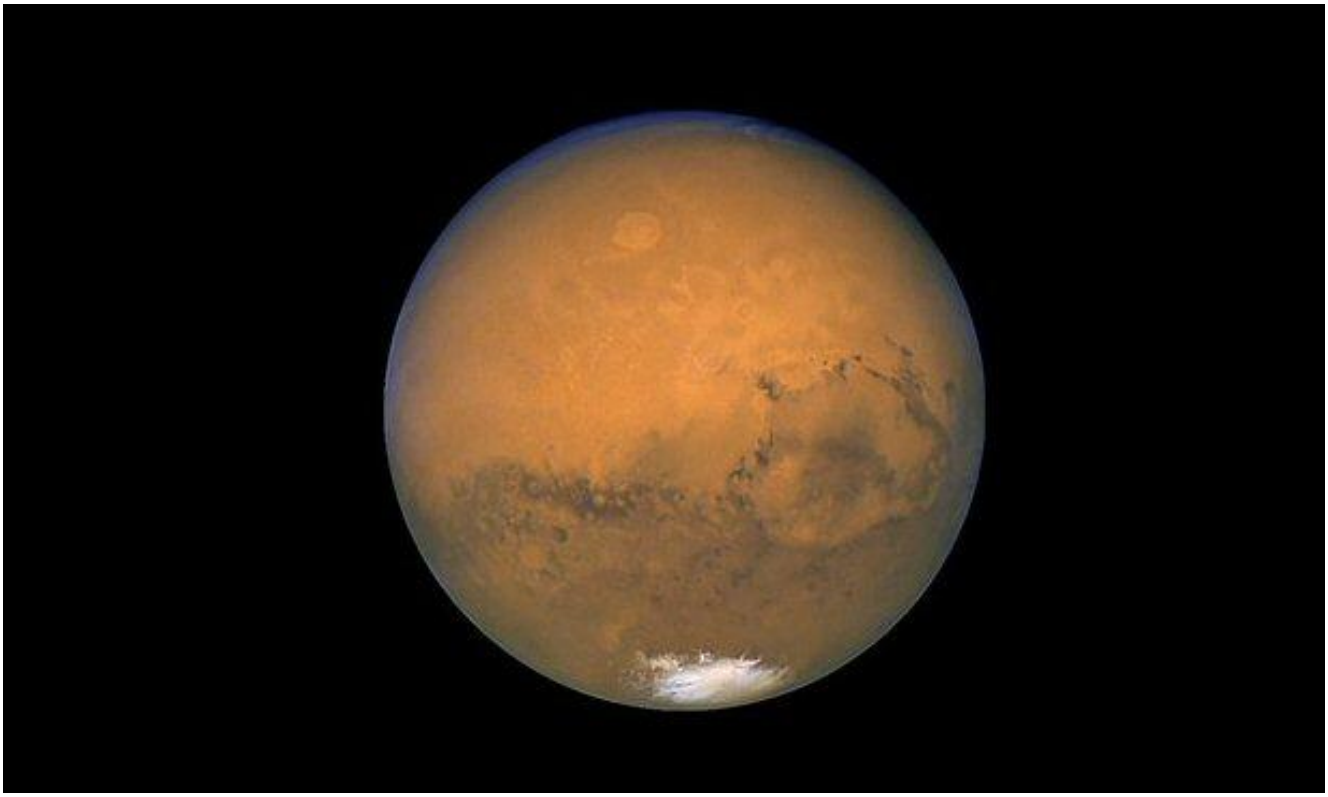
NEWBURY ASTRONOMICAL SOCIETY
MONTHLY MAGAZINE –OCTOBER 2020

MARS AT OPPOSITION THIS MONTH



Mars imaged by the Hubble Space Telescope 2003

The main interest for amateur astronomers this month is the 'OPPOSITION' of the planet Mars. Planetary Oppositions occur when a planet overtakes another planet as they move around their orbits at different speeds. On 13th October Earth will 'undertake' (pass Mars on the inside). Earth is on its orbit closer to the Sun, with Mars on its orbit further out from the Sun.

Earth's opposition with Mars occurs every 2.137 Earth years or 780.615 Earth days. This is the longest period between oppositions of all the planets seen from Earth. The period between oppositions 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 Periods for oppositions of the planets with Earth and their Sidereal (orbit) Period.

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

The following pages explain in more detail how the mechanism of oppositions work but here is a brief outline of why oppositions are important to astronomers.

The main interest is in the position of the planet relative to Earth at opposition. As a planet approaches and passes another they naturally come closer together and are at their very closest point to each other at the time of opposition. This means a planet in opposition with Earth appears at its largest when it is at its closest point to Earth. As a result we can see the planet in more detail because it looks larger through a telescope.

Mars has the most eccentric orbit of all the planets so it looks particularly different in size at opposition depending on where it is around its orbit. The oppositions of Mars and Earth occur at different positions around their orbits so the planets are closer at different oppositions. So if Earth is at its furthest distance from the Sun and Mars is at its closest to the Sun the two planets will be closest to each other. This occurred on the opposition of 2003.

NEWBURY ASTRONOMICAL SOCIETY MEETING

2nd October Astrophysics at the Highest Levels

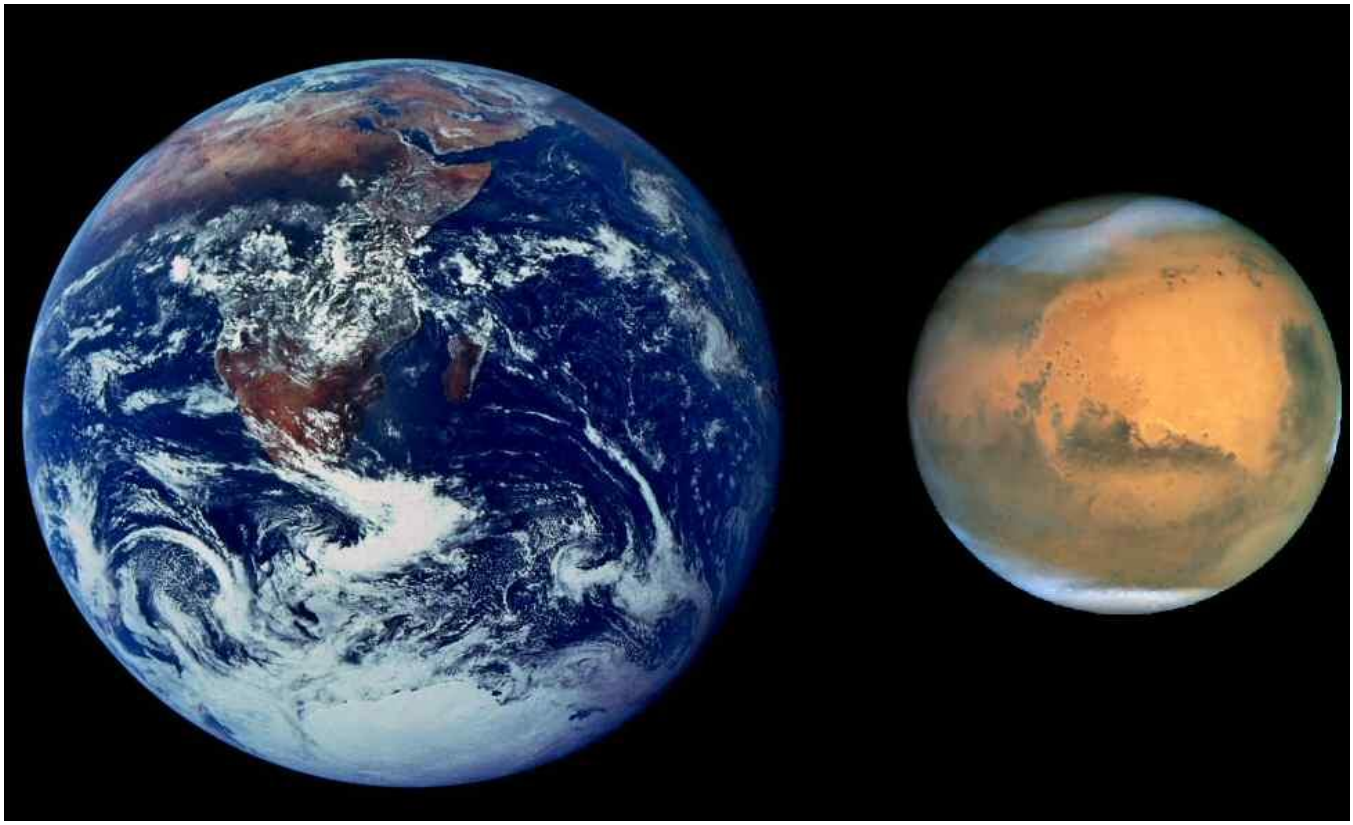
Website: **www.newburyastro.org.uk**

NEXT NEWBURY BEGINNERS MEETING

15th October Venus our Twin (Zoom meeting)

