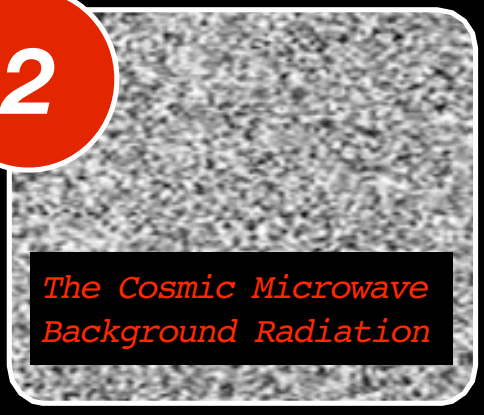
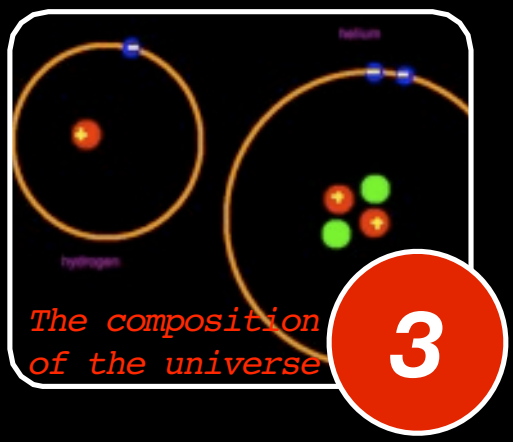
EVIDENCE FOR THE BIG BANG

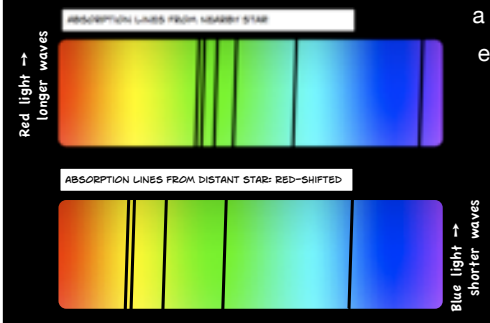




Visit the online Big Bang Time Machine at
http://resources.schoolscience.co.uk/PPARC/bang/bang.htm

1 When we look at all the colours of light coming from stars like the sun, we notice that some colours are missing, and in their place are dark "absorption lines." These colours are missing because atoms in the star are absorbing these colours. Atoms of different elements absorb different colours (or wavelengths of light), so we can tell which elements are present in a star from the position of the lines. They look a bit like a bar code.

However, when we look at these "bar codes" of distant galaxies, we see the same pattern of lines, but shifted towards the red end of the spectrum. This is an example of the Doppler shift (the same effect that causes ambulance sirens to change pitch as they pass).



This can be modeled by drawing a wave on a long, thick elastic band or length of latex and asking one student to represent an observer on Earth (holding one end of the band) and another to represent a distant galaxy. As they move apart (to demonstrate the expansion of space), students can see that the waves get longer, i.e. are red shifted. Students can then identify the limitations of the model.

2 The cosmic microwave background radiation was discovered when two scientists (Penzias and Wilson) were trying to get rid of interference to satellite broadcasts. They detected microwaves from all areas of the sky, with a temperature of 2.7K (we can see this interference as the snow pattern on untuned televisions). This discovery supported the theory of the Big Bang, which could account for these microwaves as energy left over from the Big Bang.

3 A third piece of evidence to support the Big Bang theory is the composition of the universe. The Big Bang theory predicts that in the first few minutes of the universe, only the lightest elements, hydrogen and helium, were formed. This is consistent with what we observe today: the universe is mainly hydrogen (about 73%) and helium (25%), with heavier elements created in stars and in supernova explosions since the Big Bang.

However, a mystery remains. Between 90 - 99% of the universe is unknown but scientists are currently looking for this "dark matter" and "dark energy".