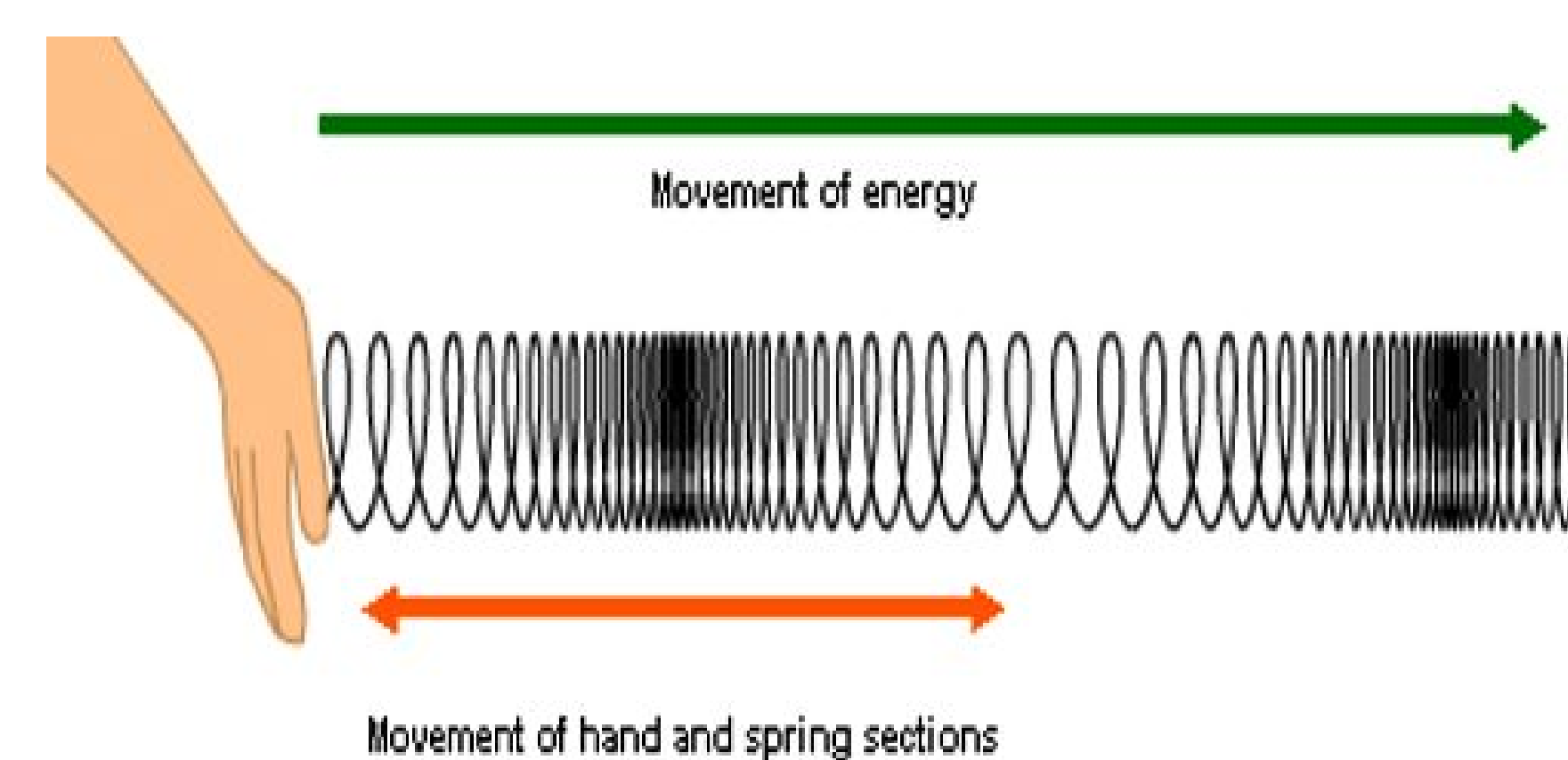


Figure 3. Slinky experiment (3)

What is an Echo?

An echo happens when multiple sound waves reflect, or bounce, from objects around you as seen in figure 4. An echo will have multiple sound waves arrive at the outside ear at different times, which is why we hear similar sounds over and over again.

