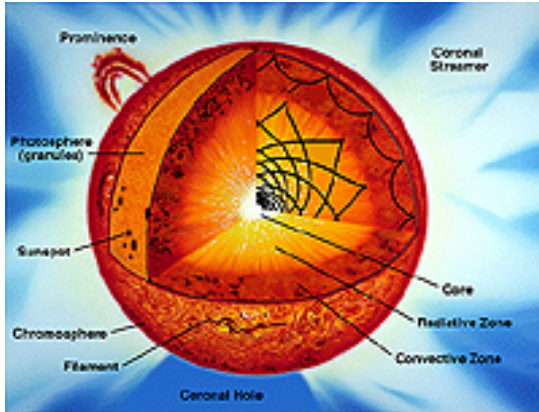


## Topic 7 - The Solar System Up Close

### The Sun



The Sun is made up of mostly hydrogen gas. It is 1.4 million km in diameter. Its temperature is about 15 million degrees Celsius. 600t of hydrogen are converted, by nuclear fusion, into helium per second. This is the energy released from the Sun. The Sun emits charged particles in all directions. This solar wind bombards the Earth at 400km/s, but the magnetic field of the Earth protects us.

### Traveling through The Solar System

<http://www-spod.gsf.nasa.gov/stargaze/Sintro.htm> (INCREDIBLE!)

<http://liftoff.msfc.nasa.gov/academy/space/solarsystem/solarsystemjava.html>

The formation of our solar system is based on the 'protoplanet hypothesis', which follows three steps:

1. A cloud of gas & dust in space begin swirling
2. Most of the matter (more than 90% of it) accumulates in the center – forming the Sun
3. The remaining materials accumulate (forming planets) and circle the Sun

### Recent Histories of the Origins of the Solar System Hypotheses

The only way to see the detail on the planets in our solar system was to send spacecraft up close to take pictures and send them back to the Earth.

### The Moon

The first other world to see up close was the Moon. On July 17, 1969 Neil Armstrong and Edwin Aldrin landed on the moon for a first hand look.

The **Inner Planets** - Mercury, Venus, Mars and the Earth - are considered the terrestrial planets because of their composition. The **Outer Planets** – Jupiter, Saturn, Uranus, Neptune, and Pluto – are similar because of their gaseous composition.

**Planet Data** <http://www.edquest.ca/content/view/208/>

provides information that helps to summarize the data from pages 412-413 **Data Cards for the Inner Planets** and pages 414-415 **Data Cards for the Outer Planets**.

These sites also are very helpful:

<http://nssdc.gsf.nasa.gov/planetary/planetfact.html>

<http://www.seds.org/billa/tnp/>

### Exploring the Outer Planets ( To boldly go where no human has gone before )

Observation equipment is sent out into space to explore distant areas of our solar system. **Space probes** are unmanned satellites or remote-controlled '**landers**' that put equipment on or close to planets where no human has gone before. Probes have done remote sensing on Mercury and Jupiter, taken soil samples on Mars, landed on Venus, and studied Saturn's rings up close.



The most recent probes to explore Mars are still there.

They are **Spirit** and **Opportunity**.

They are looking for evidence of water to determine if Mars at one time could have sustained life.



The only place that has been explored by humans in space, other than our Earth is the Moon. **Apollo 11** was the first landing and there have been many others since. The next step is to establish a base for interplanetary manned missions to **Mars**.

### Distribution of Space and Matter

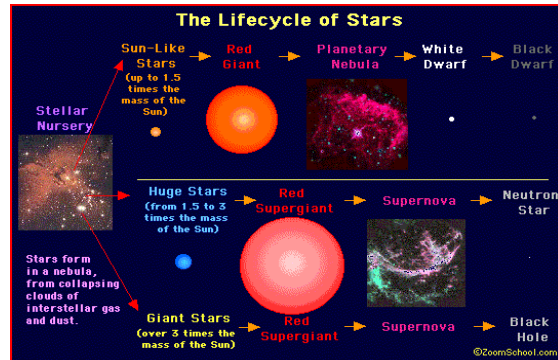
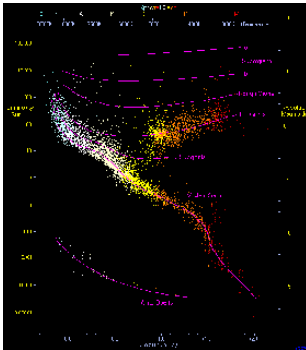
<http://zebu.uoregon.edu/~soper/Galaxies/distribution.html>

Elliptical paths can help astronomers and scientists to trace and predict where bodies in space are, have been and will be in the future. The understanding of orbits has led to the discovery of many different comets. **NASA** tracks asteroids, comets and meteors that have been discovered by observatories and amateur astronomers.

The **astronomical unit** is used for measuring 'local' distances in the solar system. It is equal to the distance from the center of the Sun to the center of the Earth (approximately 149,599,000 kms). A **light year** is equal to the distance light travels in 1 year (approximately 9.5 trillion kms). It is used for longer distances – to stars and galaxies. The distance to our nearest star, Proxima Centauri is a little over 4 light years. A **parsec** is a basic unit of length for measuring distances to stars and galaxies, equal to 206,265 times the distance from the earth to the sun, or 3.26 light-years, The nearest star, Proxima Centauri is about 1.31 parsecs from the Earth.

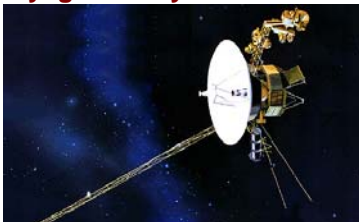
When you view an object in the sky you are seeing it as it was in the past. It has taken the light a very long time to reach the Earth. Light from the Sun takes about 5 minutes to reach the Earth, whereas light from Pluto takes about 5 hours. The farther away, the longer light takes to reach the Earth. Light from the stars in the center of the universe takes about 25,000 years to reach the Earth. The Hubble telescope is capturing light from 12 billion years ago.

A star is a hot, glowing ball of gas (mainly hydrogen) that gives off light energy. Stars vary in their characteristics. Very hot stars look blue, while cooler stars look red. In the 1920's, Ejnar Hertzsprung and Henry Norris Russell compared the surface temperature of stars with its brightness (luminosity). They graphed their data to show the relationship between brightness and temperature of stars was not random.



The process of 'star-building' is known as **fusion**, which releases great amounts of energy and radiation.

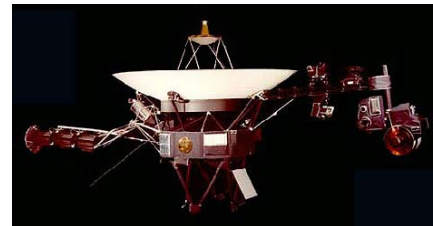
### Voyager Today



Voyager 1

As of 2002, *Voyager 1* is about 12.5 billion km from the Earth and *Voyager 2* is 9.8 billion kms from the Earth.

The communication *time lag* in transmissions is about 23 hours for Voyager 1 and 18 hours for Voyager 2.



Voyager 2