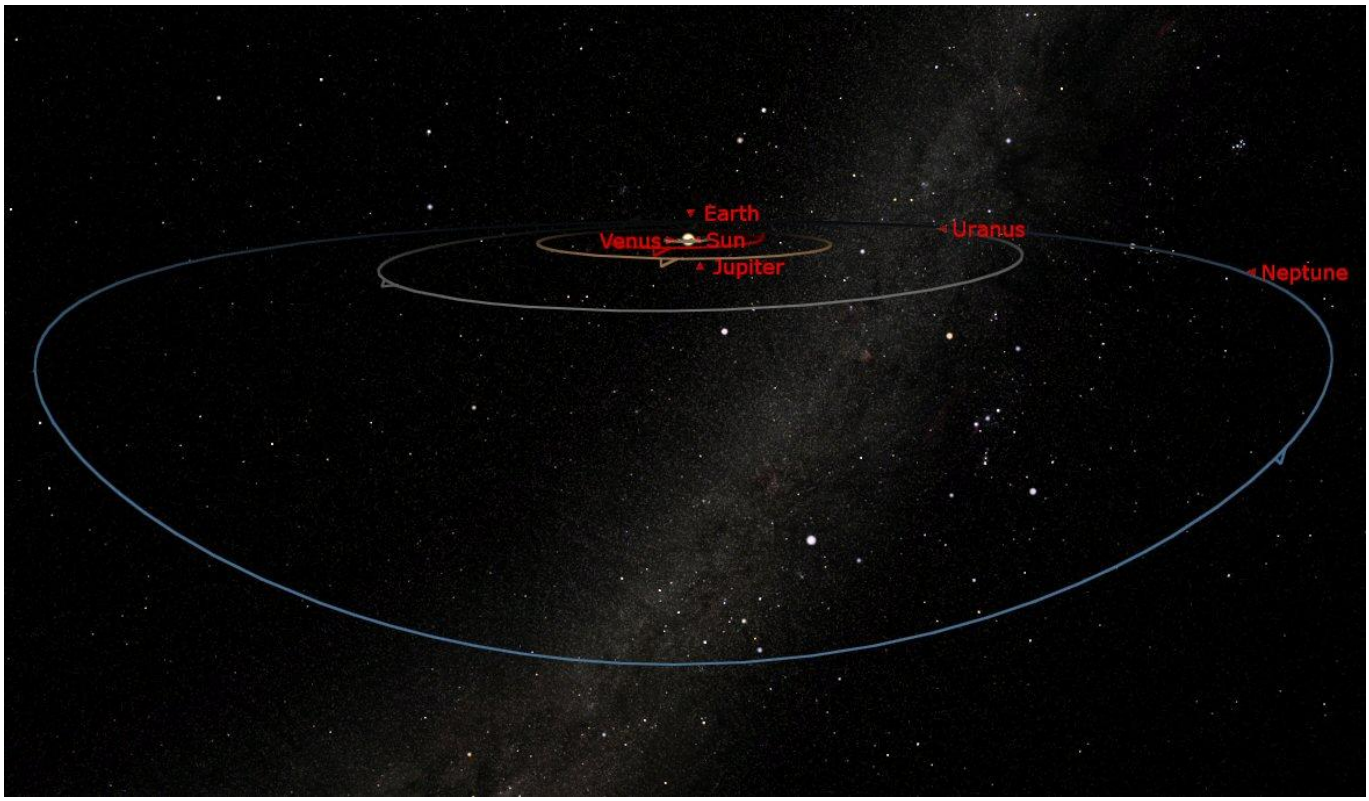
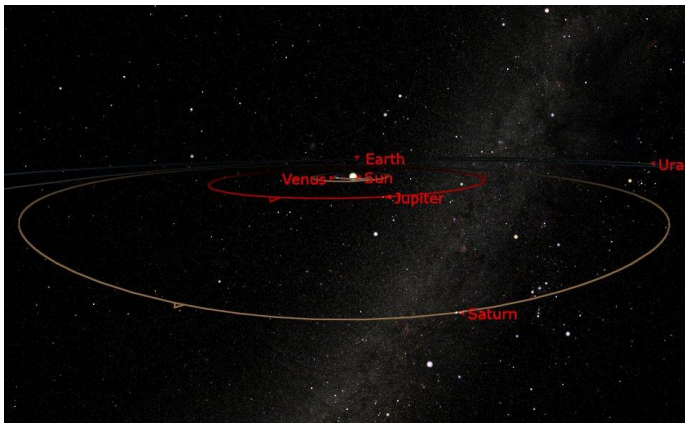
NEWBURY ASTRONOMICAL SOCIETY
MONTHLY MAGAZINE – February 2021

OUR SOLAR SYSTEM



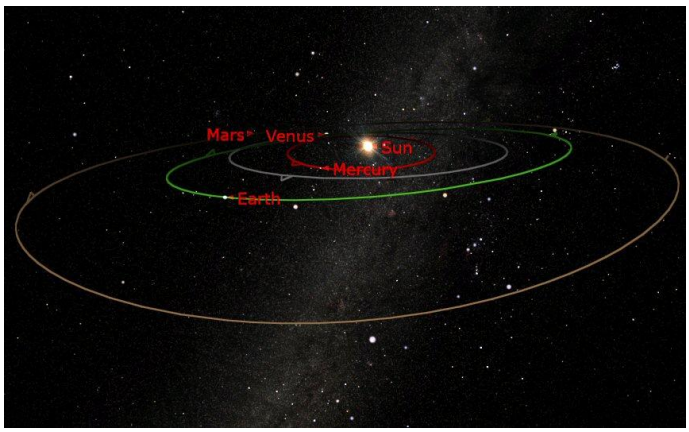
The Planets of our Solar System

In this article we will be looking at our Solar System and will explore what our Solar System is, where it came from and what it is comprised of. First of all what is our Solar System? Put simply it is our Star that we call 'the Sun' and all the space and stuff around it that comes under its influence. The chart above shows a view of our Solar System and our accepted view of it with planets orbiting around the Sun at the centre.



The Orbits of the Gas Giants

The In the chart at the top of this page the orbits of the outer icy frozen planets Neptune and Uranus are widely spaced and occupy most of the chart. If we zoom in we see the orbits of the Gas Giant planets Saturn and Jupiter take up most of the space further in. The four inner planets are gathered close to the Sun.



The orbits of the Inner Planets

The chart above shows the inner four planets Mars, Earth, Venus and Mercury clustered around the Sun. These inner planets are called the Terrestrial (or rocky) planets. They are composed of rock and Iron and are kept warm by the heat from the Sun.

