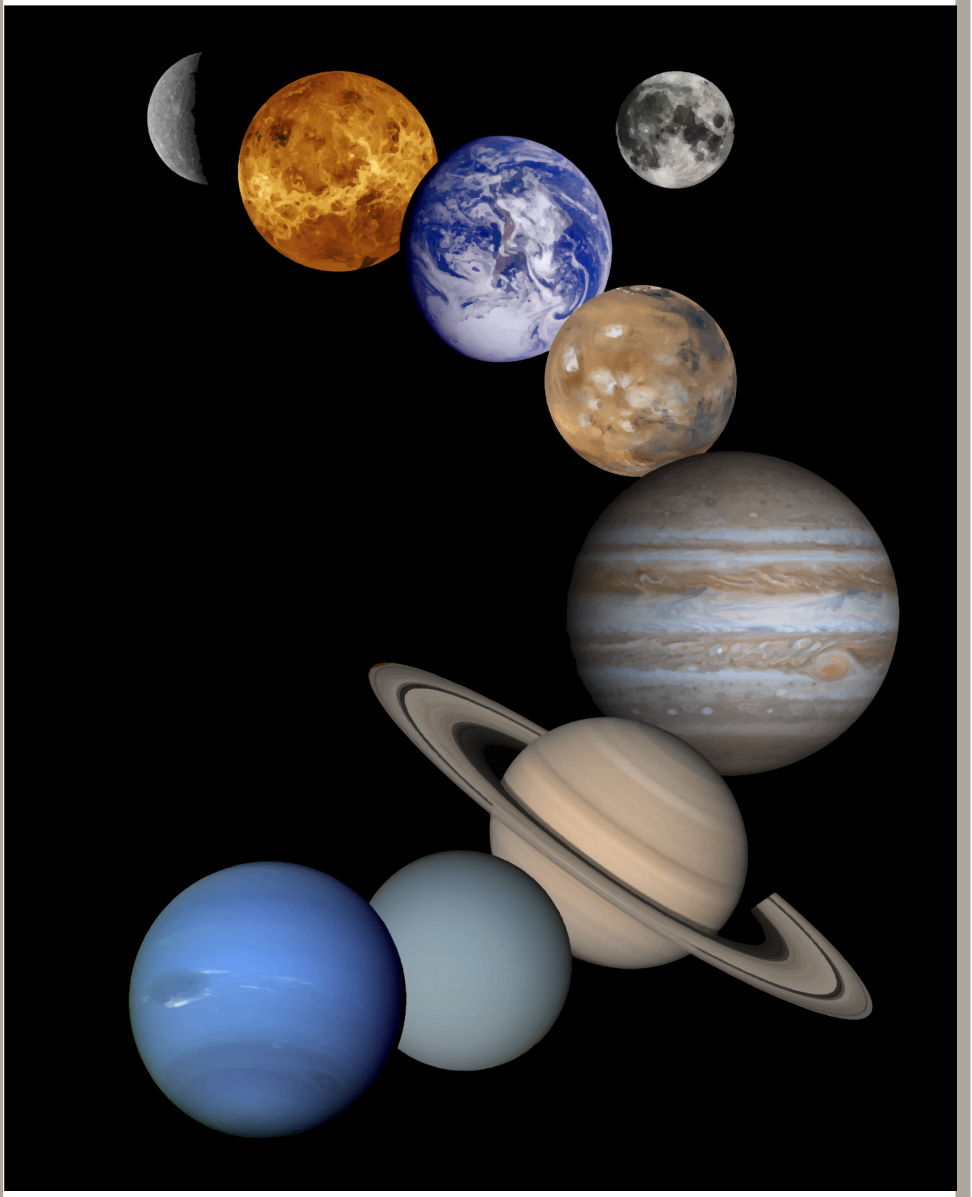
Our Solar System



Scrap book made by Kanika G and Pell G

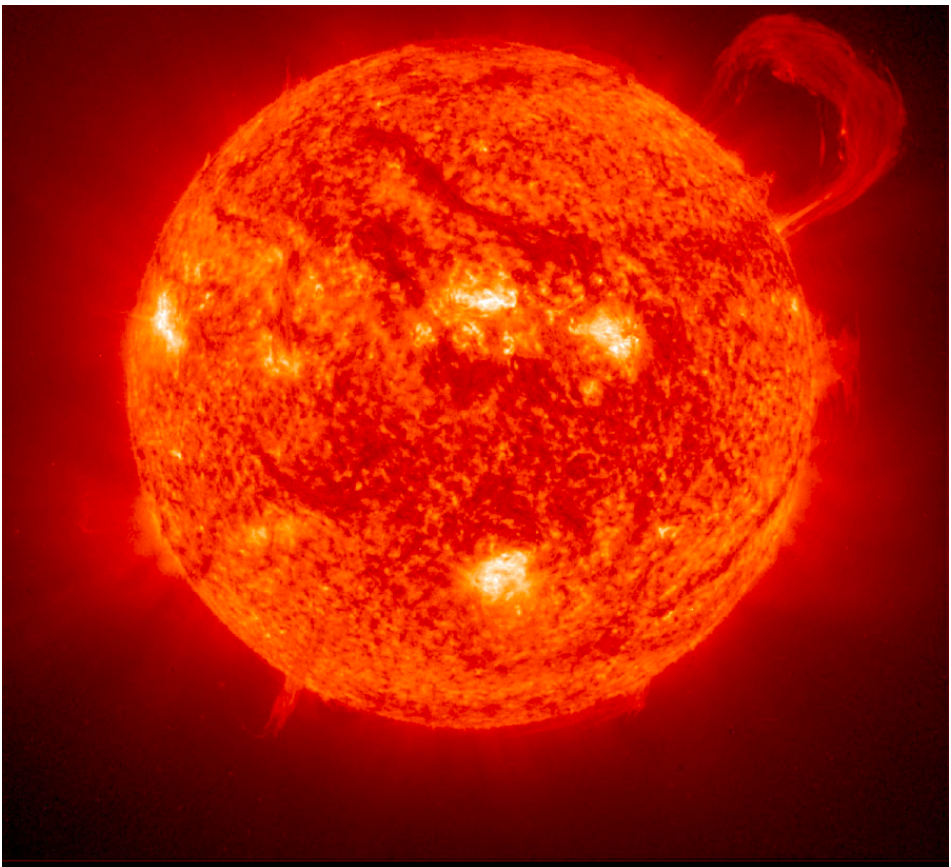
I, Kanika G, along with my daughter Pell G, put together this informative electronic scrap book.

My daughter was being taught about the solar system in school and was eager to find out more about it.

So we scoured the internet for pictures and obscure and interesting facts about the solar system. We found helpful information on various websites like Wikipedia, space.com, Nasa's official page, on many youtube videos and some other places.

We sorted the information, and put it together in a lucid, concise and organized form. In spite of being a former Physicist, I learned a lot of new things while doing this project.

Our Sun



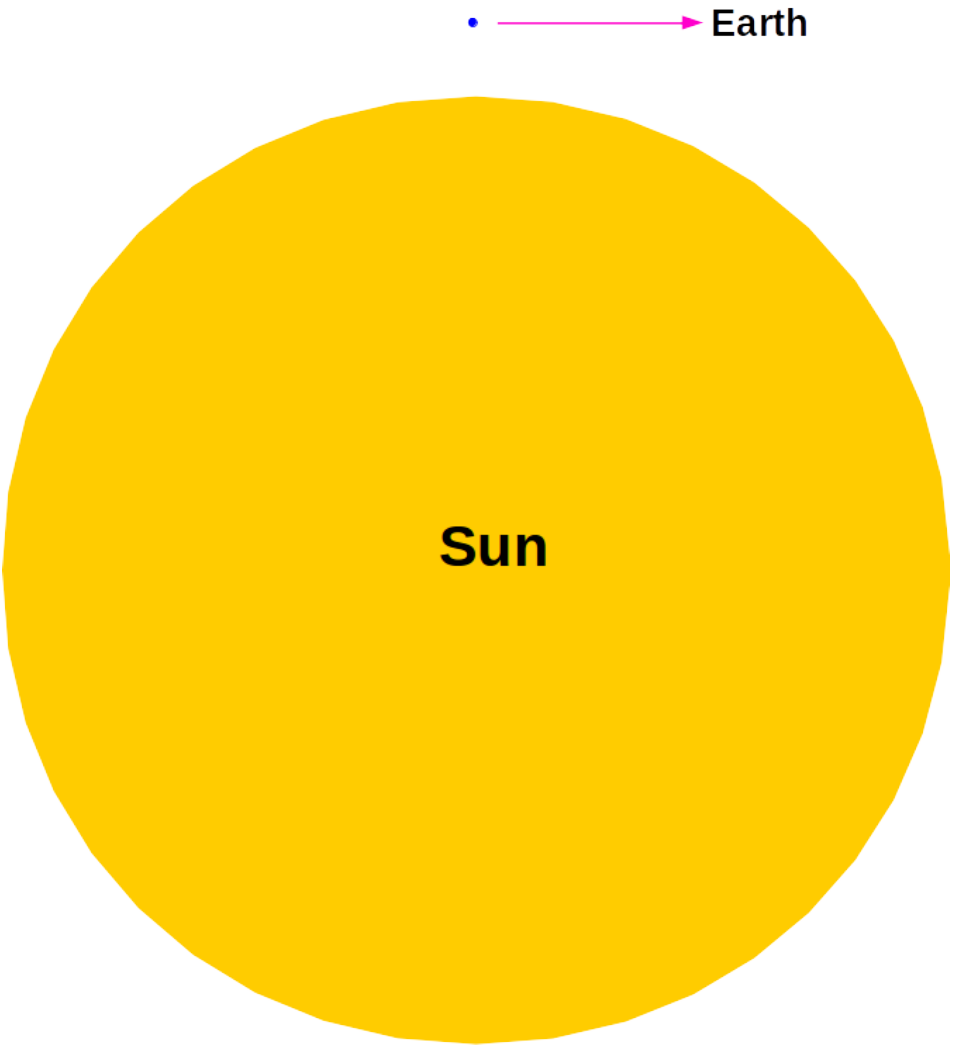
https://spaceplace.nasa.gov/review/gallery-sun/ultraviolet_T.en.jpg

Here is an interesting documentary film about the sun which is the centre of our solar system: https://youtu.be/C2FETG7tCF0

Sun facts:

The sun is 4.6 billion years old.

