NEWBURY ASTRONOMICAL SOCIETY
MONTHLY MAGAZINE – JULY 2021

PARTIAL SOLAR ECLIPSE 10th JUNE 2021

10:35

10:56

11:05

Images of the Partial Solar Eclipse 10th June 2021

On 10th June 2021 a Partial Solar Eclipse was visible from the UK. From Newbury UK we saw about 20% of the Sun covered by the Moon at 11:13 BST. The centre of the eclipse (totality) was in northern Canada, across Greenland finished over Siberia.

From these more northerly areas there was an Annular Eclipse. An Annular Eclipse occurs because the Moon's orbit is not circular but elliptical so it moves closer and further from Earth. On 8th June 2021 the Moon was at its furthest point from Earth on its orbit that we call 'apogee'. Consequently the Moon appeared smaller in the sky than normal.

The Moon was still smaller on 10th June (the day of the eclipse) and appeared slightly smaller than the Sun so it could not completely cover the Sun. Therefore at the midpoint of the eclipse the outer edge of the Sun was visible around the silhouette of the Moon. This is sometimes called the 'Ring of Fire' effect.

The weather forecast for the south of England was not very promising but on the day the clouds parted for a while and we were able to see partial eclipse from about 10:30 until around 11:15. So Steve Harris swung into action to take some photographs of the event. Unfortunately he missed the maximum cover at 11:13 due to the return of the cloud.

The author setting up his telescope and camera

From the south of the UK we saw the edge of the Moon start to 'cut' into the edge of the Sun at 10:06 this was our 'First Contact'. At 11:13 we would have been able see almost 20% of the Moon in front of the Sun if the clouds had not returned. This would have been the maximum cover of our eclipse and would have covered about 20% of the Sun. The Moon's silhouette would then have been seen to move off the Sun until it moved completely off the edge of the Sun at 12:24 and the Partial Eclipse would have been over.

The eclipse image displayed on a TV screen

The author attached his DSLR camera directly to the focuser of his Skywatcher 80mm refracting telescope that was mounted (piggy backed) on his Meade LX200 telescope. The image on the DSLR screen was relayed to a TV screen to give a larger image to make it easier for focusing. The telescope was fitted with a glass type solar filter. Three of the eclipse photos are shown above.

