NEWBURY ASTRONOMICAL SOCIETY
MONTHLY MAGAZINE –NOVEMBER 2020

A VERY UNUSUAL METEOR RECORDED BY RICHARD FLEET

A strange meteor recorded by Richard Fleet 22nd September 2020

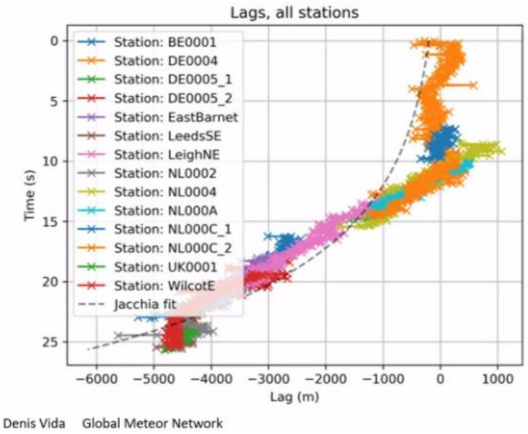
Richard Fleet who is an active member of the Newbury Astronomical Society has a rather unusual astronomical observatory at his home in Pusey, Wiltshire. It has no telescopes but it does have an array of night vision cameras. The observatory is one of a number across Europe dedicated to continually watching out for meteors. The cameras run continuously and if a movement is detected in the sky it will save the previous 10 seconds of video to memory on a laptop Hard Disk Drive.

When Richard examined the video recorded through the night of the 21st and 22nd September he noticed the meteor trail above. This trail was strange and unlike normal meteor trails. Normal trails appear and disappear in a second and are caught on just a few frames. This meteor was captured over a period of about 20 seconds.

Most meteor trails appear as a streak of light on one or a small number of frames. This meteor appeared as a bright dot on about 500 frames. It appeared to be a large object that did not 'burn up' as would be expected but appeared to just fade away. This was very odd.

Richard contacted other meteor watchers who confirmed they had also recorded this strange object. By using sightings at different locations the actual track and height of the object could be traced. It was found to have started this trail over Eastern Europe and travelled from East to West for about 900 km then disappeared over Bristol in the West Country.

The chart below shows the observations of all the stations that recorded the meteor. The data shows the meteor skimmed along the top of our atmosphere, bounced off and back into space. This was not the first time that this had been witnessed but it is very unusual.



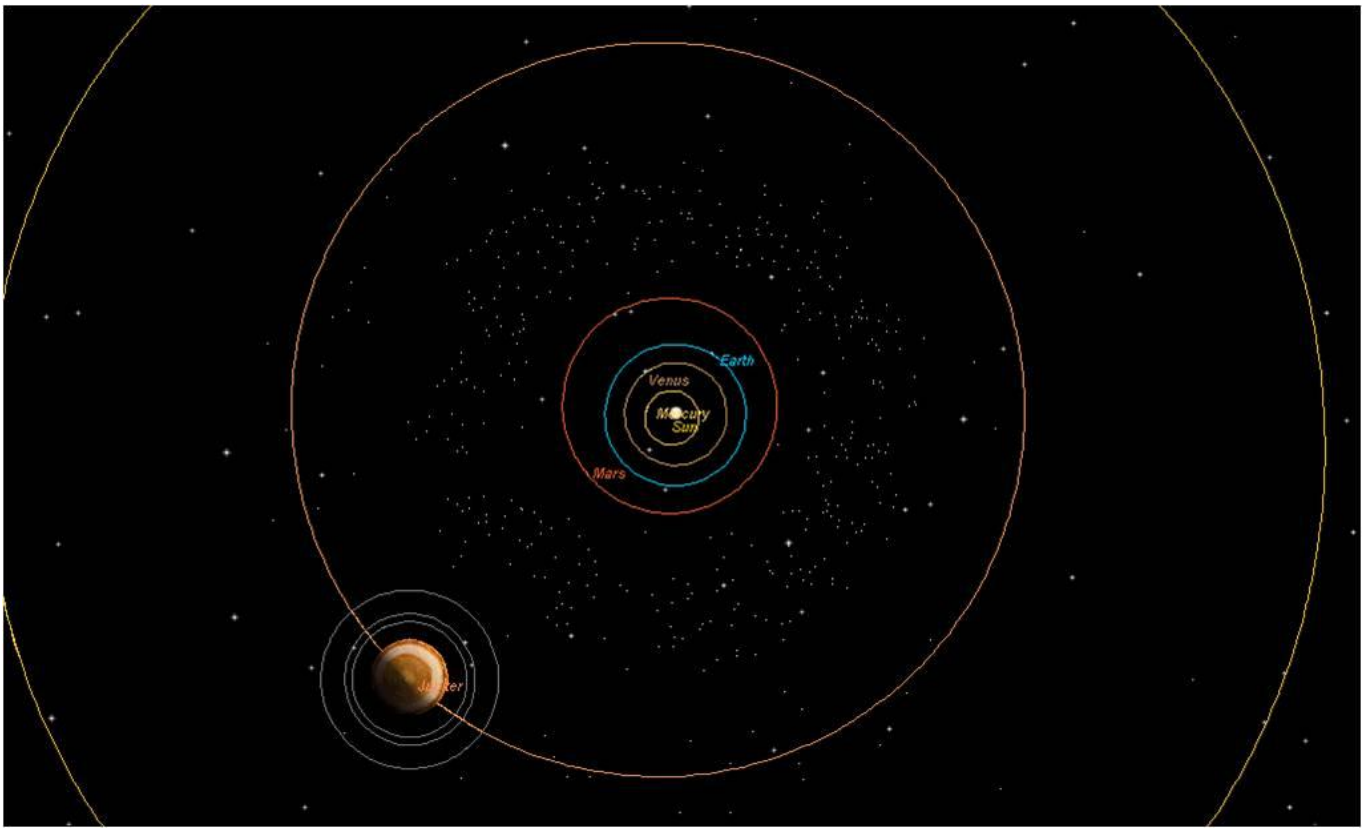
NEWBURY ASTRONOMICAL SOCIETY MEETING

6th November Rebel Star Sun's Greatest Mysteries
Website: www.newburyastro.org.uk

NEXT NEWBURY BEGINNERS MEETING

18th November The Leonid Meteors (Zoom meeting)
Website: www.naasbeginners.co.uk

VENUS – EARTH's 'EVIL TWIN'



The Inner Solar System and Jupiter

Venus is the second planet out from the Sun and in many ways the twin of our planet Earth. Venus is 12,104 kilometres in diameter so is slightly smaller than Earth that is 12,756 kilometres in diameter. It orbits 108.2 million kilometres from the Sun compared to Earth's orbit 149.6 million kilometres from the Sun. It is thought that the two planets have similar composition with one exception being the amount of water they have. The amounts of water may have been similar in the past but Venus appears to have lost nearly all its water.

Venus showing the very faint cloud formations

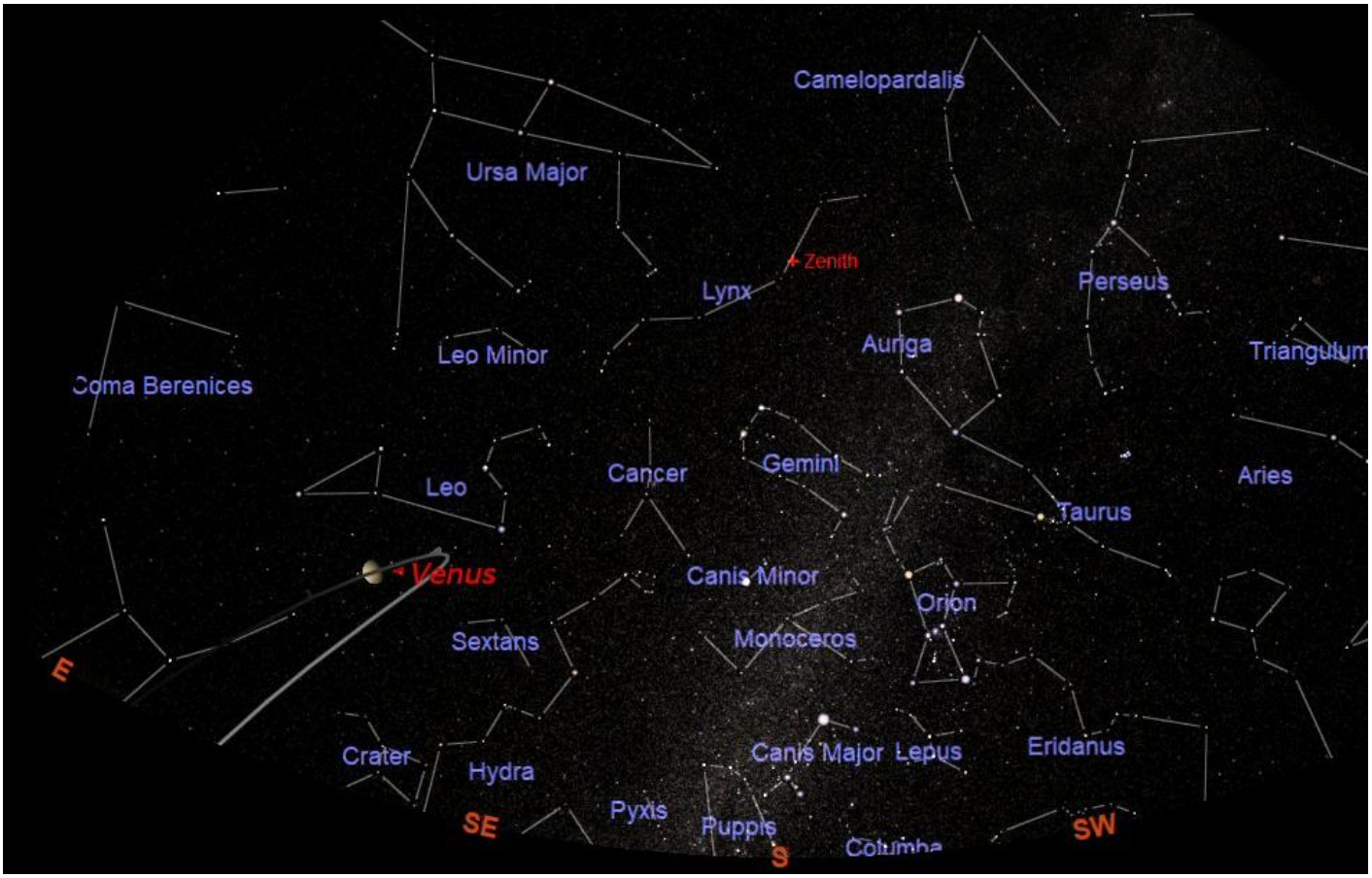
Venus is closer to the Sun and appears to have suffered a 'runaway greenhouse effect'. The additional heat from the Sun may have caused the surface temperature to rise and the Carbon that is trapped in the rocks on Earth was released into the atmosphere on Venus to form Carbon Dioxide (CO_2). The Carbon Dioxide allows the heat from the Sun to reach the surface but prevents it from being radiated back into space. The temperature then steadily increased in a runaway manner until it reached the 463°C surface temperature we see on Venus today.