Website: **www.naasbeginners.co.uk**

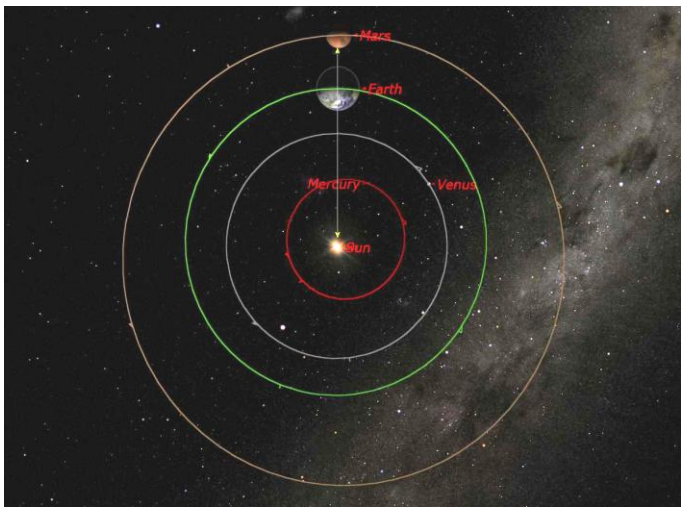
MARS – THE RED PLANET NEXT DOOR



The comparative sizes of Earth and Mars

Mars is the 4th Planet out from the Sun, the next out from Earth and the second smallest planet in our Solar System after Mercury. It is approximately half the diameter of Earth at 6780 km (Earth 12,600 km). Earth orbits the Sun at an average distance of 146.6 million km and Mars orbits at an average distance of 229.9 million km. Due to the eccentricity of their orbits the distance between Earth and Mars can vary, at their closest approach (Opposition), from about 55 million km to about 100 million km.

Mars will be at its best position for observing on 13th October when it will be at 'Opposition'. This means it is in direct alignment with Earth and the Sun as Earth overtakes Mars along the paths of their orbits. The orbit of Mars is on average 78 million kilometres further out from the Sun than the orbit of Earth. On 6th October Mars it will be at its closest just 62.7 million km away.



The positions of Earth and Mars at 'Opposition'

The orbit of Mars does take it to the opposite side of the Sun to Earth where it can be up to 400 million kilometres from Earth. When a planet is on the opposite side of the Sun we call this 'Conjunction'. Approaching the Sun near Conjunction Mars appears small but at Opposition it is closer and appears comparatively large when viewed through a telescope.

There is some more good news for the amateur astronomer on this Opposition because Mars will be positioned quite high in the sky at midnight. This means it will be observed through less of Earth's atmosphere and out of the thick murky air closer to the horizon. Also with opposition occurring in late autumn the nights will be longer and perhaps warmer to make observing more comfortable.

We all know that Earth moves around the Sun once a year which is 365¼ days this is known as its 'Sidereal Period'. Mars takes the equivalent of 1.88 Earth years (686 Earth days) to complete one orbit of the Sun. However, when Earth returns to the same place in its orbit, Mars will have moved 686.67 – 365.25 = 321.42 days further around its orbit. This equates to 321.42 ÷ 686.72 = 0.468 of 1 Mars orbit. This means Earth takes 365.25 ÷ 0.468 = 780.615 Earth days (to catch up with Mars) or put another way 780.615 ÷ 365.25 = **2.137** Earth years. This is the 'Synodic' Period of Mars.

To summarise it takes Earth 780 days (2.137 Earth years) to catch up and overtake Mars at each successive opposition. This is the longest opposition period (Synodic Period) of all the planets in our Solar System. So we should take advantage of the opposition this year it will be close to us for observing, high in the sky and it will be another 2.137 years until the next opposition of Mars.

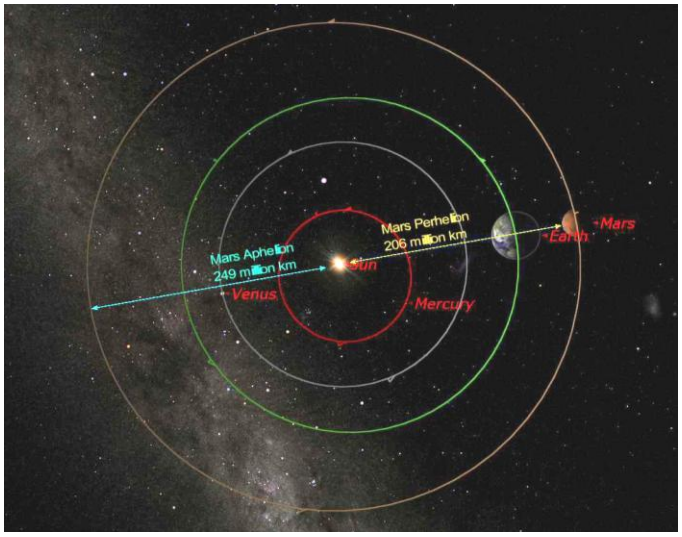
From the previous calculation we can see it takes Earth 2.137 years to catch up with Mars from one opposition to the next opposition. So every 2.137 years the planets and Sun are aligned as shown in the diagram on the previous page but the two planets will reach their next opposition at different places in their orbits.

Oppositions of Mars and Earth occur about 50 days later (7 weeks) every two years. So this means that the oppositions 'process' (advance) around the Ecliptic (the imaginary line along which the Sun, Moon and planets appear to move across the sky). The changing of the location, in the sky, of successive oppositions has two important effects on the viewing quality of Mars.

Due to the 23.4° axial tilt of Earth the Ecliptic appears low in the summer nights and high in winter. This is noticeable by the height of the Sun during the summer when the ecliptic is high during the day and the Moon appearing low because the ecliptic is low at night. When a Mars opposition occurs in the summer, Mars is low and in the turbulent and murky air close to the horizon so the view of Mars is generally poor. If an opposition occurs in the winter the planet is better placed for observing.

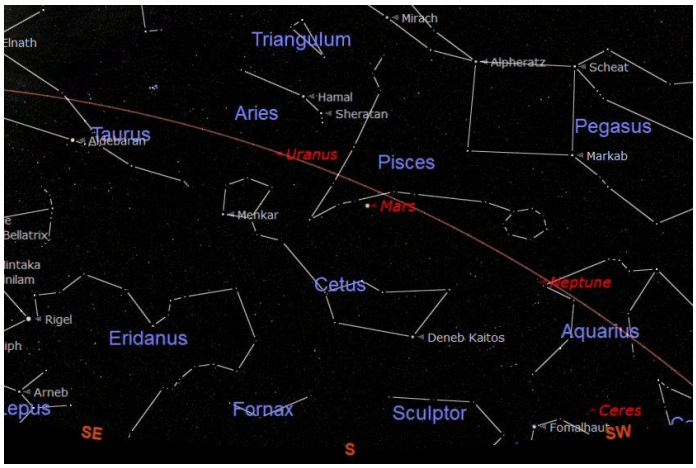
The other effect on observing Mars is the relative positions of the planets on their eccentric orbits around the Sun. The planets do not orbit the Sun in circular orbits, the orbits are elliptical (slightly 'egg shaped'). Consequently the planets are slightly closer or further from the Sun at different parts of their orbits.