NEWBURY ASTRONOMICAL SOCIETY MEETING

2nd July	The planet Neptune
Website:	www.newburyastro.org.uk

NEXT NEWBURY BEGINNERS MEETING

21st July	Astronomy during the summer holiday
Website:	www.naasbeginners.co.uk

THE SUMMER NIGHT SKY

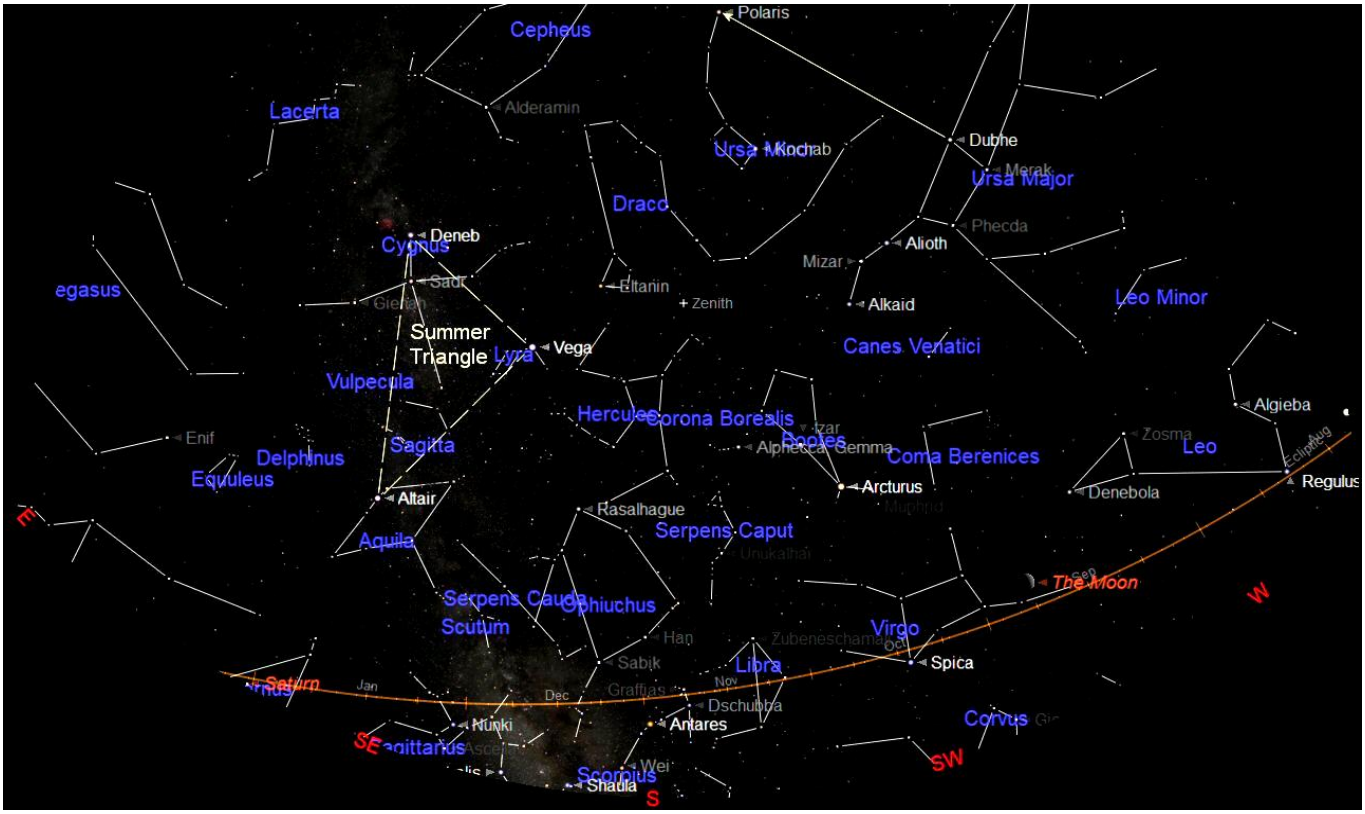


Chart showing the summer constellations looking south

The chart above shows the night sky at about 10 o'clock (22:00 BST) at the middle of July. The Milky Way (our Galaxy) is shown stretching across the sky from the south western horizon to the north eastern horizon. At the centre of the chart is the ZENITH, marked with a red cross. This is the point in the sky directly overhead when we look up. It does not matter where we are it is just the point directly overhead.

As humans we have the rather strange ability to see shapes and patterns when we look at things around us. A good example is when we see shapes of animals as we look at the white clouds on a bright day. Another example is when we look up into the clear night sky. The brighter stars appear to form patterns or groups. We can recognise these patterns and use them to help us find our way around the night sky.

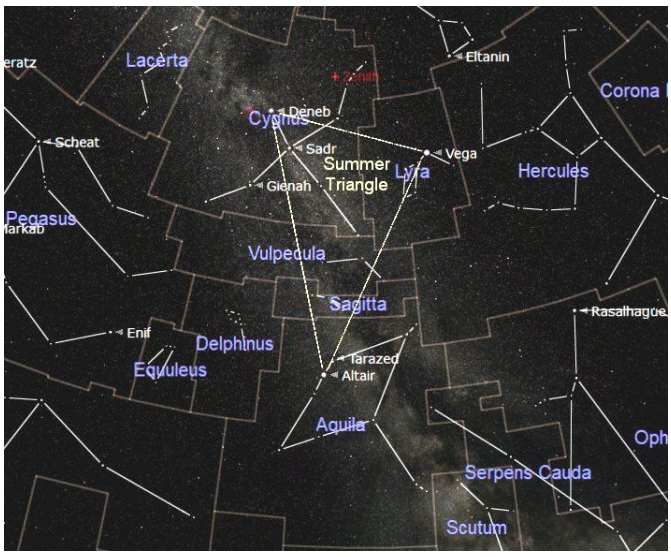
We join these patterns 'dot to dot' to make them a recognisable shape and call them 'Constellations'. Mapping the night sky is actually rather difficult as there are only the stars to use as reference features and stars all look quite similar. The only difference to the untrained eye is that some stars appear brighter than others.

With our unaided eyes (astronomers call 'naked eye') we can see about 6000 stars in a good dark sky. The brighter stars do seem to form (all be it, sometimes indistinct) groups and patterns in the night sky.

From ancient times these patterns have been recognised by different cultures around the world and given special names. The names have traditionally been taken from characters in mythological stories and are often very old. In 1922, the International Astronomical Union (IAU) standardised the constellation names and adopted the modern list of 88 universally recognised 'Constellations'.

