St Ninian's HS

S2 Physics

Space

Pupil Notes

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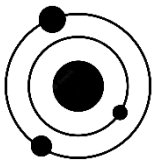

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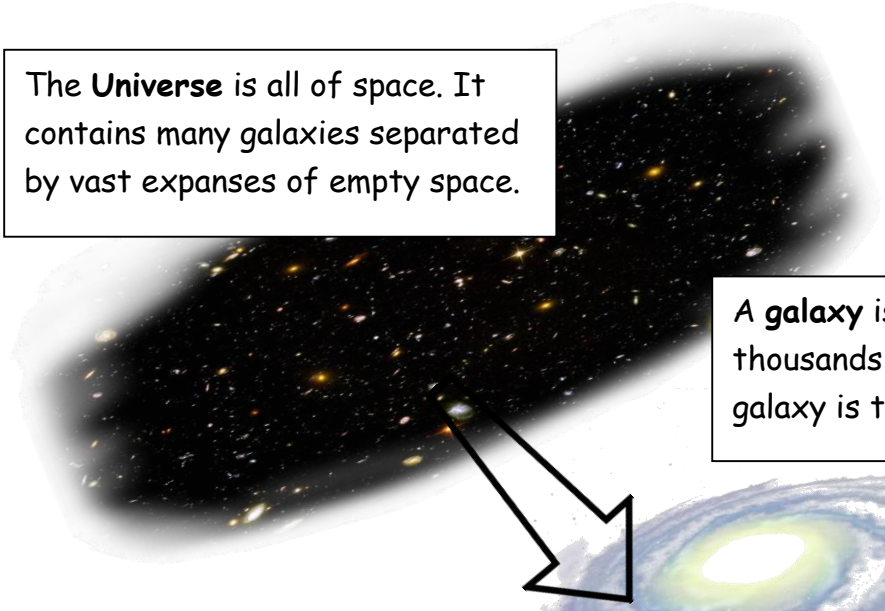
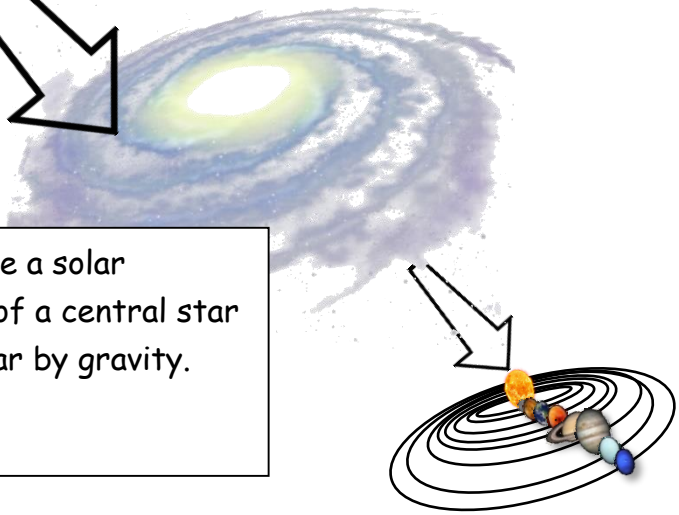
Discovery

Terminology

The **Universe** is all of space. It contains many galaxies separated by vast expanses of empty space.



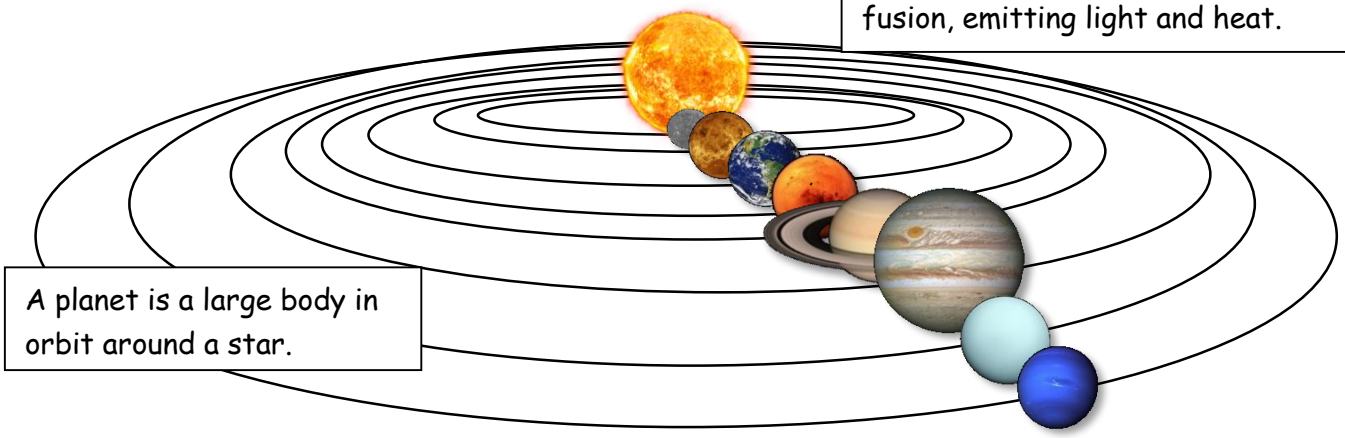
A **galaxy** is a large cluster of thousands, or millions of stars (e.g. our galaxy is the Milky Way).