Mars has a large eccentricity in its orbit around the Sun. At its closest (perihelion) it can be 206 million km but at its furthest (aphelion) it can be 249 million km from the Sun. The eccentricity of the orbit of Mars is shown clearly on the diagram below (but not to scale). As the elliptical orbits of all the planets are 'sort of' randomly aligned at oppositions, the distance between planets at opposition can vary and is particularly noticeable with the Earth / Mars oppositions.



The closest opposition of Mars (August 2003)

The August 2003 Mars opposition brought Earth and Mars just about as close as they can ever get at just 55.8 million km. Mars was at its closest approach to the Sun (perihelion) and Earth was at its most distant from the Sun (aphelion). Consequently Mars and Earth were close together and Mars appeared as large as it can be when seen from Earth it was 25.1 arc-seconds in diameter. The closest oppositions occur approximately every 15 years.



Mars at opposition on 13th October 2020

The chart above shows the position of Mars in the south at midnight (24:00 GMT) on 13th October 2020. The brown curved line across the chart is the Ecliptic (the imaginary line along which the Sun, Moon and planets appear to move across the sky). Mars appears a little below the Ecliptic due to the slight difference in tilt of its orbital axis compared to the plane of the Ecliptic. The Ecliptic is the equatorial plane of the Sun and orbits of the planets. The orbital planes of the planets are at very slightly different tilts to the ecliptic.

Mars will be well placed in the south this summer as can be seen in the chart above. It will be about 40º above the southern horizon so it will appear at its largest diameter (22 arc-seconds on 13th October). Mars will be in the relatively clear and steady air away from the murky and turbulent air closer to the horizon. Light must pass through about 300km of air close to the horizon so the image can be distorted.

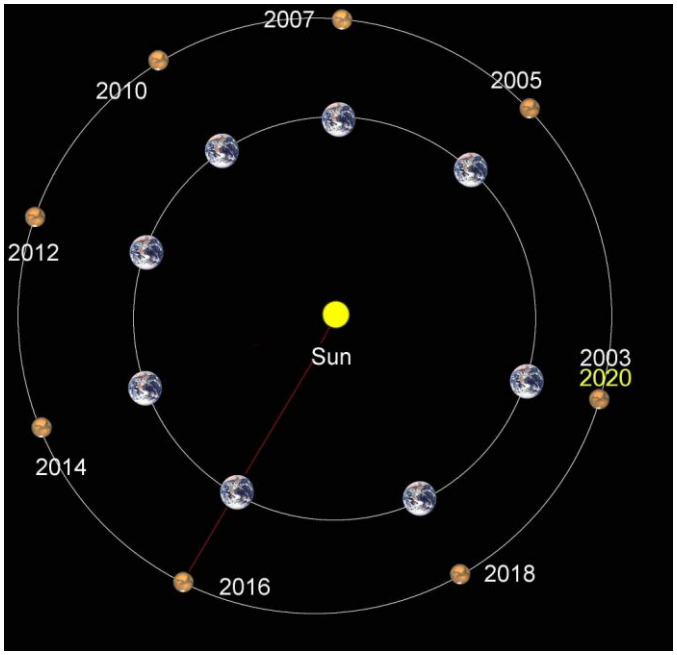
An object directly overhead has only to pass through about 100 km of our atmosphere (only about 20km can be considered to be thick). We have already mentioned the turbulence caused by heat close to the horizon but the thicker air also causes refraction that separates the colours in the image. This has the effect of causing a blue tinge to one side of the image and a red (orange) tinge on the opposite side this should be minimal this year.

The best image by the author on 13th September 2020

The view looking directly through the telescope was a little disappointing due to air turbulence over houses with heat rising from the roofs. Despite the sky being clear and still it was difficult to make out the darker areas on the surface of Mars due to the heat turbulence. The image above does show some darker markings and the polar ice cap at the bottom of the image.

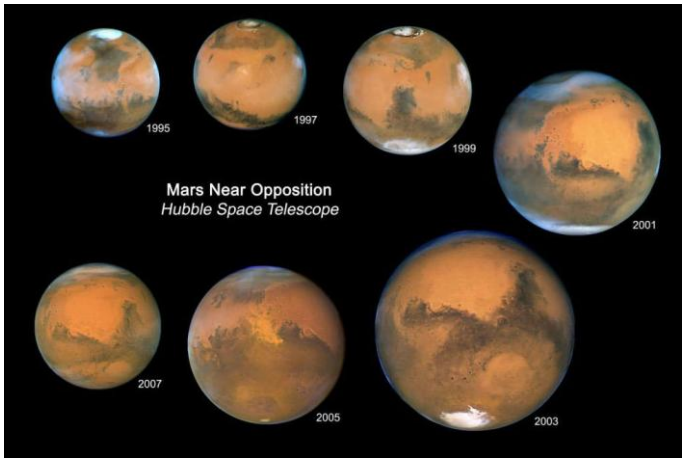
The previous image shows a much better view than was obtained when simply looking through the telescope. The view at the eyepiece was bright and large (for Mars) but was scintillating and dancing around as it was still fairly small and low in the sky in September.

The diagram below shows how the two planets were closest together in 2003 and moved further apart at subsequent oppositions. From 2014 the planets started to move closer together at oppositions. The very closest approach is on 6th October when Mars will be just 62.07 million km from Earth and with have an apparent diameter of 22.6 arc-seconds (written as 2.6").



The relative distance to Mars 2003 to 2020

The diagram below shows how Mars appeared to grow larger over the years approaching the 2003 opposition and appeared smaller from 2003 to 2007.



A chart showing the apparent size of Mars

Over the next year Mars and Earth will move around the Sun until Mars is directly on the opposite side of the Sun to Earth. We call this alignment 'Conjunction'. At this point Mars will not be visible because it will be lost in the glare around the Sun and in our sky during the day.

At conjunction Mars will be at its greatest distance about 400 million km from Earth so will appear very small, even if we could see it. This is very far away compared to the 62.1 million km at opposition on 13th October.

Mars will still be in a good position for observing for the following couple of months. The telescopic view should be good this year but Mars will not be back in the sky in a favourable position for observing for another two years so we should really take a look if possible.

The charts on the previous page and on page 9 show the location of Mars in the southern sky. Except for the Moon Mars is the brightest object in the south at a Magnitude of -2.6. To the naked eye it looks bright and distinctly orange in colour. A pair of binoculars will show it brighter and but surface detail cannot be seen.

A telescope is required to see Mars as a disc. A small telescope even with an aperture of just 75mm will do because Mars is so bright. It will however require a magnification of at least 100 times. This means a telescope with a focal length of 1000mm will require a 10mm eyepiece to be used (1000 ÷ 10 = 100x).

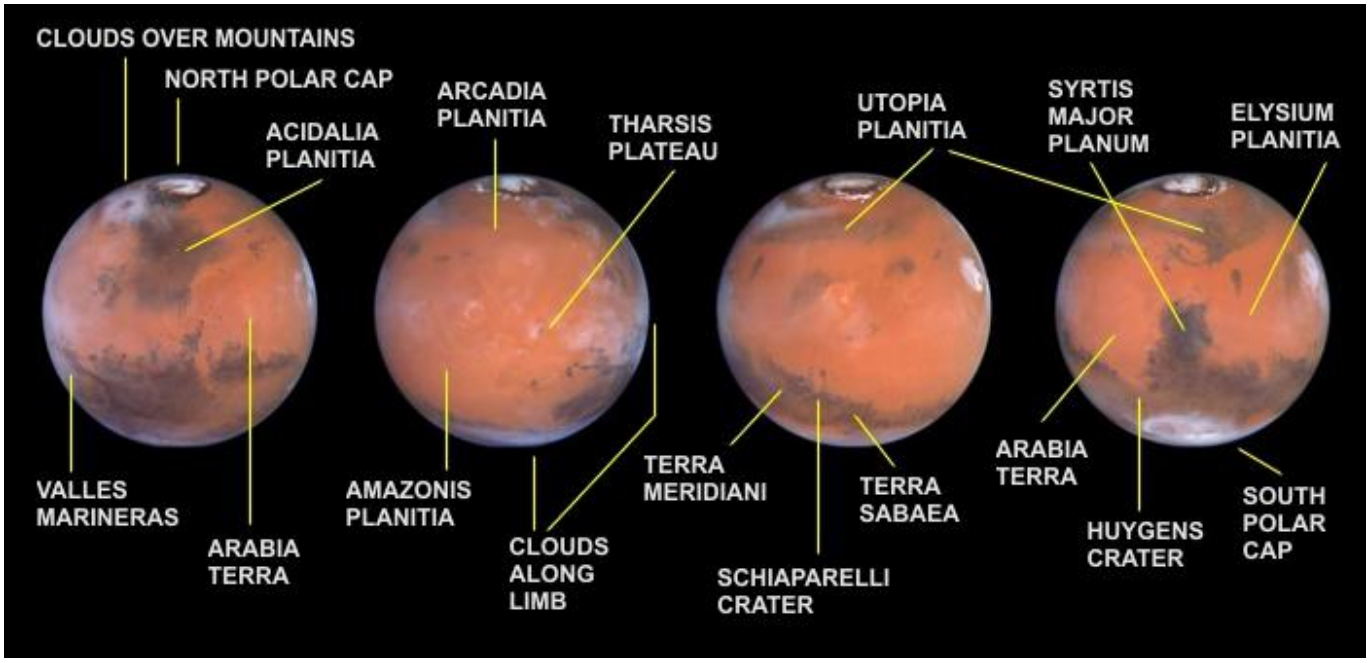
The author's 90mm x 900mm focal length telescope

