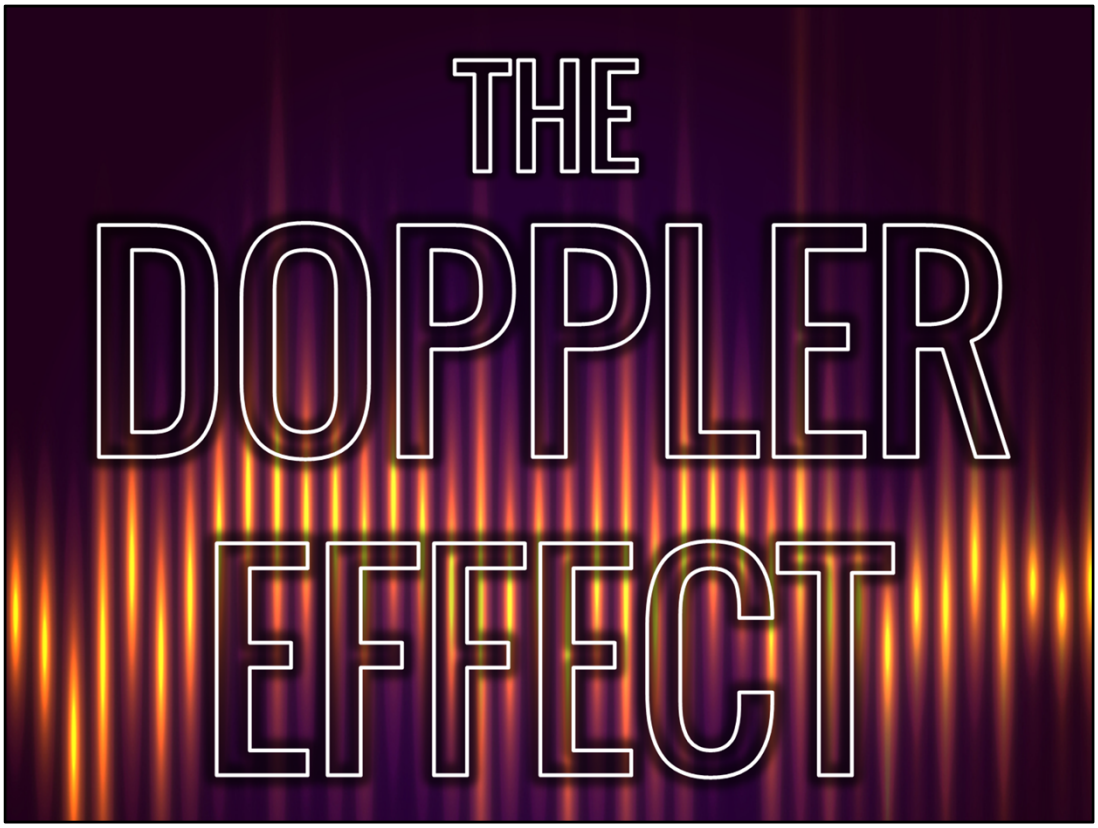
Module 3: Astronomy – The Universe

Topic 4 Content: The Doppler Effect Presentation Notes



The Doppler Effect

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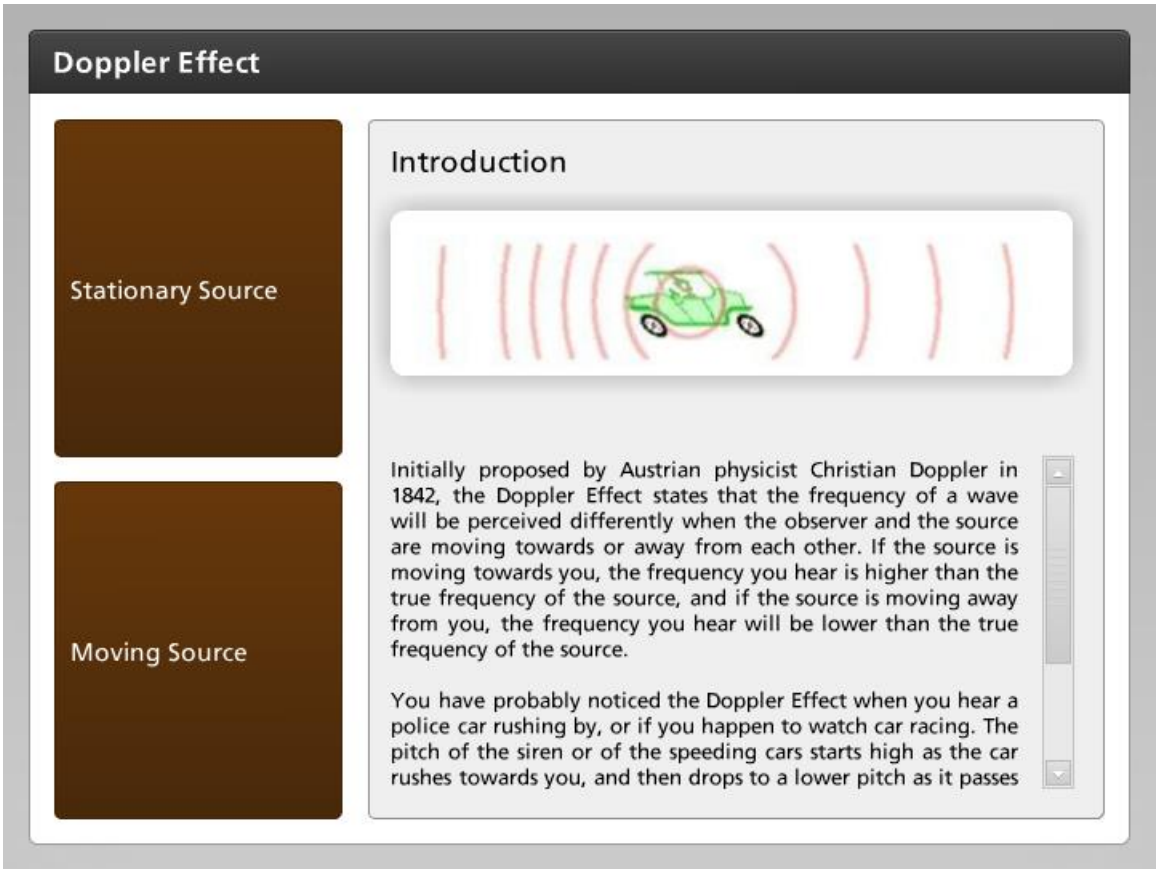
Introduction

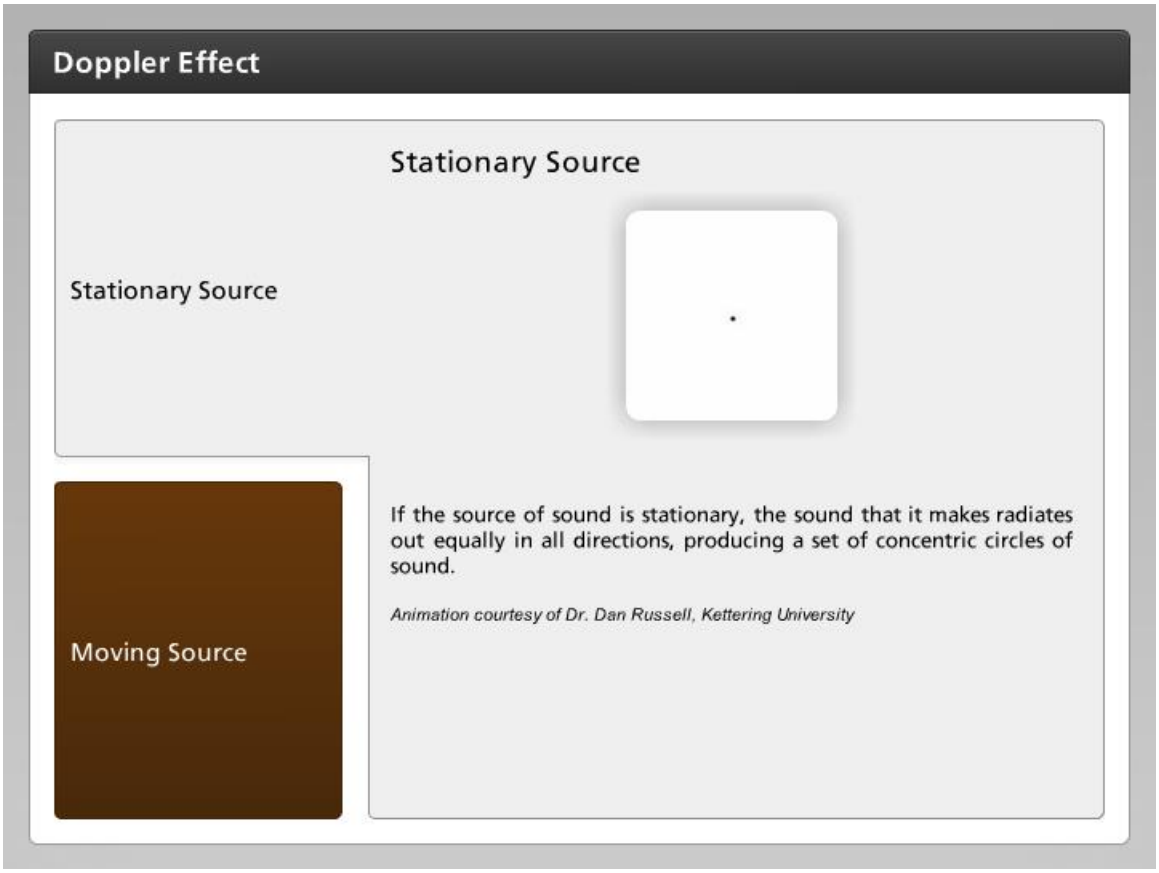


Initially proposed by Austrian physicist Christian Doppler in 1842, the Doppler Effect states that the frequency of a wave will be perceived differently when the observer and the source are moving towards or away from each other. If the source is moving towards you, the frequency you hear is higher than the true frequency of the source, and if the source is moving away from you, the frequency you hear will be lower than the true frequency of the source.