The sun and many other stars have a solar system. A **solar system** consists of a central star and all the objects held to the star by gravity.

Our solar system has 8 **planets**;

The Sun is a star. A star is a large body of matter undergoing nuclear fusion, emitting light and heat.



A planet is a large body in orbit around a star.

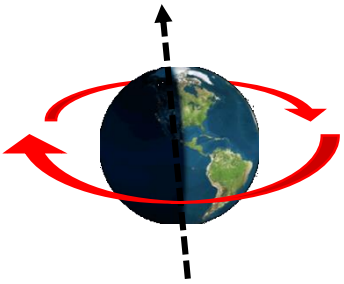
Mercury, Venus, Earth, Mars, Jupiter, Saturn, Uranus, Neptune.

Pluto was once classed as a planet, but astronomers now consider it to be a dwarf planet.

Orbits

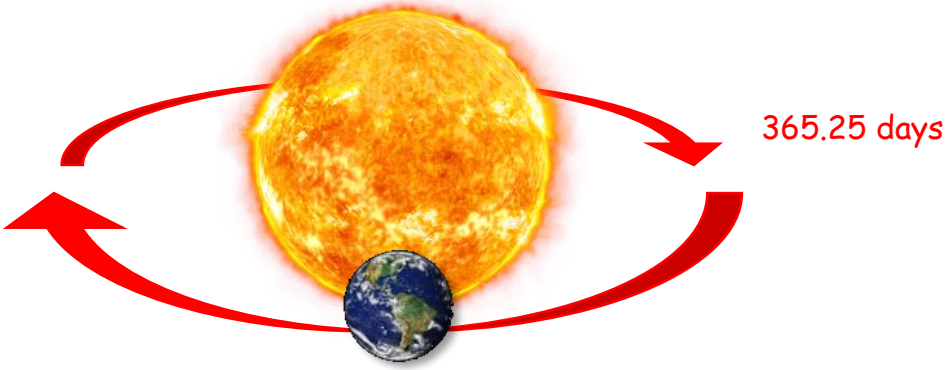
The earth rotates on its own axis.

This takes 24 hours and is known as a day.



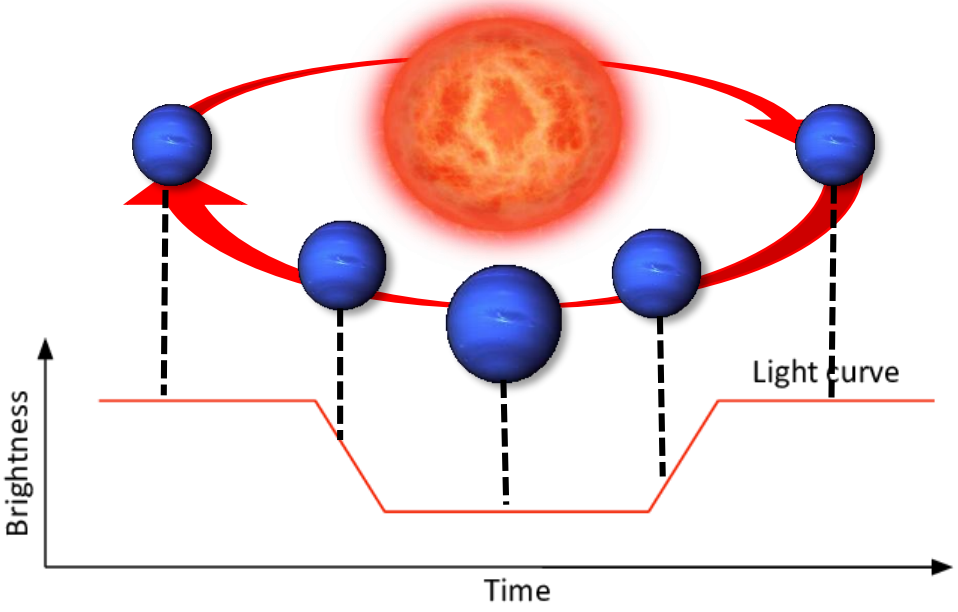
The earth **orbits** the sun.