The Carbon Dioxide (CO_2) atmosphere on Venus is not only hot but is very thick as well. The atmospheric pressure at the planet's surface is 90 times that on Earth, or roughly the pressure found 900m (3,000ft) underwater on Earth. If it was possible to stand on the surface of Venus (which it is not, it is far too hot) the view would be very odd because the refraction of light would cause large distortions compared to our atmosphere.

Venus has an orbital period (year) equivalent to 226.5 Earth days but its axial rotation (day) is equivalent to 243 Earth days. This means a day on Venus is longer than its year. Not that this makes any difference on the surface because the Sun is never visible due to the very thick Carbon Dioxide (CO_2) clouds.

The upper layer of the atmosphere exhibits a phenomenon known as Super-Rotation. This means the atmosphere circles the planet in just four Earth days, much faster than the planet's day (243 Earth days). The winds supporting Super-Rotation can blow at a speed of 100m/s (360km/h) or even faster.

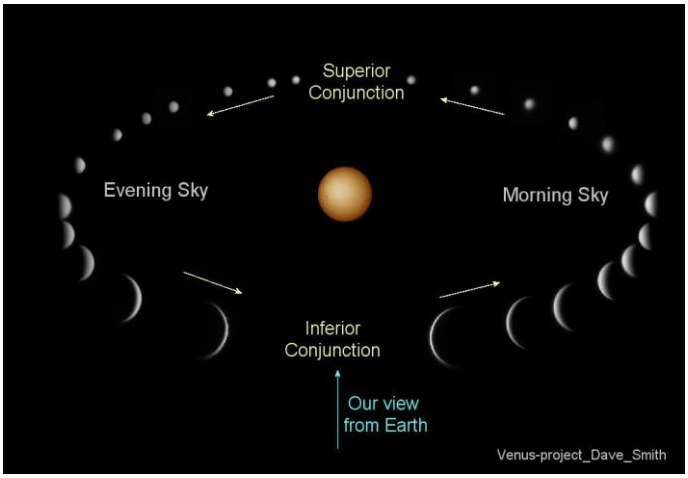
With its thick white impenetrable atmosphere Venus is the brightest planet but looks featureless and rather uninteresting to the amateur astronomer. It appears as a very bright but plain white disc or crescent. However it can be quite interesting to follow the phase changes as Venus orbits the Sun inside the orbit of Earth.



Venus in the east before sunrise in early November

Venus is currently on view in the east before sunrise in the early morning. The chart above shows the location of Venus and its orbital path. Venus was in Inferior Conjunction (between Earth and the Sun) on 3rd June 2020 when it was not visible. As it moved out from Inferior Conjunction and away from the Sun, it followed the orbital path shown on the chart above. The brighter part of the orbit shows the path out from conjunction.

The furthest point from the Sun (Greatest Western Elongation) was reached on 13th August then Venus started to move back towards the Sun. It will be in Superior Conjunction (pass behind the Sun) on 26th March 2021. As Venus moves out from Superior Conjunction it will appear as a small, full disc in the west in the evening. It will appear small in diameter because it will be at its most distant point from Earth on the opposite of the Sun and fully illuminated by the Sun.



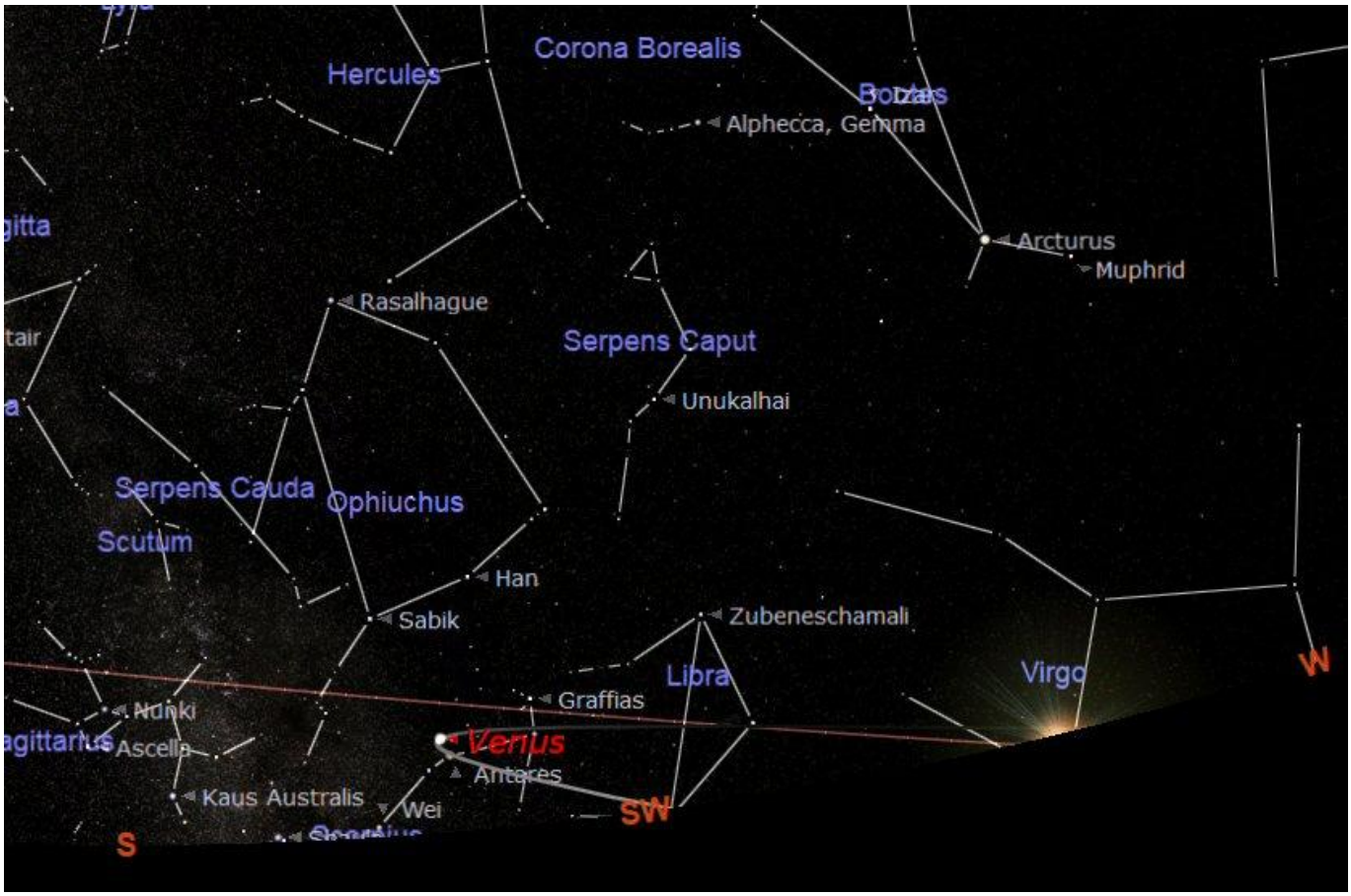
The Orbit, Phases and Conjunctions of Venus

At the time of writing this article Venus was still fairly low in the east before sunrise and moving towards the Sun and Superior Conjunction (on the other side of the Sun). This is the part of the orbit shown on the right of the diagram at the bottom of the preceding column.