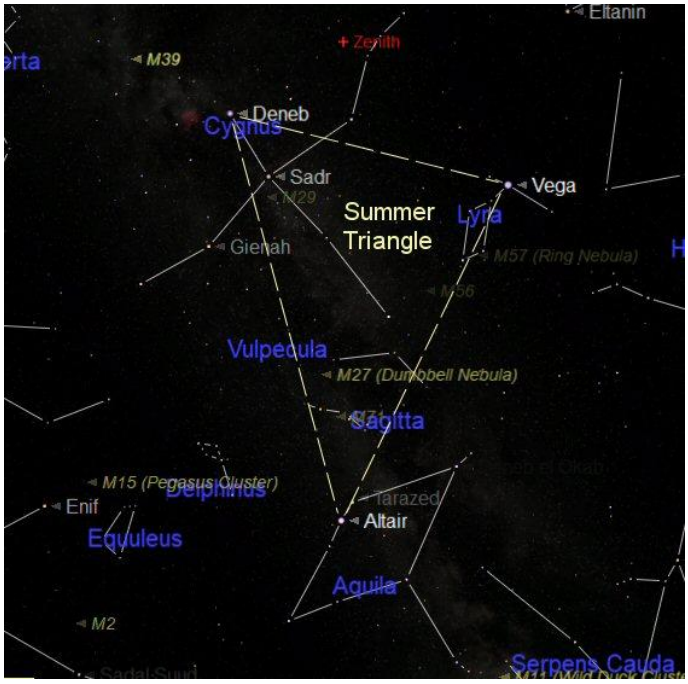
It would not be possible to find and identify all the constellations at once so we must learn to recognise the most prominent constellations first. We can then use these to spread out and identify the surrounding and less obvious constellations. So we can begin by identifying some of the most obvious constellations that have distinctive bright stars.

At this time of the year we are lucky to have a number of constellations with bright stars and a shape that is easy to recognise and then remember. Let us start with the best known summer constellations and the obvious place to start is the famous 'Summer Triangle'.



The Summer Triangle with constellation borders

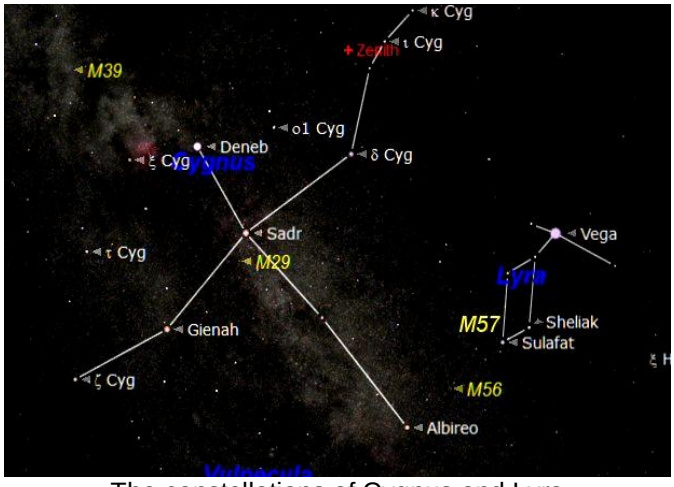
The Summer Triangle is very easy to find so it is very useful as the starting place for finding our way around the night sky so we will start this introduction to the summer sky from the Summer Triangle.



The Summer Triangle

The chart above shows the sky around the Summer Triangle. The term 'Summer Triangle' was suggested by Sir Patrick Moore and has now become one of the most well known features in the summer night sky. The corners of the imaginary triangle are positioned on the three obvious bright stars: Deneb in the constellation of Cygnus, Vega in Lyra, and Altair in Aquila. The Milky Way (our Galaxy) flows through the Summer Triangle and passes through Aquila and Cygnus. The Triangle is bigger than may be expected but once it has been found it is very easy to find again.