This takes 365.25 days and is known as a year or the orbital period.



Transit Method

When a planet passes between a star and the earth, there is an observed dip in brightness.



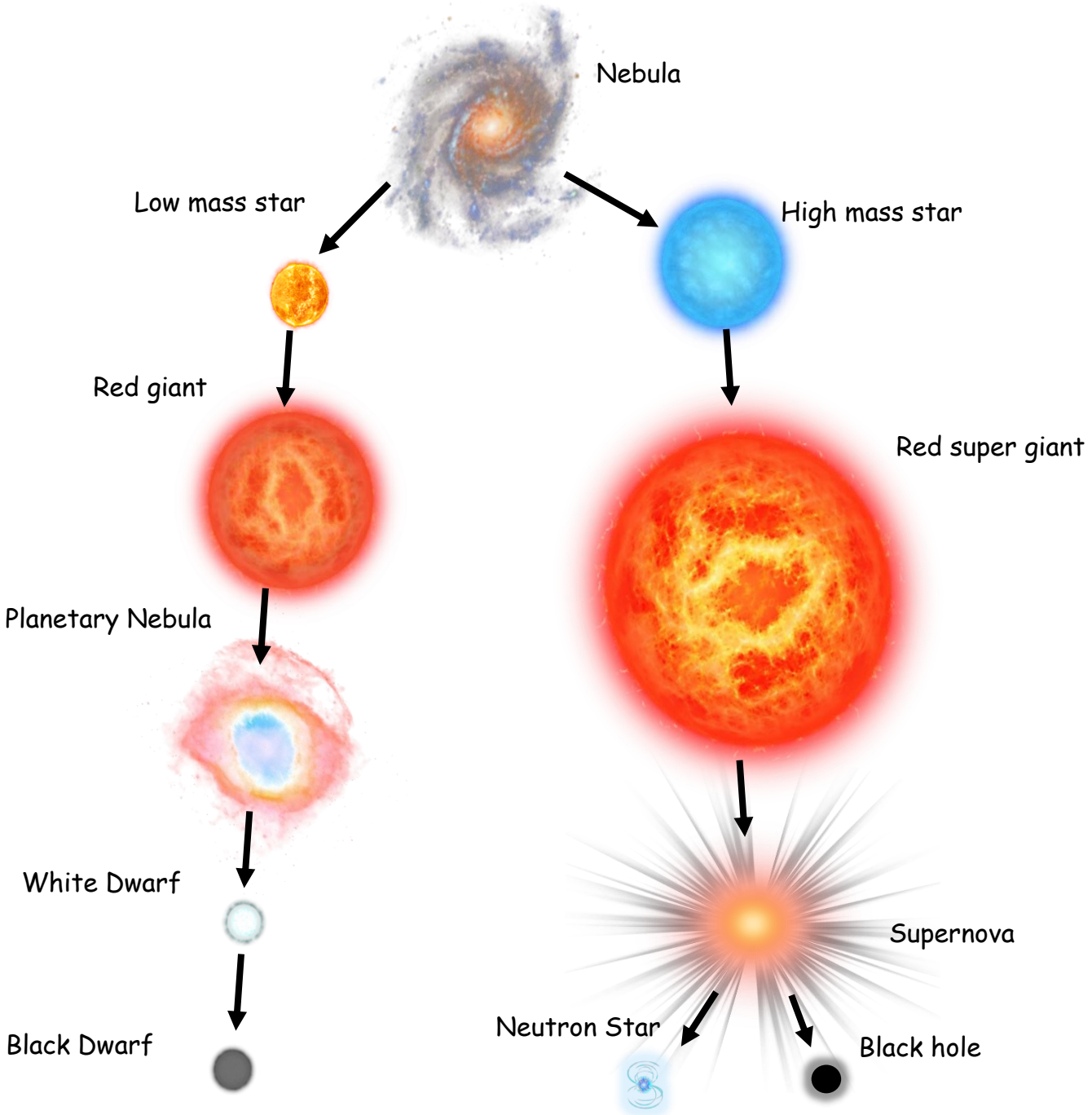
This is known as the **transit method**. Currently this is our most successful method for detecting exoplanets with over 4000 planets having been discovered this way.