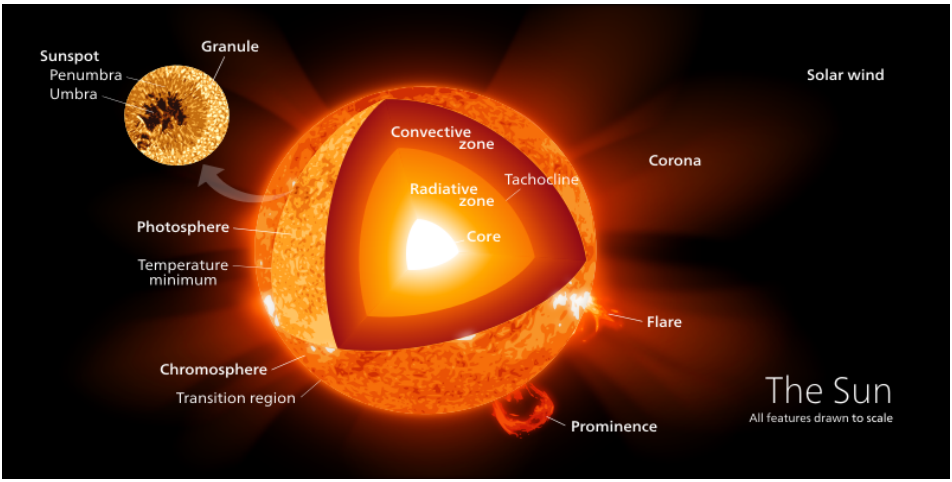
109 earths can be lined up side by side to fit across the sun.



The Sun is so far away from the earth, that it takes 8 minutes and 19 seconds for the light from the Sun to reach the Earth.

About 10,000 Earths can be lined up side by side between the Earth and the Sun.

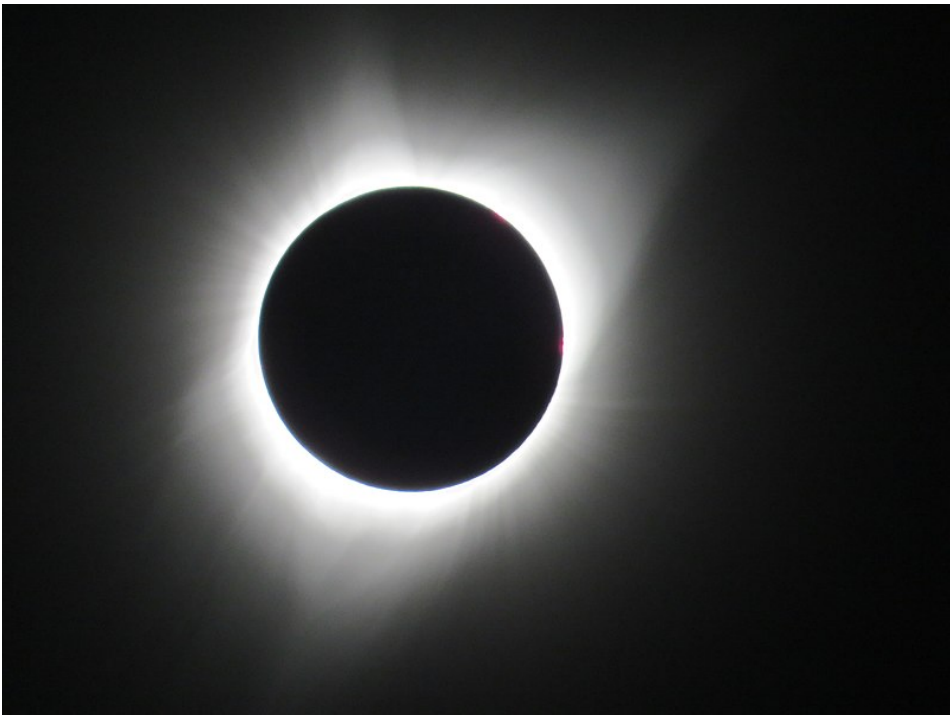
The sun and it's atmosphere have many layers. The core of the sun is the hottest at 15 million Kelvin. The surface, photosphere is between 4500 and 6000 K.



https://en.wikipedia.org/wiki/File:Sun_poster.svg

But then as you go away from the surface in to the Sun's atmosphere, the temperature rises again, until you reach the corona, which is very hot.

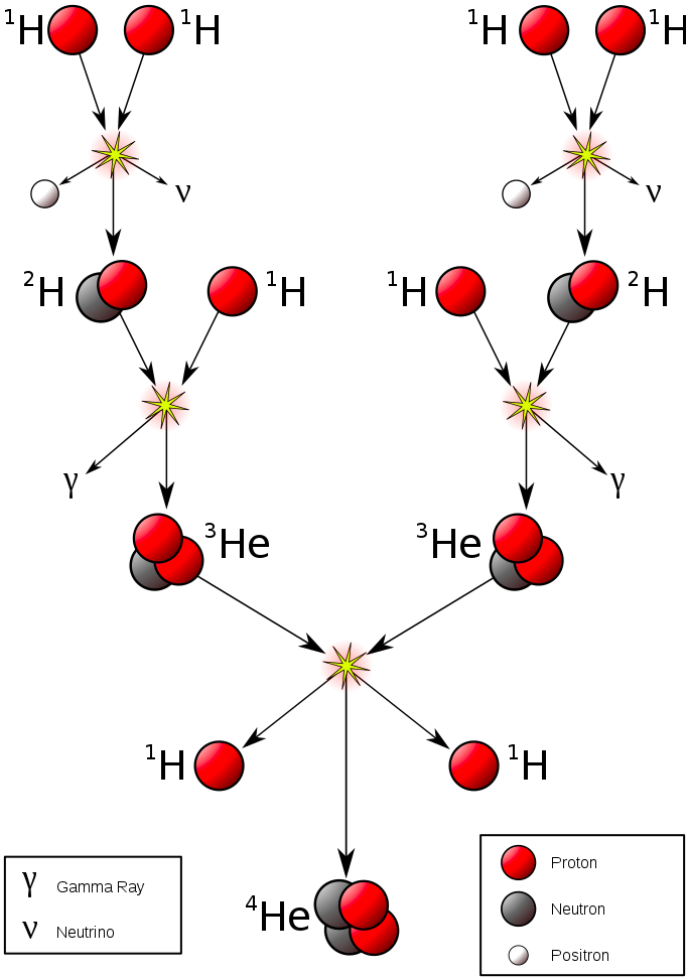
The corona is the part of the Sun's atmosphere that can be seen during a total solar eclipse.



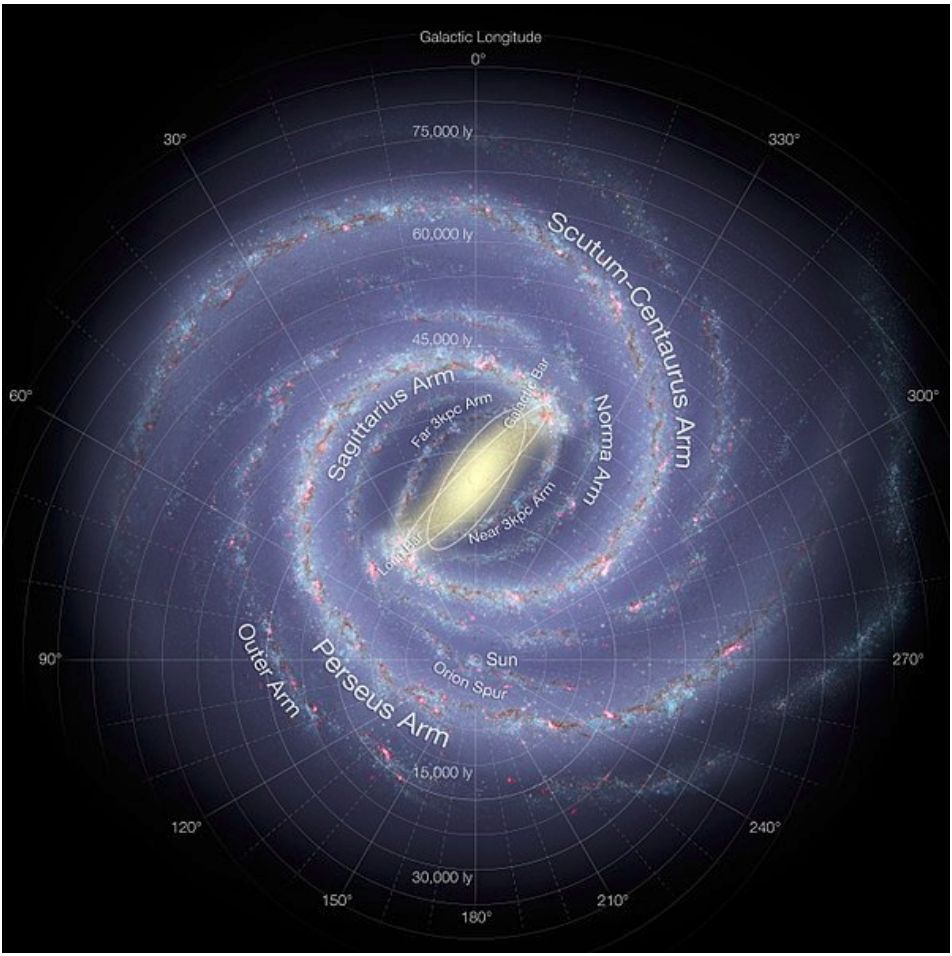
https://en.wikipedia.org/wiki/Sun#/media/File:2017_Solar_Eclipse_Weiser_Idaho.jpg

The solar wind, which is made of charged particles emitted from the sun's corona protects the solar system from gamma ray bursts produced during a collapse of a distant star.

