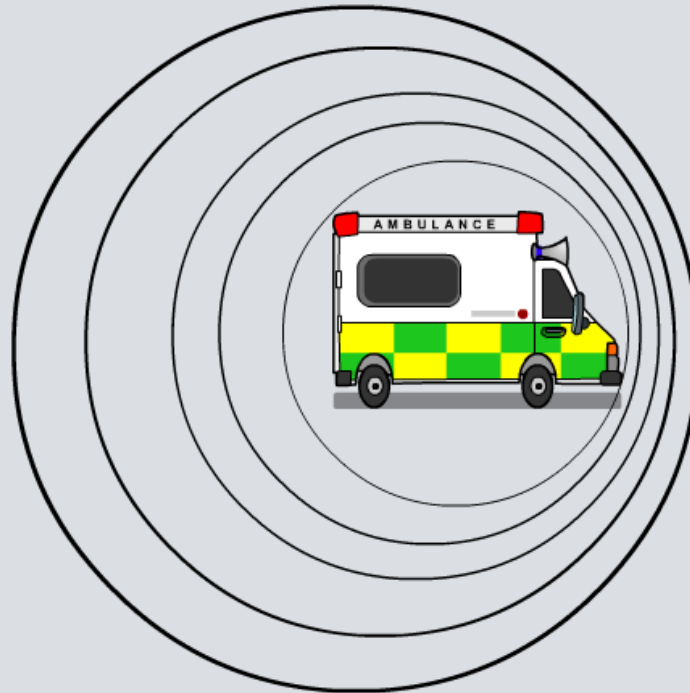


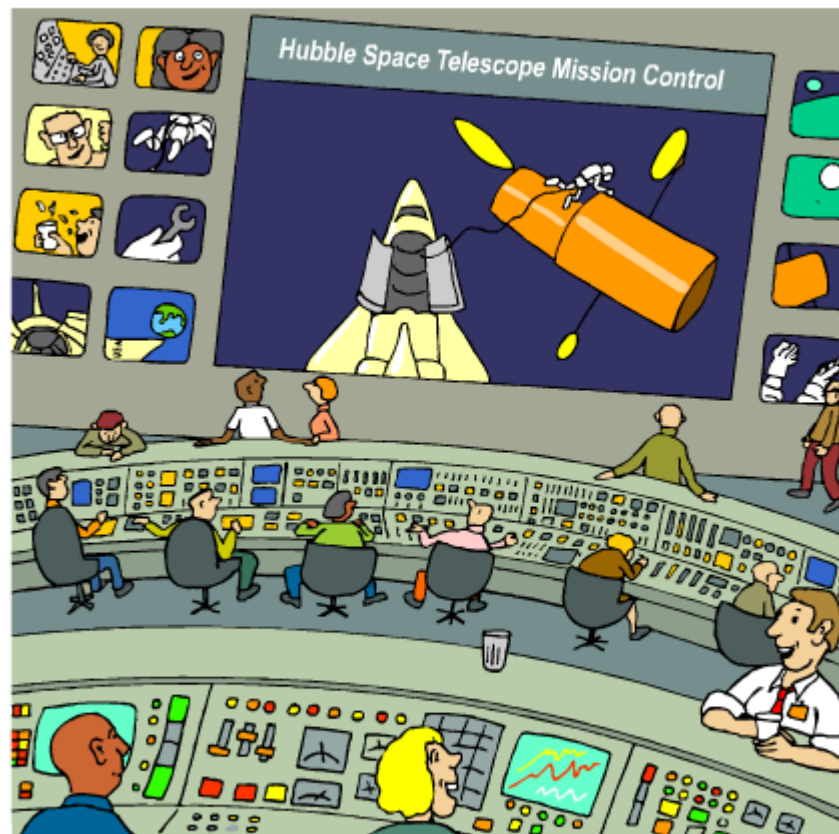
## Doppler Effect



## Edwin Hubble and the expanding Universe

Before the work of Edwin Hubble, people believed that the Universe was much smaller and a lot more stable than they do today.

Click "**start**" to find out more about the incredible life of Edwin Hubble and how he was responsible for 'expanding' the Universe.



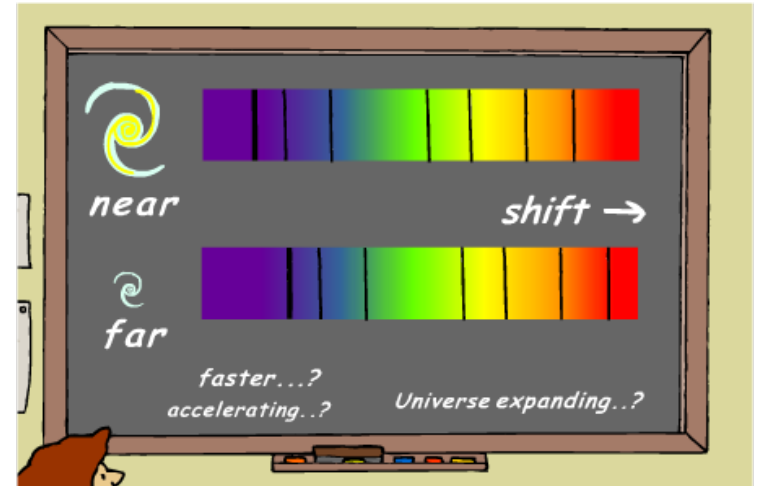
start



# What is red shift?

Scientists examining the light emitted by stars observe dark lines in the spectrum.

These dark lines are caused by different elements, such as helium, in the stars being studied.



Edwin Hubble observed that the pattern of dark lines in light from distant galaxies is shifted towards the **red end** of the spectrum.

This red shift suggests that distant galaxies are moving away from Earth and supports the idea of an expanding Universe.

