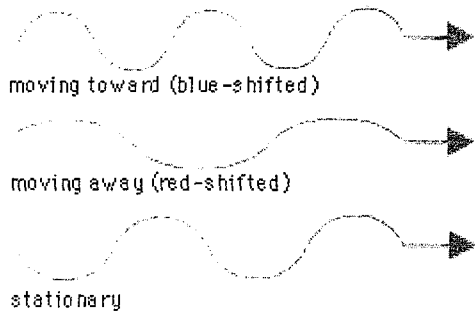


How was the Universe created?

When was the Big Bang?

What is the evidence for the Big Bang?

What is the Doppler effect?



How did Hubble come up with the Expanding Universe Theory

Laboratory spectrum
Lines at rest wavelengths.

Object 1
Lines redshifted: Object is moving away from us.

Object 2
Greater redshift: Object is moving away faster than Object 1.

Object 3
Lines blueshifted: Object is moving toward us.

Object 4
Greater blueshift: Object is moving toward us faster than Object 3.

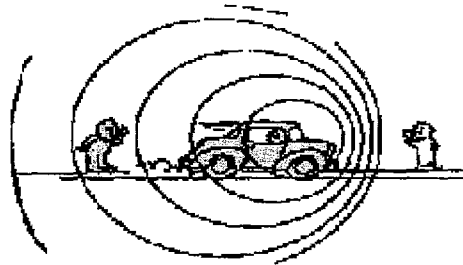
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Science has generally accepted the Big Bang Theory

Approximately 14 billion years ago

1. Doppler Red Shift of distant galaxies
2. Cosmic Background Radiation. (left over radiation from the explosion)

An apparent change in the wavelength of energy waves due to motion.



If the source of energy is moving away from you, the waves appear to be spread out. A longer than expected wavelength is noticed. The reverse is true if the energy is moving toward you.

Hubble looked at the spectrum bands of distant galaxies. The spectral bands showed a red shift.



How is the Universe organized?

Universe → Clusters of galaxies →
Galaxies → Clusters of stars → Stars (and
Solar Systems) → Planets → Moons

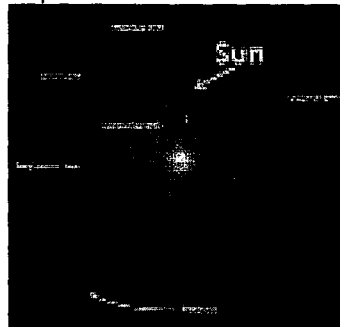
What is our stellar address?

Milky Way Galaxy
A spiral galaxy

Profile (side) view



Top view



You live approximately 1/2 way down one arm of
the galaxy

How are stars classified?

Our sun is an "average" star.

It has an average temperature (~5000°C)

It has an average color (yellow)

And, it is of an average size, so it has an average
luminosity (brightness).

Our Sun is part of the Main Sequence Stars.

What does it mean to be on the main sequence?

The star is in a state of dynamic equilibrium.

The nuclear fusion reactions outward force is balanced
by the stars gravitational force inward.

Outward force = Inward force (Dynamic Equilibrium)

What is the sun's nuclear fusion reaction?

Hydrogen atoms are fused together to create helium
This reaction releases a great deal of energy.

What type of energy does the sun emit?

All types, but mostly visible light.

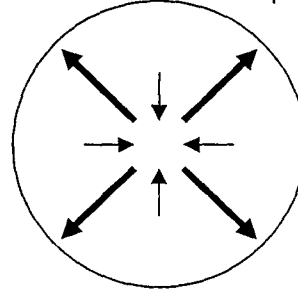
What will happen to the sun when it runs out of H?

The state of dynamic equilibrium will no longer be
maintained. The Sun will start to fuse Helium atoms
into Lithium atoms, then Li into Be, Be → B, B → C and
down the line of the periodic table of elements.

Smaller atoms are fused together to create larger
atoms in stars. All the carbon in your body was
created billions of years ago in the nuclear furnace of
an ancient star.

What is the fate of our Sun?

Once the state of dynamic equilibrium is left. The sun will become a Red Giant. The nuclear fusion reactions outward force will be greater than the gravitation inward force and the star will expand.



Outward > Inward force; star expands

What happens after the Red Giant phase?

It will become a white dwarf.

Smaller fusion reactions will start to occur outside the star's core. These reactions will literally blow the star's outer layers away. The star will lose mass, and become smaller. The star will become less luminous. Cross over the main sequence and become a white dwarf.

What is after the White Dwarf phase?

Nothing. The Sun will burn out as a white dwarf.

If a star is massive enough, a Supernova explosion will occur after the Red Giant phase. The stellar life cycle may start all over again, or the supernova may produce a black hole.

(see handout on the life cycle of stars)