Almost three-quarters of the sun is made of Hydrogen. The Hydrogen atoms in the Sun's core, join together to form Helium atoms. Almost one quarter of the Sun is made of Helium.



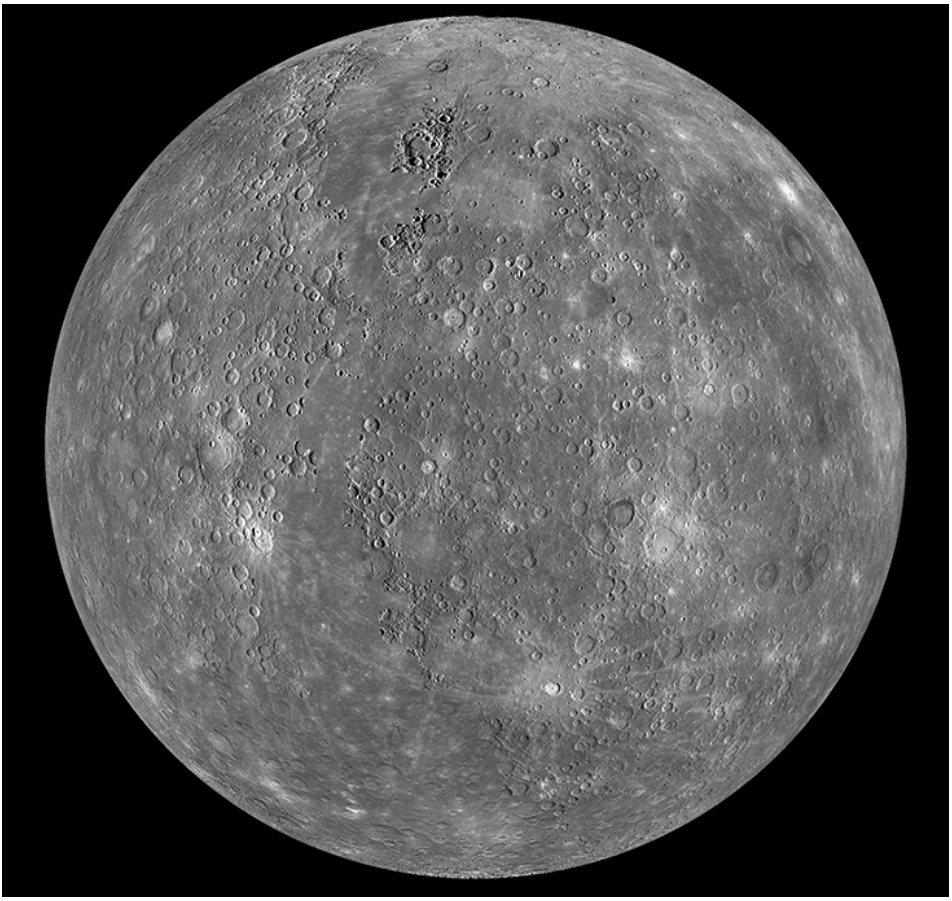
The Sun is only one of many many stars in the Milkyway galaxy.



https://en.wikipedia.org/wiki/File:Artist%27s_impression_of_the_Milky_Way_(updated_-_annotated).jpg

The sun completes an orbit about the centre of the milky way galaxy in 225 – 250 million earth years. This is called a galactic year.

Mercury



https://solarsystem.nasa.gov/planets/mercury/galleries

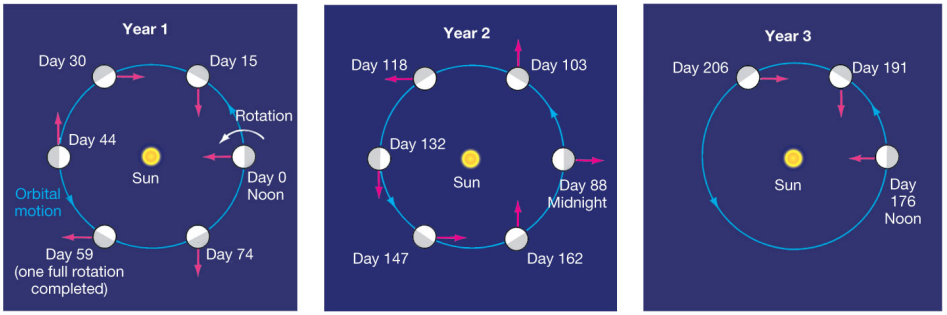
Position: Mercury is the planet closest to the Sun. It has an elliptical orbit, with closest distance from the sun being 29 million miles and the farthest distance being 43 million miles, making it the planet with the most eccentric orbit in the solar system.

Rotation & Revolution

1 day (time from noon to midnight to noon again) on Mercury = 2 years (time taken to complete one orbit) on Mercury

1 year on Mercury = 88 Earth days

Mercury rotates on it's axis once in 58 earth days.



http://pages.uoregon.edu/jimbrau/BrauImNew/Chap08/7th/AT_7e_Figure_08_12.jpg

Size

Mercury is the smallest planet in the solar system. It has a radius of 2440 Km, little less than half the radius of Earth, and 1.4 times the radius of our Moon.

Mercury is the second most dense planet after Earth in the Solar sytsem

Climate

Mercury cannot support an atmosphere and only has an exosphere. So the half of Mercury facing the Sun is very hot with a surface temperature reaching 430 C, while other half is very cold with a surface temperature as low as -170 C.

The difference in temperature between the hottest and coldest spots on mercury is 600 C.

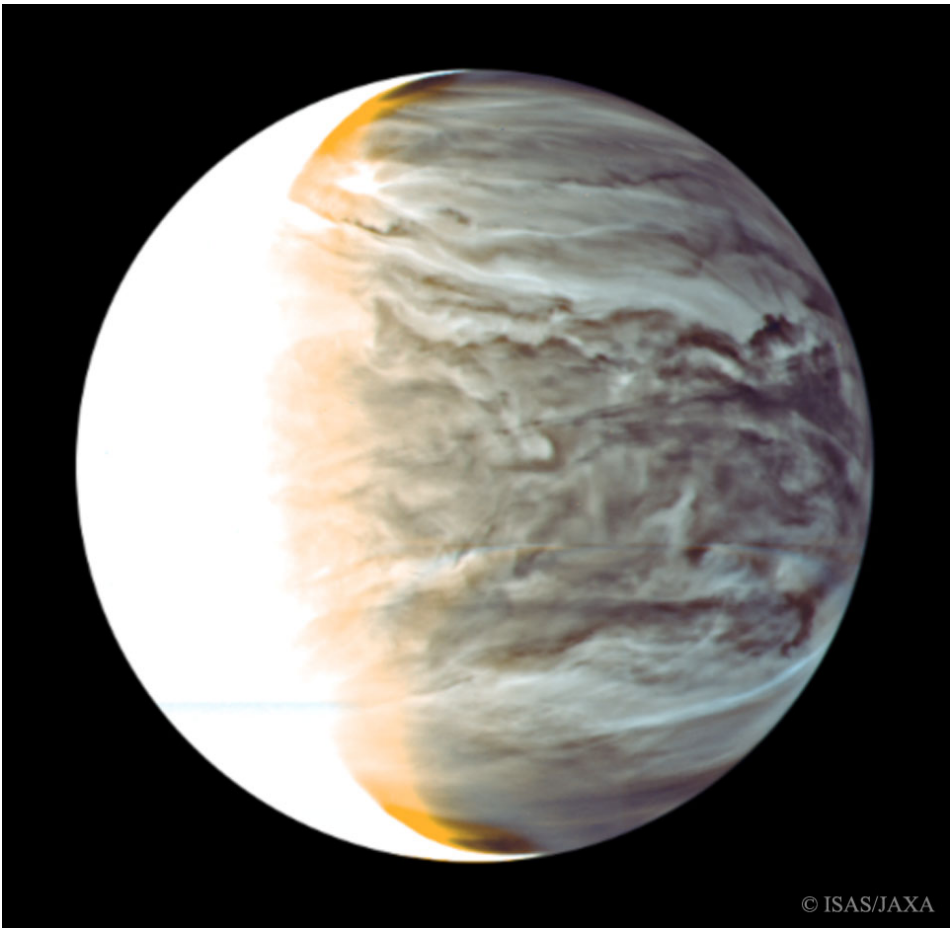
Other Facts

Mercury does not have a moon.

It's surface is full of craters and looks a lot like our moon.

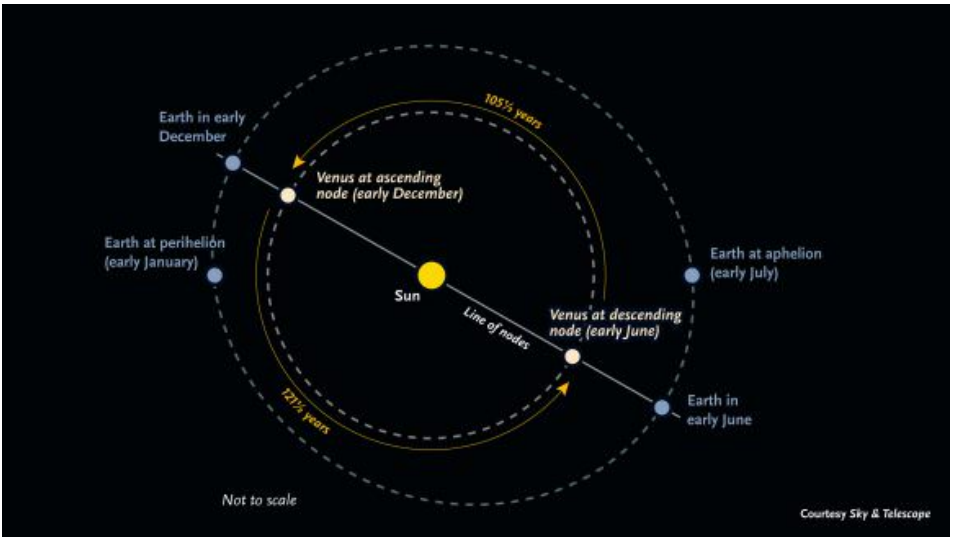
Surface gravity of Mercury is 38% the surface gravity of Earth.