The telescope shown above was used to observe Mars in September and proved satisfactory with the darker surface markings able to be seen. A more detailed view was obtained using a Barlow lens to increase the magnification to 180x. This was possible as the seeing was good with the sky looking clear and steady. So Mars can be observed using a small £155 telescope.

Mars imaged by Peter Tickner Reading AS

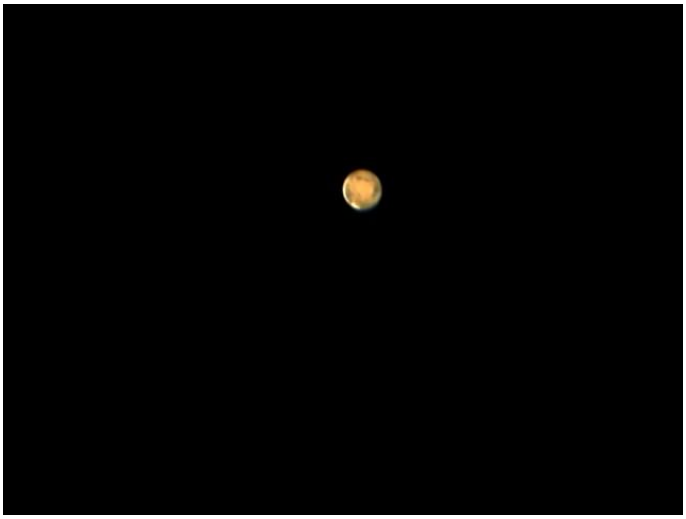
We can go on to the internet and see the wonderful images taken by Hubble but there is still a great thrill in seeing the planets with our own eyes.

OBSERVING MARS



Hubble images with the main features on Mars labelled

The picture above shows the main features that may be identified on the surface of Mars labelled for identification. It must be pointed out that the view of mars as seen through the average amateur astronomer's telescope will not be as clear as those shown in pictures above. The very best view possible using ~200x magnification and a medium sized telescope (120mm) on a very still clear night is likely to be something like the image below.



A good image through a telescope eyepiece

Before starting to observe Mars point the telescope towards a fairly distant object during the day, a chimney is a good target. Take note of the orientation of the image to see if it is upside down or back to front? This will help with identifying features on Mars. The images above are the right way up (north at the top).

The rotation period of Mars is almost 40 minutes longer than Earth's, at 24 hours, 39 minutes and 35 seconds. This means that features centrally located on Mars' disc appear 40 minutes later on each consecutive night. This rotation speed also means half of the surface of Mars can be seen over the course of one night's viewing. That is if the weather and the observer's persistence permit.

Imagine looking at Mars one night and seeing a dark feature at the centre of its disc (what's known as the Central Meridian of Mars). The following night at exactly the same time, that feature would appear slightly further west and take an extra 40 minutes to reach the central meridian once again. The night after that, viewing at the same time, the feature would take 80 minutes to reach the central meridian.

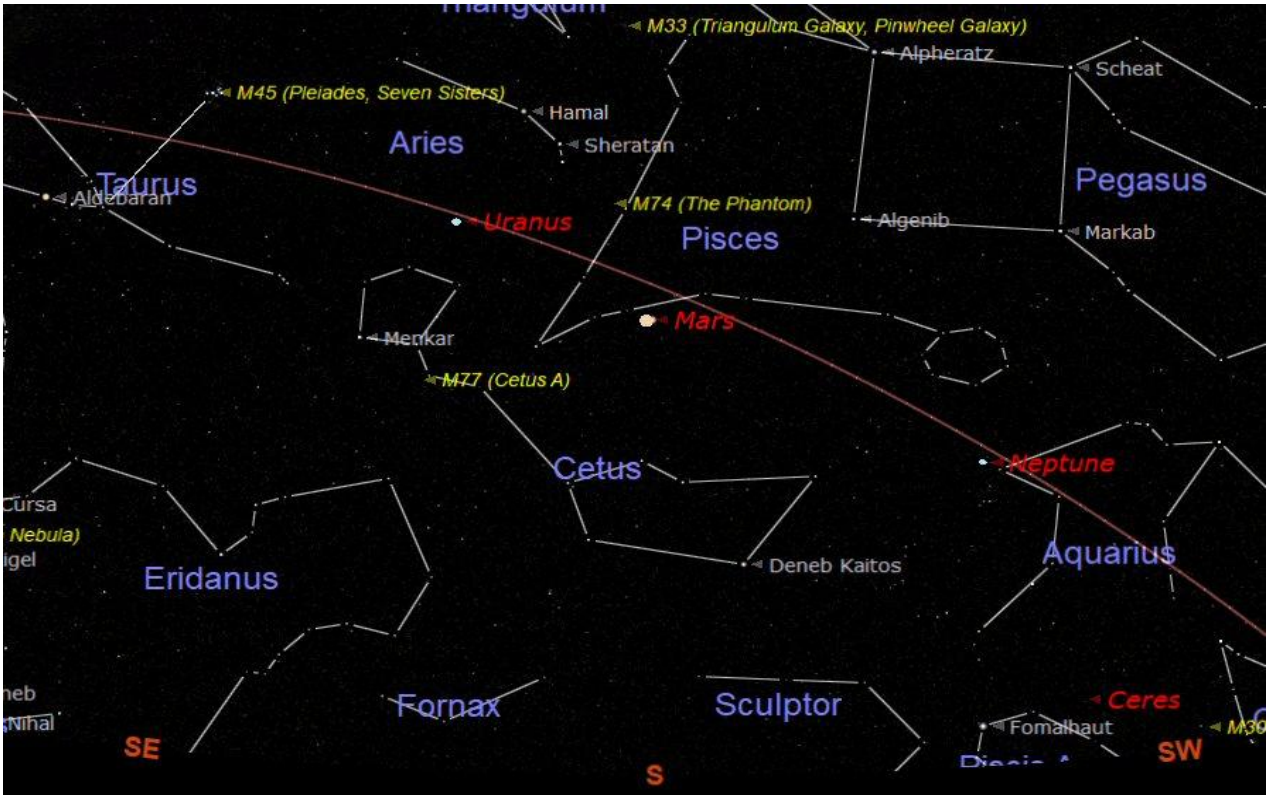
A telescope is needed to see Mars as a disc and the larger the telescope the more detail can be seen. The 'seeing conditions' (the clarity and stability of our atmosphere) is a very important factor for having a good view. Use a low power eyepiece (25mm) to start observing Mars then use a higher power (magnification) eyepiece (10x) to have a good look. If the image looks good then a Barlow Lens can be used to effectively double the magnification of the 10mm eyepiece. As Mars gets larger, its surface detail should be easier to see (it will be at its very closest and largest on 6th October).