Life Cycle of Stars

The exact lifetime of a star depends very much on its mass.

Very large, massive stars burn their fuel much faster than smaller stars and may only last a few hundred thousand years.

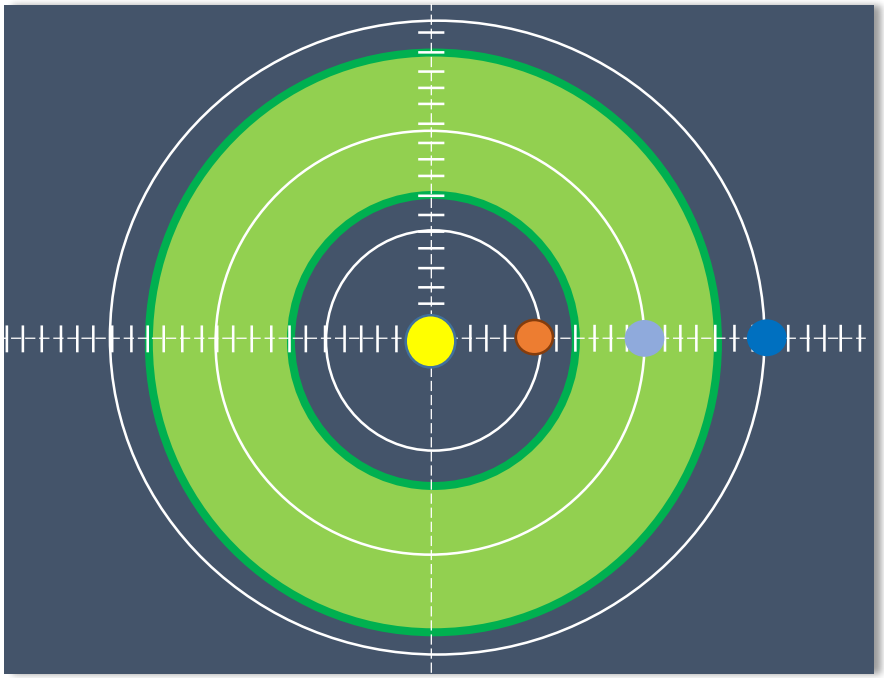
Smaller stars, however, will last for several billion years, because they burn their fuel much more slowly.



Habitable Zone

The "habitable zone" is the distance from a star at which liquid water could exist on orbiting planets' surfaces.

Habitable zones are also known as Goldilocks' zones:



If a planet is too close to its star it will be too hot to contain liquid water.

If a planet is too far away it will be too cold.

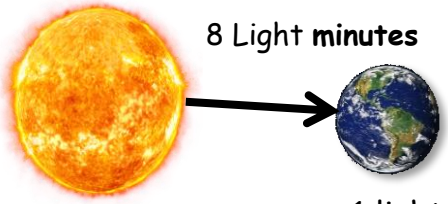
If a planet is in the "Goldilocks' Zone" it could be just right to support life.

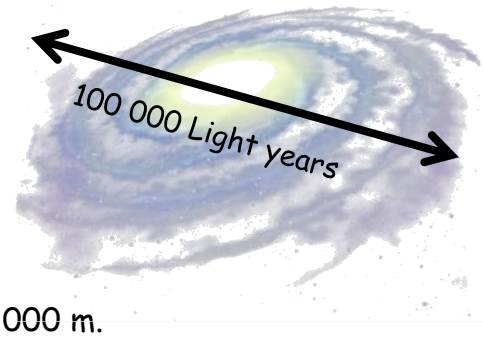
The Earth is in our Suns' Habitable Zone.

Light years

The distances involved in space are huge: the distance is so large that we measure it in light years.

A **light year** is the distance that light travels in a year.



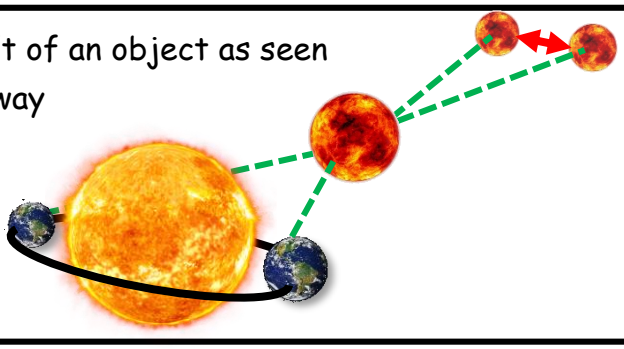


1 light year = 9 460 000 000 000 000 m.