Venus



https://solarsystem.nasa.gov/planets/venus/galleries

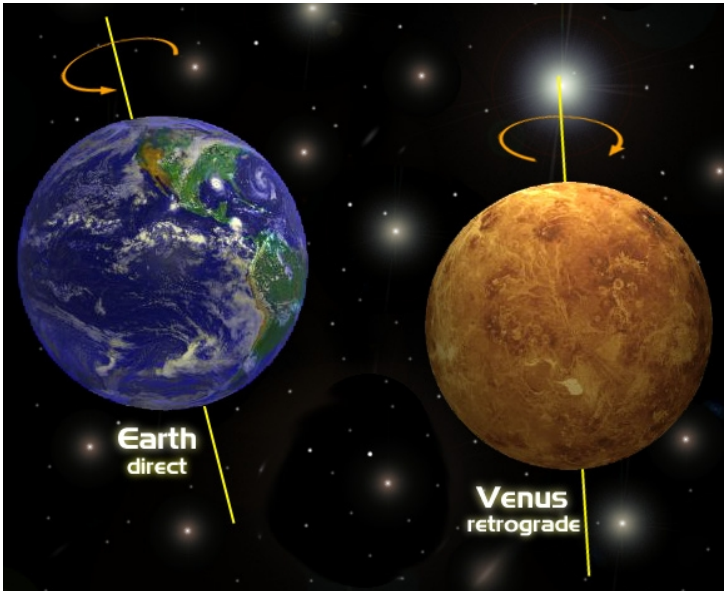
Position: Venus is the second closest planet to the Sun. It has the most circular orbit of all the planets in the solar system.



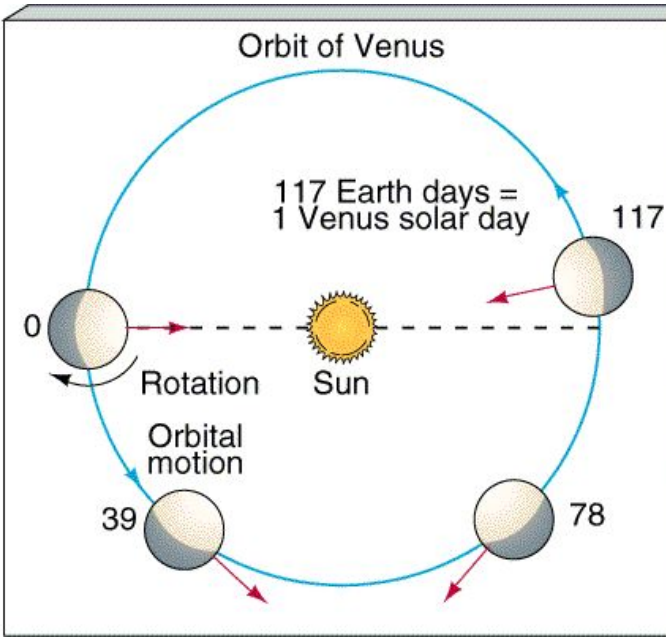
https://www.universetoday.com/47900/length-of-year-on-venus/

Rotation & Revolution

Venus rotates in a direction opposite to Earth and most other planets.



1 day (time from noon to midnight to noon again) on Venus = 117 Earth days



http://frigg.physastro.mnsu.edu/~eskridge/astr102/venus_rot.jpg

1 year on Venus ~ 225 (224.7) Earth days

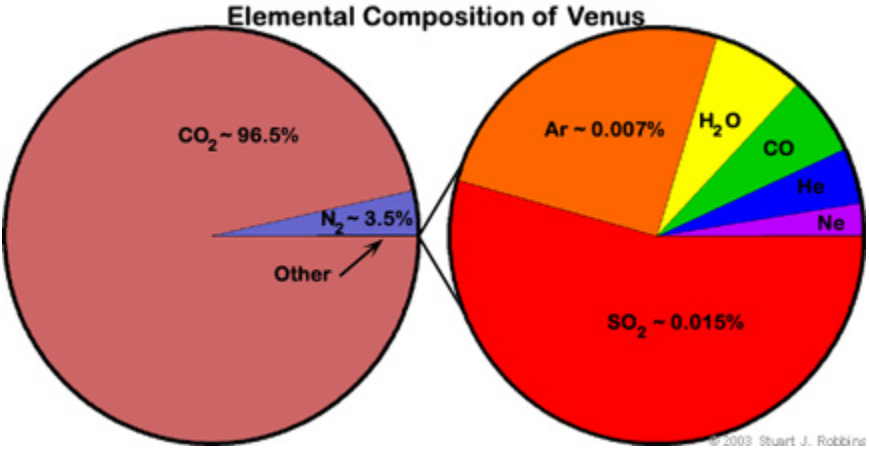
Venus rotates on it's axis once in 243 earth days.

Size

Radius of Venus is 6052 Km. So Venus is almost as big as Earth. Earth's radius is 6371Km.

Climate

Most of Venus's atmosphere is made of CO_2 along with small amounts of nitrogen.



Venus's atmosphere is 90 times as dense as Earth's amosphere. There are some clouds of sulphuric acid too. Because of the dense green house gasses in it's atmosphere, Venus is the hottest planet in the solar system.
The average temperature of Venus is 462 C.

Other Facts

Venus does not have a moon.
Venus is the brightest object in our night sky after the moon.

Moon

https://www.nasa.gov/feature/goddard/rare-full-moon-on-christmas-day

The Moon completes an orbit around the Earth in 27 days. We always see the same side of the Moon. The motion of the moon is locked with the Earth, meaning it has the same period or rotational and orbital period, resulting in tides in our oceans.

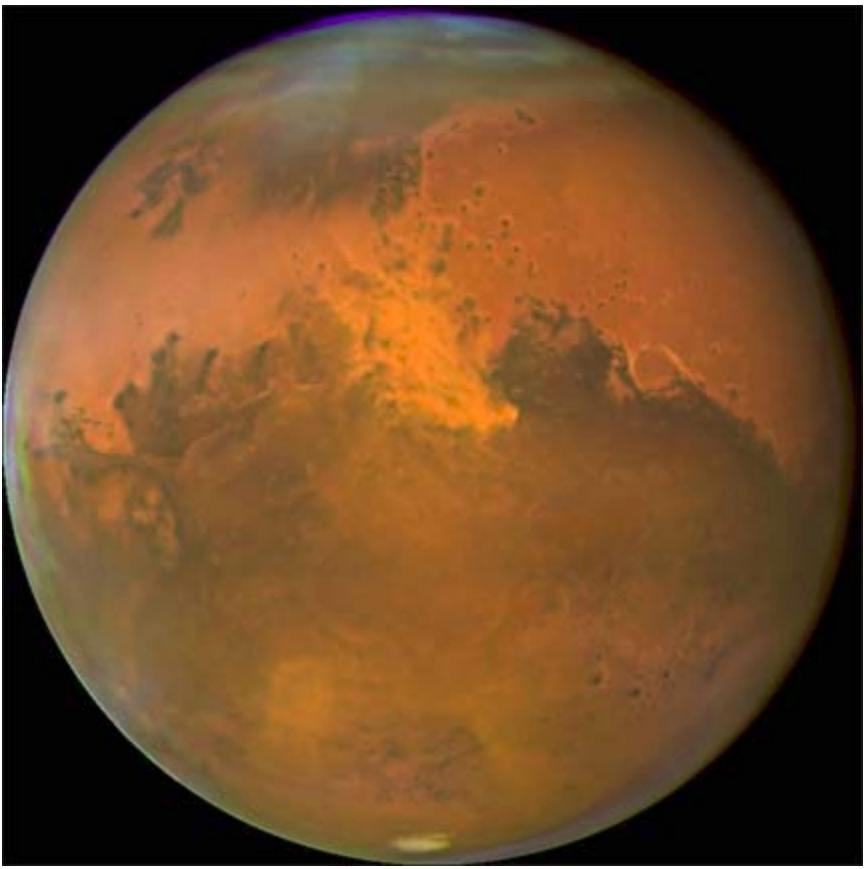
Moon Landing

On 16th July 1969 the first humans, Neil Armstrong and Edwin Aldrin landed on the Moon during the lunar mission Apollo 11.

