

## **WEEK 1: P10/M7: Evidence to support the Big Bang.**

**TASK:** To achieve P10/M7 you need to write or type what evidence scientists have to support the Big Bang and then comment how each piece of evidence supports the Big Bang.

Use this information to help.

[http://www.bbc.co.uk/schools/gcsebitesize/science/aqa\\_pre\\_2011/radiation/originsrev2.shtml](http://www.bbc.co.uk/schools/gcsebitesize/science/aqa_pre_2011/radiation/originsrev2.shtml)

<http://www.bbc.co.uk/schools/gcsebitesize/science/aqa/origins/redshiftrev4.shtml>

<http://www.space.com/20330-cosmic-microwave-background-explained-infographic.html>

There are **two** key pieces of evidence for **Big Bang** theory.

These are **red shift** and the **Cosmic Microwave Background Radiation (CMBR)**

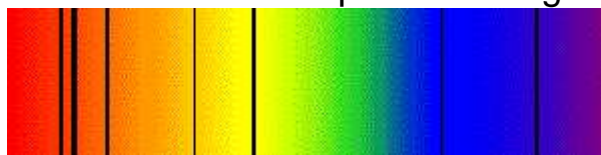
### **1) Red shift (P10)**

Red shift happens when objects that emit light move away from or towards an observer. When objects move away from an observer their wavelength is stretched which causes them to appear red when looked at through the Hubble telescope.

This shift in wavelength is called 'red shift' and can be seen when looking at distant stars and galaxies through the Hubble telescope which shows that they are moving away from us and so the Universe is still expanding.

How does Red shift happen?

- In space light travels as waves.
- Light is made up of a spectrum of colours which absorbs helium from the sun and other stars to produce an absorption spectrum which shows all the colours in the spectrum of light and a pattern of black lines.



**Absorption Spectrum of the sun**

- When a star is moving away from Earth, their wavelength is stretched causing the black bands to shift towards the red end of the spectrum and it appears red when looking through the Hubble telescope.



**Absorption Spectrum of a distant star**

## **HOW DOES THIS SUPPORT THE BIG BANG theory?**

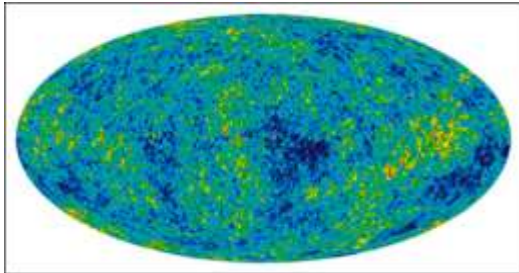
**(M7)** Red Shift shows that distant galaxies are moving away from us and it supports that the Universe is still changing by expanding. The further the galaxy is away then the bigger the red shift is, showing that distant galaxies are moving away faster.

The Big Bang Theory suggests that everything started from a single point and after the initial explosion (The Big Bang), expansion happened as the Universe was formed. This expansion still continues to today and Red shift supports this theory by showing that distant galaxies are red shifted and therefore the Universe is expanding. It supports the Big Bang as expansion had to happen from a single point and galaxies further away from that point are Red Shifted to a greater amount.

## **2. Cosmic Microwave Background Radiation (CMBR) (P10)**

- Scientists discovered that there are microwaves (which are a form of radiation in the Electromagnetic Spectrum) coming from every direction in space called Cosmic Microwave Background Radiation, or CMBR for short.
- Two astronomers; Arno Penzias and Robert Wilson accidentally discovered CMBR in 1964.
- CMBR comes from radiation created at the beginning of the universe and it has been travelling through space ever since.

- A NASA satellite called COBE (Cosmic Background Explorer) has mapped the background microwave radiation of the Universe as we see it today.



### **HOW DOES THIS SUPPORT THE BIG BANG THEORY? (M7)**

Big Bang theorists are still working on the full interpretation and understanding of this evidence from the COBE satellite but the Big Bang theory says that CMBR is the energy created and released at the beginning of the Universe, just after the Big Bang. This is the energy that can still be detected today and the only theory that can explain the presence of the CMBR.

The Big Bang theory states that expansion happened from one single point and CMBR supports this theory because the CMBR is relatively uniformly spread out across the Universe showing that expansion has happened and is still happening.

### **Table summarising the evidence that the Universe is changing by expanding and how that supports the Big Bang theory for the formation of the Universe.**

<b>Evidence (P10)</b>	<b>Interpretation (M7)</b>
The light from other galaxies is red-shifted.	The other galaxies are moving away from us.
The further away the galaxy, the more its light is red-shifted.	The most likely explanation is that the whole universe is expanding. This supports the theory that the start of the universe could have been from a single explosion.
Cosmic Microwave Background	The relatively uniform background radiation is the remains of energy created just after the Big Bang.