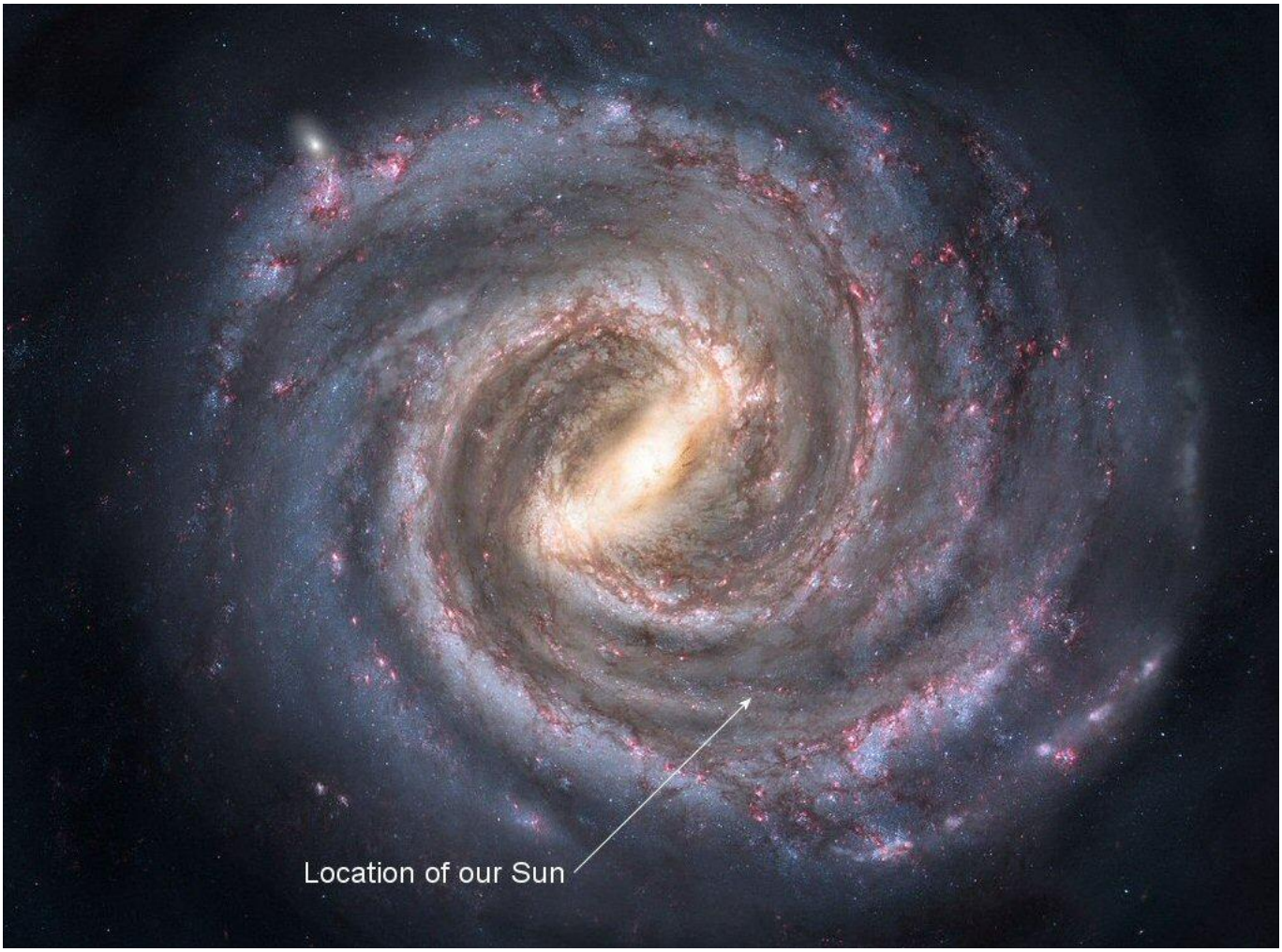
NEWBURY ASTRONOMICAL SOCIETY MEETING

5th February A bit of a Marathon
Website: www.newburyastro.org.uk

NEXT NEWBURY BEGINNERS MEETING

17th February Planetarium Applications
Website: www.naasbeginners.co.uk

FORMATION OF OUR SOLAR SYSTEM



An artist's impression of our Galaxy and the position of our Sun

Stars form in vast clouds of gas and dust, called Nebulae that are located in the arms of Spiral Galaxies. Galaxies are huge rotating discs of stars, gas and dust where hundreds of billions of stars form. The spiral arms of these galaxies are created by shock waves of star formation moving through the nebulae. These shock waves stir up the gas and dust causing the atoms to swirl around and be drawn together by gravity.

The Pillars of Life Nebula imaged by Hubble

Dense clumps of gas develop that pull in more gas and dust as they grow and their gravity increases. These dense clouds begin to spin and form into a flat disc of rotating gas and dust.

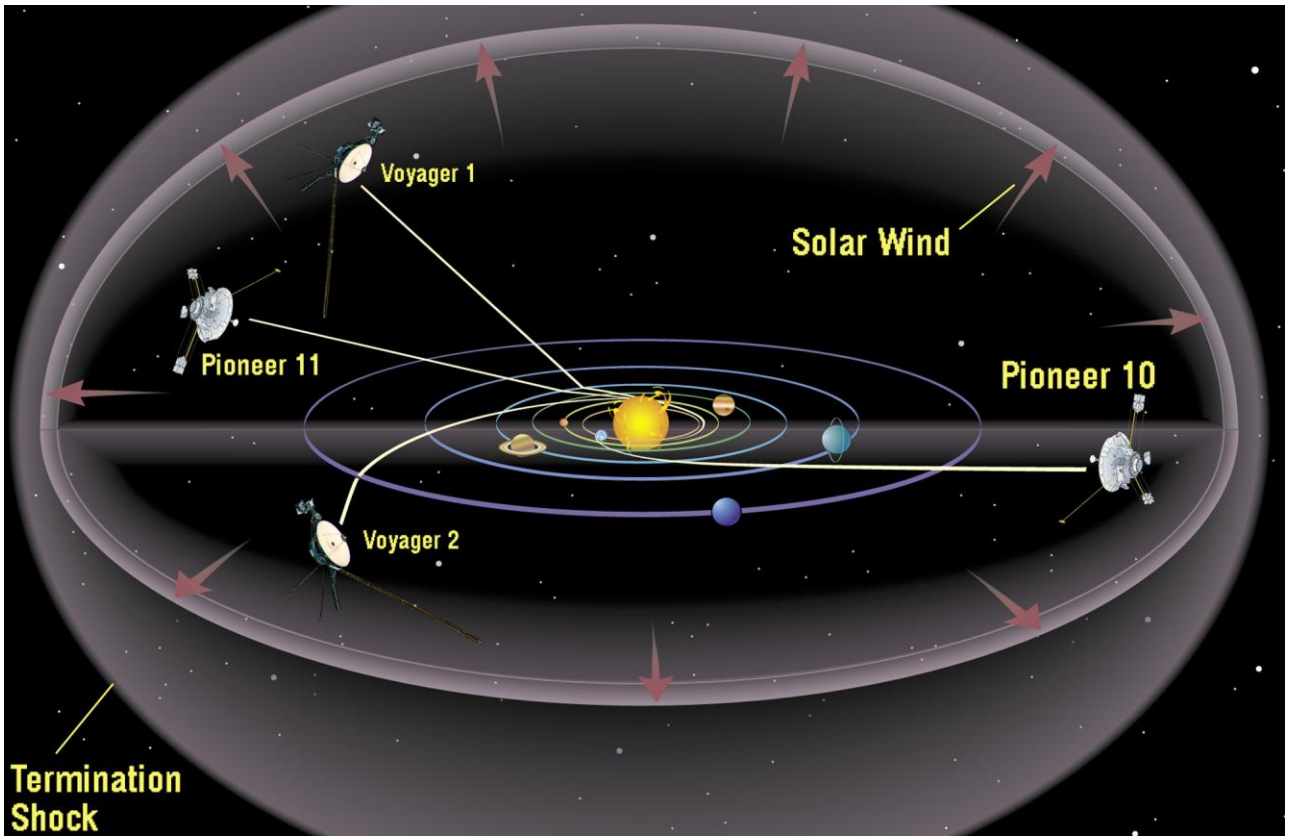
As more and more material is pulled in by the increasing gravity the centre of the disc is compressed and begins to heat up. This core becomes so compressed it is forced into its most compact shape, a ball or sphere. Eventually the pressure and temperature become so great that the Hydrogen atoms are pressed together until they fuse and are transformed into a Helium atom.

The new Helium atom will have slightly less mass that the two Hydrogen atoms that it formed from. This lost mass is converted into energy in the form of a X-Ray or Gamma-Ray that heats the sphere so it begins to shine and a star is 'born'. This process is called Nuclear Fusion as described by Albert Einstein in his famous equation $E = Mc^2$ where E = Energy, M = Mass and c^2 = the speed of light squared.

Other stars form in the Nebula creating a group of stars that blow away any remaining gas to reveal a new cluster of stars called an Open Custer. Our Sun was one star in an Open Cluster of between 30 and up to about 1000 stars. Gradually the stars of the cluster drifted apart and were distributed around our Galaxy that we call the Milky Way.

As the early Solar System rotate, see the picture on page 4, the gas and dust in the disc formed into larger and larger lumps under the force of gravity. These lumps developed into planets and gradually cleared paths around the star to establish a clear orbital path for each planet.

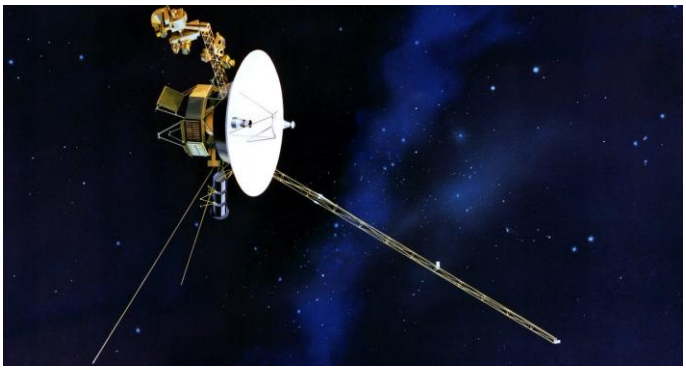
WHAT IS THE BOUNDARY OF OUR SOLAR SYSTEM



The paths of our most distant probes

We need to ask the questions: How big is our Solar System? and Where does it end and where does Deep Space begin? We describe the limits of our Solar System as being the furthest reach of the influence of our Sun. So this is the distance where the radiation from the Sun no longer affects the structure of deep space. We refer to the volume of space influenced by our Sun as the Heliosphere and the boundary as the Heliopause.

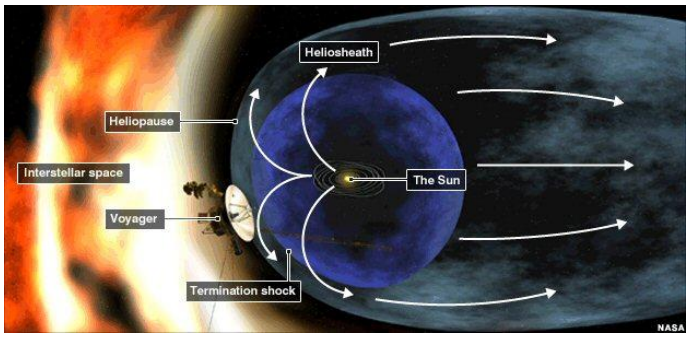
The diagram above shows the trajectories of the NASA's Voyager probes 1 and 2 along with Pioneer 11 and 12. These probes have reached the greatest distances of human made machines. On 12th January 2020 NASA revealed that Voyager 1 had reached a distance of 152.2 AU (22.8 billion kilometres) from Earth.



NASA's Voyager 1 Space Probe

NASA announced in June 2012 that the probe Voyager 1 (launched on 5th September 1977) was detecting changes in the environment that were suspected to correlate with arrival at the Heliopause. Voyager 1 had reported a noticeable increase in its detection of charged particles from interstellar space which is normally deflected by the solar winds produced by the Sun within the Heliosphere. The craft thus began to enter the interstellar medium at the edge of the Solar System.

What this meant was Voyager 1 and Voyager 2 had entered Deep Space and left our Solar System. The probes had become the first objects made by Humans to actually leave our Solar System. In doing so they also confirmed the distance to the edge of the Solar System (the Heliopause) at 22.8 billion kilometres.