Venus appears bright in the east as the Sun is rising and is often called the 'Morning Star'. It will also appear to be moving away from us as it moves further around its orbit and behind the Sun. Therefore it will appear to become smaller but fully illuminated. It will eventually disappear from view in the brighter glare close to the Sun.

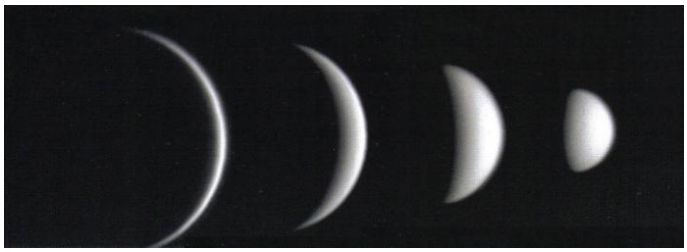
Venus imaged as a wide crescent by the author

Venus will spend a couple of months in Superior Conjunction when it will be difficult to see in the bright sky close to the Sun. It will also be close to the eastern horizon and low in the sky.



Venus at Greatest Eastern Elongation October 2021

When Venus emerges from its Superior Conjunction behind the Sun it will appear to the east of the Sun in the Evening sky at sunset. It will be small but full, close to the western horizon and in the bright sky after sunset. It is sometimes called the Evening Star. As Venus appears to move further east and away from the Sun it will also be moving towards Earth. It will begin to appear larger in diameter but less will be illuminated by the Sun.

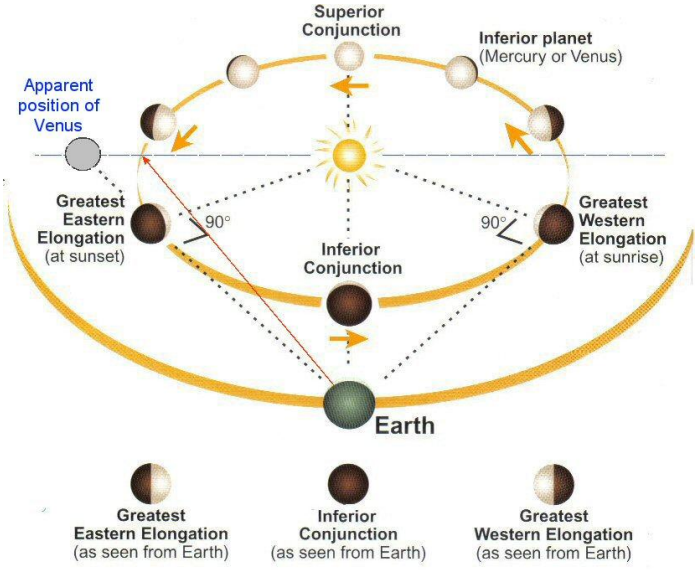


The change in diameter and phases of Venus

As Venus moves out from Superior Conjunction it appears as a full disc because it is on the opposite side of the Sun to us. From our point of view we see the whole surface of Venus illuminated. Venus then moves on its orbit around the Sun and appears to us to move away from the Sun to the east (left). As it moves further away from the Sun its orbit also brings it towards us so some of the illuminated surface begins to disappear from our view. See the images above.

After about 70 (Earth) days Venus will have moved a quarter of its way around the Sun and will be at its apparent furthest point from the Sun as we see it so we call this Greatest Easterly Elongation. At this point Venus will be the same distance from us as the Sun so we will see the half of Venus facing the Sun illuminated and appearing 'Half Moon' shaped. See the chart above.

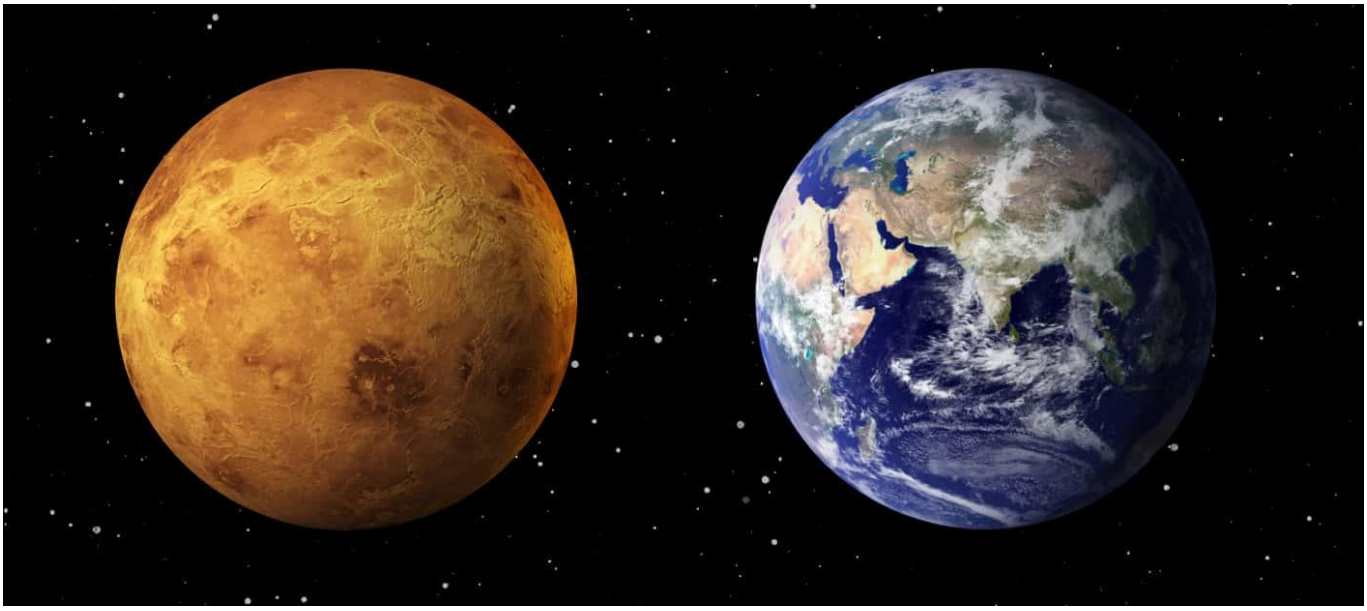
Up to this point more than half of Venus would have been illuminated and the apparent shape would have been more than half, a shape we call 'Gibbous'. Actually the Greatest Easterly Elongation occurs after the point when Venus is half way around its orbit and occurs when Venus is at 90º from the Sun as we see it from Earth as shown on the diagram below (dotted lines).



The orbit of Venus around the Sun

After Greatest Easterly Elongation, Venus will appear to start moving back towards the Sun in a westerly direction. As it is still moving closer to Earth it will appear to increase in diameter. As less and less of the illuminated side of Venus will be visible to us it develops into a narrowing crescent. However the overall perceived brightness will remain about the same.

OBSERVING VENUS



A comparison of the size of Venus and Earth

Venus has a very thick and clouded atmosphere that covers the whole surface. Consequently there are no surface features to see. All that is visible on Venus is the top of the thick white clouds. Some faint features can be seen in the clouds but special filters are required to see them. See the image on page 7.

The main interest for amateur astronomers when observing Venus is to follow the progress of the phases. The two inner planets Mercury and Venus (known as Inferior Planets) are the only planets to show phases. Phases occur when these planets (and our Moon) are partially illuminated by the Sun. The phases change as the planets move around the Sun on their orbits.

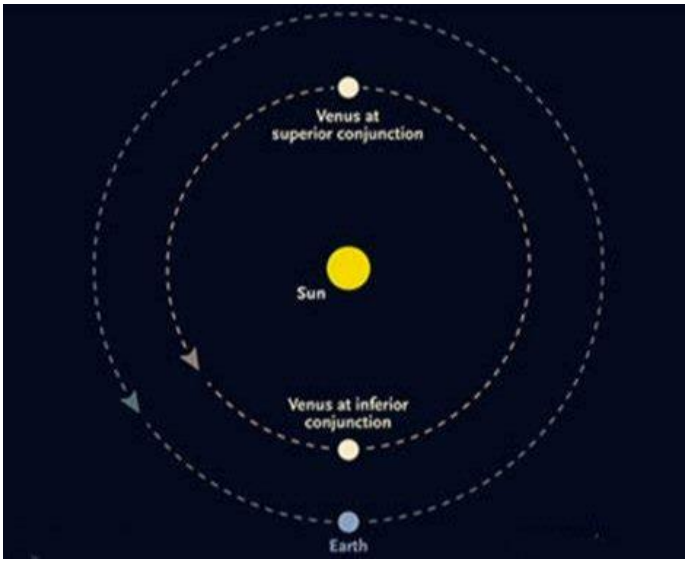
We have already seen that Venus has an orbital period (year) equivalent to 226.5 Earth days but its axial rotation (day) is equivalent to 243 Earth days. This means a day on Venus is, very oddly, longer than its year. However this makes no difference on the surface because the Sun is never visible due to the very thick Carbon Dioxide (CO_2) clouds.