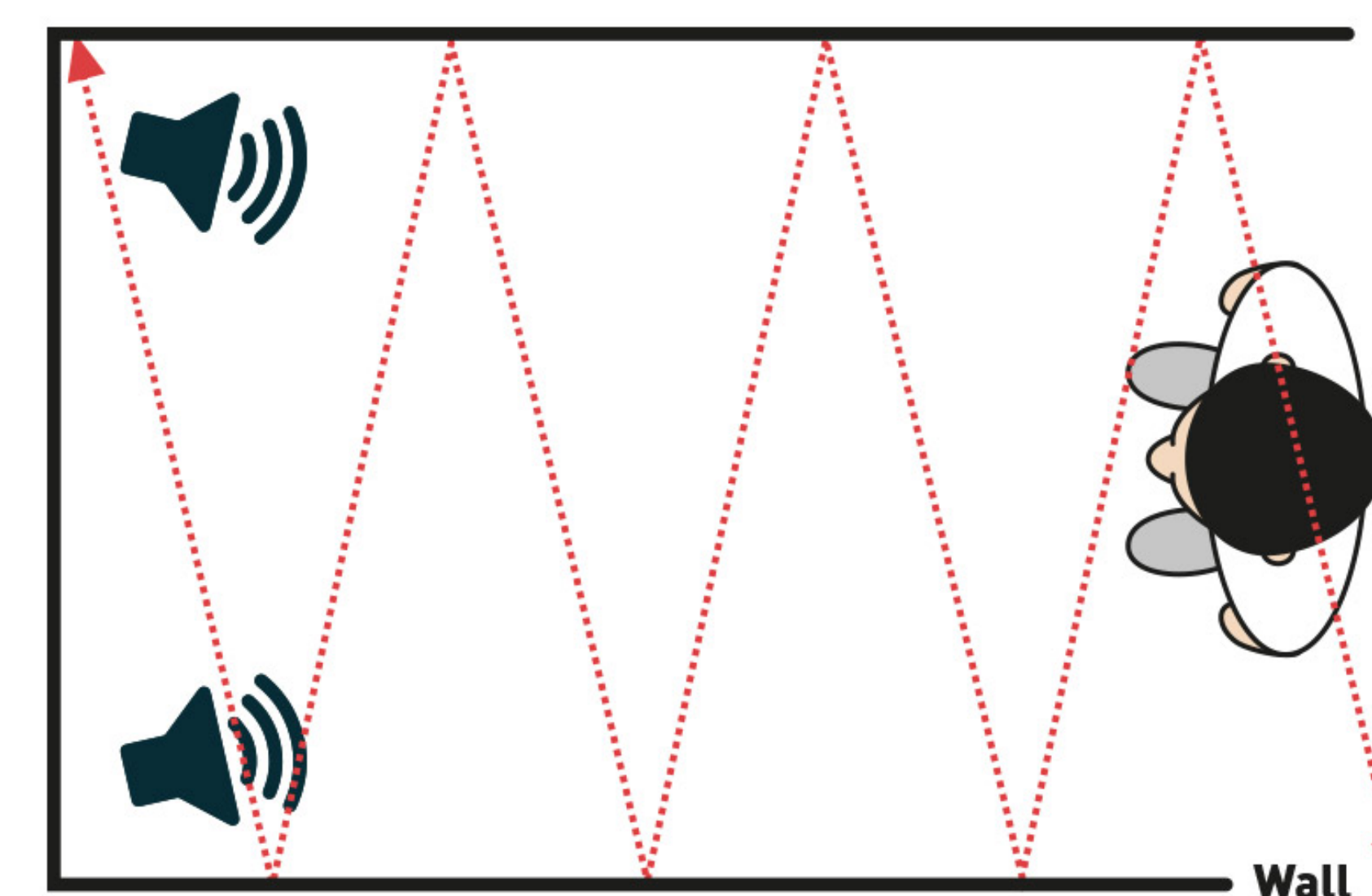


Figure 4. Reflection of sound waves creating an echo (4)

Reflection and Refraction

Sound waves can be both reflected and refracted. Refraction involves the change of direction of sound waves as they travel from one space to another with different properties, like air and water.

Longitudinal and Transverse Waves

The two main types of waves are longitudinal and transverse waves. Longitudinal waves travel from side to side, like sound waves, and transverse waves travel up and down, like ocean waves or ripples of water in a pond.

References

- [1] Transverse vs. Longitudinal Wave: <http://astronomy.swin.edu.au/smaddiso/astro/SiS/NPS/sound1.html>
- [2] How Do We Hear? <https://www.nidcd.nih.gov/health/how-do-we-hear#:~:text=Sound%20waves%20enter%20the%20outer,bones%20in%20the%20middle%20ear.>
- [3] Slinky Experiment: <https://www.qsstudy.com/physics/experiment-demonstration-longitudinal-wave>
- [4] Flutter Echo: <https://www.gbfoamdirect.co.uk/foam-cut-to-size/acoustic-foam-sound-proofing/flutter-echo-diagram/>
- [5] Reflection, Refraction, Defraction: [https://www.sonic-shield.com/behavior-of-sound-waves#:~:text=Diffraction%20of%20Sound%20Waves,a%20barrier%20in%20their%20path.text=The%20amount%20of%20diffraction%20\(the,and%20decreases%20with%20decreasing%20wavelength.](https://www.sonic-shield.com/behavior-of-sound-waves#:~:text=Diffraction%20of%20Sound%20Waves,a%20barrier%20in%20their%20path.text=The%20amount%20of%20diffraction%20(the,and%20decreases%20with%20decreasing%20wavelength.)