You have probably noticed the Doppler Effect when you hear a police car rushing by, or if you happen to watch car racing. The pitch of the siren or of the speeding cars starts high as the car rushes towards you, and then drops to a lower pitch as it passes and zooms away from you.

Click on the tabs to learn more about the Doppler Effect in relation to stationary and moving sources of sound.

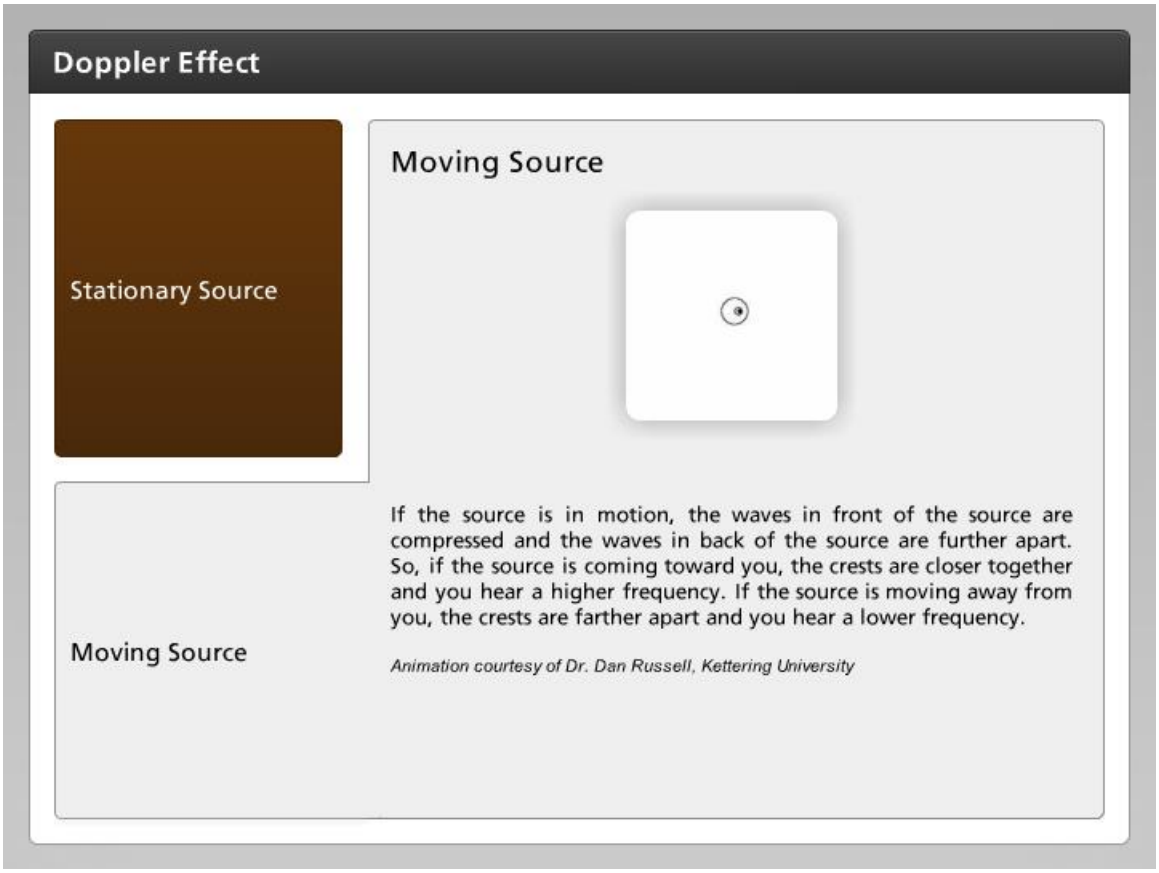
Stationary Source



If the source of sound is stationary, the sound that it makes radiates out equally in all directions, producing a set of concentric circles of sound.

Animation courtesy of Dr. Dan Russell, Kettering University

Moving Source



If the source is in motion, the waves in front of the source are compressed and the waves in back of the source are further apart. So, if the source is coming toward you, the crests are closer together and you hear a higher frequency. If the source is moving away from you, the crests are farther apart and you hear a lower frequency.