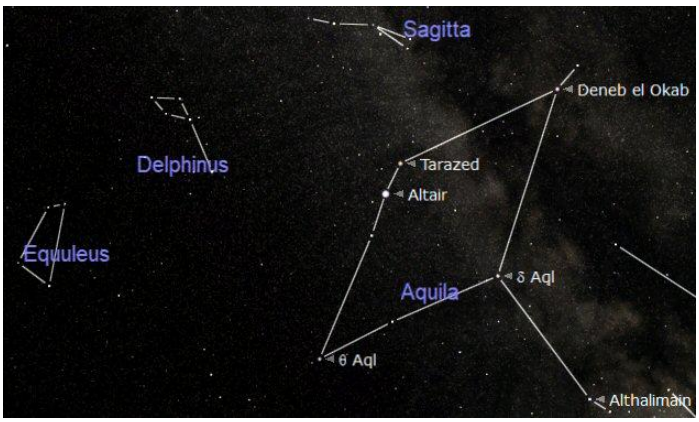
The constellation of Cygnus (the Swan) is located at the top of the Summer Triangle. The brightest star in Cygnus is Deneb which denotes the upper point of the Summer Triangle and represents the Swan's tail. The wings spread from the star Sadr and the head is marked by Albireo. Deneb is one of the largest and brightest stars in our vicinity in our galaxy the Milky Way and is classified as a Supergiant.



The constellations of Cygnus and Lyra

To the west (right) is the very bright star Vega. Below Vega is a lozenge shaped asterism comprised of four stars. Between the two lower stars: Sulafat and Sheliak is the Messier object M57. This is a 'Planetary Nebula' which has nothing to do with a planet. It is in fact a dying star that was similar to our Sun but older.

The constellation of Aquila (the Eagle) is found at the bottom corner of the Summer Triangle. Aquila has one bright star called Altair that has a fainter star above and below making it quite easy to find.



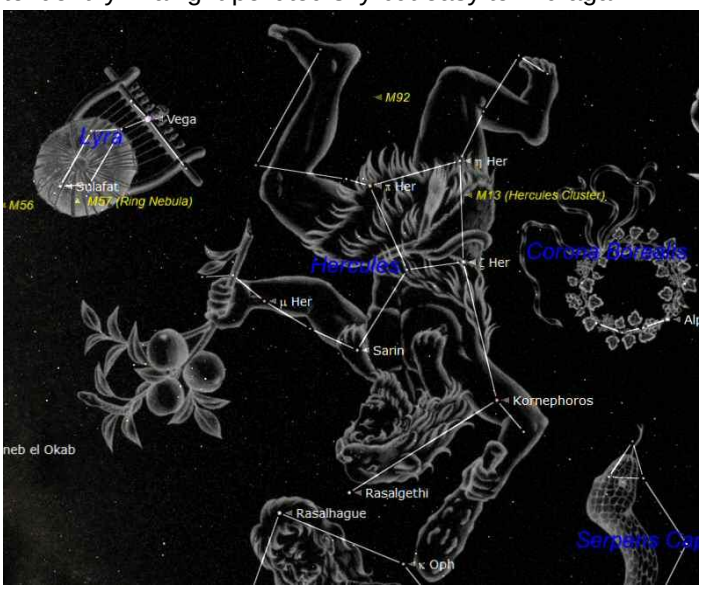
The constellations of Aquila, Sagitta and Delphinus

There are two small but interesting constellations that are located within and close to the Summer Triangle. They are both small and comprised of relatively faint stars but are worth seeking out using binoculars.

Sagitta (the Arrow) is good fun to find using binoculars because it really does look like an 'arrow'. It is composed of three stars that look like the shaft of an arrow and two stars that resemble the flight feathers.

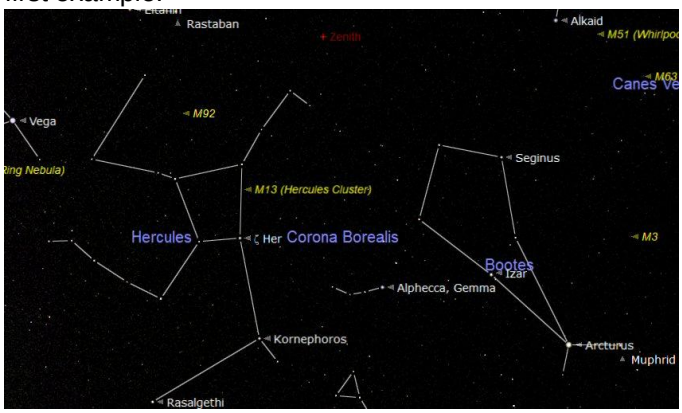
The asterism (shape) of Delphinus (the Dolphin) is comprised of a four stars that form a neat diamond shape and a fifth star a short distance from the diamond shape that completes the dolphin's body and tail. With a little imagination it does look remarkably like a dolphin leaping out of the water and can be seen with our naked eyes. It looks even more striking when using binoculars.

