Cosmological red shift

AYLA Is it me? Or is the school getting further away?

ADA Searching answer... yes it is.

AYLA It is? I was just joking.

ADA The entire Universe is expanding. Scientists know this because the frequency and wavelength of a wave changes when the source of the wave moves.

You can notice this whenever you hear an ambulance siren go past you.

As sound waves go from the ambulance towards you, you hear the siren. However, because the source of the sound is getting closer, the sound wave between you and the ambulance gets compressed. This makes the frequency higher and the wavelength shorter, making the pitch of the sound higher too.

But as the ambulance drives away from you, the sound waves stretch, lowering the frequency and increasing the wavelength, which lowers the pitch. This is called the Doppler effect.

Light waves are exactly the same. The movement of a light wave source causes the frequency and wavelength of a light wave to change too. Except, whilst you can notice the change of frequency in a sound wave by hearing it, you notice the change of frequency and wavelength in a light wave by seeing it instead.

As different frequencies have a different pitch, each frequency of a light wave has a different place on the electromagnetic spectrum. On one end of the visible part of the spectrum is the colour red, which indicates a low frequency and long wavelength, and on the other end of the visible spectrum is the colour blue, which indicates a high frequency and short wavelength.

As the source of the light moves away, like that sound wave from the ambulance, the light wave stretches, causing a lower frequency and a longer wavelength. This causes the source of the light to appear red. This is called a red shift.

In 1929, when astronomer Edwin Hubble analysed the stars in the Universe, he noticed that they all had a reddish colour to them - the cosmological red shift. This suggests that the stars must be moving away from the viewer. And because the stars were moving away, it must therefore mean that earlier in time, they were once closer. If you keep rewinding time, everything in the Universe must have at one time been all in one location, and then proceeded to expand out. Therefore, cosmological red shift supports the idea of a Big Bang. This expansion of the Universe is still happening to this day!

AYLA That's amazing Ada, I never knew that about…

Ada, what day is it?

ADA Saturday.