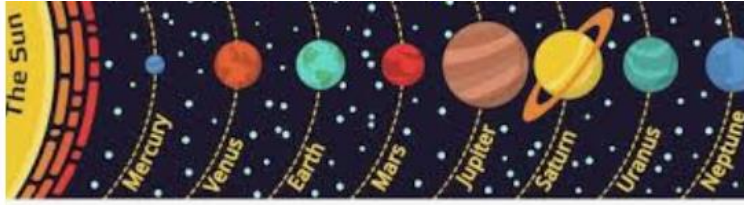


The Sun and our Solar System

Within our solar system there is one star, the Sun, plus the eight planets and the dwarf planets that orbit around the Sun. Natural satellites, the moons that orbit planets, are also part of the solar system.



The Milky way Galaxy.

Our solar system is a small part of the Milky Way galaxy, a spiral system that contains 100 billion stars. Our sun is near the end of one of the spiral arms.



Satellites

Man made satellites are used for weather and communications and are placed in orbit around the earth.

A planet is a natural satellite of a star.

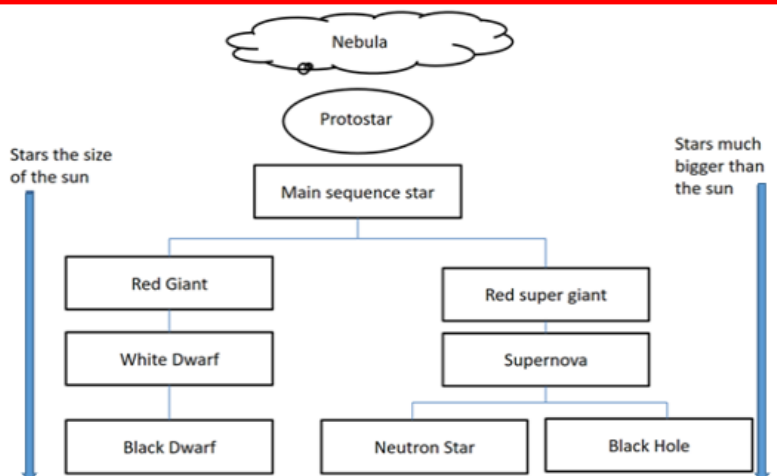
A moon is a natural satellite of a planet.

Gravitational forces keep objects in their circular orbits.

The larger the circular orbit then the slower the speed of the satellite

Eg. Mercury moves with the greatest speed and Neptune the slowest

For a stable orbit, the radius must change (increase) if the speed changes (decreases). Satellites in a higher orbit travel more slowly.



Nebula

A region of dust and gas in space.

Protostar

Dust and gas in a nebula are pulled together by gravity. This forms a protostar. No nuclear fusion reactions happen yet.

Main Sequence Star

Gravitational forces have now pulled so much dust and gas together with so much force that nuclear fusion reactions start, where Hydrogen and Hydrogen nuclei are joining together to make Helium nuclei. Heat and light are given off. This is a very stable state which could continue for several billion years. The fusion reactions lead to an equilibrium between the gravitational collapse of a star and the expansion of a star due to fusion energy.

Red Giant

Stars the same size as the sun will start to run out of hydrogen nuclei. The nuclear fusion reactions slow and helium nuclei are now fusing to form heavier elements (up to iron). The star swells, cools and becomes red in colour.

Red Super Giant

Stars bigger than our sun will also start to run out of hydrogen nuclei and form all the elements up to iron. They will then swell, cool and become in red colour and eventually collapse in a more dramatic way as a supernova

White Dwarf

Eventually the smaller nuclei in the core run out and the fusion reactions stop. It collapses in on itself causing it to heat up again. Its colour changes from red to yellow to white. It is hotter, denser and smaller in diameter than it was.

Black Dwarf

Finally a white dwarf will cool down and stop giving off any light.

Supernova

When a Red super giant collapses dramatically, its compression suddenly reverses in a supernova explosion. In this event all the elements heavier than iron are made. All the elements are spread out across space.

Neutron star

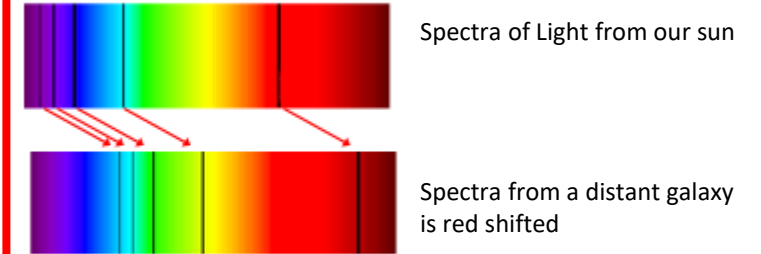
What's left of the core after a supernova explosion is compressed into an incredibly dense object made of only neutrons.

Black hole

If the star was massive enough then the collapse of its core continues and forms a black hole. Gravity is so high that not even light can escape it.

Red shift

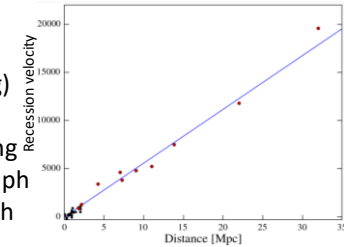
As a galaxy moves away from observers on earth, its light becomes longer in wavelength this means its light is shifted towards the longer, red waves. This can be shown in absorption spectra, where the dark lines are shifted towards the red



Red shift can only be explained if whatever you are looking at is moving away from you. If all the galaxies are moving away from each other then the universe must be expanding.

The Expanding Universe

The further the galaxies are, then the faster they are moving away (receding) and the greater the red shift. This is evidence that the universe is expanding and supports big bang theory. This graph shows recession velocity increases with distance



Big Bang Model The universe began from an initial small point, which was extremely hot and dense, 13.7 billion years ago and it has been expanding ever since. Scientists use observations such as Red Shift and CMBR to provide evidence to support this theory

CMBR Cosmic Microwave Background Radiation: this was detected and explained as the high energy gamma radiation which was emitted at the start of the universe. The universe has been expanding ever since and so has the radiation, it has been stretched into the microwave region. Scientists are able to use evidence like this and red shift to arrive at theories such as the big bang theory

Dark mass and Dark Energy There is still much that scientist can't explain about the universe and are developing new theories such as dark mass and dark energy to explain observations.