https://www.nasa.gov/sites/default/files/images/339773main_apollo_image_11a.jpg

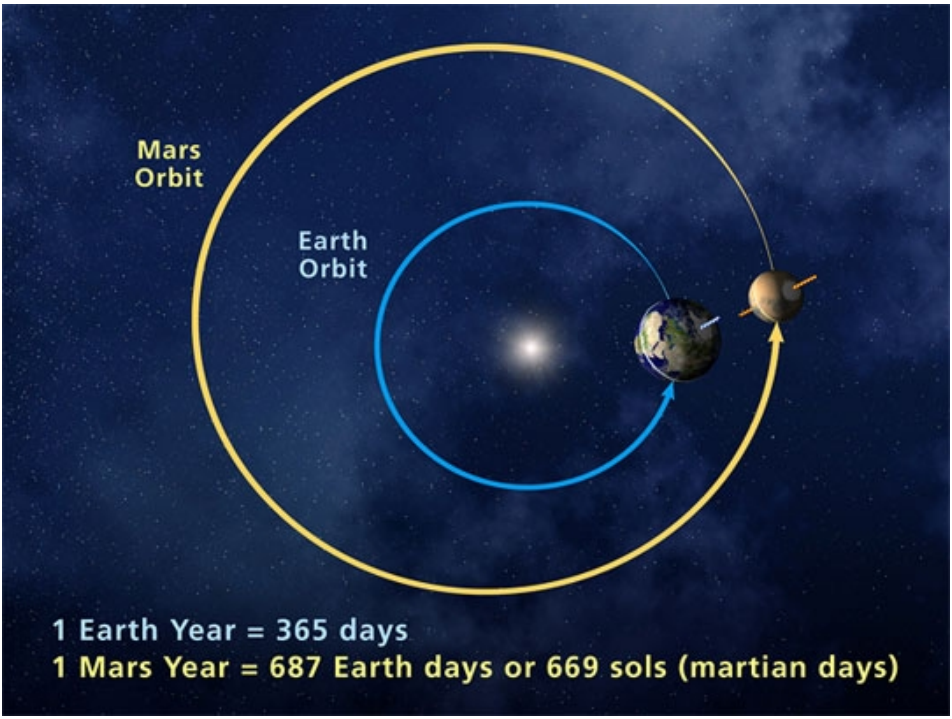
https://www.nasa.gov/mission_pages/apollo/40th/images/apollo_image_12.html

Mars



https://www.nasa.gov/sites/default/files/thumbnails/image/edu_what_is_mars.jpg

Position: Mars is the fourth closest planet to the Sun, situated after Earth. It has the most eccentric orbit of all the planets in the solar system after Mercury.



https://www.universetoday.com/wp-content/uploads/2008/06/earthmarsorbittop.jpg

Rotation & Revolution

Mar's axial tilt is very similar to Earth's, resulting in similar seasons and temperature variations.

A day on mars is 24 hours and 40 minutes, which is only a little longer than an Earth day.

1 Mars year = 687 Earth days or 669 Mars days.

Size

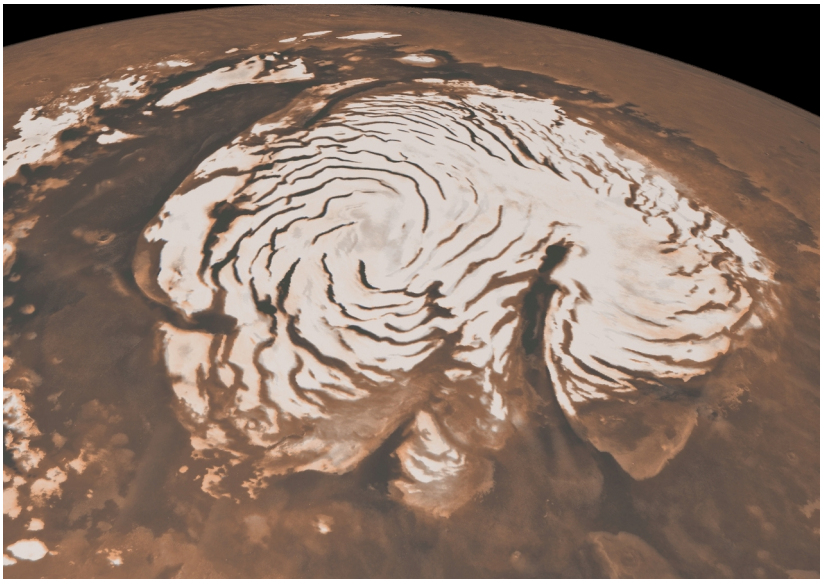
Radius of Mars is 3390 Km. Mars is one-sixth the size of Earth. Surafce gravity of Mars is only 38% that of Earth.

Climate

The atmosphere on Mars mainly consists of CO_2 and some argon and nitrogen. Mars appears red from a distance because of a lot of iron oxide dust in the atmosphere. That is why Mars is called *The Red Planet*.

Surface temperature of Mars reaches 20 C at noon on the equator and goes as low as -153 C at the poles.

The poles have frozen CO_2 and water.



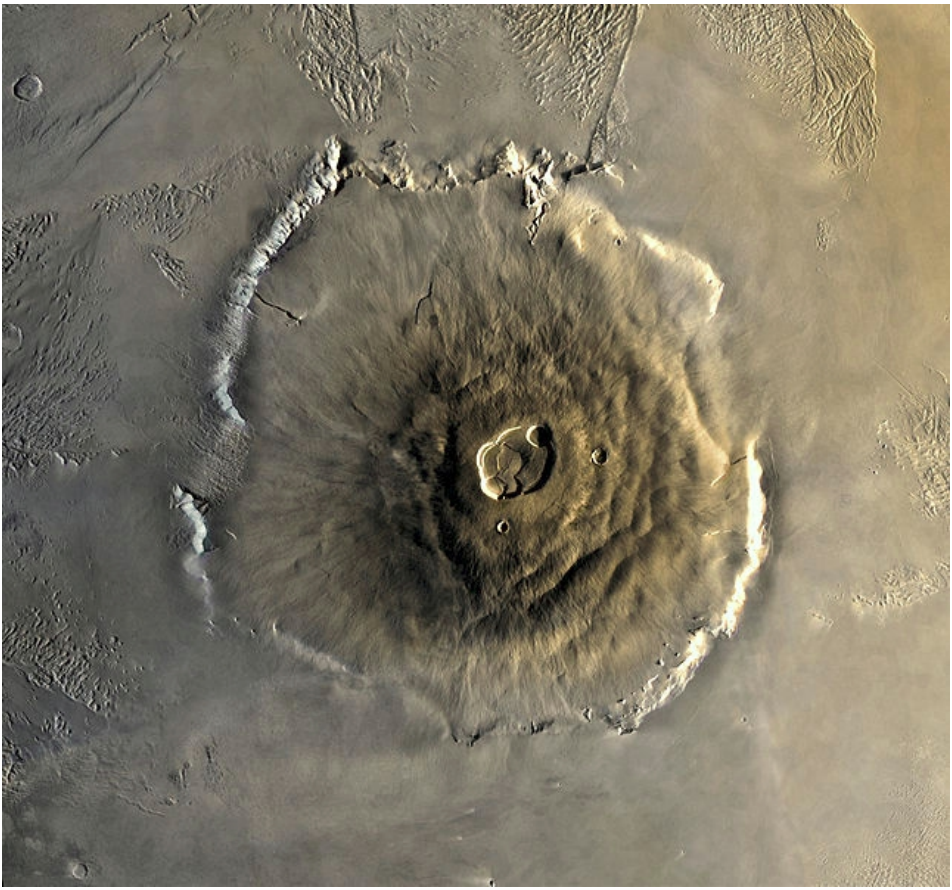
Mars Missions

Starting from 1964, we have successfully sent a number of missions of Mars. The first was a fly by mission conducted by NASA called Mariner 4. Since then we have sent other flyby missions as well as orbiters, landers and rovers. Currently there are 8 operational missions, of which Curiosity and Opportunity are rovers sent by NASA and Mangalayan is a orbiter mision sent by ISRO in India.

Pictures are from Wikipedia

Other Facts

Olympic Mons, a volcano on Mars, is the tallest mountain in the solar system. It is about 2 and a half times the height of Mount Everest above sea level.



https://en.wikipedia.org/wiki/File:Olympus_Mons_alt.jpg

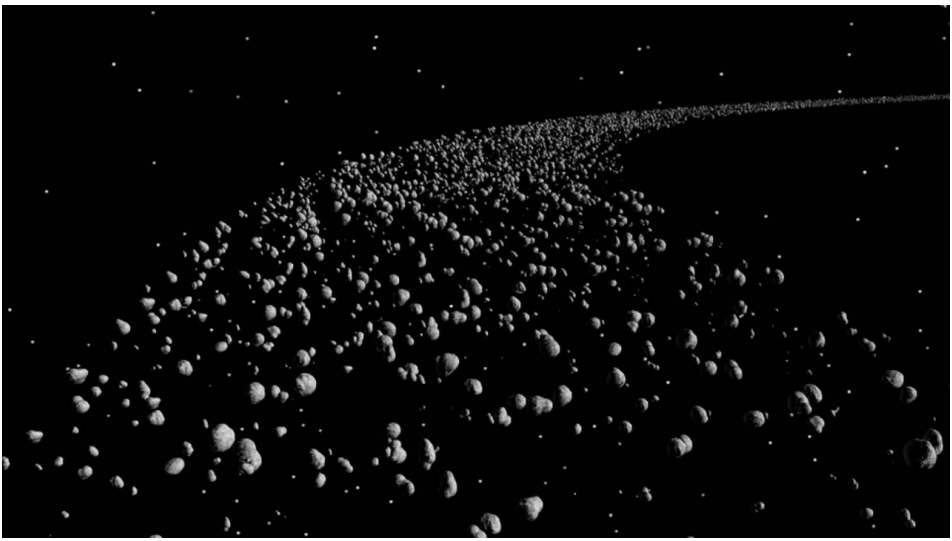
Valles Marineris on Mars is one of he largest canyons in the solar system.

https://en.wikipedia.org/wiki/Valles_Marineris#/media/File:VallesMarinerisHuge.jpg

Over the years scientists have speculated about the existance of liquid water on the surface of Mars at some point.

Recently, Curiosity discovered some perchlorates in the Gale Crater of Mars that result in briny water that may possibly support life.