The period taken for Earth to catch up with another planet is called the Synodic Period and the time taken for a planet to complete one orbit around the Sun is called its Sidereal Period. The table below shows the Synodic and Sidereal Periods for Earth and the other planets.

Planet	Synodic Period (days)	Sidereal Period
Mercury	116 (~3x y)	88 days
Venus	584 (~1.5x y)	225 days
Earth	-	1.0 year
Mars	780 (2.137y)	1.9 years
Jupiter	399 (y + ~34d)	11.9 years
Saturn	378 (y + ~13d)	29.5 years
Uranus	370 (y + ~5d)	84.0 years
Neptune	368 (y + ~3d)	164.8 years

Table showing the Synodic Periods of the planets

From a point where Earth and Venus are in the same point on their orbits as on the diagram opposite, at Inferior conjunction, Earth will take 365.25 days to return to the same spot. As the orbit of Venus is inside the orbit of Earth it completes its orbit of the Sun in just 225 Earth days. When Venus catches up with Earth it will have completed 2.6 of its own orbits. Earth will have needed to move around its orbit for 584 days for Venus to catch up. This is called the Synodic Period of Venus.

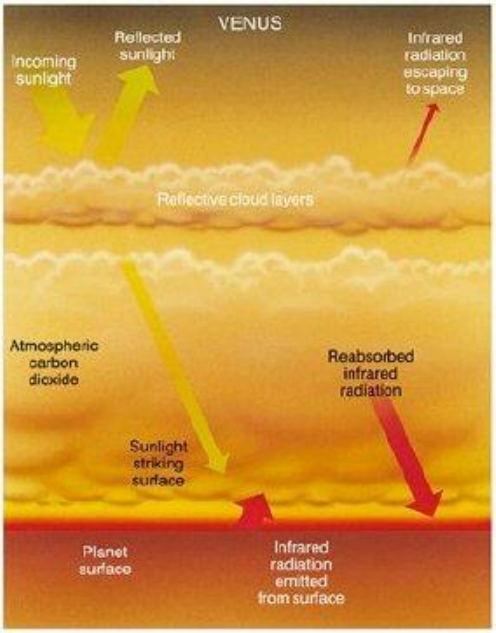


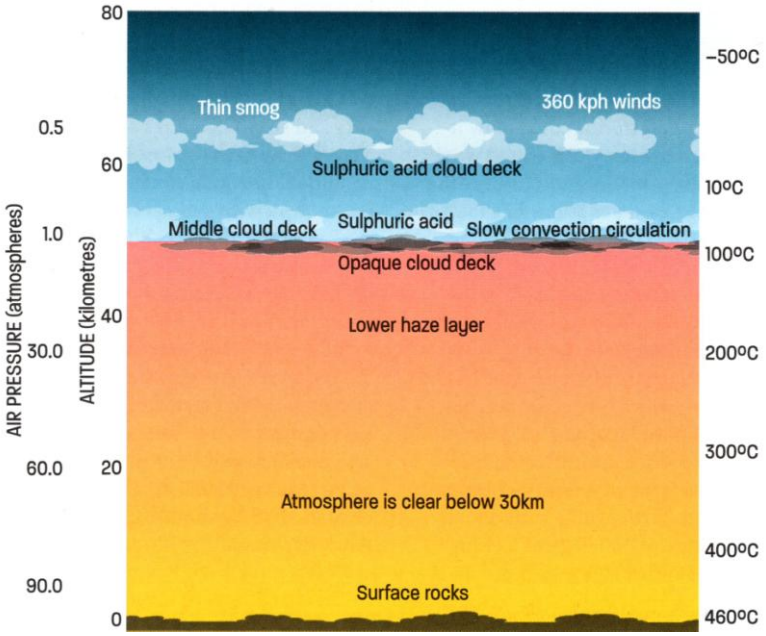
The orbits of Venus and Earth

A telescope is needed to see Venus as a disc and the larger the telescope the bigger Venus will appear. Venus often appears low in sky and in the murky and turbulent air close to horizon. It is best to start with a low power eyepiece (25mm) when observing Venus then use a higher power (magnification) eyepiece (10mm) to have a closer look. If the image is too bright then a Moon filter can be used. Alternatively the Dust cap can be fitted to the telescope and the small 'Moon' cap removed to reduce the glare.

If the image looks good then a Barlow Lens can be used to effectively double the magnification of the 10mm eyepiece. When Venus is low in the sky and we are looking through more of the atmosphere some colour distortion can be seen as red and blue fringes.

COULD THERE BE LIFE IN THE ATMOSPHERE OF VENUS?





Greenhouse Effect on Venus and the effect on the atmosphere

For many years Hollywood Science Fiction films have postulated the possibility of life existing beneath the (wet tropical) clouds of Venus. Films have been made featuring invasions of Earth by advanced civilisations from Venus. These story lines have stopped over the last few decades since our knowledge about the true nature of Venus has improved.

Since we have developed ways of examining the atmosphere of Venus it has been accepted that the harsh conditions would prevent the development of life. However recent discoveries in the atmosphere of Venus have challenged these assumptions. We have now have some evidence that there is a possibility of some exotic forms of simple life may exist in the temperate zones in the upper cloud structure of Venus.

The diagram on the left above shows how the thick and extensive atmosphere on Venus can allow much of the sunlight to enter the atmosphere but prevents the heat escaping back into space. In recent years we have become familiar with this effect in relation to our own atmosphere. This rise in temperature is what we now call 'the Run-away Greenhouse Effect' as the levels of Carbon Dioxide increases in our own atmosphere.

Studies have revealed that the atmosphere of Venus is comprised predominantly of Carbon Dioxide that acts rather like a blanket preventing heat from the surface escaping into space. This causes the temperature in the atmosphere of Venus to become heated to about 460ºC on the surface. The temperature and conditions on the surface has been confirmed by probes that have landed on the surface and sampled the atmosphere.

The diagram on the right above shows the temperature, atmospheric pressure and the nature of the atmosphere of Venus at various levels above the surface. It can be seen that the surface has a pressure 90 times that on the surface of Earth and the temperature is 460ºC compared to an average of about 20ºC on Earth. However at an altitude of between 50km and 60km the pressure and temperature is similar to that at the surface on Earth where liquid water could exist.

It can also be seen that the atmosphere at these levels is very harsh with clouds and rain composed of Sulphuric Acid and very strong winds of up to 360km/hour. However the upper atmosphere is clear of the thick smog that is present at the lower levels.

Evidence from the surface of Venus has indicated that a global super eruption of volcanoes occurred 700 million years ago. This global event could have caused huge amounts of CO_2 to be released from the rocks and sent into the atmosphere by the volcanoes. Up to this time there may have been oceans of water and a terrain similar to that on Earth. As the atmosphere was filled with CO_2 the temperature rose and caused all the water to evaporate. The high temperature, Ultraviolet light and Solar wind caused the Hydrogen and Oxygen of the water to separate and to be lost into space.

Strangely 700 million years ago was around the period when simple life forms began to develop into more complex life forms on Earth. Venus may have passed through this phase of life development at sometime, perhaps earlier but we will probably never know. All trace of the geological and any biological history has now been destroyed by the volcanoes, Sulphuric Acid rain and the searing heat on the surface of Venus.

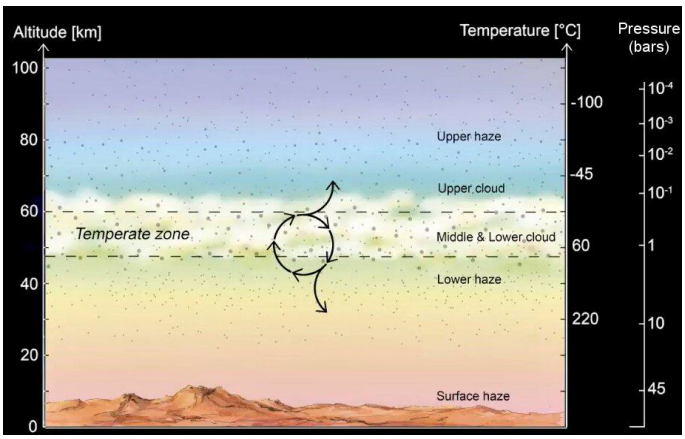
However, recently there have been studies into searching for life on other worlds, using a 'biosignature' created by life in an atmosphere. Here on Earth life has filled our atmosphere with Oxygen. As Oxygen is quickly combined with other elements it would soon disappear from the atmosphere if it was not replenished by the plant life through the photosynthesis process.

Jane Greaves of the University of Cardiff tested this idea by searching for a rare molecule called Phosphine to see if it could used to identify the possibility of life existing on Exo-planets in orbit around other stars. Before using this technique on expensive giant telescopes a nearer target was selected for a trial. Phosphine was looked for in the atmosphere of Venus and surprisingly it was found in large quantities. As it can only exist for a short period it must be replenished but how?

WHERE DID THE PHOSPHINE COME FROM?