The Summer Triangle chart (on page 2) shows the constellation of Hercules located to the west of the Summer Triangle. Hercules is the great strongman from mythology. He is illustrated in the picture below (up-side-down), as he appears in the sky. He can be a little difficult to identify in a light polluted sky but easy to find again.



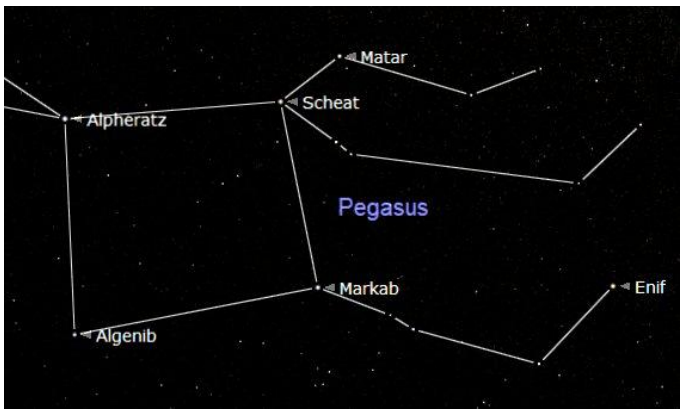
The constellation of Hercules

Once we have found and had a good look at the Summer Triangle and have become familiar with it we can use it to find some neighbouring constellations. The constellation of Hercules was mentioned on the previous page as a first example.



The constellations of Hercules and Boötes

Further to the west (right) from Hercules is the 'kite' shape of Boötes (the Hunter). The bright and noticeably orange star Arcturus is easy to find and shows us where Boötes is. Although not so bright, the other stars in Boötes do form the shape of a traditional diamond shaped kite. Arcturus is located at the bottom of the 'kite' shape where the tail would be attached. The chart above shows the location of Hercules and Boötes in relation to Vega, the bright star at the top right of the Summer Triangle (shown on the left of the chart).



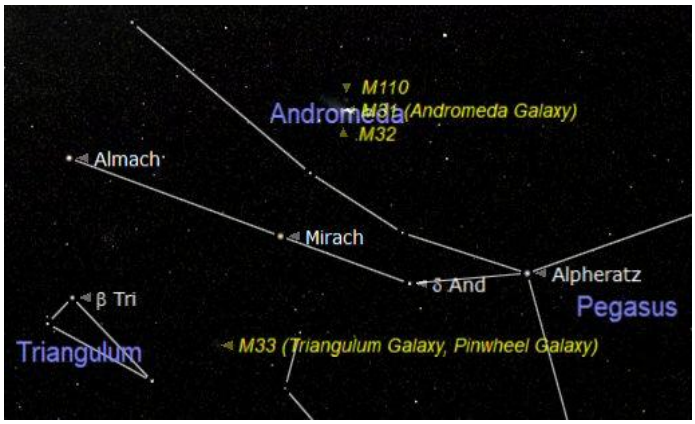
The constellation of Pegasus

To the east (left) of the Summer Triangle is the constellation of Pegasus (the Flying Horse). See the Summer Triangle chart on the page 2. The dot-to-dot representation of Pegasus really does not look remotely like a flying horse. The four stars Alpheratz, Scheat, Markab and Algenib do form the shape of a square (known as the Great Square of Pegasus). This square represents the body of the horse and the three lines joining the fainter stars to the west (right) represent three of the legs of the horse. It does however require a lot of imagination to see it as the shape of a horse.

The Great Square of Pegasus can be quite difficult to discern especially in a light polluted sky but once it has been found it should be easier to locate again. It is actually much larger in the sky than may be first thought when looking at a sky chart.

Once found the square can be used to judge the clarity of the sky. If five or more stars can be seen in the square then seeing should be good. If no stars are visible in the square then seeing will be poor.

Joined to the star Alpheratz at the top east (left) of the Great Square of Pegasus is the constellation of Andromeda (the ancient queen of Ethiopia).