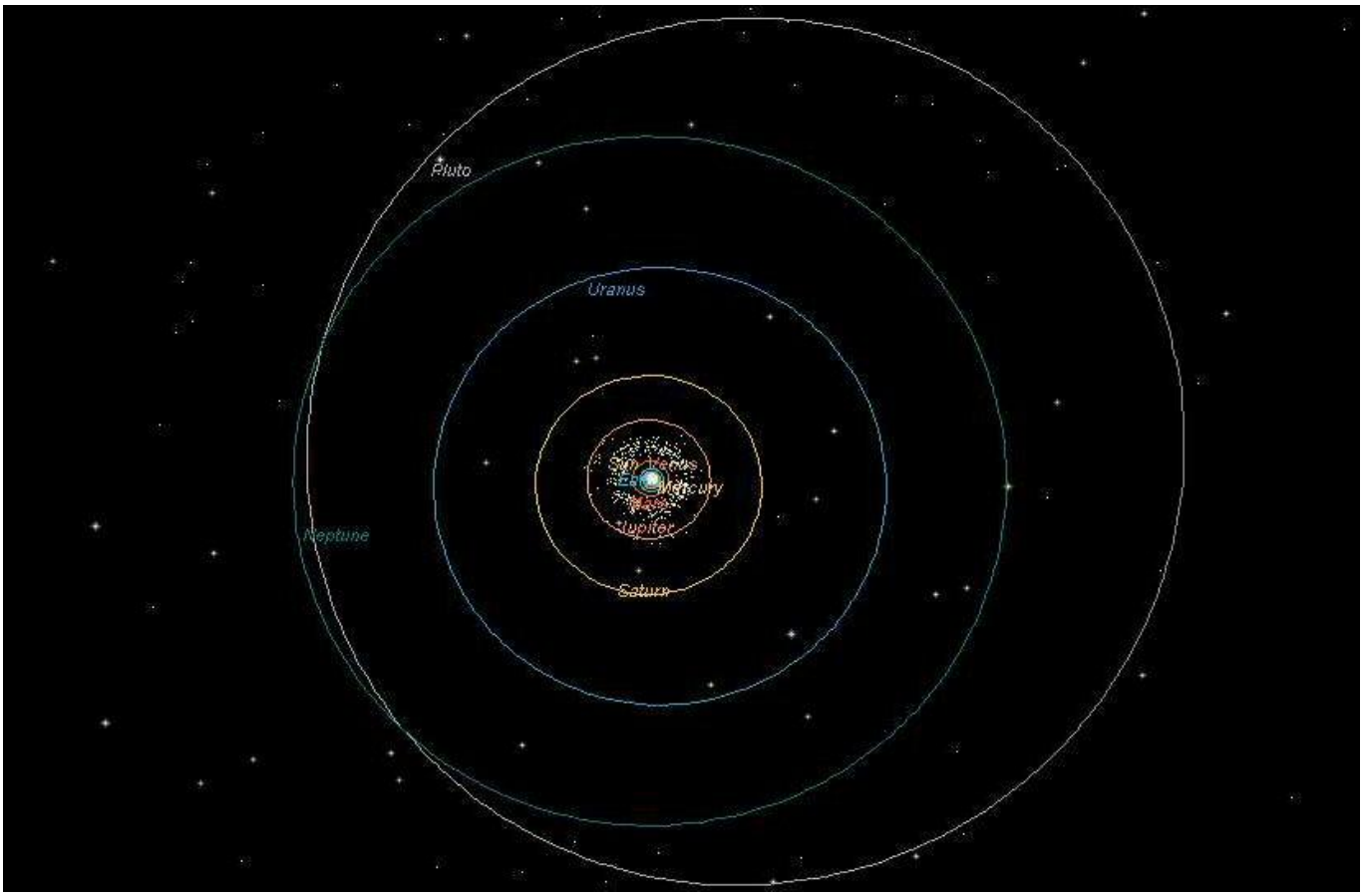


An artist's impression of the Heliosphere

The diagram above shows in dynamic detail how we perceive the Heliopause and how it creates a 'bow wave' where it is interacting with energetic deep space 'cosmic' particles. In reality all the Voyager experience as it entered deep space was less dramatic and amounted to counting an increase in the cosmic particles that pervade deep space.

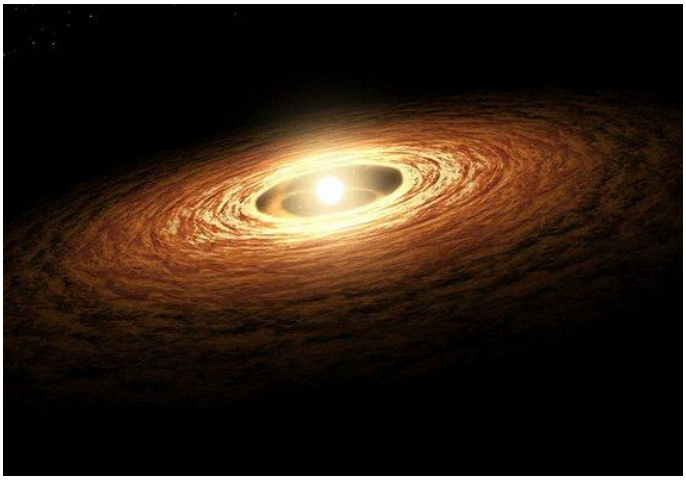
The Heliopause pushes the cosmic particles around the Heliosphere as shown by the white arrows. These particles are then directed around the outside of the Heliosphere and therefore are not detected inside. So when the Voyager probes started to detect these particles it indicated the probes had left the Solar System and had entered Deep Space.

THE DEVELOPMENT OF OUR SOLAR SYSTEM



The orbits of the main planets and Minor (dwarf) planet Pluto

The chart above shows how we think of our Solar System as it is now but it was not always like this. It is thought there were originally many more planets. There may have been up to 80 planets but due to close encounters or collisions many planets were lost. Close encounters can change the orbits of planets and may cause them to be thrown out of the Solar System or sent crashing into the Sun.



The early formation of our Solar System

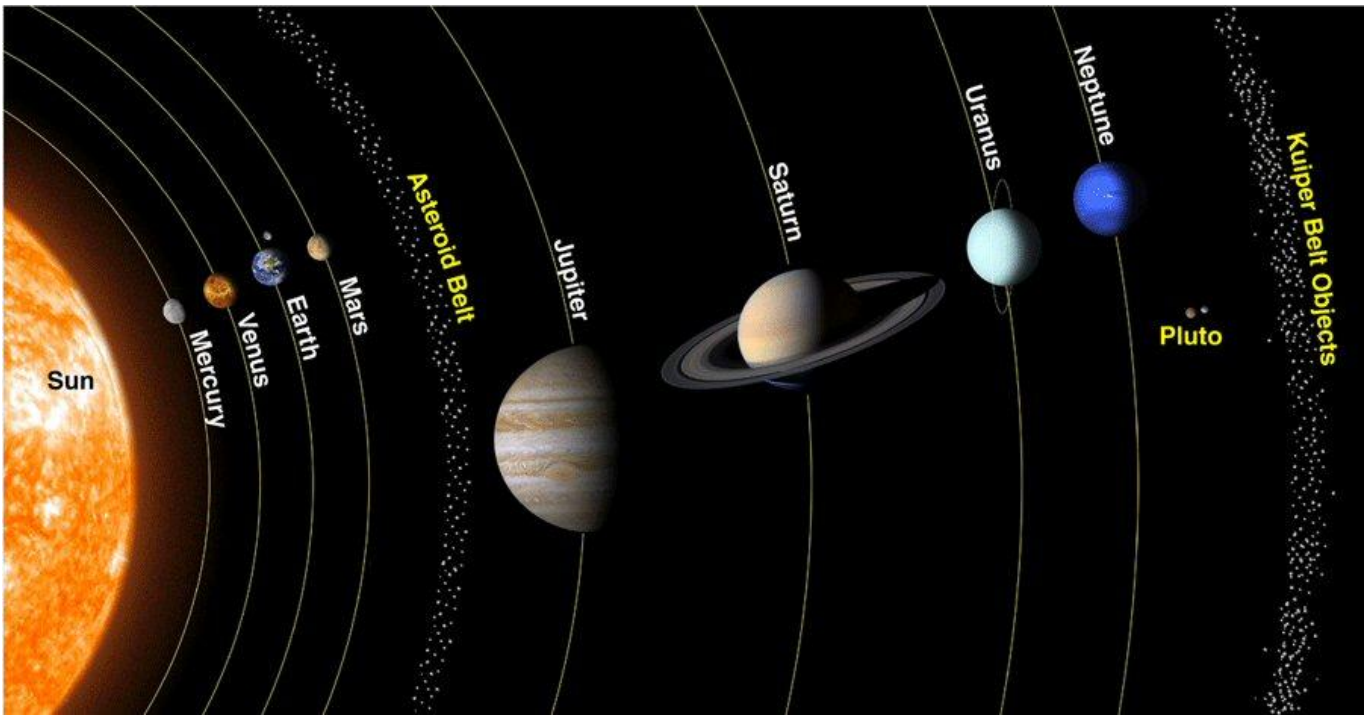
It is almost certain that the early Earth was hit by another planet that we call Thea. Thea was about the same size as Mars and is thought to have hit Earth off centre, crashed right through Earth knocking off a huge mass of rock and some of the Iron core. The debris was thrown into orbit around the molten remains of Earth. The Iron including the core of Thea soon crashed back on to the remains of Earth causing another massive impact.

Much of the remaining mass of rock remained in orbit and formed into our Moon. The impact of Thea knocked Earth off its axis and caused the 23.4º tilt of Earth's axis that we see today. Thea was completely destroyed and became part of Earth as our planet cooled and became the planet we live on today.