The discovery of large quantities of the rare and short lived molecule Phosphine, in the atmosphere of Venus, came as a great surprise to scientists. Phosphine is a gas comprised of one atom of Phosphorus and three atoms of Hydrogen and has the chemical symbol PH_3. On Earth it is almost exclusively produced as waste by non-Oxygen breathing (anerobic) microbial life, typically found in stagnant ponds and sewage works. Some Geological processes can produce Phosphine but they are rare events like asteroid impacts or released in small amounts by volcanism.

This lead to scientists to realise that if Phosphine is found in the atmosphere of a planet orbiting another star then it was probably produced by some kind of life form. To test the possibility of detecting small quantities of Phosphine the James Clerk Maxwell Telescope (JCMT) was used to search the atmosphere of Venus. The large quantities of Phosphine discovered on Venus indicated that it was very unlikely to have been created by any known Geological processes.



The Temperate Zone in the atmosphere of Venus

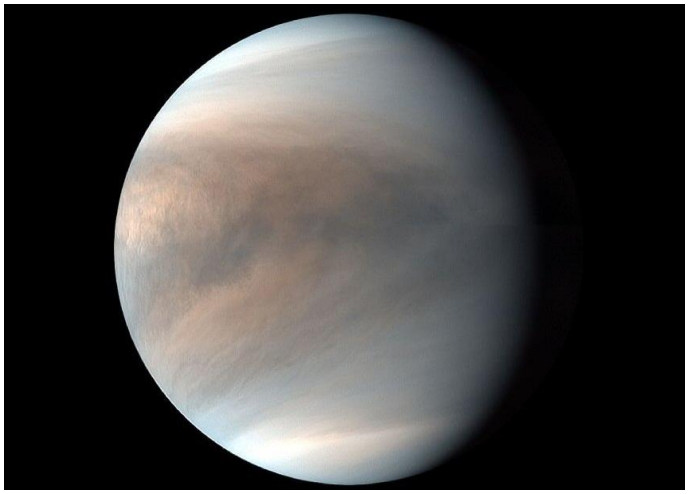
The chart shown above shows the layers in the atmosphere of Venus with the Temperate Zone marked. This is the Zone where the atmospheric pressure is close to pressure on the surface of Earth. It is also where the temperature can be between 0ºC and 100ºC when water can be solid, liquid and gas (vapour). This is also the zone where the concentration of Phosphine was found.

Having said the Temperate Zone is where water can exist as a liquid there is very little water to be found in the atmosphere of Venus. As the temperature on Venus began to rise dramatically any water evaporated into the atmosphere. The water molecules (H_2O) were split into the Hydrogen and Oxygen atoms and were blown away from the top of the atmosphere by the Solar Wind.

If this news is not bad enough for any possible life forms there is the problem of the Sulphuric Acid clouds and rain in the atmosphere. The Sulphuric Acid is very concentrated and would dissolve almost anything it comes into contact with. So it would appear that any kind of life as we know it could not survive on Venus.

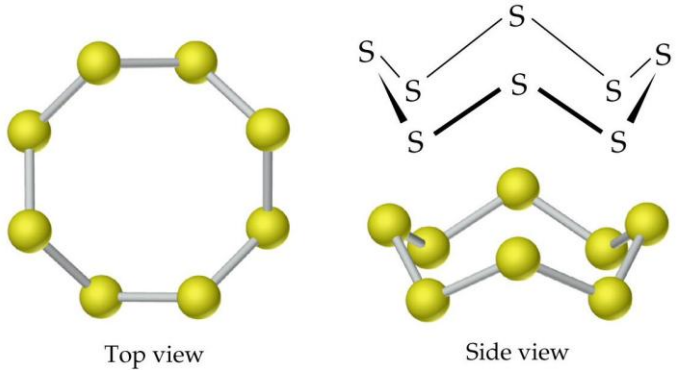
However, perhaps any life that might exist in the atmosphere of Venus might not be life as we know it. If Venus did have oceans of water like Earth it could have been like that for billions of years. We think most of our water may have been delivered to Earth by Comets between 4.2 and 3.8 billion years ago. This was a period we call 'the Late Heavy Bombardment' when millions of comets (large lumps of water) spiralled into the inner Solar System from the outer regions of the Solar System. Earth and Venus were both in the path of these 5km plus giant snowballs from space. So Venus would have received the water at the same time as Earth.

If the oceans had lasted until the global volcanic disaster 700 million years ago, life would have had time to develop like on Earth. Some simple forms of life may have clung on and adapted to life in the atmosphere. One adaptation they might have utilised is a rather strange polymer composed of eight Sulphur atoms known as S_8 which also exists in the atmosphere of Venus. This S_8 polymer is resistant to Sulphuric Acid and could possibly be used as a protective skin for life forms. The S_8 polymer can also absorb Ultraviolet light to protect any life forms in the atmosphere of Venus from the Sun.



Dark cloud markings on Venus

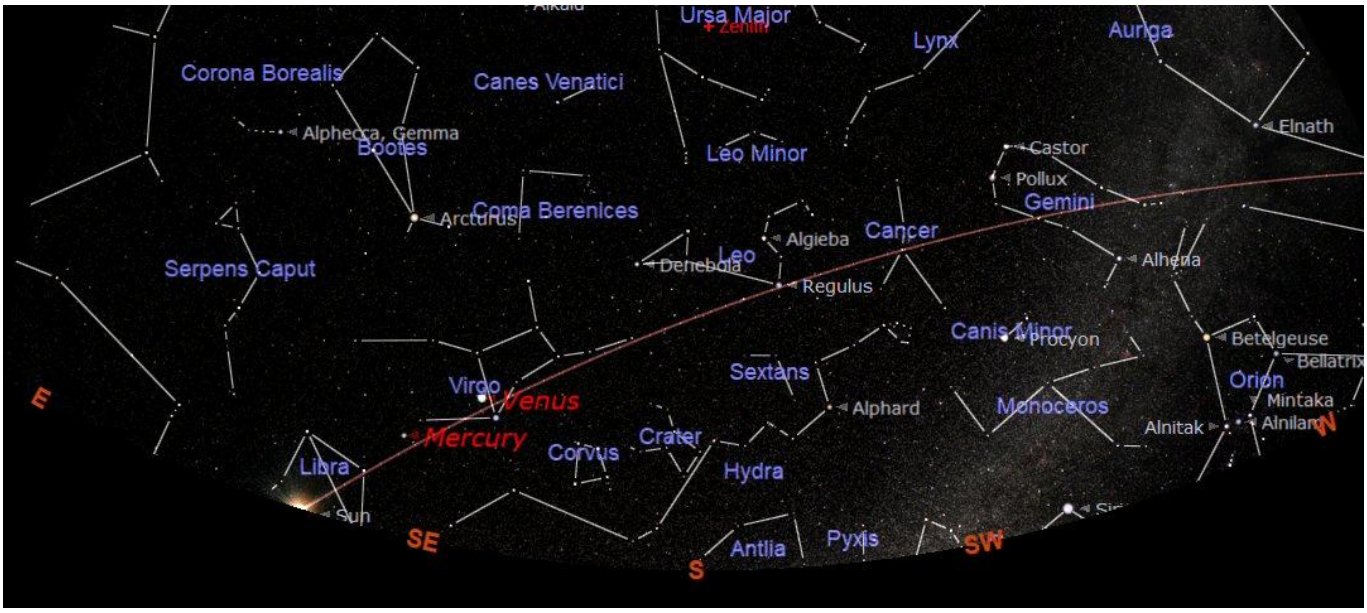
The dark markings in the atmosphere of Venus shown on the image above have been seen to mysteriously absorb Ultraviolet light. They are thought to possibly be clouds of the S_8 polymer so there could be plenty of it there.



The S_8 Polymer Ring

So what does all this mean to our knowledge of the prospect of finding other life in our Galaxy? Until now the only life we know to exist is the life on our planet Earth. All life on Earth is the same in that it has the same type of fingerprint of life, our DNA. If we can find a different kind of life that has a completely different base (unlike our DNA) then we will know that we must search with a wider concept of life. The detection of Phosphine could be a marker for another kind of life. It also tells us that we may need to look for markers that we do not even know about. So part of our search for life may be to look for things that we have never seen before and are not naturally occurring.

THE INNER SOLAR SYSTEM - NOVEMBER 2020



The morning sky at 07:00 (in the morning) showing the positions Mercury and Venus

MERCURY will be in it best position for observing in the early morning sky in the east this year on 10th November. See the chart above (the sky has been darkened to allow the planets to be seen).

VENUS reached its greatest western elongation (at its furthest apparent distance from the Sun) on 14th August. It is still rising in the in the east before the Sun rises. It is now 'gibbous' (wider than half Moon shaped see below).