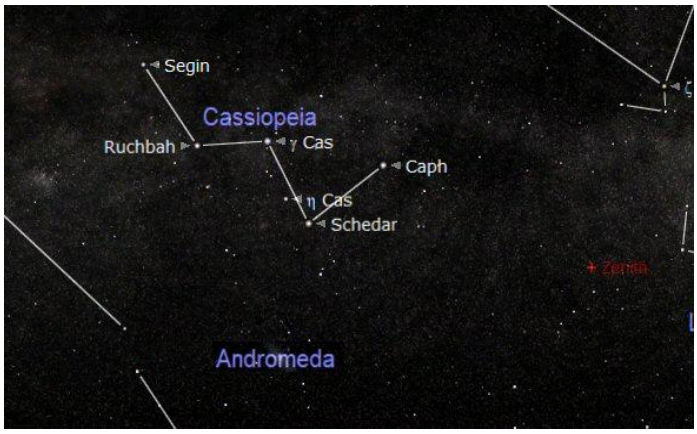


The constellation of Andromeda

Andromeda is comprised of two lines of stars converging on the star Alpheratz. This star 'Alpheratz' is officially the brightest star in Andromeda but it also forms the upper left star of the Great Square of Pegasus. Even though it is not actually a member of the constellation of Pegasus it still regarded as part of the Great Square as well.

Andromeda is famous for hosting the nearest and brightest giant spiral galaxy that is similar to our own Milky Way Galaxy. Our star the Sun is one of ~200 billion stars that comprise the Milky Way. The Great Spiral Galaxy also known as the Great Andromeda Galaxy or 'Messier 31 (M31) is thought to be larger than the Milky way hosting about 400 billion stars and is located 2.2 million light years away from us. It is the most distant object that can be seen using our unaided (naked) eyes (on a clear night from a dark location).

On the opposite side of Polaris to Ursa Major is the quite distinct 'W' shape of Cassiopeia (the queen of Aethiopia). See the chart on the last page and the next page.