Animation courtesy of Dr. Dan Russell, Kettering University

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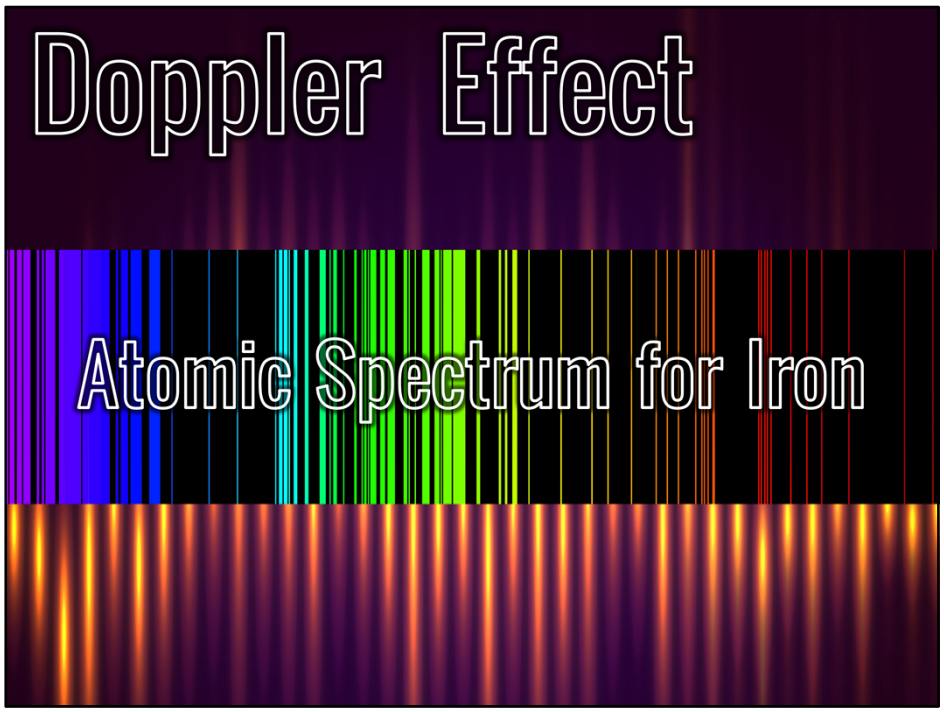
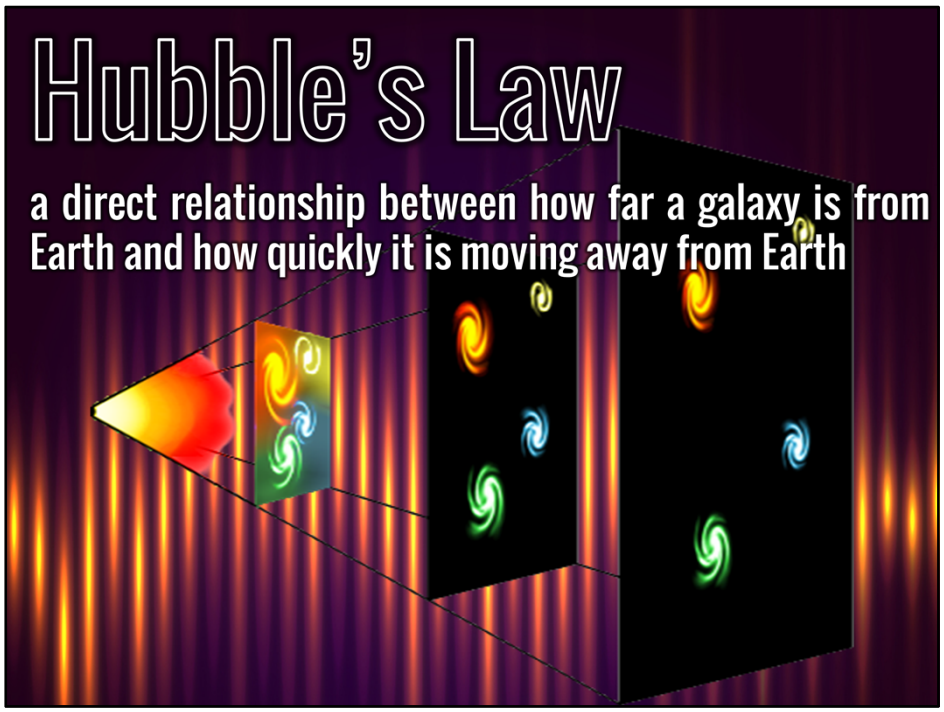


One of the wave phenomena for sound is the Doppler Effect. If light is a wave, then it too should experience a similar phenomenon.

Remember that each element has a distinct atomic spectrum due to its specific electron energy levels.


Redshift/Blueshift


Hubble's Law
a direct relationship between how far a galaxy is from Earth and how quickly it is moving away from Earth