The bright southern polar cap should be quite easy to see even using a smaller telescope. The planet surface has areas of light and dark, representing deserts and exposed rock. These are known as Albedo features, areas that appear bright or dark due to the amount of light they reflect. The larger and darker an albedo feature is the easier it is to see through a telescope.

Probably the easiest feature to recognise is Syrtis Major shown on the right image above. This large triangular feature points to the North Pole of Mars as can be seen above so North is up. So try to identify this feature if it is in view. Between the southern boundary of Syrtis Major and the southern polar cap lies the Hellas Basin. This 2,300km diameter basin is one of the largest impact craters in the Solar System. Hellas can sometimes appear bright due to clouds that can form in the basin.

The Hubble images above can be used to identify features seen through our telescope or on photographic images we have produced. HST images can be downloaded for the view during the observing period.

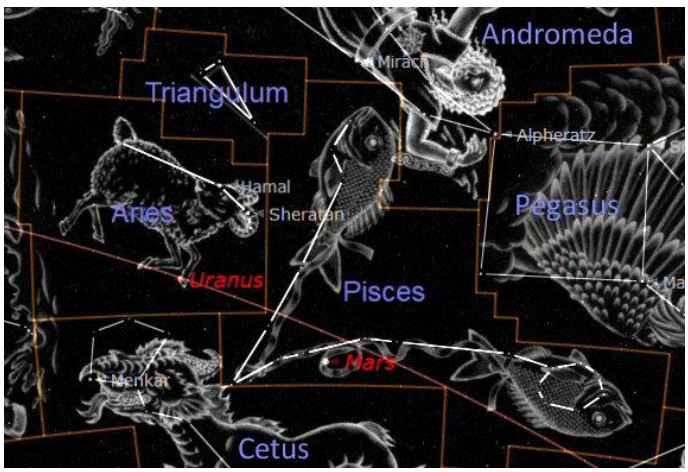
CONSTELLATIONS OF THE MONTH – PISCES AND ARIES



The constellations of Pisces and Aries

The constellations of Pisces (the Fishes) and Aries (the Ram) are not the easiest constellations to find as their stars are not very bright. However this year the presence of the planet Mars within the boundaries of Pisces will help in identifying these rather illusive constellations. Mars is very bright this month and cannot be missed in the southern sky.

Pisces is one of the twelve constellations of the Zodiac and appears as one of the birth signs. The Zodiac is called the Ecliptic by astronomers and is the imaginary line along which the Sun, Moon and planets appear to move across the sky. Pisces is preceded on the Ecliptic by Aquarius (the Water Carrier) to the west (right) and followed by Aries (the Ram) to the East) left.



Pisces and Aries showing its illustrations and borders

The easiest way to find Pisces is to find Mars then look above and to the west (right) to locate the Great Square of Pegasus (the Winged Horse). The Great Square of Pegasus is larger than may be expected but once the square is found it is much easier to find again.

The recognised asterism (pattern of stars) that represents the constellation of Pisces (the Fishes) does not, even with the best imagination, look anything like fishes. It is a meandering line of fairly faint stars that loop around the lower eastern (lower left) corner of the Square of Pegasus. It looks more like a sea serpent or an eel rather than any kind of fish. See the charts above.

So the constellations surrounding Pisces are Pegesus to the North West (above and to the right), Aquarius to the South West (lower right), Cetus (the Whale) to the South (below) and Aries (the Ram) to the East (left). Pisces does host one Messier deep space object known as Messier 74 (M74). This is a lovely Spiral Galaxy with very distinct curved spiral arms. This is difficult to see with a telescope but looks beautiful in images.

Aries (the Ram) is represented by a rather indistinct line of three stars and looks nothing like a Ram. Aries has no deep sky objects but is host to the outer planet Uranus this year. Uranus can just about be seen using a good pair of binoculars in a very dark and clear sky but does really need a telescope to see well.

Aries has no interesting objects but it is important for one ancient reason. The First Point of Aries is the location of the vernal equinox, used as a reference point in celestial coordinate systems. In diagrams using such coordinate systems, it is often indicated with the symbol ♈. It is one of the two points on the celestial sphere at which the celestial equator crosses the ecliptic, the other being the First Point of Libra, located exactly 180° from it.

Due to precession of the equinoxes since the position was originally named in antiquity, the position of the Sun on the spring (March) equinox is now in Pisces (but still called the First Point of Aries). The autumn (September) equinox is now in Virgo.

A homemade DSLR mount and Finder Scope

The author's homemade DSLR camera mounting

While imaging Comet 2020 F3 (NEOWISE) the author found it rather difficult to find the comet using the camera screen and keep it in view. He came up with the idea to mount the camera with a telescope finder that can be fixed to a tripod. Here is a brief story of the project.

The Alt Az tripod used with the Mount

The tripod above is generally used with the Author's PST Solar telescope so was available for this project.

DSL Mount bottom and top view

The images above show the 200 x 200 x 8mm plywood mounting base with a wooden location strip secured underneath using countersunk screws. Two M6 bolts were fitted to clamp the mount to the tripod head using two M6 Wing Nuts.

The DSLR mount shown was available from a junk drawer but the Camera Hot Shoe Mount, shown below, can be bought from Amazon for about £6. The Camera Hot Shoe mount base can be drilled for securing using screws or small bolts. The Finder Mount Shoe can be bought from astronomy shops for about £7.

The Camera Hot Shoe and finder mount shoe

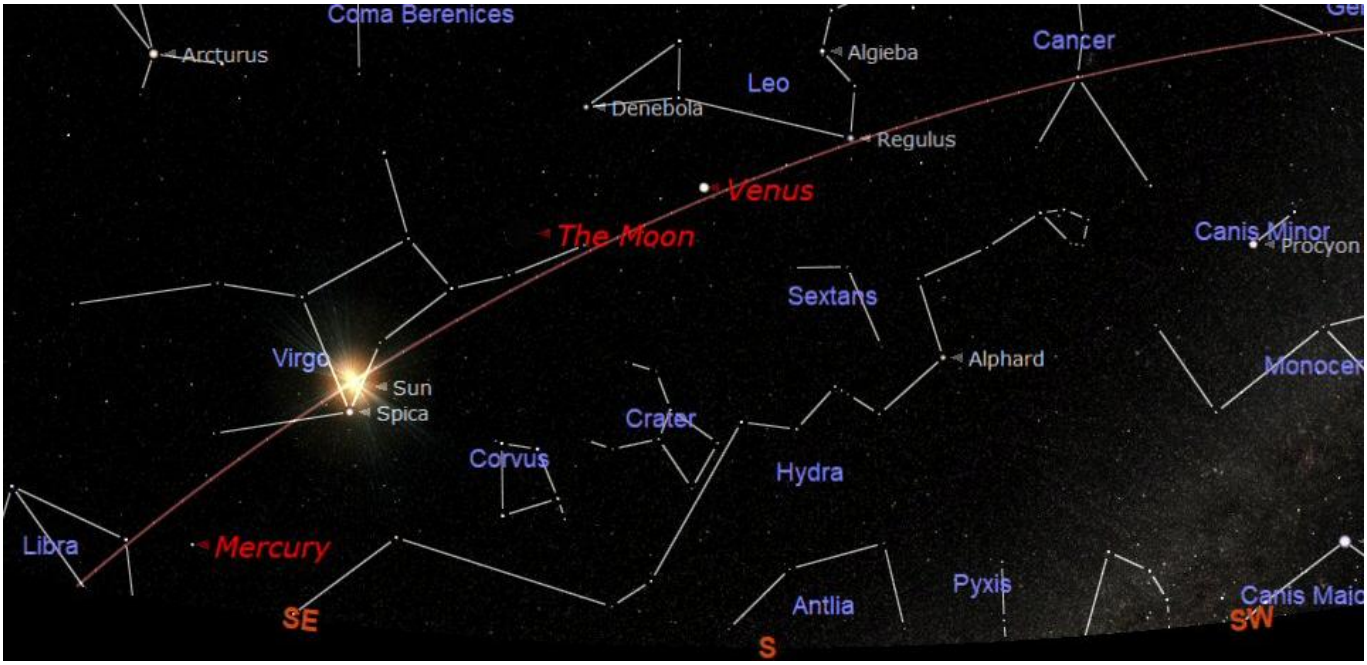
If a finder is not to hand then they can be bought from Astronomy shops like Rother Valley Optics. Skywatcher manufacture two sizes of Finder Scope a 50 x 9 (£45) model and a 30 x 6 model (£26). The smaller one is perfectly adequate, has a wider field of view and the lesser light gathering capability will not be a problem.