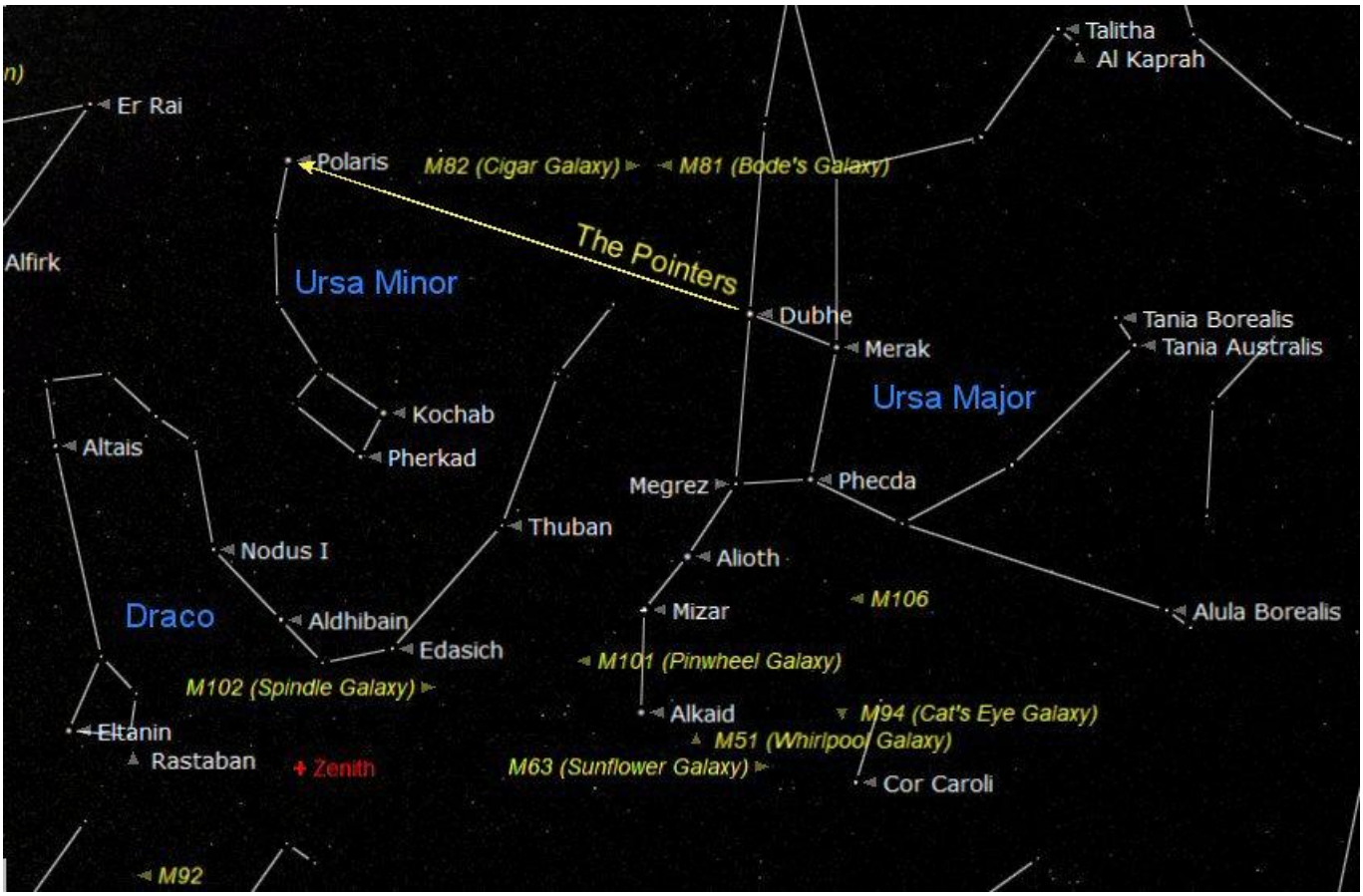


The constellation of Cassiopeia

Cassiopeia is rather impressive to see even with the 'naked eye' (not using binoculars). The 'W' shape is very obvious and makes this one of the easiest constellations to find. The five bright stars form the 'W' shape but there are lots more moderately bight stars surrounding the 'W'. The area around Cassiopeia is even better explored using binoculars. The abundance of bright stars really looks breathtaking especially against the background of the countless stars of our Milky Way Galaxy.

So let us be encouraged to go out to locate the Summer Triangle and start to find our way around the night sky.

URSA MAJOR (Great Bear) AND URSA MINOR (Little Bear)



The Constellations of this Month are among the best known of all the constellations and one is certainly the most recognisable. It is Ursa Major (the Great Bear) also known as the 'Plough' or 'the Big Dipper' in the USA. It has very little resemblance to a bear and looks much more like a 'Saucepan'.

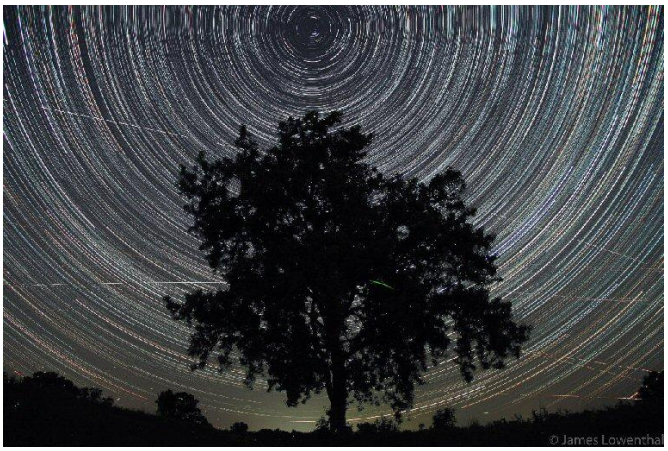
Ursa Major is high in the west at this time of the year as can be seen on the chart on the last page. The point in the sky directly overhead of the observer is called the 'ZENITH' and is shown in red on the chart. The chart shows the sky as it will appear at 22:00 on 15th July.

Ursa Major is a circumpolar constellation, this means it never disappears below the horizon from the UK and so is always visible somewhere in the night sky throughout the year. All the stars in the night sky appear to rotate around a point in the sky that we call the 'North Celestial Pole'. This point is located very close to the star Polaris in the constellation of Ursa Minor (the Little Bear) also called the Little Dipper in the USA.

The sky also rotates around Polaris once a year due to Earth's orbit around the Sun. Polaris can always be found by first finding Ursa Major. Then by following the two stars opposite the handle of the 'saucepan shape', up out of the pan and looking about five times the distance between the pointer stars. See the chart above.

Our planet Earth rotates around the North Celestial Pole once a day (24 hours). As Earth rotates the sky appears to rotate above us. As the sky appears to rotate, Ursa Major and the other constellations will appear to move around the North Celestial Pole in an east to west direction. It will appear to move anticlockwise around Polaris as shown on the chart above (handle behind). The movement is slow and not perceivable in real time.

However a long exposure using a camera will show the stars as trails as they rotate around the Pole Star as shown in the image below.