Red shift occurs because of the Doppler effect, which can be observed in sound waves and electromagnetic waves.

# What is the Doppler effect?



## What is the Doppler effect?

Light from distant stars appears red shifted due to the Doppler effect.

This effect is also observed in sound waves.

Click "**start**" to find out more.



start



# How does the Doppler effect work in space?

The Doppler effect means that sound moving away from an observer appears to be lower in frequency.

The same thing happens with light from distant galaxies, which appears to be shifted towards the low frequency, red end of the spectrum.

This means the distant galaxies must be moving away from the Earth.

It has also been observed that the further away a galaxy is, the greater the amount of red shift.

This means that very distant galaxies must be moving faster than closer ones – this is evidence for the Big Bang theory.





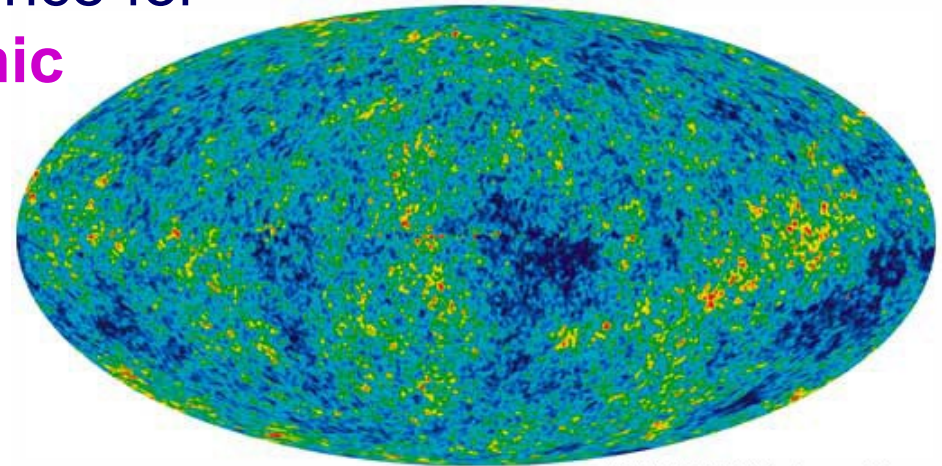
# What is the Big Bang theory?

The observation of red shift is a key piece of evidence for the **Big Bang theory** about the origin of the Universe.

This states that the Universe “began” with a colossal explosion 13,700 million years ago and has been expanding ever since.

The other key piece of evidence for the Big Bang theory is **cosmic microwave background radiation** (CMB).

CMB is radiation remaining from the Big Bang explosion and fills the whole of the Universe.



NASA/WMAP Science Team

This radiation has cooled as the Universe has expanded and is now slightly less than 3 degrees above absolute zero.

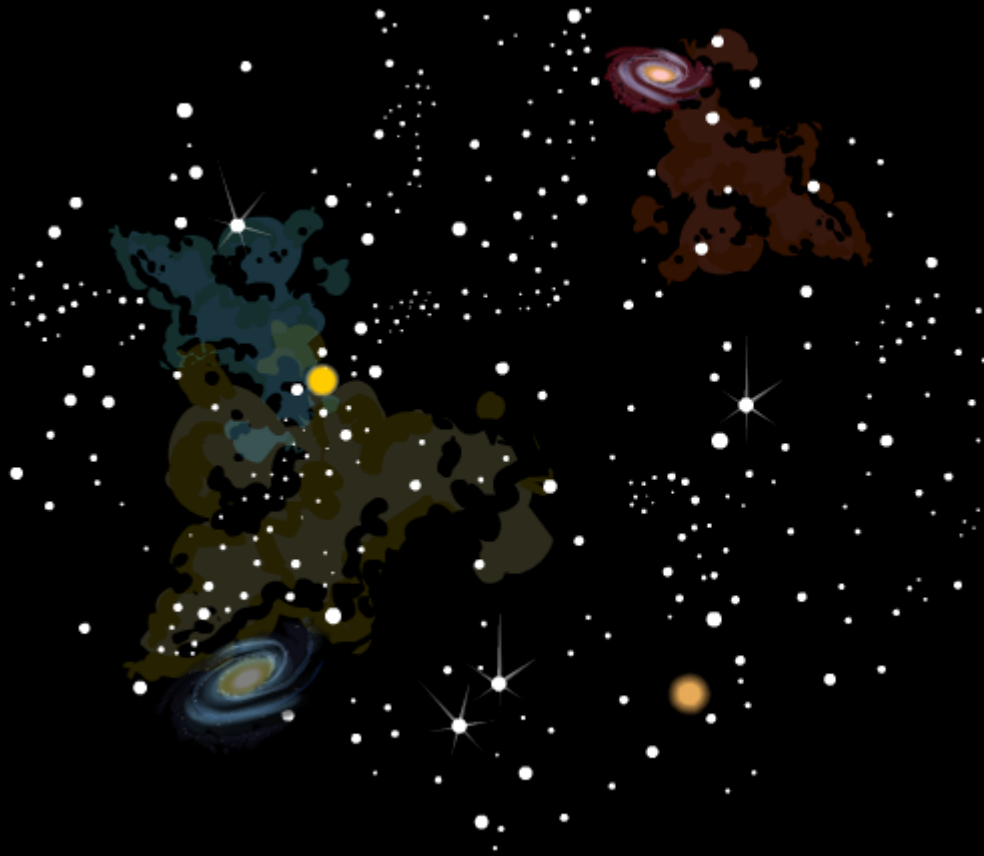


Our knowledge and understanding of the Universe have increased significantly over the past few decades.

There are various theories about the beginning and the end of the Universe.

Click "**start**" to find out more.

## The Universe



start