The finder used by the Author was borrowed from his Skywatcher 90mm refracting telescope.

The Camera Mount used and Finder options

The mount was used to image Mars rising but the main purpose for this building project was to follow the Conjunction of Jupiter and Saturn in December this year. The two planets appear close in the sky already but will become much closer. See page 10.

THE INNER SOLAR SYSTEM - OCTOBER 2020

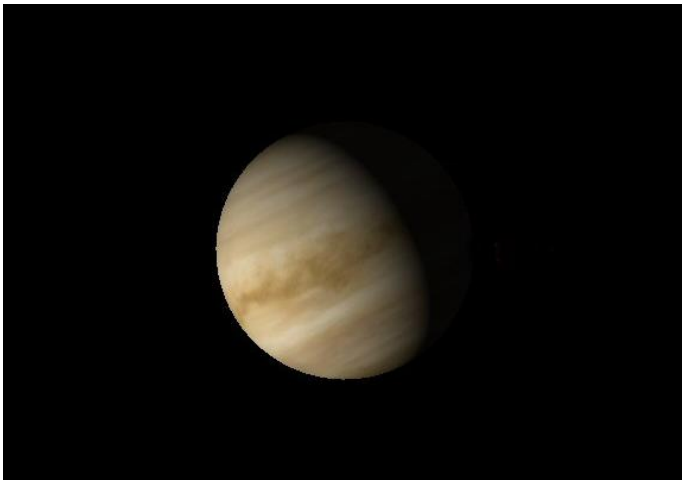


The mid month morning sky at 10:00 (in the morning) showing the positions Mercury and Venus

MERCURY will not be visible this month as it is in the bright morning sky. 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 after the Sun has set.

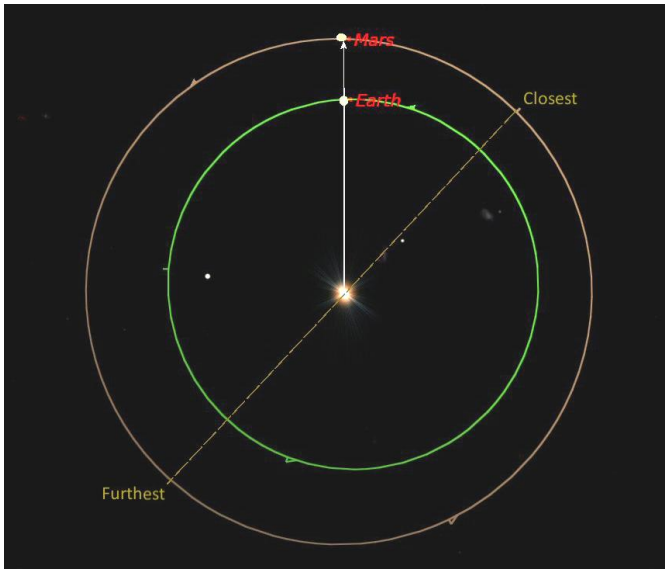


Venus as it will appear on 15th October

After conjunction it 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 looking large at about 22 arc-seconds. Earth is catching up with Mars on their orbits around the Sun. This is because Earth's orbit is inside the orbit of Mars and is consequently travelling faster. Earth will catch up and overtake Mars on 13th October and this is called Opposition. At opposition Mars will be in direct line with Earth and the Sun as shown on the chart below.

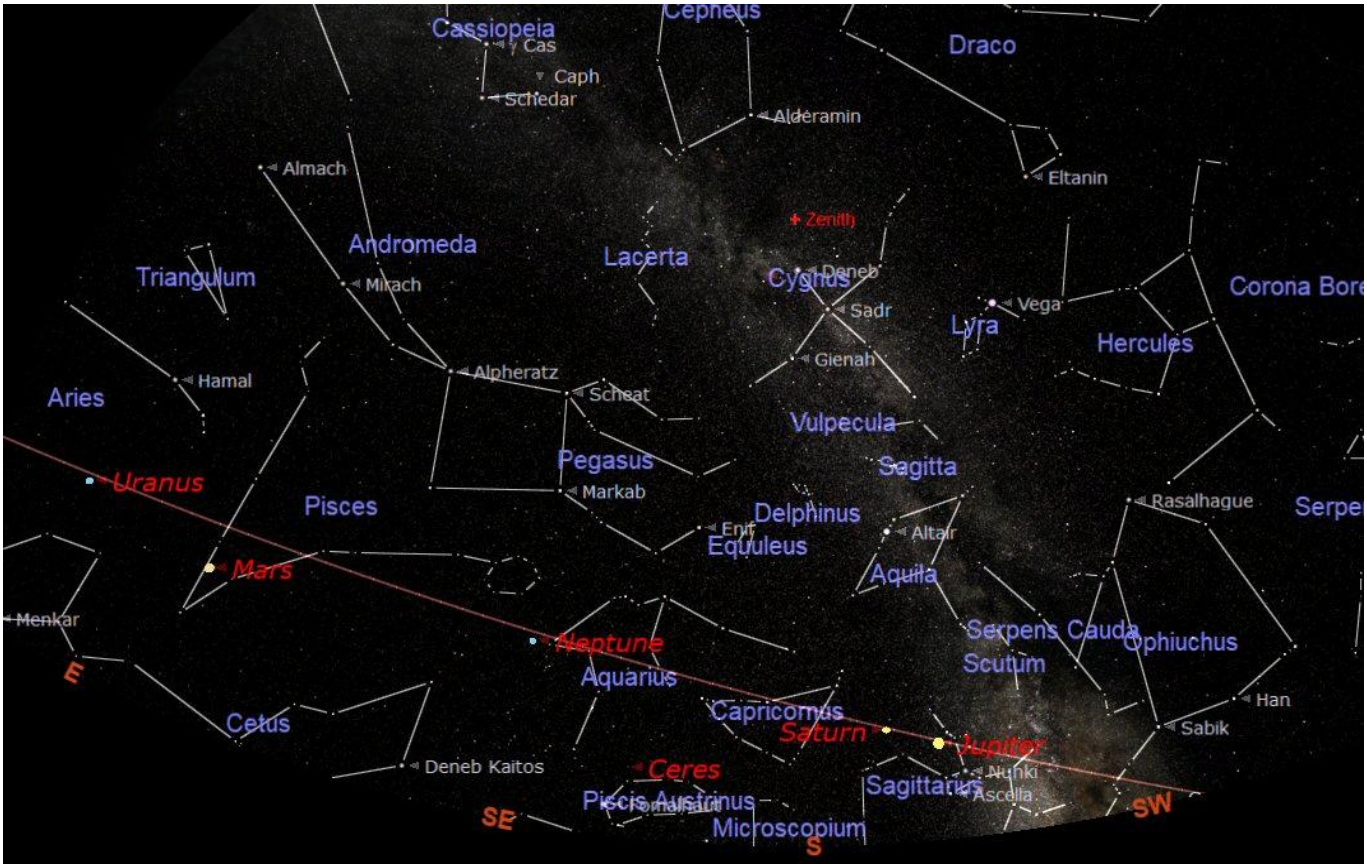


Mars at Opposition on 13th October 2020

At opposition Mars will be 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 will actually be at its very closest on 6th October at 62.07 million km.

There is another bit of good news for this opposition. The Ecliptic will be high so Mars will also be in good stable air for viewing. See the main theme article about Mars on the previous pages.

THE OUTER SOLAR SYSTEM – OCTOBER 2020



The chart shows the positions of the planets observable in the night sky this month. Jupiter and Saturn were both at Opposition in July, Jupiter on 14th July and Saturn on 20th July. Opposition was the exact time when Earth overtook (to be more precise 'undertook') Jupiter and Saturn on their orbits around the Sun.