An artist's impression of the Great Thea Impact

A number of the other planets and their moons also show signs that they have been involved in major impacts. Astronomers and scientist believe there are billions of wandering planets moving around our galaxy after being expelled from their developing solar systems.

Theorists have studied how solar systems evolve and now think that planets often migrate to different orbits and shuffle the other planets around until a stable system develops. It appears that there is not a standard plan for the structure for planetary systems.



The structure of our Solar System showing the orbits and Zones

The chart above shows the Sun, main planets and minor planets that make up our Solar System. Let us first clarify the terms we use. Our Sun is a star and is in many ways a very ordinary star. A star is a vast cloud of mainly Hydrogen with about 11% Helium. This cloud has been compressed by gravity into its most compact shape which is a sphere. The enormous force of gravity produces Nuclear Fusion that powers the star and causes it to shine.

Planets are objects that orbit a star and have cleared paths from the original disc and have become massive enough to become spherical. Our Solar System has eight main planets that in order out from the Sun are called: Mercury, Venus, Earth, Mars, Jupiter, Saturn, Uranus and Neptune. See the diagram above.

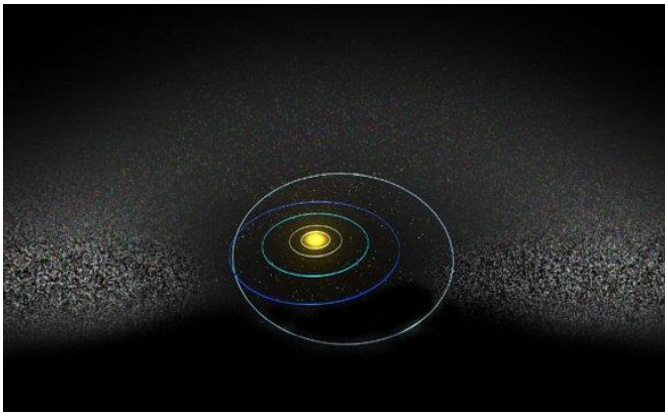
There are also smaller objects orbiting the Sun that we have called Minor Planets. These objects mainly orbit in specific zones around the Sun. Minor Planets that are large enough to become Spherical (over 300 to 500 km depending on composition) are called Dwarf Planets.

ASTEROIDS are mostly found between the orbits of Mars and Jupiter in what is known as the Asteroid Belt but there are some special groups of asteroids that orbit outside this zone. The sizes of these objects are from a few metres to a few hundred kilometres. They are mainly comprised of rock and Iron.

DWARF PLANETS are found beyond the orbit of the outermost main planet Neptune. These are composed mainly of water ice and frozen gases. When the Solar System first formed the Sun was more powerful than it is now and produced powerful ultraviolet radiation. Any volatile materials on the inner planets were vaporised by the radiation and blown away into the outer reaches of the developing Solar System. Here these volatile materials cooled and froze into ice and accumulated into objects up to a few thousands of kilometres in size.

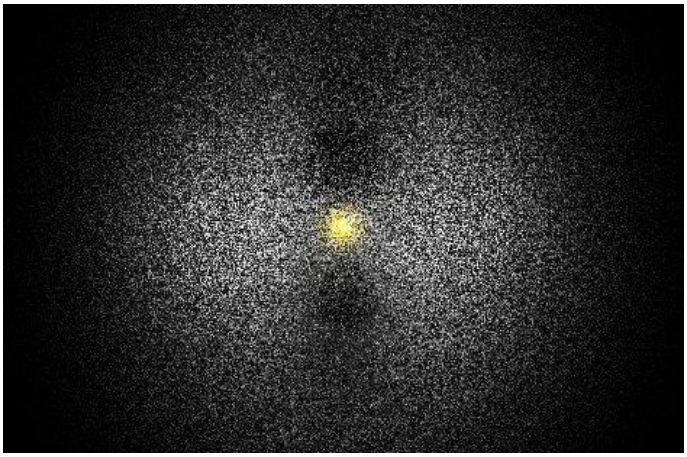
There are vast numbers of these Dwarf Planets orbiting the Sun beyond the orbit of the outermost main planet Neptune so Pluto is just the closest of these objects.

This Minor Planet Zone beyond the orbit of Neptune is called the Kuiper Belt and may contain millions of icy objects with many around the size of Pluto. This is why the decision was made to reclassify Pluto. So far there have been over 1000 objects, like Pluto and around the size that have been found, identified and named.



The Kuiper Belt beyond the orbit of Neptune

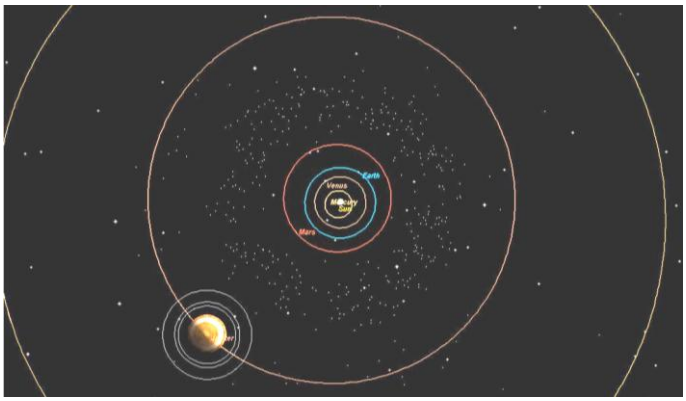
There is also thought to be a halo of icy objects beyond the Kuiper Belt and surrounding the Sun that is called the Oort Cloud but these objects are too far away to detect.



The Oort Cloud

THE PLANETS OF OUR SOLAR SYSTEM

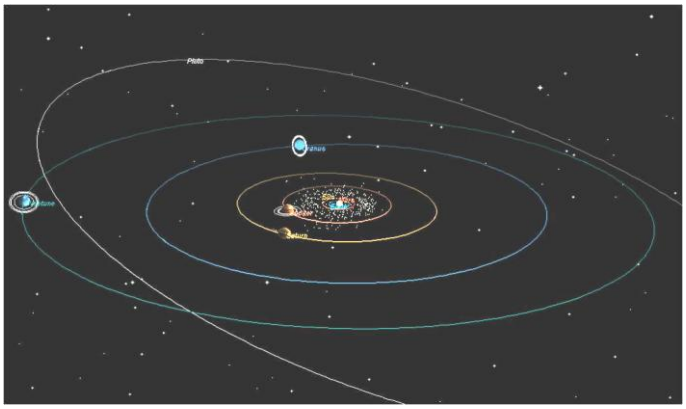
We have seen in the previous pages how our Solar System was formed now we will look in a little more detail at the various objects that populate this system. We have seen that the Sun is a star and it is by far the largest and most important thing in the Solar System. Its gravity holds the Solar System together and its energy powers the various processes that are active within the system.



The inner Terrestrial Planets

The four inner planets Mercury, Venus, Earth and Mars are the smallest and are comprise of rock with an Iron core. They are clustered closely around the Sun with their orbits spaced about 50 million kilometres apart. They are called the 'Terrestrial Planets' because they are 'Earth like'. Earth is the only Terrestrial Planet with a significant Moon but Mars does have two small moons. Moons are objects that orbit the planets.

There is a large gap between the Terrestrial Planets and the next two planets out from the Sun. In this gap there are millions of small lumps of rock and Iron we call these Asteroids. A few of these larger asteroids are big enough to become spherical and can be seen using a medium sized telescope.



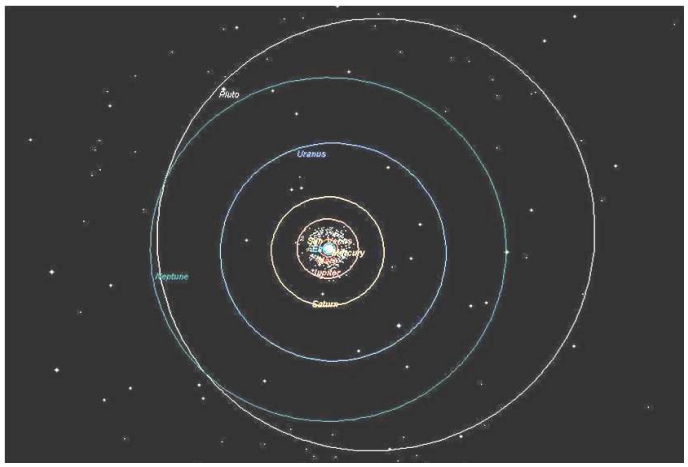
The Gas and Ice Giant Planets

Beyond the Asteroid Belt are the two Gas Giant Planets Jupiter and Saturn. Jupiter is the largest planet and is comprised mainly of Hydrogen gas with traces of other gases. Jupiter has beautiful cloud formations that can be seen using a telescope. These features can be seen even using a small telescope (100mm to 150mm aperture) but more detail will be seen using larger telescopes. Jupiter has four large moons that can be seen using the smallest telescopes and even a good pair of binoculars. It has many smaller moons but these are too small and faint to be seen using modest telescopes.

Saturn is the second largest planet and is famously the one with a beautiful ring system. The ring system and one of Saturn's many moons called Titan is visible using the smaller telescopes previously mentioned. Saturn is also comprised mainly of Hydrogen gas and has surface markings but they are not as noticeable as those seen on Jupiter. Details in the ring system can be seen using a larger telescope and five or six of the smaller moons may visible on a clear night.

The orbits of the outer planets are much further apart than the Terrestrial Planets so there is a noticeable difference in brightness and size between Jupiter and Saturn. This is because the orbit of Saturn is about as far from Jupiter as Jupiter is from us therefore Saturn appears less than half the diameter and much fainter.