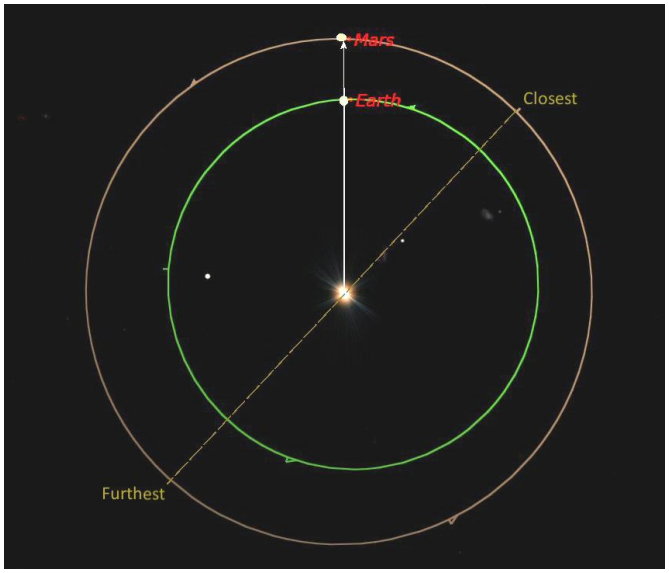
It is moving back towards the Sun and will appear smaller but 'fuller' as it moves into Superior Conjunction (behind the Sun) on 25th March 2021. After passing through Superior Conjunction Venus will reappear in the evening sky in the west as the Sun is setting.

Venus appearing 'Gibbous' during November

After conjunction Venus will first appear close to the Sun and will be round when viewed using a telescope. As it will be located on the other side of the Sun it will fully illuminated but will become larger and crescent shaped as it moves out from the Sun and towards us.

Venus can be observed during the day in the sunlit sky but this must only be done with great care. A GOTO telescope would be best but setting circles can be used. The dust cap must only be removed when it is confirmed that the Sun is not in view through the telescope.

MARS rises in the east at about 18:00 and is still looking quite large at about 17 arc-seconds. Earth caught up and passed Mars on their orbits around the Sun. This was because Earth's orbit is inside the orbit of Mars and is consequently travelling faster. Earth overtook Mars on 13th October and this is called Opposition. At opposition Mars was in direct line with Earth and the Sun as shown on the charts below and on page 10.

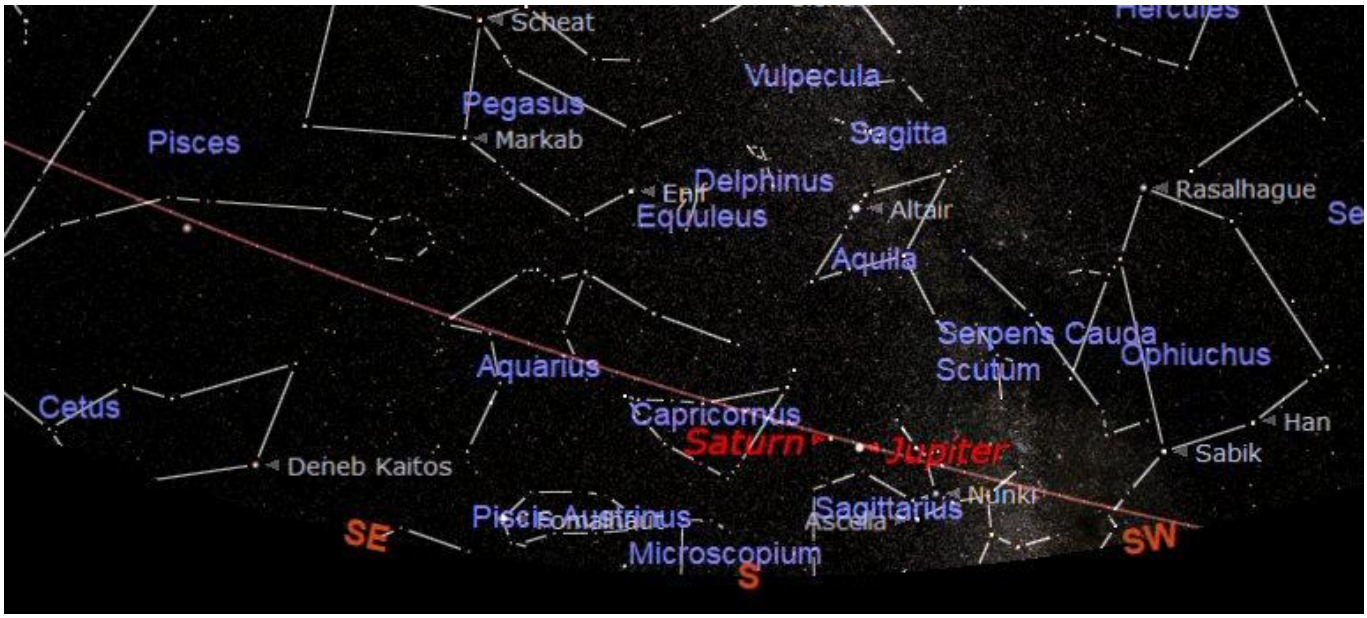


Mars at Opposition on 13th October 2020

At opposition Mars was at it its closest point to Earth on this orbit. It can be seen on the chart above that the orbit of Mars is quite eccentric. The closest and furthest points possible are marked on the orbit. This opposition brings the two planets quite close together so Mars will appear significantly larger than it would appear at the 'furthest' conjunction point on its orbit. Mars was actually at its very closest on 6th October at 62.07 million km.

Mars will still be in a good position for observing for another month or so but will be moving closer to the south western horizon. It will also be quickly reducing in size. After it has moved over the horizon we will not see it again for two years. See the Synodic Period Table on page 5.

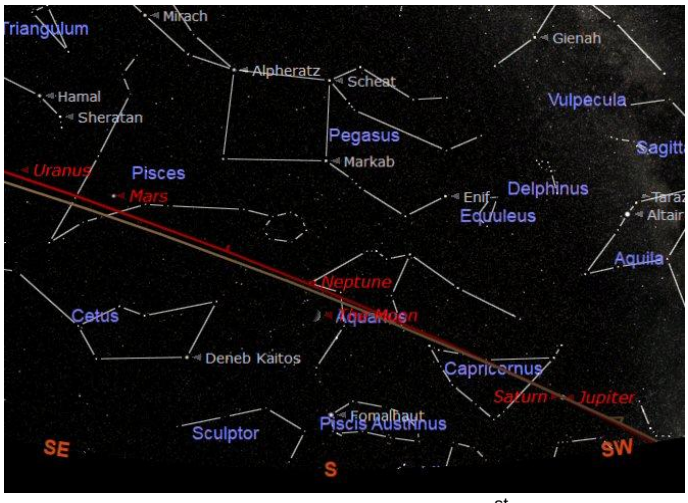
THE OUTER SOLAR SYSTEM – NOVEMBER 2020



The chart above shows the positions of the Gas Giant Planets this month low in the west in the early night sky after sunset this month. Jupiter and Saturn are moving closer together in the Conjunction (close together in the sky). They will be at their closest on 21st December.

This interesting event, involving Jupiter and Saturn, will develop and become even more interesting through the months from now until the end of this year. Jupiter and Saturn are located close together in the sky at the moment and this is what astronomers call a 'Conjunction'. This is a term used when two (or more) objects appear to move close together in the sky. See the chart above.

The two Gas Giant Planets have appeared close together in the sky all summer and will continue to move even closer together until the end of the year. The converging orbital paths of the planets are shown on the chart below.



Orbital paths of Jupiter and Saturn 21st December

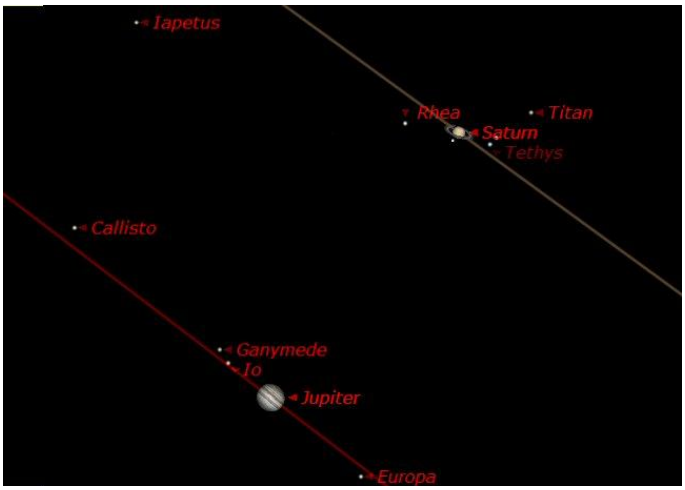
The orbital paths of the planets are show as red for Jupiter and brown for Saturn. It can be seen on the chart above that the orbital paths a getting closer towards the end of the year as the planets move further west.

Unfortunately Jupiter and Saturn have been low in the southern sky this year and not in a good position for observing. They have been in the thick and turbulent air close to the southern horizon so it has been difficult to see the surface details.

However the Planetary Conjunction next month should make up for the disappointing views of the planets. A clear view to the western horizon will be required to see the conjunction and the early evening sky will be bright just after the Sun has set.

Jupiter and Saturn will not be any closer to each other than they normally are and will still be moving around their established orbits. This conjunction is just a 'line of sight' effect from our point of view on Earth. The two planets will actually be as far apart from each other as Earth is from Jupiter (about 750 million kilometres).

Jupiter is approaching Saturn as it is moving faster than Saturn along its orbital path and will overtake Saturn on 21st December. From our point of view they will appear very close together so at this time the two planets will be at their closest conjunction.