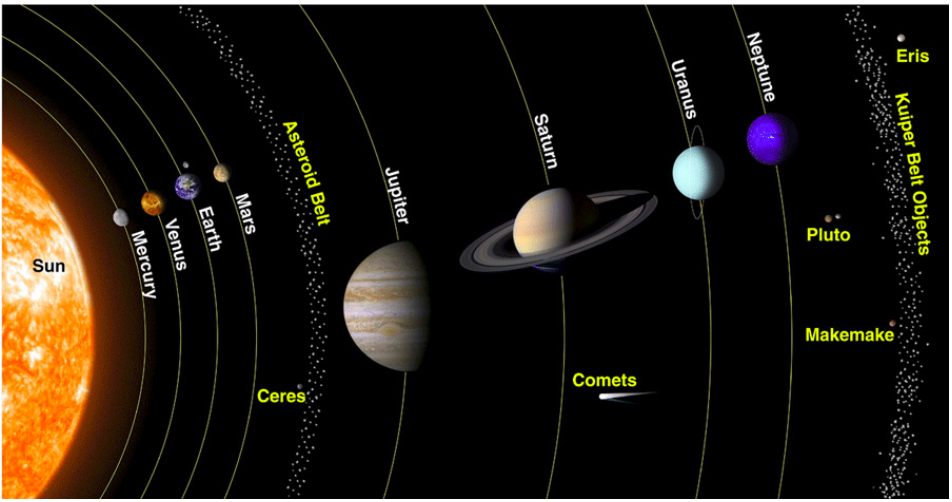
The Asteroid Belt



https://www.tes.com/lessons/rNCN3twbu8tS-w/astroid-belt

Asteroids are small rocky bodies orbiting the sun. The vary, from 1 metre to a 1000 Kms across, in size. Asteroids smaller than 1 metre are called meteoroids.

The largest asteroid is the dwarf planet Ceres with a diameter of 975 Km. The next two largest are 4Vesta and 2Pallas with diameters of about 500 km. Smaller asteroids have irregular shapes.



https://www.tes.com/lessons/rNCN3twbu8tS-w/astroid-belt

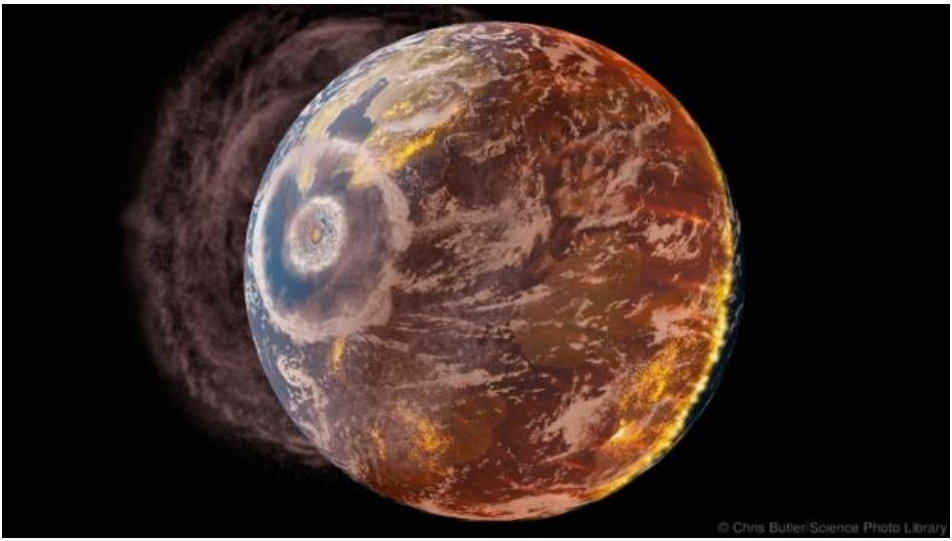
The asteroid belt is between Mars and Jupiter, where all the asteroids can be found. There are several million asteroids in the astroid belt.

It is believed that all planets were originally asteroids that coalesced together. However Jupiter's high gravitaional pull may have prevented the coalescing of the asteroids in the asteroid belt.

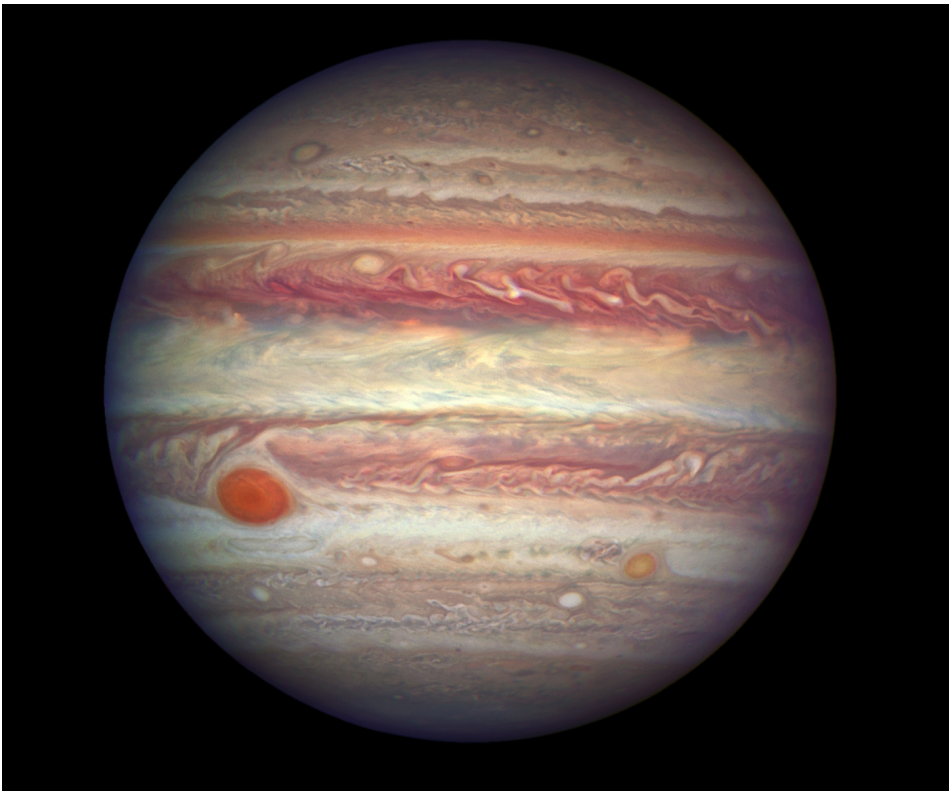
Ceres, Vesta and Pallas are protoplanets, while Ceres is the only asteroid with a fully ellipsoidal shape and therefore qualifies as a drawf planet.

66 million years ago a 6 mile wide asteroid crashed in to the earth making the 100 Km wide Chicxulub crater in Mexico.

Apart from the local damage, world wide earthquakes and tsunamis that followed, and the ice age that resulted from the sunlight being blocked by the dust and smoke from the collision, resulted in the extinction of dinosaurs. For details see http://www.bbc.com/earth/story/20160415-what-really-happened-when-the-dino-killer-asteroid-struck



Jupiter



https://www.nasa.gov/sites/default/files/thumbnails/image/jupapr3color-jd-170304.png

Jupiter is the fifth planet from the Sun.
This gas gaint is the biggest planet in the solar system. Almost 10 Jupiters lined up next to each other would fit across the diameter of the Sun. Jupiter is also twice the mass of all the other planets combined.

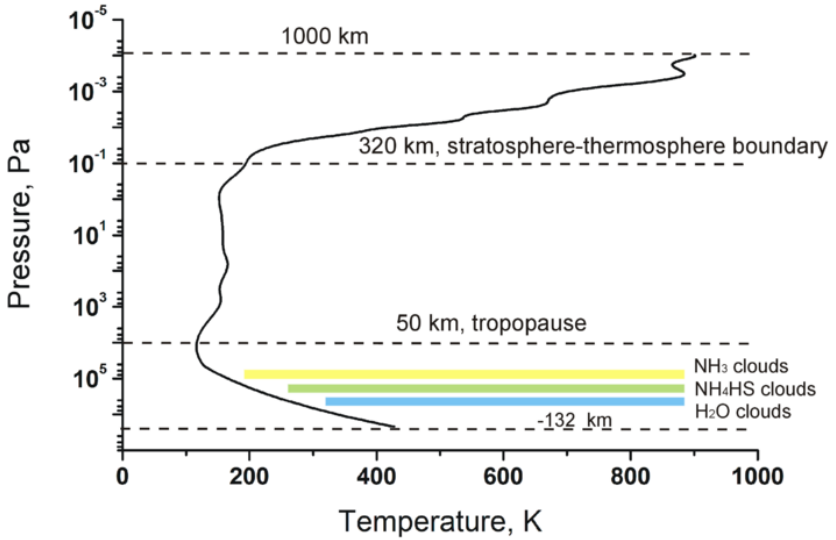
Rotation & Revolution

Jupiter is the fastest spinning planet in the solar system and completes it's rotation in a little less than 10 Earth hours. Jupiter takes 12 Earth years to complete one revolution around the Sun.

