Understanding Redshift through Physics and simulations

Bristi Mukherjee

Department of Physics, KNU

Redshift, which opens up a window into the expanding Universe, is one of the most fundamental tools that helps us to understand how far away a galaxy/a cosmic body is present, relative to Earth. This phenomenon occurs when the wavelength of light from a cosmic body (source) is stretched, shifting to the red end of the spectrum. Red has the longest wavelength, around 620-750 nm. We observe the Doppler effect in Redshift as well. We have the knowledge of wavelengths of emission/absorption lines of elements. After taking light from a distant source (star/galaxy) and pass it through a spectrograph to get its absorption/emission lines, we compare the previous two observations, in order to conclude whether we're observing redshift (lines shifting towards longer wavelengths) or blueshift (lines shifting towards shorter wavelengths). Redshift also gives evidence on the expansion of the universe. Measuring such shifts across the distant galaxies led Edwin Hubble to discover the expansion of the universe. The Redshift is not due to the motion of the cosmic bodies through space but rather the stretching of space itself, which further provides evidence of the Big Bang. Einstein's theory of general relativity also talks about, where light climbing out of a strong gravitational field loses energy and shifts to longer wavelengths. In this presentation, I will explore the physics underlying the redshift, demonstrate simple simulations and how this concept helps us understand our universe better.