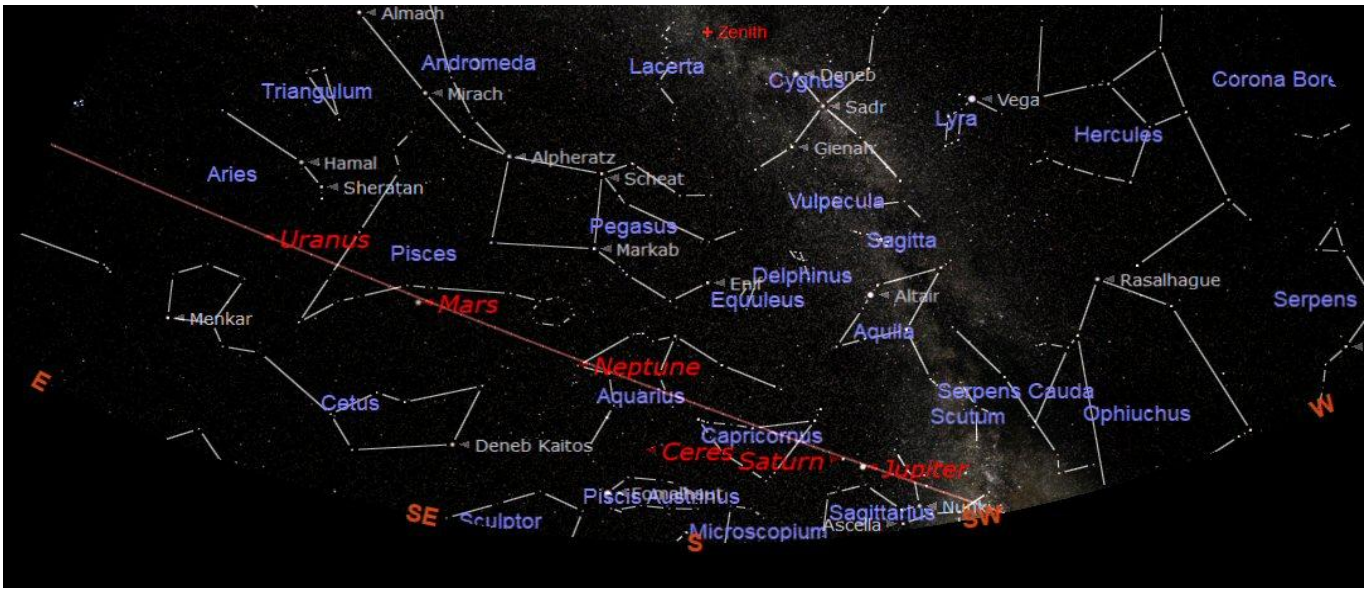


Jupiter and Saturn at their closest conjunction

The chart above shows how the two planets and their moons will appear using a telescope around the 21st December. They should fit into the field of view of most small telescopes and some larger telescopes using a low power eyepiece.

Like all astronomical events the weather must be kind to us and we will need a clear view towards the western horizon. The conjunction will unfortunately also be in the bright sky after sunset.

THE REST OF THE SOLAR SYSTEM NOVEMBER 2020



The mid month sky at 22:00 showing the positions of Mars, Uranus and Neptune

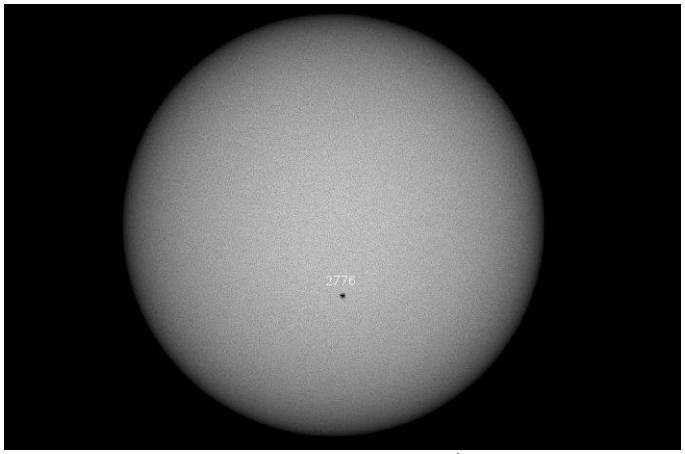
URANUS will not be easy to see as it will be close to the southern horizon. It will rise at about 15:30 and be visible for the rest of the night. Uranus was at opposition on the 31st October. This month it will be due south and at its best at 22:40 but will need a telescope to see it.

NEPTUNE will rise at about 14:00 but will not be easy to observe this month it will be due south at about 19:30. It does require a medium sized telescope to see well.

THE SUN

The Sun rises at about 07:00 at the beginning of the month and 06:40 at the end. It sets at 18:20 at the beginning of the month and 16:40 at the end.

A small Sunspot was visible during the middle of October and the picture below was taken on 19th October by the Solar and Heliospheric Observatory (SOHO). This may be the first sunspot as we move into the 'build up' to the next maximum of the Sun's 11 year cycle of increased activity. The Sun has been passing through its period of low activity over the last year or two and the previous Maximum was rather sparse and disappointing.



A small Sunspot seen on 19th October

Sunspots are caused by the strong magnetic field of the Sun. We can think of the Sun being like a gigantic magnet with lines of magnetic force linking the North Pole to the South Pole. However the Sun is not solid as it is mainly comprised of Hydrogen gas and is fluid.

The equatorial region actually rotates faster than the Polar Regions. Consequentially the lines of magnetic force are dragged out and distorted around the equator. Over a period of about five years the lines of magnetic force become tangled and begin to break up.

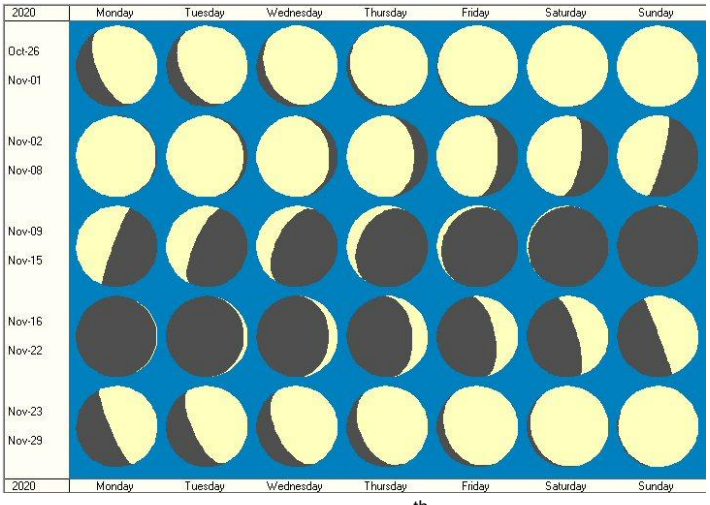
Where the lines of magnetic force interact with the surface of the Sun a cavity is created where a lower and cooler layer is exposed. As this lower layer is cooler it is less bright and appears darker hence the Sun Spot.

This build-up of magnetic forces has a cycle of about 11 years so we see increased and decreased solar activity over periods of about 5½ years. We are currently about to begin a period of increasing activity so we should be starting to see more Sunspots.

Any activity on the Sun can be followed by downloading the day to day detailed images of the Sun at the SOHO website at: http://sohowww.nascom.nasa.gov/.

THE MOON PHASES DURING NOVEMBER

There will be a partial Lunar Eclipse on 30th November but it will not be visible from Southern England.