The outer most planets are Uranus and Neptune that are known as the Ice Giants. Jupiter and Saturn are over ten times the diameter of Earth but Uranus and Neptune are about four times the diameter of Earth so are still regarded as giants. Both of the Ice Giants appear blue but look more like 'fuzzy stars' than the other planets.



The planets and Pluto

Beyond the orbit of the outer planet Neptune is an area called the Kuiper Belt. In this area is a huge ring (torus) of icy minor planets orbiting the Sun at vast distances. There are millions of these objects but they are very widely separated in space. Occasionally they may have a close encounter and could be slightly nudged by gravity out of their orbit. This may send one on a new path that will take it spiralling in towards the Sun.

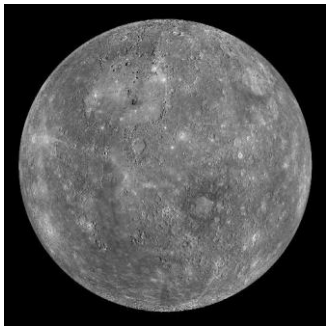
As this object that we now call a Comet moves closer to the Sun its ice will begin to melt. The melt will form a halo around the comet that we call the Coma. Radiation from the Sun known as the Solar Wind will push the lighter gas from the melt into a tail pointing away from the Sun. This tail can be millions of kilometres long and can sometimes be seen from Earth as a tailed comet.

Some gas may be ionised by the solar wind and form a second straight (usually blue) tail. Particles of dust can be released from the 'dirty' ice as the comet melts. As these dust particles are heavier than the gas released they tend to carry on along the same path as the comet. We call these particles 'Meteoroids'. If the comet crosses the orbit of Earth a trail of meteoroids can be left in the path of Earth. When Earth passes through this trail of dust the particles will burn up as they hit the upper atmosphere as a 'Meteor'. Earth travels at about 100,000 km/h along its orbit so there is a lot of Kinetic Energy in the particle to heat the atmosphere.

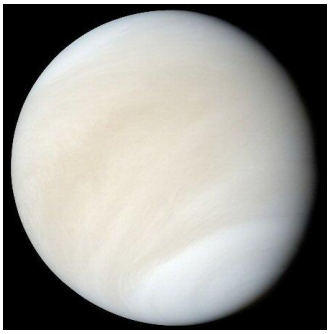
THE PLANETS AND THIER MOONS

We have looked at our Solar System as our star, the Sun, being the dominating central object of the system with the Planets, Dwarf Planets, Asteroids and Comets having primary orbits around the Sun. Now we can consider those objects that have secondary orbits within the Solar System. We call these Moons as they orbit around planets that in turn orbit the Sun.

There are two planets that do not have moons these are MERCURY and VENUS the two innermost planets of the Solar System.



Mercury



Venus

MARS has two moons but they are very small and are thought to be asteroids that have been captured by the gravity of Mars and are now in orbit around the planet. Phobos is 22.2 km wide and Deimos is 12.6 km wide.

The moons of Mars Phobos and Deimos

EARTH has the largest moon compared the size of its parent planet of all the planets and is sometimes said to be almost a double planet system.

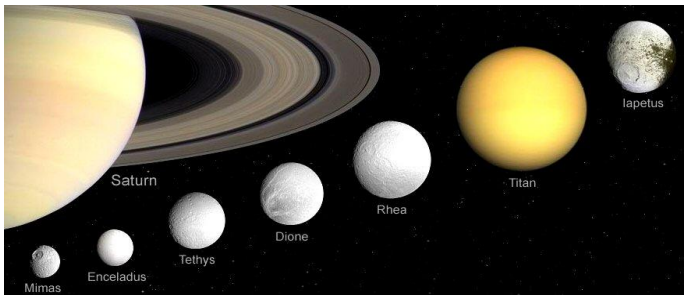
Earth and Moon comparison of size

JUPITER is the largest planet and classified as is a Gas Giant Planet. It has about 80 moons but only four are large and about the same size as our Moon. They are called Io, Europa, Ganymede and Callisto. These four largest moons are known as the Galilean moons as they were discovered by Galileo Galilei in 1610. Ganymede is the largest moon in the Solar System at 5262km in diameter. The Galilean moons can be seen in any telescope and even using binoculars.

Jupiter's Galilean moons are very different to each other in size and appearance. Io is the inner moon and is covered in active volcanoes. Europa is the smallest and mainly water ice. Ganymede is the largest moon and Callisto has the oldest surface in the Solar System.

Jupiter's largest 'Galilean Moons'

SATURN has 82 moons but most are quite small. One moon Titan is 5150 km in diameter. It is the second-largest moon in the Solar System after Jupiter's moon Ganymede. The other moons are smaller but Titan and three or four of the other moons can be seen using a medium sized (150 – 200mm) telescope.



The largest of Saturn's 82 moons

URANUS has 27 known moons with four over 1000km in diameter. The largest is Titania which is 1580km with Oberon almost as large at 1524km in diameter. All of the moons of Uranus are too small and faint to be seen using a telescope but can be imaged using a large telescope.

The moons of Ice Giant Planet Uranus

NEPTUNE has 13 known moons including one large moon called Triton. Triton was a surprise to scientists when the first close up images were returned to Earth. It was shown have a geologically active surface. Geysers were seen erupting with dark plumes and leaving trails across the surface. This indicated that there was a heat source below the surface and winds in the thin atmosphere. None of the moons can be seen using an amateur astronomer's telescope.

The moons of Neptune

CONSTELLATION OF THE MONTH – ORION

The Constellation of Orion photographed by Nicky Fleet

Orion (the Hunter) is one of the best known constellations and one of the easiest to recognise and dominates the southern sky at this time of the year. There are many depictions of Orion shown on many different star charts. Some old pictures of Orion are very beautifully drawn in fact some are so beautiful that the artists even moved the positions of some of the stars so they would fit the image they had drawn.

Orion the Hunter appears in the winter sky, with his club held over his head and his shield (sometimes shown as a lion's skin) held out in front of him. His hunting dogs, Canis Major (the star Sirius) and Canis Minor (the star Procyon) following behind him.

Greek mythology tells us that Orion was known as a great hunter. He boasted that he could rid the earth of all the wild animals however this angered the Earth goddess Gaia. She sent a scorpion to defeat Orion. Orion tried to battle the scorpion but he quickly realised that he could not shoot his arrow through the creature's armour. To avoid the scorpion he jumped into the sea.

It was then that Apollo (the Greek god of the Sun) decided to take action. He pointed out to his twin sister Artemis a small black object in the sea. Claiming it was a horrible villain and he dared her to shoot it with her bow and arrow. Artemis easily hit the target. However when she swam out to retrieve her victim she discovered that the villain was in fact her friend Orion.

Artemis begged the gods to bring Orion back to life but they refused. Instead she put Orion's picture in the sky so she could always see and remember him.

Orion is one of the few constellations that does look (with a little imagination) like what it is named after. The most obvious feature is the line of three stars, called Alnitak, Alnilam and Mintaka that make up Orion's belt. From his belt we can see two bright stars called Saiph and Rigel below. These define the bottom of his 'skirt like' tunic. Above the belt are two stars Betelgeuse and Bellatrix that denote the position of his shoulders.

Above and between his shoulders is a little group of stars that mark out the head. From his right shoulder (Bellatrix) he holds out a shield. From his left shoulder (Betelgeuse) a club is held above his head. It almost looks as if Orion is fending off the charge of the great bull Taurus who is located above and to the west (right) of Orion.

Down from Orion's very distinctive belt there is a line of stars, ending at the star Nair al Saif that looks very much like a sword attached to his belt. Here can be found the main interest in Orion, the Great Nebula, see the next page for details.

If an imaginary line is traced down from the belt for about six belt length towards the south eastern horizon, a bright twinkling star will be seen. This is Sirius, Orion's Large Hunting Dog in the constellation of Canis Major. It is the brightest and closest star to be seen from the UK at just 8.6 light years from us.

To Orion's left (east) of Betelgeuse a quite bright star in a rather large empty area of sky can be seen. This is Procyon in Canis Minor, Orion's Small Hunting Dog. Coincidentally both of these 'dog stars' are double stars that have an invisible companion. They were normal stars that had reached the end of their lives and used all their Hydrogen fuel. They have collapsed to become very compact and dense White Dwarfs stars.