Climate

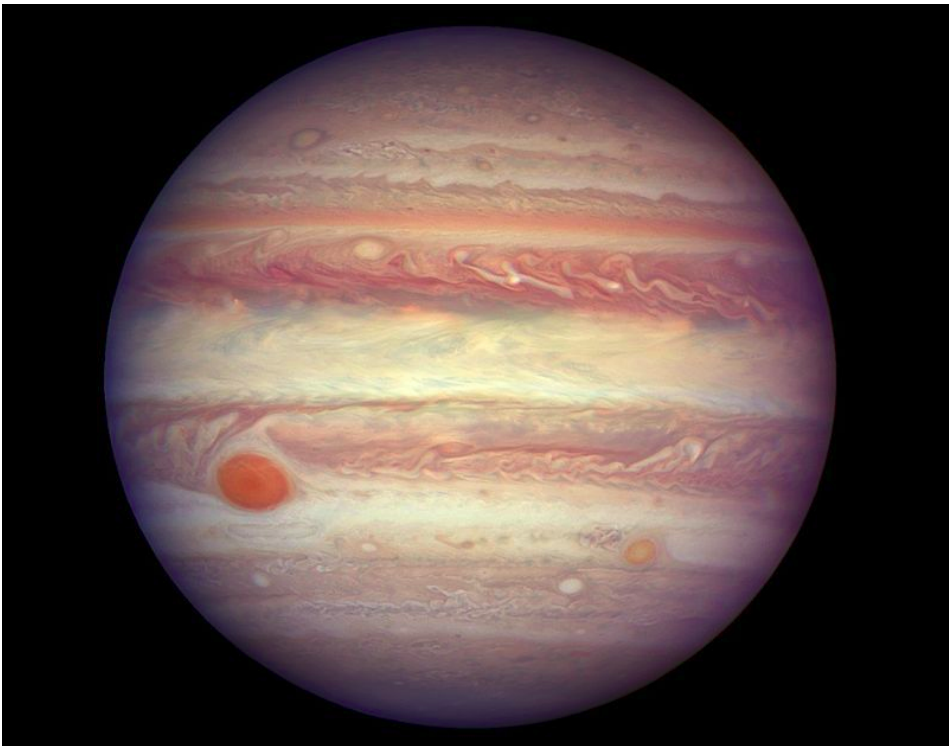
Jupiter's average surafce temperaure is -145 C. Jupiter is entirely made of gas, liquid and plasma. So it does not have a surface as such. Scientists have defined the surface of Jupiter as the position where the pressure is 1 bar, which is the pressure on Earth's surface

Jupiter, like the Sun, is mostly made Hydrogen and Helium, and in almost the same proportion as the sun.



Jupiter's atmosphere extends up to 5000 Kms above it's surface. Initially the temperature falls to a minimum of -165 C at the tropopause 50 km above the surface.

Then the temperature rises again up to -73 K at the stratosphere 320 Km above the surface. Next comes the thermosphere where the temperature rapidly increses to almost 800 C at 1000 Km above the surface.



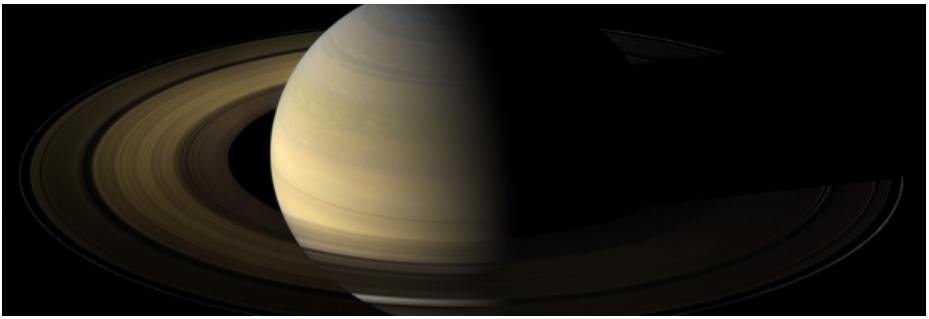
Jupiter has prominent stripes which are likely due to its ammonia clouds. In the white zones dense white ammonia clouds are formed, and in warmer belts, the ammonia clouds evaporate making the lower darker clouds visible.
The Great Red Spot is a persistent storm over 350 years old on Jupiter. It is as large as 2 Earths and has a rotation period of 6 earth days. The size of the spot fluctuates and at the moment it is shrinking.

Jupiter's Moons

https://en.wikipedia.org/wiki/Jupiter#/media/File:The_Galilean_satellites_(the_four_largest_moons_of_Jupiter).tif

Jupiter has at least 69 moons. The largest, Ganymede is larger than Mercury. The picture shows the 4 largest moons of Jupiter, Io, Europa, Ganymede and Callisto from left to right.

Saturn



https://solarsystem.nasa.gov/planets/saturn/indepth

Saturn is the sixth planet from the Sun. This gas gaint is the second biggest planet in the solar system, only a little smaller than Jupiter. But Saturn is also the least dense planet in the solar system, and the only one that could float on water.

Rotation & Revolution

Saturn spins almost as fast as Jupiter and completes it's rotation in about 10 and a half Earth hours. Saturn takes almost 29 and a half Earth years to complete one revolution around the Sun.

Climate

Saturn's average temperaure is -178 C. Saturn, like Jupiter and the Sun, is mostly made Hydrogen and Helium in almost the same proportion as the sun.

The lowest layer, just above the rocky core, is at about 0C and made of clouds of water vapour. The next higher layer made of ammonium hydrosulphide clouds at -70C.

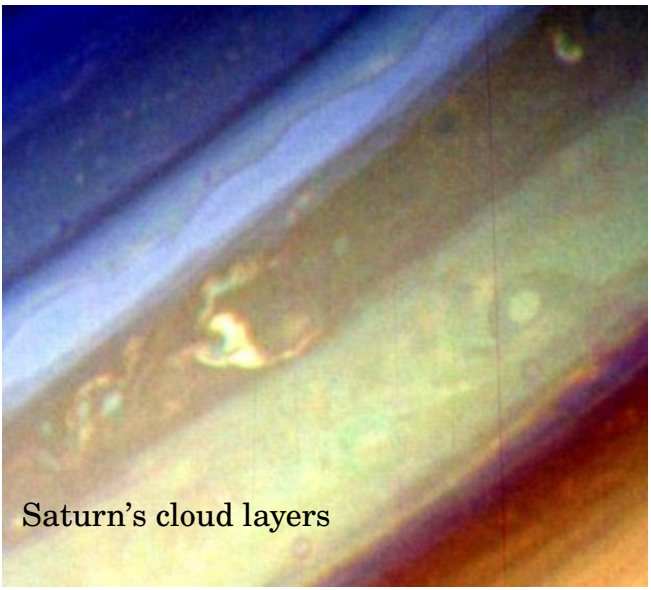
The top visible layer is made of ammonia clouds at -250 C.

The next higher layer is the troposphere where the temperature ranges from -130 C to 80 C.

Saturn is very windy with wind speeds around 1800Kmph at the equator.

Reference:

http://www.esa.int/Our_Activities/Space_Science/Cassini-Huygens/Saturn_s_atmosphere



Saturn's cloud layers

Cassini – Huygens space craft

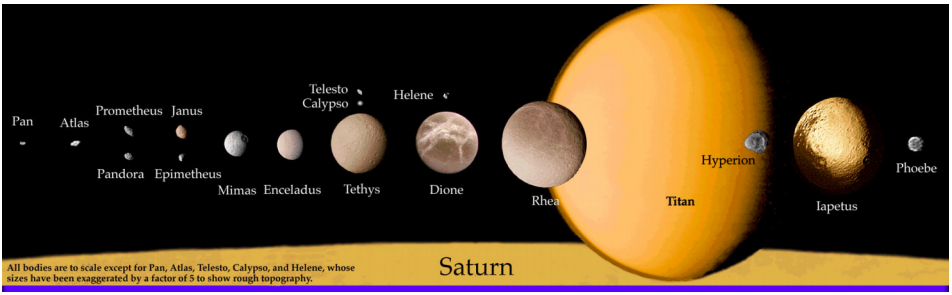
Cassini was sent to study Saturn 20 years ago. It took 7 years to reach Saturn. Then for 13 years Cassini sent us information about Saturn and it's moons, till it ran out of fuel in mid September.

https://en.wikipedia.org/wiki/File:Cassini-Huygens_is_installed_to_the_payload_adapter.jpg

The scientists arranged for it to crash in to Saturn, and obtain information about the rings and atmosphere of Saturn, as it crashed.

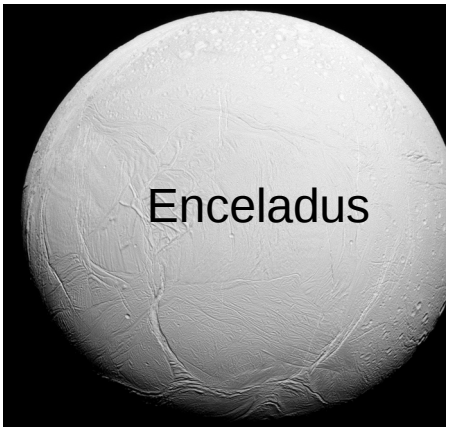
Saturn is the gas giant in the Solar system with the most prominent and beautiful rings. Cassini sent us plenty of data and pictures of these rings.

Saturn's Moons

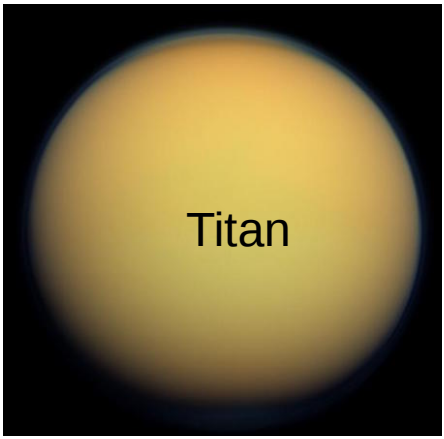


http://www.sci-news.com/space/cassini-saturns-moon-pan-04007.html

Saturn has at least 62 moons. The largest, Titan is larger than Mercury and the second largest moon in the solar system, only smaller than Ganymede. Titan and Enceladus are interesting because they are most likely to support life. Titan has an Earth like nitrogen rich atmosphere and Enceladus is likely to have a global ocean under it's surface.