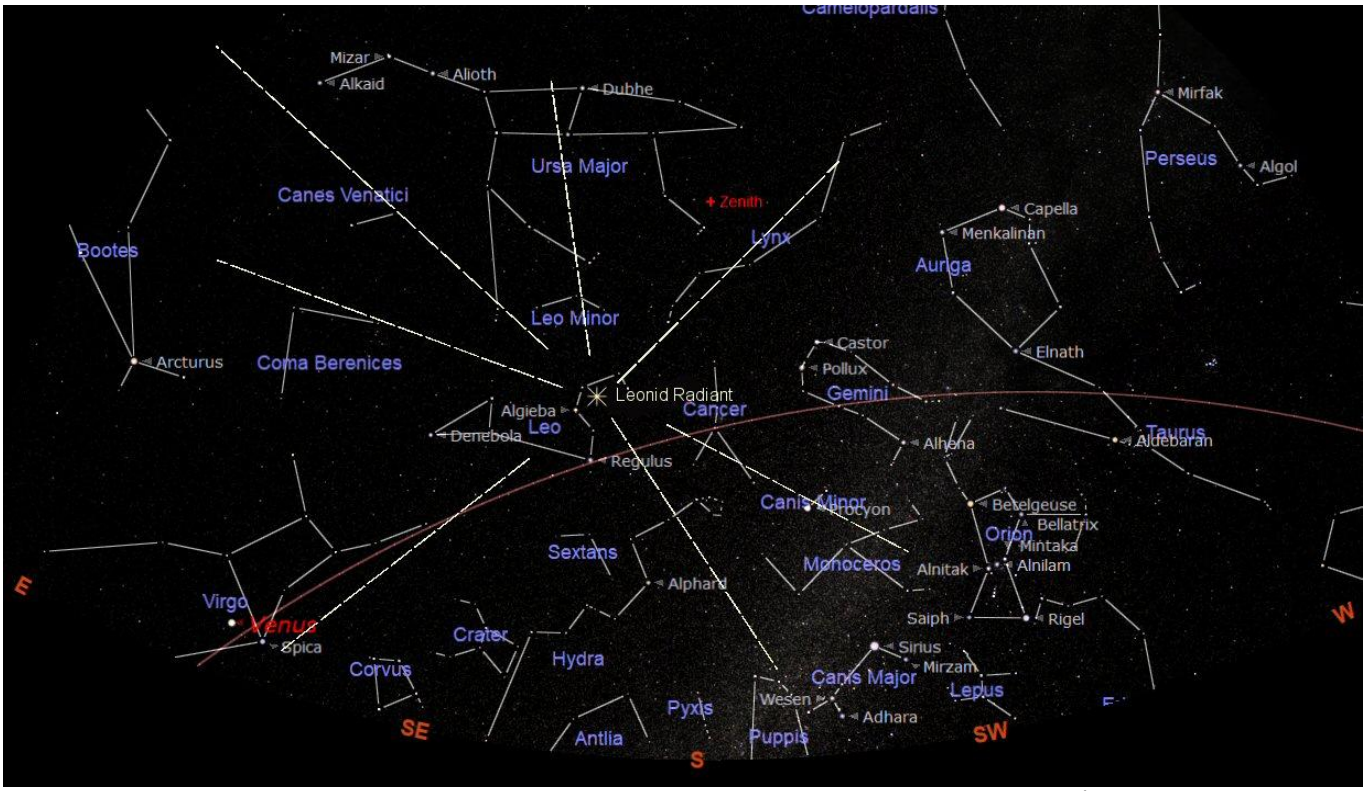
Last Quarter will be on 8th November

New Moon will be on 15th November

First Quarter will be on 22nd November

Full Moon will be on 30th November

THE LEONID METEOR SHOWER



The Radiant of the Leonid Meteor Shower at its peak at 05:00 on 18th November

Meteor showers are notoriously unpredictable. The exact time of any spectacular increase in numbers or if the meteors will be bright is as difficult to predict as is the clear weather needed to see them. However every year on the evening of the 17th and morning of 18th November there is usually a spectacular display from the peak of activity during the Leonid Meteor Shower.

Fortunately this year the Moon will not be a in the night sky so even some of the fainter meteors may be seen. The meteors of a shower appear to radiate from a point in the sky that is called the 'Radiant'. The meteors of this particular shower appear to originate from a 'Radiant' point in the constellation of Leo. See the chart above.

The radiant point of the Leonid Meteor Shower is shown close to the star Algieba. The paths of the meteors are shown by the straight lines emanating from the direction of the radiant point. The meteors are small specks of dust debris from the Comet Temple Tuttle.

During the evening of 17th November the constellation of Leo will be below the eastern horizon so any Leonid meteors will appear to originate from over the horizon. This means all the meteors will be moving up from the eastern horizon and in a 'fan' shape across the sky. Leonid meteors tend to be fast and relatively bright so look anywhere from the eastern horizon to overhead.

If the trail of any meteor that is seen can be tracked back and found to have originated from this radiant point it will be a Leonid Meteor. A few meteors might appear to originate from other directions so these are the meteors that might be seen randomly and not part of any named shower. These are known as Sporadic Meteors.

Make sure you are dressed warmly with a hat and gloves and sitting comfortably. A garden lounger chair will allow the observer to lay back and have their head supported to avoid getting a neck ache from looking up.

On any clear night if you sit back and look up into the night sky for a while you will more than likely see a streak of light speed across the sky - this will be a METEOR or shooting star. It is not a star at all it is just a small speck of dust known as a METEOROID entering the Earth's atmosphere at very high speed.

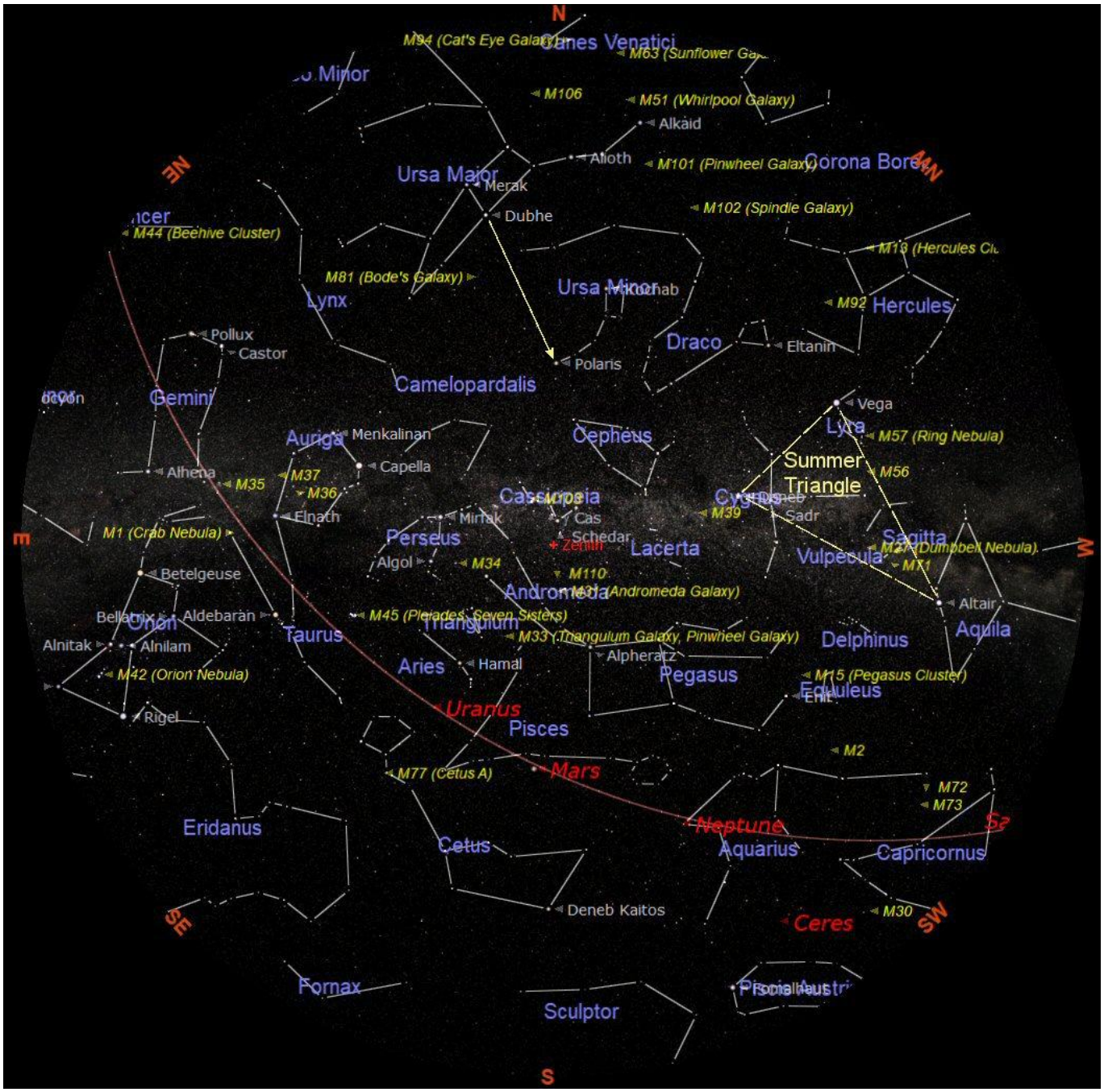
Just as the space shuttle or other space craft become very hot as they re-enter the atmosphere at about 30 thousand km/h. However these dust particles get even hotter at their re-entry speed of up to 270 thousand km/h. At this speed the dust is vaporised by the heat and the surrounding air is also heated until it glows in a similar way to a fluorescent light.

There are two types of Meteor, the first is thought to originate from the large lumps of rock and iron left over when the planets formed, known as ASTEROIDS. Most asteroids orbit the Sun in a belt between Mars and Jupiter. The huge gravitational forces exerted by Jupiter may have pulled the rocks apart before they could accumulate into a planet.

Very rarely two asteroids may collide but when they do, chips of rock and Iron are thrown off and occasionally may head towards Earth. These can be a few millimetres across or up to tens or even hundreds of metres across. They are quite rare and are seen as individual 'fireballs'. Large ones can sometimes impact the ground as METEORITES and may even cause craters.

The second type of meteor originates from a comet and is much more common. Comets are large lumps of ice, typically between five and thirty kilometres across. They orbit the Sun in an area beyond the orbits of the outer planets called the Kuiper Belt. There are millions of these objects just sitting there quietly orbiting around the Sun at enormous distances. This is the kind of meteor seen in the Leonid Shower.

THE NIGHT SKY – NOVEMBER 2020



The chart above shows the whole night sky as it appears on 15th November at 21:00 (9 o'clock) in the 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 10 o'clock GMT at the beginning of the month and at 8 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. 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: Jupiter, Saturn, Neptune, Mars and Uranus.