M42 THE GREAT NEBULA IN ORION

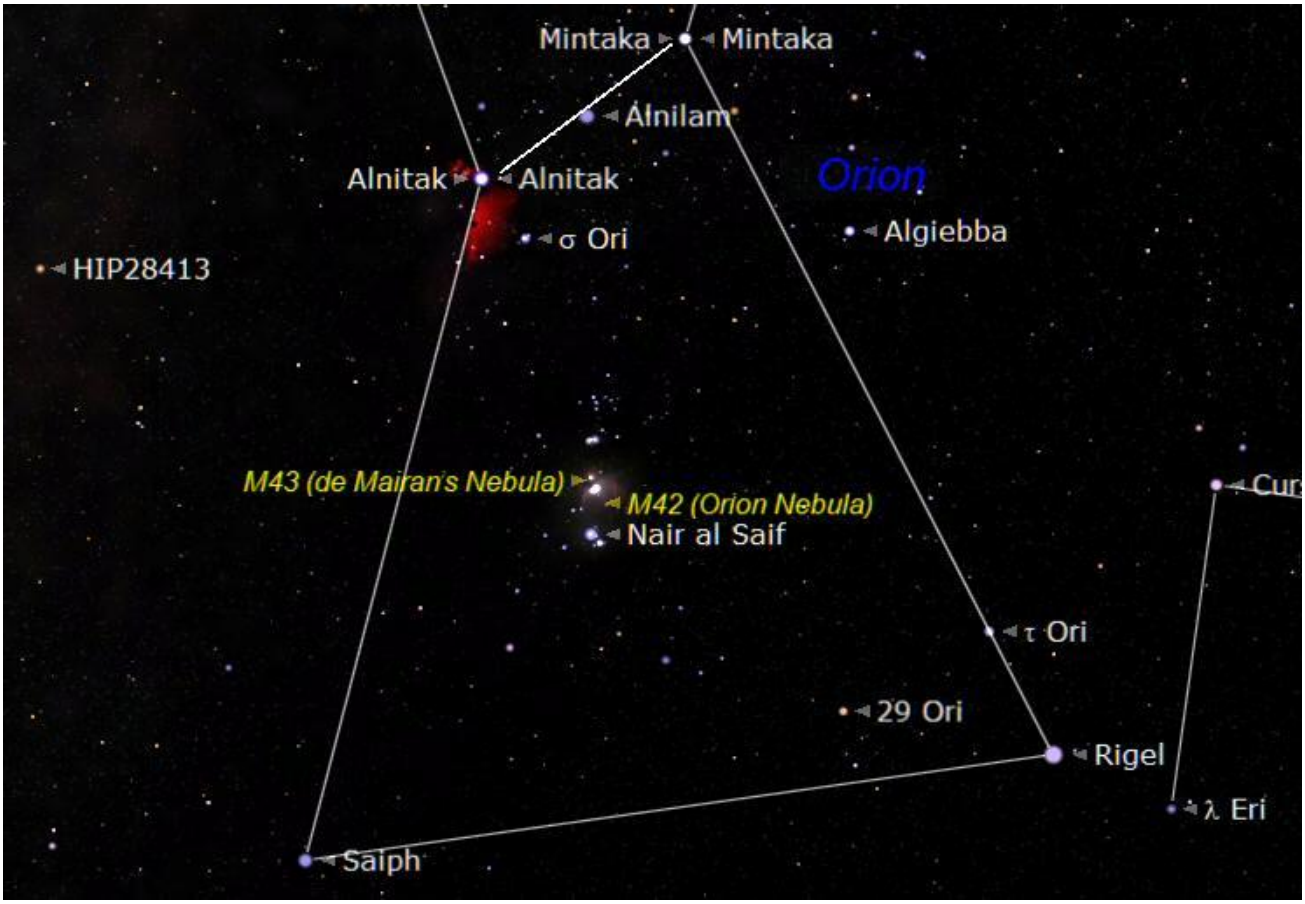
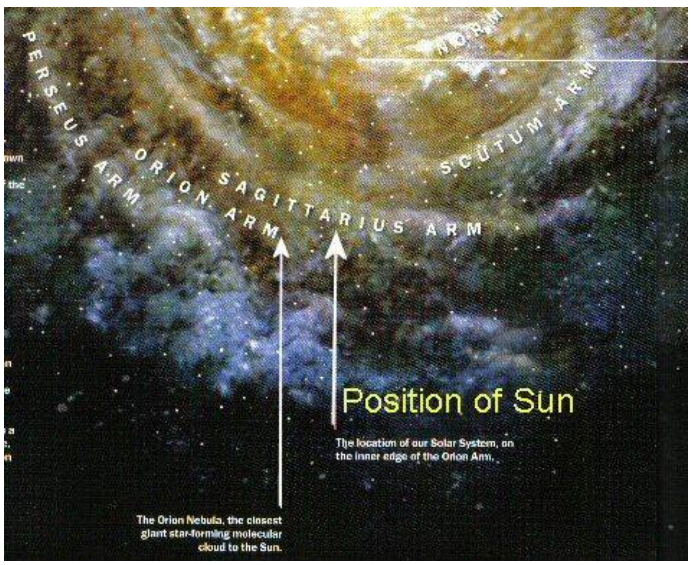


Chart showing M42 the Great Nebula in Orion

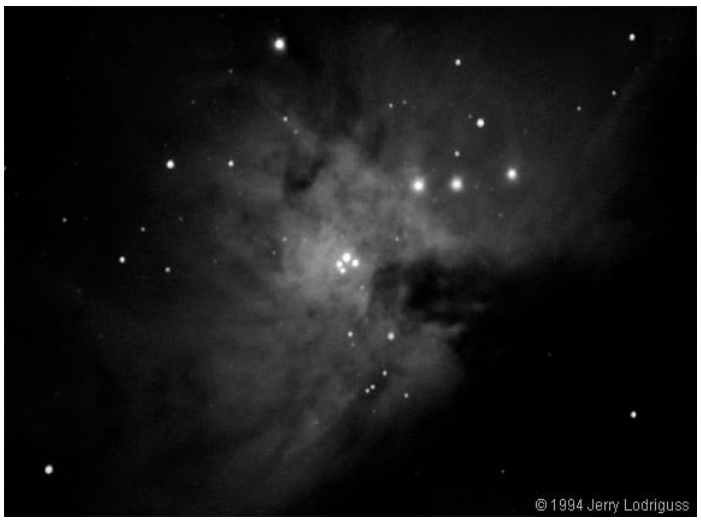
When we look towards Orion we are looking into one of the nearest spiral arms of our galaxy the Milky Way. Our Sun appears to be located in the area between two spiral arms. Towards the centre of the galaxy from our point of view is the Sagittarius Arm and looking away from the centre is the Orion Arm.



An artist impression of our position in the Galaxy

Most of the stars in Orion are located about 900 light years away from us including Rigel but Betelgeuse is much closer at only 310 light years distant. Because the stars of Orion are in a spiral arm there is a lot of gas and dust around the whole area of the constellation. Huge numbers of stars are hidden by the gas and dust.

Below the line of three stars of Orion's belt there is a vertical line of stars forming his sword (hanging below his belt). In the line of stars making up Orion's sword a hazy patch can be seen using binoculars or even with just the naked eye on a clear night. The hazy patch is known as M42 (Messier 42), the Great Orion Nebula. This Nebula is part of a gigantic cloud of Hydrogen gas mixed with other gases and dust from which new stars are being formed. Through a pair of binoculars the nebula looks like a small fuzzy patch in the line of stars.



The Trapezium cluster superimposed on M42

When seen through a telescope the 'fan shaped' cloud like structure can been made out. Swirls of gas and dust can be seen, some are lit up but some are dark and silhouetted against the illuminated clouds behind.

The cloud is actually illuminated by the young stars forming in it. Most of the energy illuminating this nebula comes from a group of 4 stars known as the Trapezium. These stars have formed out of the gas and dust in the nebula; they are young, hot and very active. The Trapezium can be seen easily using a small telescope. The four stars of the trapezium (there is a fifth fainter star) are just the brightest of what is an Open Cluster in the process of forming. The Orion Nebula actually contains many more very young stars that are still hidden by the gas and dust of the nebula.

Special telescopes that can detect ultraviolet and inferred radiation can be used to penetrate the gas and dust to see the stars forming inside the nebula. The image below shows most of the stars that are normally hidden by the gas and dust clouds.

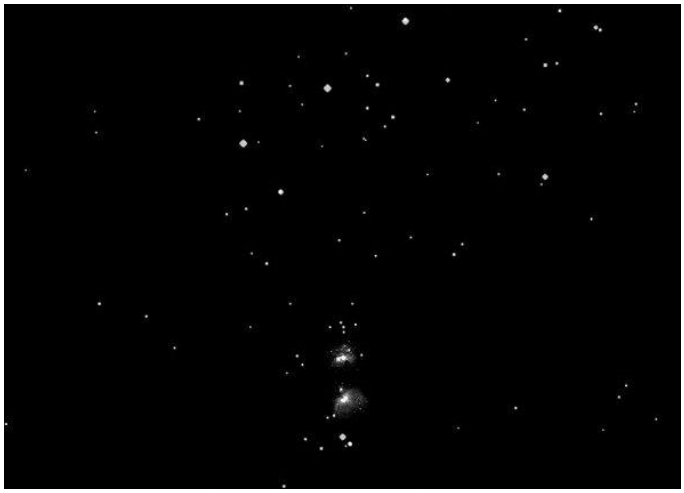
Stars forming in M42

Gravity draws the atoms of the gas together and as the gas becomes denser it pulls in even more until huge spheres of gas are formed. As the pressure in the core of a sphere increases the temperature rises to tens of millions of degrees and the Hydrogen atoms begin to fuse together to form atoms of Helium. In this process known as Nuclear Fusion a small amount of mass is lost and converted into energy in the form of a powerful flash of X-Rays. This heats the mass of gas of the sphere and it begins to shine as a bright new star.

Much of the gas and dust in the nebula shines by reflecting light from the very young stars of the Trapezium in the centre of the nebula. Some gas also produces its own light because the ultraviolet radiation energy from the powerful young stars excites the gas atoms. This causes them to glow somewhat like a fluorescent light or the Aurora (Northern Lights).

When a photon of ultraviolet light from the powerful young stars hits a gas atom it causes an electron to jump from its normal orbit to a higher orbit. After a very short time the electron jumps back to its original orbit and emits a flash of light. The colour of this light is unique to the type of atom that has emitted it. For example Hydrogen always emits red light. See the image opposite. ➔

The Orion Nebula can be seen with the naked eye from a dark location on a clear moonless night. It is easily seen using a pair of binoculars. The image below shows the sort of view seen using a pair of 8 x 50 binoculars.



