

EXPLORING REDSHIFT (AND THE UNIVERSE!)

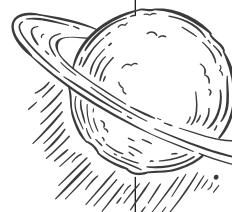
Find out about the phenomenon of redshift below, then answer the questions.

How can an ice cream truck help us understand the universe?

Imagine an ice cream truck playing a cheerful tune. When the truck is parked, the tune you hear is the same as the tune coming from the truck's speakers—the **wavelength** of the sound doesn't change as it travels. However, when the truck is approaching you, you will notice that the **pitches** that you hear become higher and higher. The same number of sound waves leaves the ice cream truck, but because the truck is moving, the waves become closer together. Consequently, the **frequency** of the sound waves increases, so you hear a higher pitch. The opposite is true as the truck drives away—the wavelength decreases and the frequency decreases, so you hear the pitch become lower and lower.



This phenomenon, known as the **Doppler effect**, is also observed in light waves. As an object moves away from you, the light waves it emits are stretched farther apart, and the wavelength increases. On the **spectrum** of visible light, red has the longest wavelength, and blue and violet have shorter wavelengths. Therefore, as the object moves farther away, its light appears to shift to the red end of the spectrum. While the object itself emits the same light as always, **redshift** occurs by the time that light reaches you. (You would not be able to observe redshift with your eyes alone; instead, you would need to use scientific tools to separate the light into its component wavelengths.)



Redshift is a particularly important concept in understanding the universe. In 1929, astronomer **Edwin Hubble** used his observations of redshift from faraway galaxies to determine that galaxies were moving away from each other—and the farther away they were, the faster they were moving away. This discovery provides evidence to support the **Big Bang** theory.



Today, scientists continue to investigate the redshifted light from distant galaxies to better understand the origins of the universe. Light from so long ago, that is so far away, has redshifted out of the visible light spectrum and into the **infrared spectrum**, invisible to the human eye. That's why powerful telescopes like NASA's Webb Space Telescope are built to detect infrared light, to better study how the first galaxies formed.

Think It Through



Answer the following questions on a separate sheet.

- Based on what you've learned about redshift, predict what blueshift is. What situations would cause blueshift?
- Draw a diagram to demonstrate the concept of redshift in space observation.

Learn more or check your work with diagrams of redshift at: go.nasa.gov/2PDPVN9.