

Redshift

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This article is about the physical phenomenon. For the photochemical usage, see bathochromic shift. For other uses of the phrase "red shift" or "redshift", see red shift. In physics and astronomy, redshift occurs when the visible light from an object is shifted towards the red end of the spectrum. More generally, redshift is defined as an increase in the wavelength of electromagnetic radiation received by a detector compared with the wavelength emitted by the source. This increase in wavelength corresponds to a decrease in the frequency of the electromagnetic radiation. Conversely, a decrease in wavelength is called blueshift.

Any increase in wavelength is called "redshift" even if it occurs in electromagnetic radiation of non-optical wavelengths, such as gamma rays, x-rays and ultraviolet. This nomenclature might be confusing since, at wavelengths longer than red (e.g. infrared, microwaves, and radio waves), redshifts shift the radiation away from the red wavelengths.

A redshift can occur when a light source moves away from an observer, corresponding to the Doppler shift that changes the frequency of sound waves. Although observing such redshifts has several terrestrial applications (e.g. Doppler radar and radar guns),[1] spectroscopic astrophysics uses Doppler redshifts to determine the movement of distant astronomical objects.[2] This phenomenon was first predicted and observed in the 19th century as scientists began to consider the dynamical implications of the wave-nature of light.

Another redshift mechanism is the expansion of the universe which explains the famous observation that the spectral redshifts of distant galaxies, quasars, and intergalactic gas clouds increase in proportion to their distance from the observer. This mechanism is a key feature of the Big Bang model of physical cosmology.[3]

Yet a third type of redshift, the gravitational redshift (also known as the Einstein effect), is a result of the time dilation that occurs near massive objects, according to general relativity.[4]