Binocular view of M42 with Orion's belt at the top

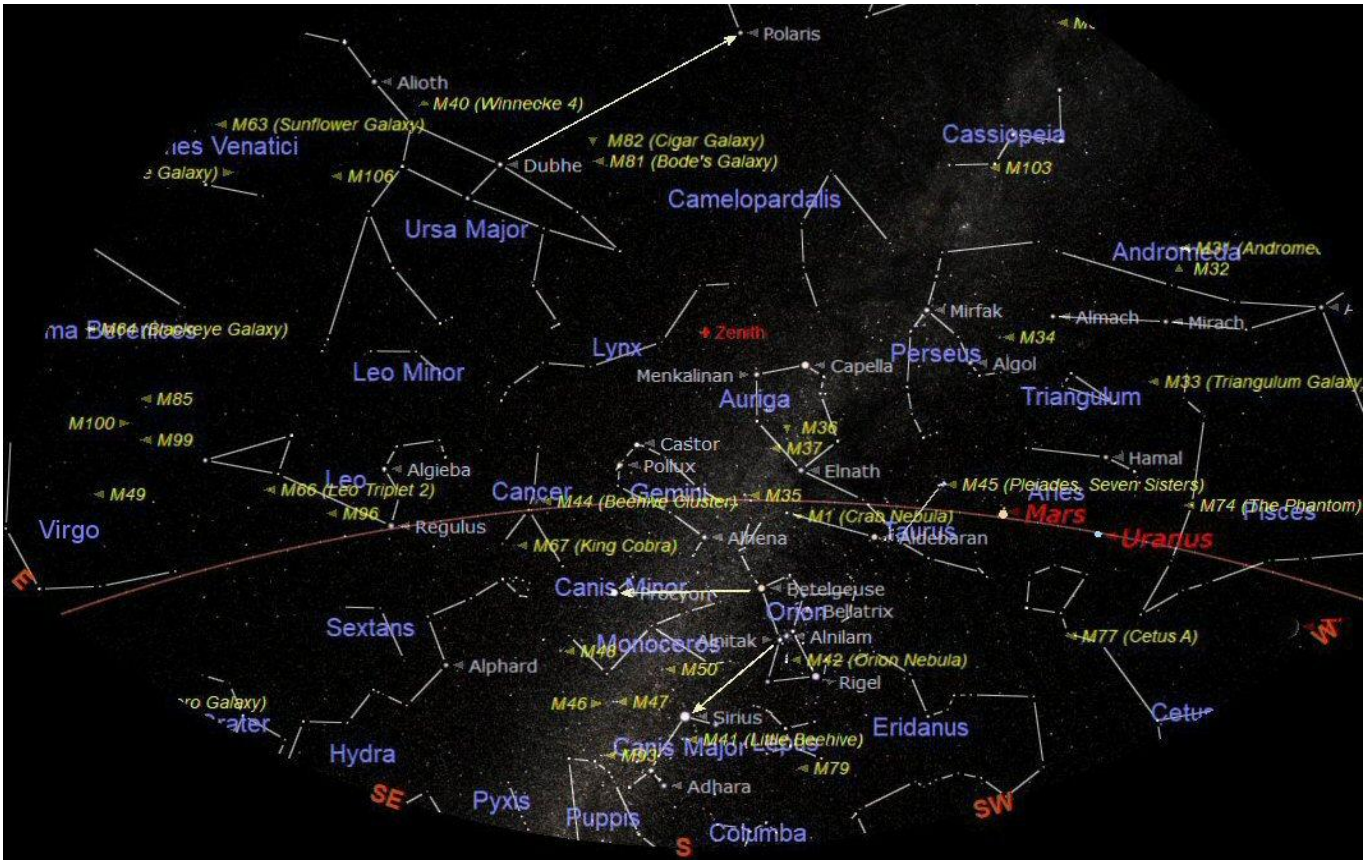
A small telescope will show a larger view and some detail in M42. Structure in the nebula can be seen with parts of the nebula illuminated and other parts appearing dark.

The sort of view seen using a small telescope

A larger telescope will show more detail in the structure with the nebula made up of wisps of gas appearing. Photographic images show much more detail including colour in the clouds of gas and dust. The red in the image below is typical of the emissions from Hydrogen gas in the nebula.

A photographic image of M42

A TOUR OF THE NIGHT SKY - FEBRUARY 2021



The chart above shows the night sky looking south at about 20:00 GMT on 15th February. West is to the right and east to the left. The point in the sky directly overhead is known as the Zenith and is shown (in red) at the upper centre of the chart. The curved brown line across the sky at the bottom is the Ecliptic or Zodiac. This is the imaginary line along which the Sun, Moon and planets appear to move across the sky. The brightest stars often appear to form a group or recognisable pattern; we call these 'Constellations'.

Constellations through which the ecliptic passes this month are Aquarius (the Water Carrier), Pisces (the Fishes), Aries (the Ram), Taurus (the Bull), Gemini (the Twins), Cancer (the Crab), Leo (the Lion) and Virgo (the Virgin).

Close to the south western horizon is the constellation of Pisces (the Fishes). Pisces a little faint and indistinct but it is easy to find this month because the bright and orange planet Mars is located within its boundaries.

Prominent in the south west in the early evening is the constellation of Pegasus (the Winged Horse). The main feature of Pegasus is the square formed by the four brightest stars. This asterism (shape) is known as the Great Square of Pegasus. The square is larger than might be expected but once found is easier to find again. Attached to the star at the top left of the Great Square is the '>' shape of Andromeda. Andromeda contains the only 'naked eye' galaxy Messier 31 (M31). It is visible as a small 'fuzzy' patch of light using binoculars.

High in the south is the constellation of Taurus (the Bull). The most obvious star in Taurus is the lovely Red Giant Star called Aldebaran. It appears slightly orange to the 'naked eye' but it is very obviously orange when seen using binoculars or a telescope. Aldebaran is located at the centre of the 'flattened' X shape formed by the brightest stars in Taurus. At the end of the top right (upper west) arm of the 'X' is the beautiful 'naked eye' Open Star Cluster Messier 45 (M45) known as the Pleiades (or the Seven Sisters). It really does look magnificent using binoculars. See the January issue.

Following Taurus is the constellation of Gemini (the Twins). The two brightest stars in Gemini are Castor and Pollux and they are named after mythological twins. To the north of Taurus is the odd pentagon shape of Auriga (the Charioteer). Dominating Auriga is the brilliant white star Capella which is almost directly overhead. For those with a telescope there is a line of lovely open clusters to search out in Taurus and Auriga. These are M35 in Taurus and M36, M37 and M38 in Auriga.

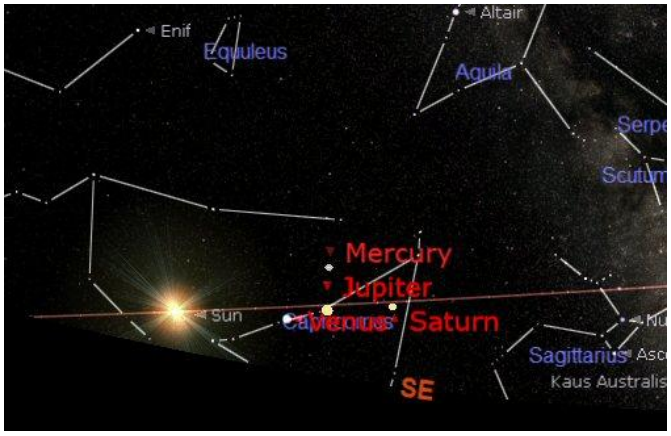
To the east (left) of Gemini is the rather indistinct constellation of Cancer (the Crab). The stars of Cancer are quite faint and can be difficult to discern especially in a light polluted sky. It is really worth searching out Cancer using binoculars or a telescope to see the Open Cluster M44 (the Beehive Cluster). M44 is older and further away than M45 (the Seven Sisters) so is fainter than M45 but still looks lovely. It has a group of stars that resemble an old straw Beehive with bees around it.

To the south of Taurus and Gemini is the spectacular constellation of Orion (the Hunter). Orion is one of the best known constellations and hosts some of the most interesting objects for us amateur astronomers to seek out. Orion is the constellation of the month. See pages 8, 9 and 10.

The Milky Way (our Galaxy) flows down through the 'W' Cassiopeia in the high North West. Then down through Auriga, between Taurus and Gemini and down through Orion to the South Eastern horizon.

THE SOLAR SYSTEM - FEBRUARY 2021

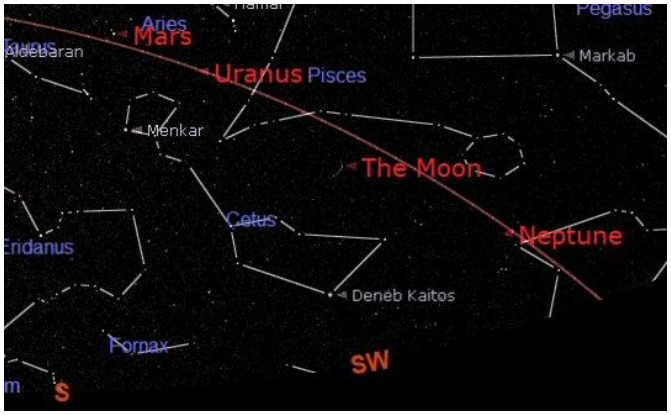
MERCURY will be rising just before the Sun low in the east this month. It will be difficult to see this month. The smallest planet will be close to Jupiter and Saturn as they rise in the bright dawn sky.



Mercury, Venus, Jupiter and Saturn at sunrise

VENUS is now too close to the Sun, low in the eastern early morning sky and will be very difficult to see. It is moving towards the Sun and moves into Superior Conjunction (behind the Sun) on 25th March 2021.