Parallax

Scientist use trigonometry and the apparent shift of an object as seen from two different points to calculate how far away it is.

This is known as parallax.



Travel

Newton's 3rd Law

When we walk, ride a bicycle, or drive a car, we are able to start, stop, and change direction by pushing against the road this is because of Newton's 3rd Law which states that:

Every "action force" has an equal, **and opposite**, "reaction force."

For example:

Action: Foot exerts a force on the ground.

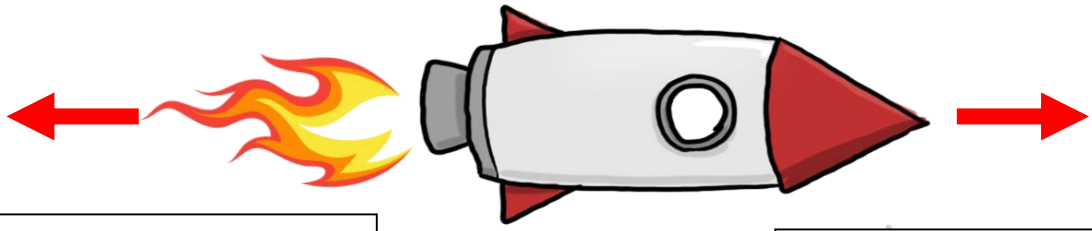
Reaction: Ground exerts a force on the foot.

Action: Gun exerts a force on the bullet.

Reaction: Bullet exerts a force on the gun.

Rocket Science

When space craft are in space there is nothing to push against. There is no friction in space, and no air resistance, so Newton's laws are very apparent in the motion.



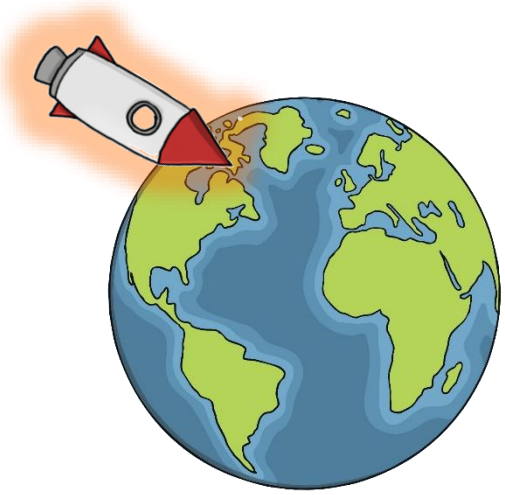
Action: Rocket engines exert a force on the exhaust gases.

Reaction: Exhaust gases exert a force on the rocket.

Heat Shields (Re-Entry)

One of the most dangerous parts of space exploration is re-entry. Re-entry is when a craft travels from outer space and into the gases of an atmosphere.

Friction from the air converts kinetic energy into heat energy.



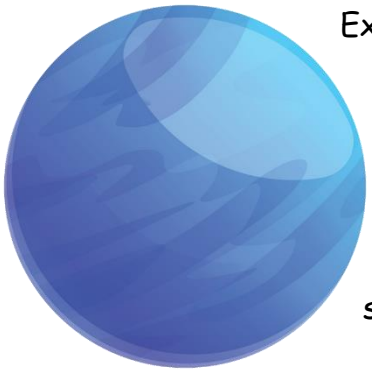
Much thought is given to the design of space crafts to protect astronauts from this heat.

This includes: The underside of the shuttle is covered with ceramic tiles and painted with black evaporating paint. The black paint radiates heat. It also removes heat as it evaporates and the tiles insulate the astronauts from the worst effects of the heat. Even still, it can become very uncomfortable in the cabin.

Habitation

Exoplanets

Exoplanets are planets outside of our Solar-System.



Exoplanets are interesting to scientist because we can find out more about the Universe, could find another world that hosts living organisms and find "Earth like" planets.

Exoplanets are discovered in a variety of ways. Currently the most successful technique is the transit method.

Requirements for Life

On Earth life is abundant, but we haven't yet found it anywhere else in the universe.

Scientists say we should look for four key ingredients that make life possible:

1. liquid water,
2. chemistry,
3. energy,
4. And time.

If a planet has these things it could be a candidate for supporting life.