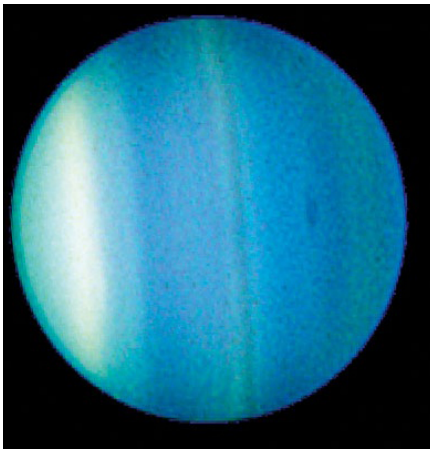


https://solarsystem.nasa.gov/planets/enceladus



https://solarsystem.nasa.gov/planets/titan

Uranus



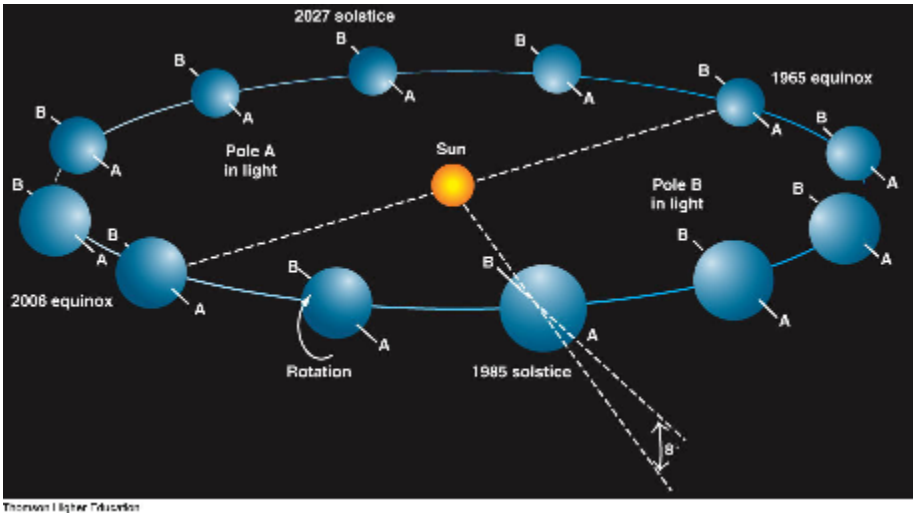
https://solarsystem.nasa.gov/planets/uranus/galleries

Uranus is the seventh planet from the Sun. It has the third largest planetary radius and the fourth largest planetary mass. Approximately 8 Earths placed next to each other would fit across Uranus. It rocky icy core surrounded by an icy (a hot dense fluid referred to as icy in planetary science) mantle over which is the hydrogen helium layer common to all gas giants.

Rotation & Revolution

Uranus completes it's rotation in about 17 and a quarter Earth hours. It takes almost 84 Earth years to complete one revolution around the Sun.

The strange thing about Uranus is that it spins on it's side with an axial tilt of ~ 98 degrees.



https://www.universetoday.com/19305/seasons-on-uranus/

So the north and south poles each face the sun for 42 earth years at a stretch. Uranus was probably knocked over by a planet that crashed in to it, causing it to have such a strange tilt.

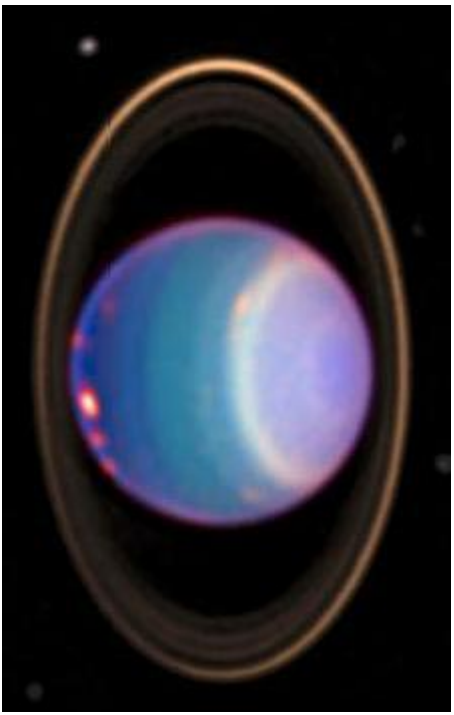
The magnetic axis of Uranus has a tilt of 60 degrees. Due to such a large difference between the geographic and magnetic poles, Uranus's magnetic shield keeps moving around, making its magnetic sheild unstable, and hence the planet temporarily vulberable to deadly solar winds. (see https://www.youtube.com/watch?v=ckdJ4945dHs)

Climate

Uranus's upper atmosphere is made of water, ammonia and methane ice cristals that give it it's blue colour. It's minimum atmospheric temperature is -224 C.

Uranus's Moons And Rings

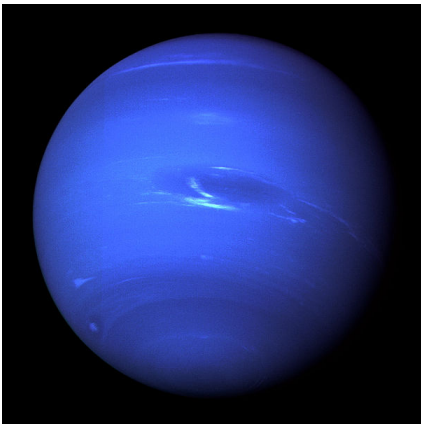
Uranus has rings that revolve around the planet as it rotates on it's side. But the rings are faint compared to Saturn's rings.



In addition to it's rings, Uranus has 13 known moons, 5 of which have regular orbits.

https://science.nasa.gov/science-news/science-at-nasa/1999/ast29mar99_1

Neptune



https://upload.wikimedia.org/wikipedia/commons/thumb/5/56/Neptune_Full.jpg/600px-Neptune_Full.jpg

Neptune is the eighth planet from the Sun. It has the third largest planetary mass and the fourth largest planetary radius. It is 17 times the mass of Earth.

It's core made of iron, nickle and silicates surrounded by an icy mantle (a hot dense fluid referred to as icy in planetary science) which consists of a water-ammonia ocean and possibly superionic water and diamonds floating in liquid carbon. Over the mantle is the hydrogen helium layer common to all gas giants.

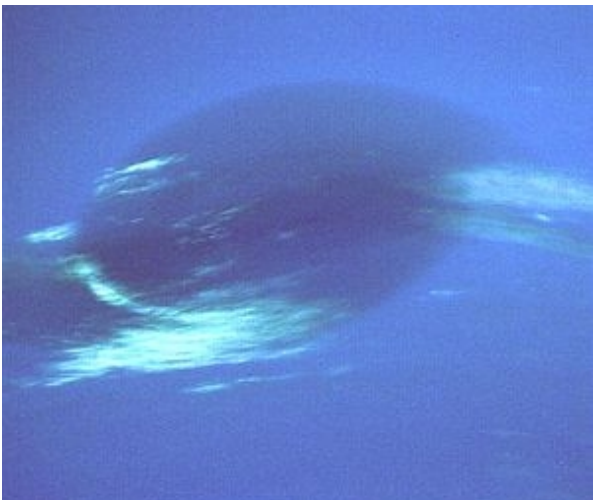
Rotation & Revolution

Neptune completes it's rotation in about 16 Earth hours. It takes 165 Earth years to complete one revolution around the Sun.

Climate

Neptune's average temperature is -214 C. Neptune's atmosphere is made mostly of hydrogen and helium, along with some methane which gives it it's blue colour.

Neptune has great dark spots that are anticyclonic storms. They form and dissipate every few years.

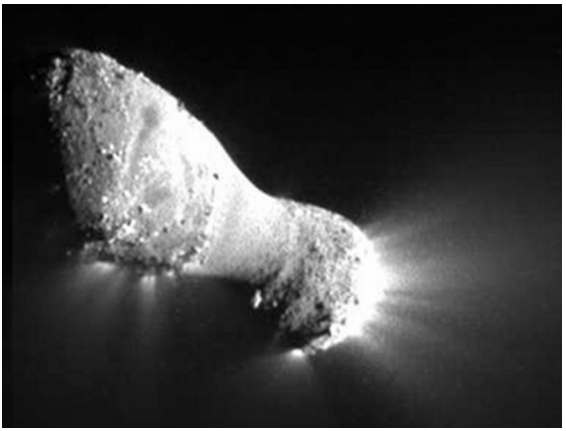


https://en.wikipedia.org/wiki/Great_Dark_Spot#/media/File:Neptune%27s_Great_Dark_Spot.jpg

Neptune's Moons

Neptune has 13 known moons. Triton is Neptune's largest moon and circles Neptune in the direction opposite to Neptunes rotation. It is believed that Neptune captured Triton and this disrupted Nereid's (3rd largest moon of Neptune) orbit and made it highly eccentric.

Comets



https://upload.wikimedia.org/wikipedia/commons/e/e6/Comet_Hartley_2.jpg

Comet nuclei are made of a loose collection of ice (frozen ammonia, carbon-di-oxide and methane), dust and rocky particles. Their sizes range from a few 100 meters to tens of kilometers.
When a comet passes near the sun, it gets warm, releasing trapped gasses which results in it having a visible atmosphere, the coma. Some comets also have a tail.

https://upload.wikimedia.org/wikipedia/commons/c/c6/17pHolmes_071104_eder_vga.jpg

Comets have highly eccentric elliptical orbits with orbital periods ranging from several years to several millions of years.

Commets that have an orbital period of less than 200 years are called short period commets. Halley's commet has a period of 76 years.

Comets with orbital periods less than 20 years and low inclinations to the eliptic are called Jupiter-family- comets.

Those with orbital periods n=between 20 and 200 years are called Halley-type-comets.

The information about comets was obtained from https://en.wikipedia.org/wiki/Comet#Short_period

Footnote:
Pluto was once considered the ninth and most distant planet, but is now the largest known drawf planet. Most known dwarf planets of the solar system, like Pluto, belong to the Kuiper belt beyond the orbit of Neptune.