When the planets were at Opposition they were due south at midnight 01:00 BST (00.00 GMT) during the night of the dates shown in the previous paragraph. At these times the planets were at the centre of the night sky in the south and at their maximum altitude on the Ecliptic above the horizon. Earth was located in a direct line between Jupiter (or Saturn) with the Sun on the opposite side of Earth at midnight.

Jupiter at Opposition imaged by Steve Harris

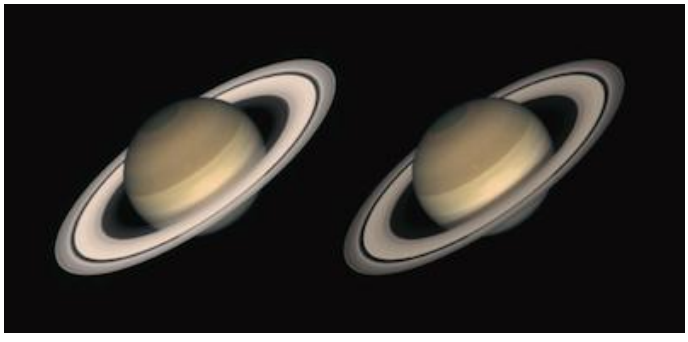
So on these nights the two giant planets were at their very best but unfortunately the Ecliptic is at its lowest at midnight in the summer (and highest at midday).

Therefore Jupiter and Saturn were low in the sky and close to the southern horizon where the air is thickest and most turbulent therefore appeared very unsteady.

At opposition Jupiter was 'in theory' at its best and brightest on 14th July but in reality it did not look any different. It always looks large and bright and will continue to look impressive for the rest of this year until it disappears over the western horizon around Christmas.

However it was a different matter for Saturn on 20th July. At 23:00 BST (22:00 GMT) for about two hours the rings brightened. This was the exact time of opposition and the sunlight was reflected directly back towards the Sun and Earth. At this point the ice particles in Saturn's ring did not cast shadows on other particles because the Sun and Earth were in perfect line. The particles in the ring appeared fully illuminated and reflected all the light back making the ring brighter this is called the Seeliger Effect.

The image below shows the Seeliger Effect with the ring brighter at the time of Opposition shown on the left and how the ring system normally appears on the right.



Images showing the Seeliger Effect

The ring really did actually appear noticeably brighter when viewed through a telescope this year.

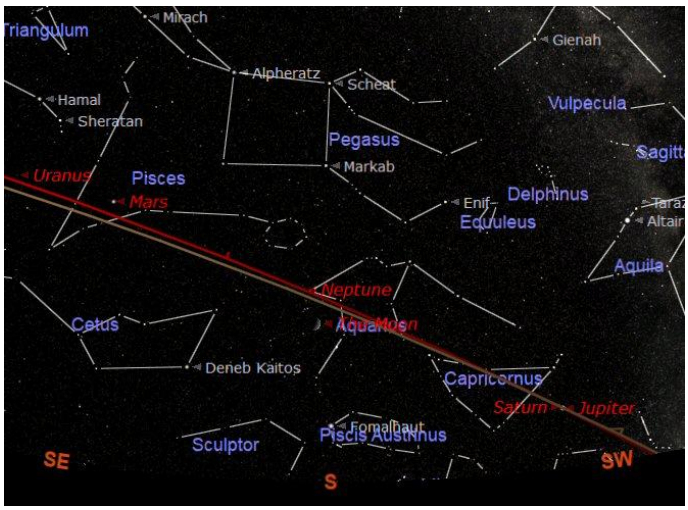
THE CLOSE CONJUNCTION OF JUPITER AND SATURN

Jupiter and Saturn in conjunction 20th September 2020

The image above was taken using the DSLR Camera Mount shown on page 7 and using a 5 second exposure. The following article was published in the September issue of this magazine and repeated here.

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 image 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.

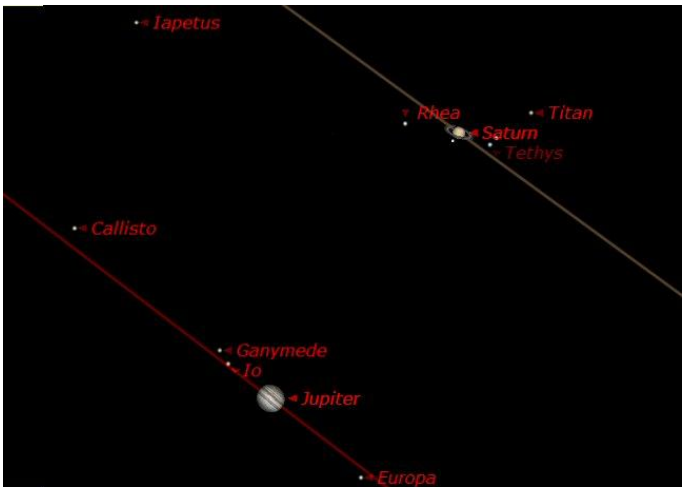


Orbital paths of Jupiter and Saturn 21st December

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 west.

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.

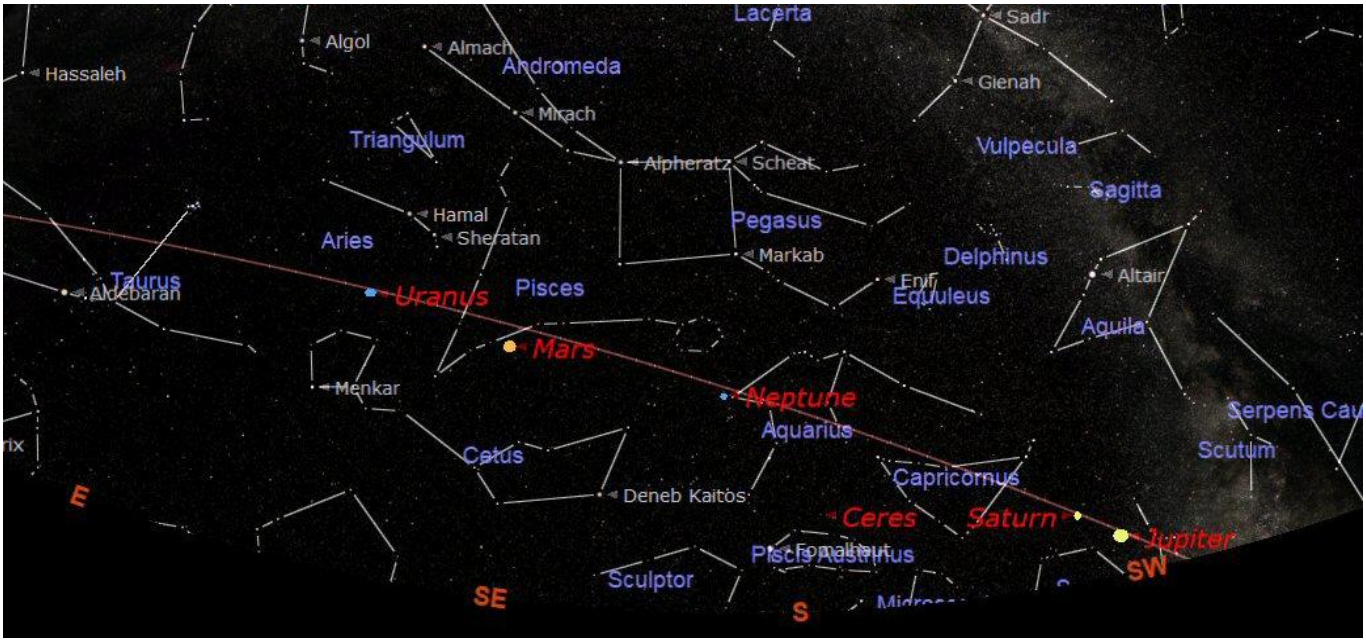


Jupiter and Saturn at their closest conjunction

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 OCTOBER 2020



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

URANUS will not be easy to see as it will be close to the southern horizon. It will rise at about 18:30 and be visible for the rest of the night. Uranus will be at opposition on the 31st October. It will require a clear view to the horizon and modest telescope to see.