MARS is still well positioned in the evening sky for observing and will be in the south as the sky darkens. However it is getting smaller at about 7 arc-seconds as Earth pulls further away from it. Mars will be around until May but will be moving closer to the south western horizon and appearing smaller. After it has moved over the horizon we will not see it again for two years.



Mars, Uranus and Neptune after sunset

JUPITER will not be visible this month as it was in conjunction with the Sun on 29th January so is hidden in the glare of the sky just before the Sun rises. It will start moving far enough away from the Sun to see in the morning sky next month. From March onwards it will be worth getting up in the early hours to see it rising in the South East from about 04:00. Jupiter and Saturn will move further away from the Sun during the year and will be at their best for observing in August. Jupiter will be at opposition on 20th August.

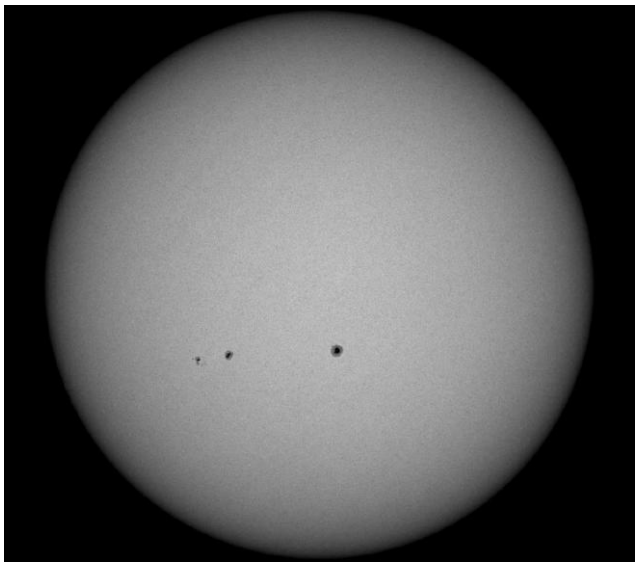
SATURN will be even more difficult to see in the bright early morning sky than Jupiter. The ringed planet rises just before Jupiter the South West at about 04:00. It is moving into the early morning sky before sunrise after its journey behind the Sun during its conjunction with the Sun on 24th January. Saturn will be at its best this year on 2nd August when it will be at opposition so it will be due south at midnight.

URANUS will be easy to find as it will be close Mars. This month it will be in the south west and at its best at about 18:30 but it will need a telescope to see it.

NEPTUNE will not be easy to observe this month as it will be in the south west and close to the horizon. It will be setting over the horizon at about 19:00 and will be moving into conjunction with the Sun on 11th March. It will require a telescope to see in the bright sunset sky.

THE SUN

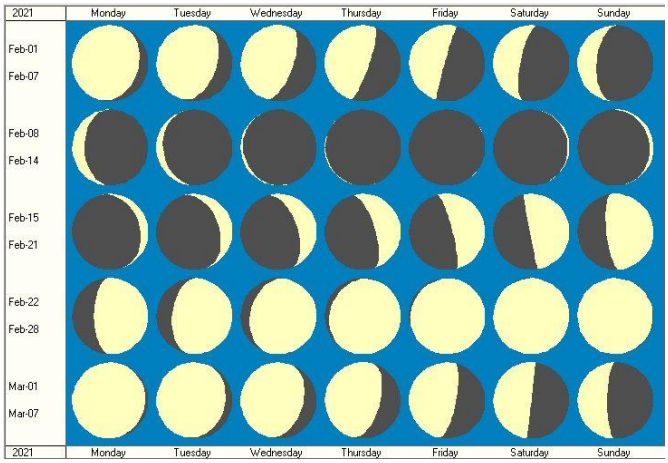
The Sun rises at about 07:35 at the beginning of the month and 06:50 at the end. It sets at 16:50 at the beginning of the month and 17:40 at the end. There have been some very nice Sunspots recently like those seen over Christmas see the following image.



Sunspots imaged by SOHO on 27th December

It has been confirmed that the Sun has moved into its increasing active phase for Solar Maximum 25. We can expect the numbers of sunspots and surface activity to increase during this year. A special Solar filter must be used when observing the Sun.

THE MOON PHASES DURING FEBRUARY



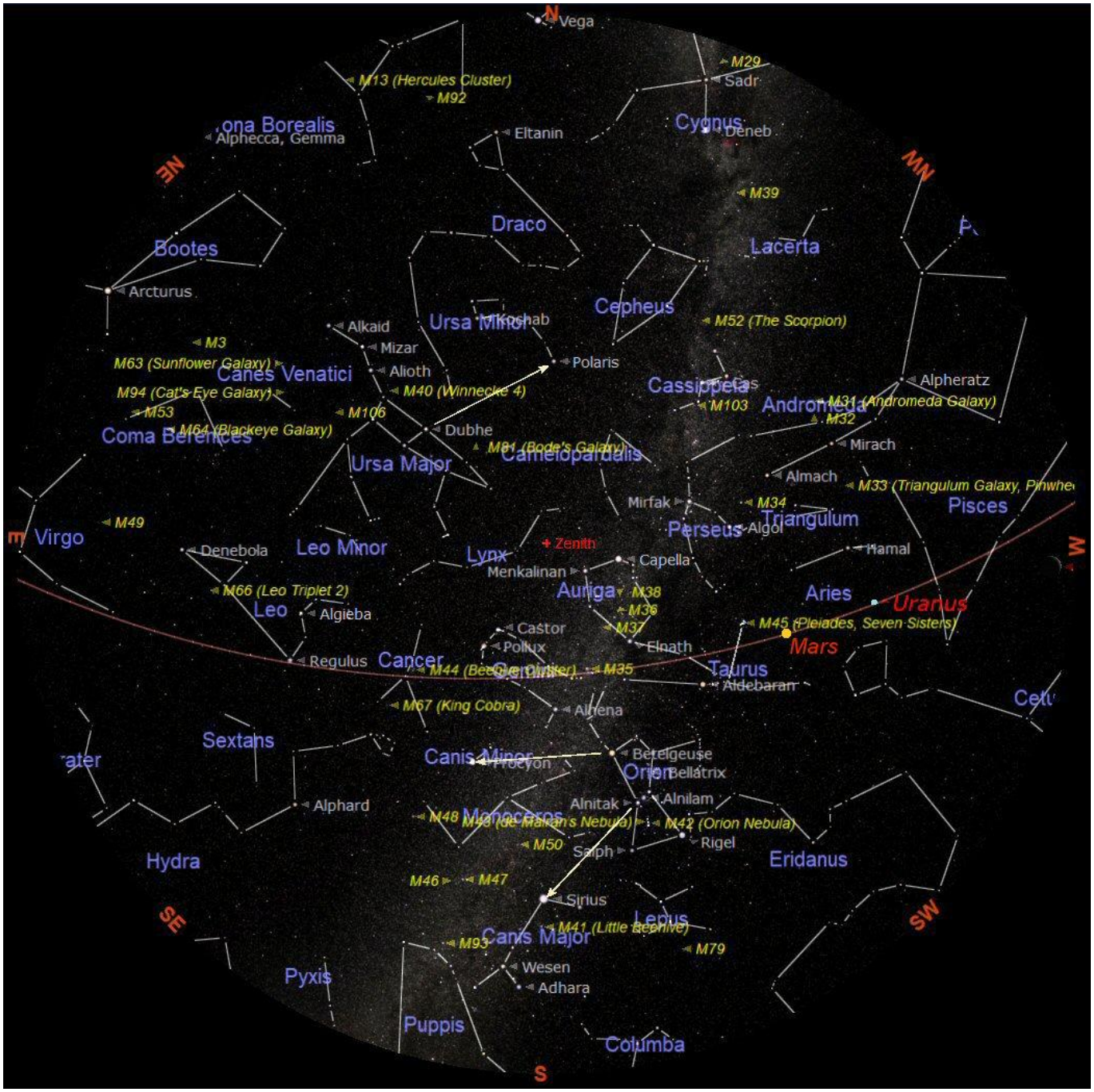
Last Quarter will be on 4th February

New Moon will be on 11th February

First Quarter will be on 19th February

Full Moon will be on 27th February

THE NIGHT SKY – FEBRUARY 2021



The chart above shows the whole night sky as it appears on 15th February at 21:00 (9 o'clock) Greenwich Mean Time (GMT). As the Earth orbits the Sun and we look out into space each night the stars will appear to have moved across the sky by a small amount. Every month Earth moves one twelfth of its circuit around the Sun, this amounts to 30 degrees each month. There are about 30 days in each month so each night the stars appear to move about 1 degree. The sky will therefore appear the same as shown on the chart above at 8 o'clock GMT at the beginning of the month and at 10 o'clock GMT at the end of the month. The stars also appear to move 15º (360º divided by 24) each hour from east to west, due to the Earth rotating once every 24 hours.

The centre of the chart will be the position in the sky directly overhead, called the Zenith. First we need to find some familiar objects so we can get our bearings. The Pole Star **Polaris** can be easily found by first finding the familiar shape of the Great Bear 'Ursa Major' that is also sometimes called the Plough or even the Big Dipper by the Americans. Ursa Major is visible throughout the year from Britain and is always quite easy to find. This month it is in the North East. Look for the distinctive saucepan shape, four stars forming the bowl and three stars forming the handle. Follow an imaginary line, up from the two stars in the bowl furthest from the handle. These will point the way to Polaris which will be to the north of overhead at about 50º above the northern horizon. Polaris is the only moderately bright star in a fairly empty patch of sky. When you have found Polaris turn completely around and you will be facing south. To use this chart, position yourself looking south and hold the chart above your eyes.

Planets observable in the evening sky: Neptune (early evening), Mars and Uranus.