NEPTUNE will rise at about 17:00 but will not be easy to observe this month as it and will be close to the south horizon and requires a larger telescope.

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. Any activity on the Sun can be followed live using the day to day images of the Sun in detail by visiting the very good SOHO website at: http://sohowww.nascom.nasa.gov/.

THE MOON PHASES DURING OCTOBER

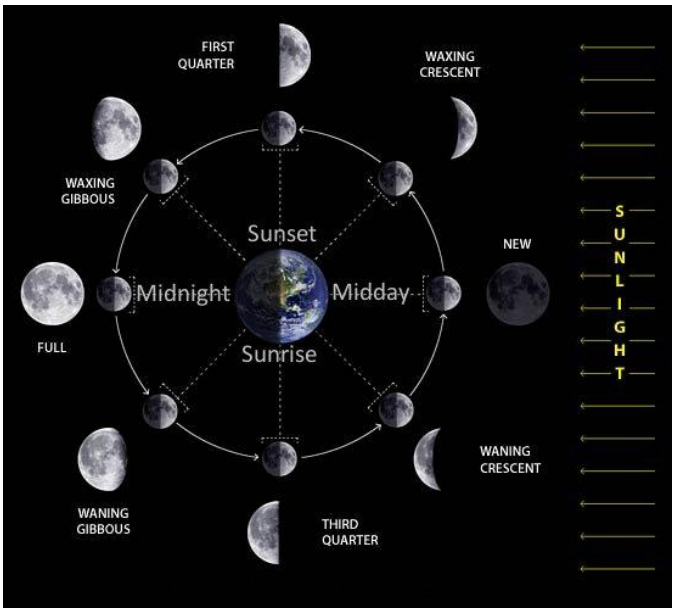


Diagram showing the illumination of the Moon

As the Moon orbits Earth about once a month the Sun illuminates different areas of the surface as we see it from our position on Earth. We call these different views 'Phases'. See the preceding diagram and the phase chart below.

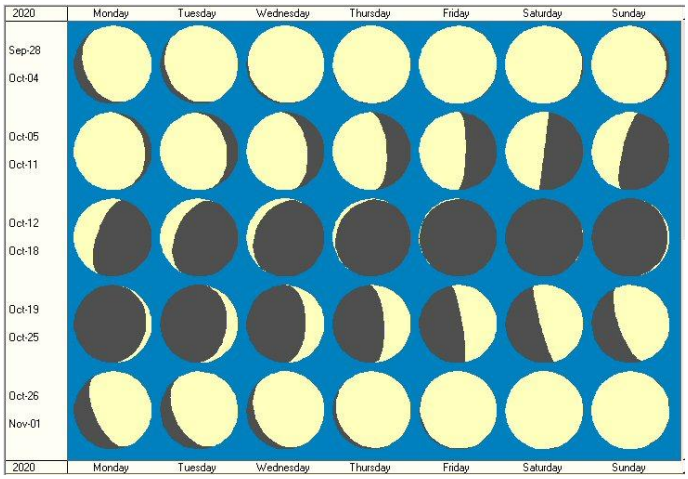
When the Moon is in the same direction as the Sun the side facing us is dark and we cannot see the Moon. As the Moon moves away from the Sun we see a thin slither of the illuminated side, we call this phase 'New Moon'.

A week later the western (right) half of the Moon will appear to be illuminated we call this phase 'First Quarter'.

Two weeks after New Moon, the Moon will be on the opposite side of Earth to the Sun and the whole of the Moon is illuminated so we call this phase 'Full Moon'.

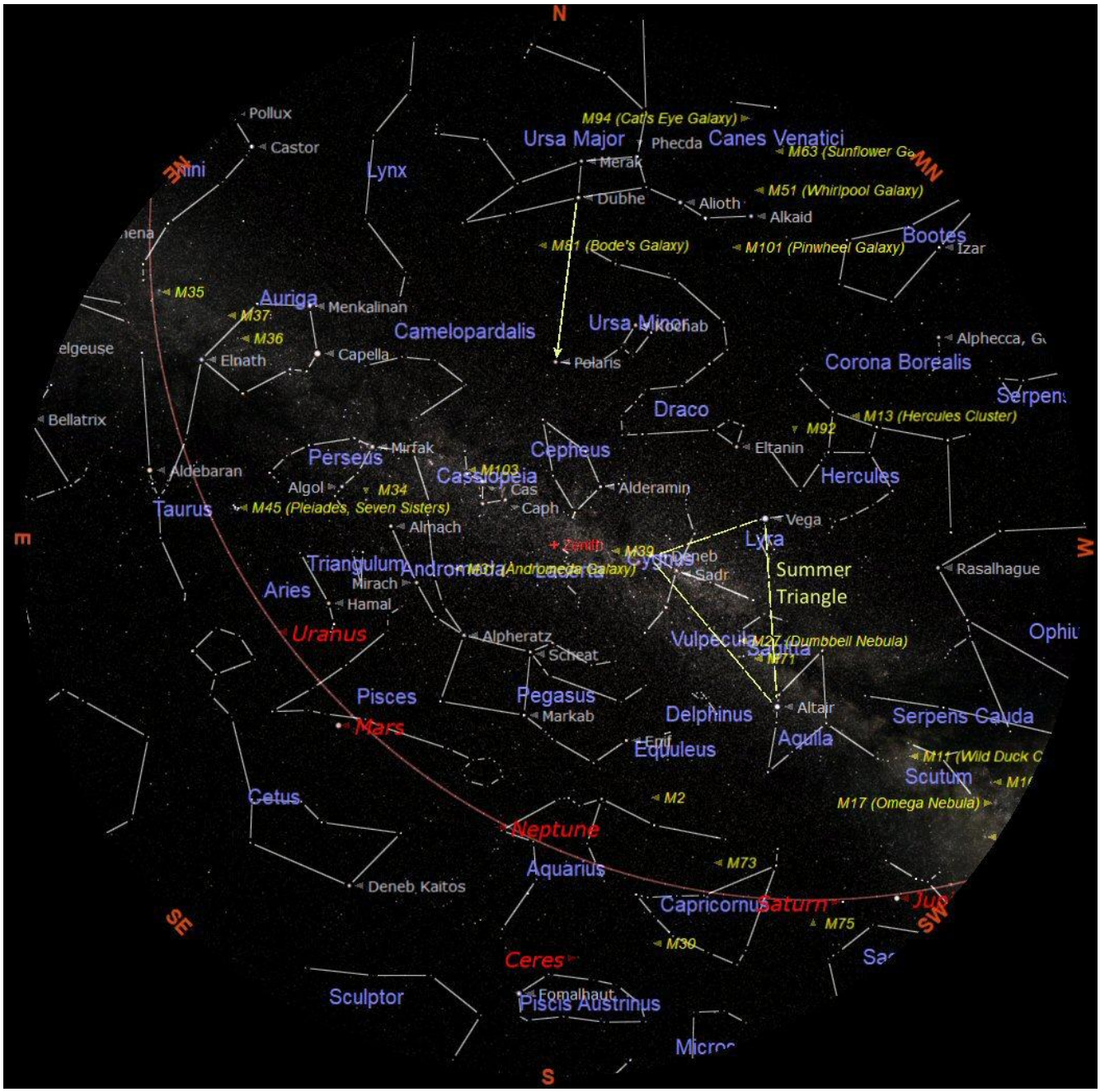
Three weeks after New Moon the eastern half of the Moon is illuminated we call this phase 'Last (or Third) Quarter'. Here the opposite side to the First Quarter is illuminated as the Moon moves back towards the Sun.

This month there will be an extra Full Moon on 31st October this is sometimes referred to as a 'Blue Moon'.



Full Moon will be on 1st October
Last Quarter will be on 10th October
New Moon will be on 16th October
First Quarter will be on 23rd October
Full (Blue) Moon will be on 31st October

THE NIGHT SKY – OCTOBER 2020



The chart above shows the whole night sky as it appears on 15th October at 22:00 (10 o'clock) in the British Summer Time (BST). 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 11 o'clock BST at the beginning of the month and at 9 o'clock BST 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.

British Summer Time (BST) ends at 02:00 on 25th October and Greenwich Mean Time begins.