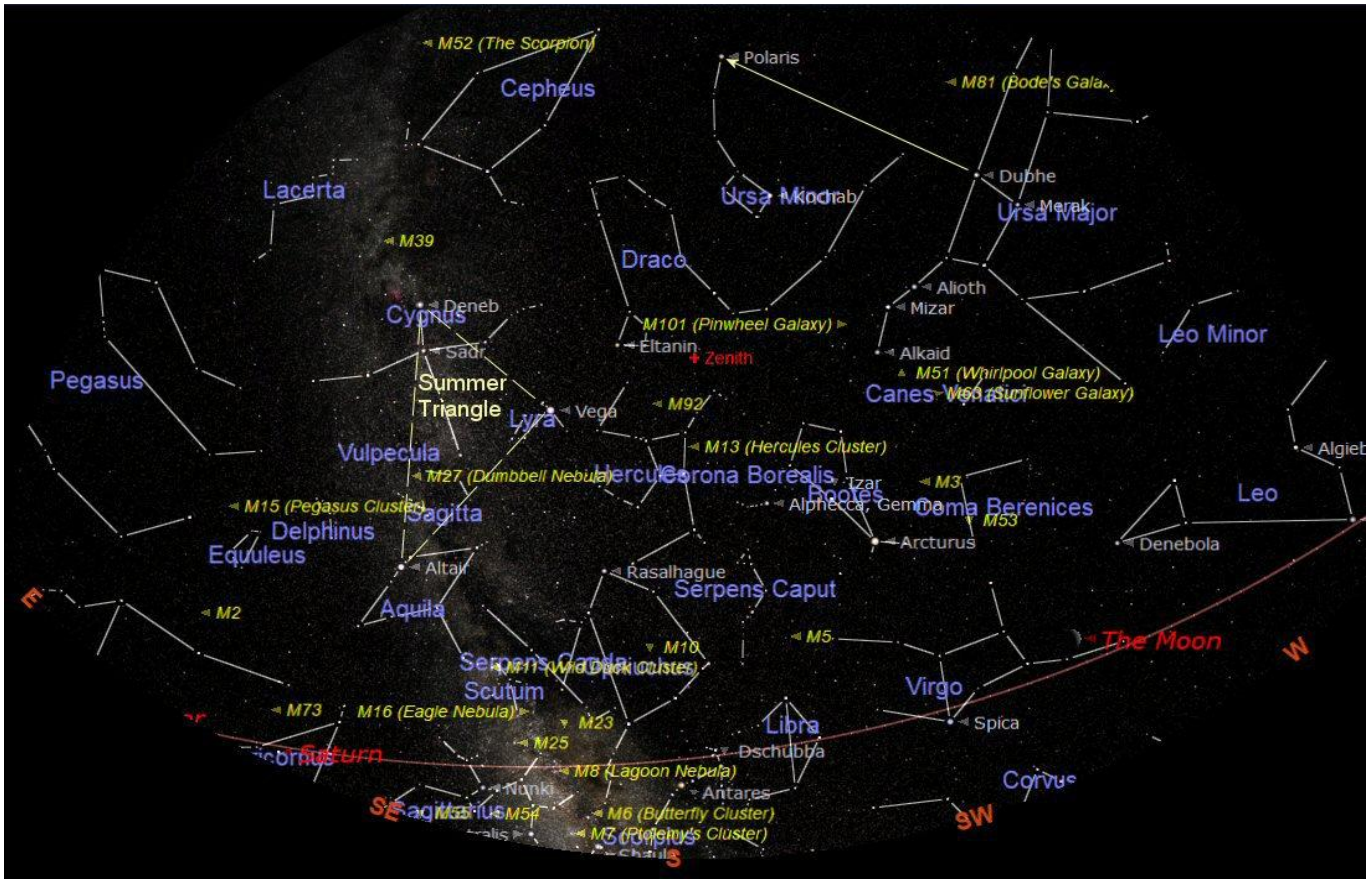


Star trails imaged by James Lowenthol

The axis of rotation of our Earth is tilted over at 23.4º to the axis of rotation of our Solar System. So we see our axis of rotation 23.4º to the north of our Zenith (the point directly overhead). We do not normally notice that we have a slightly odd view of the sky due to this tilt of Earth. Astronomers are acutely aware of this strange perspective we have of the sky as we need to take account of it when we are observing the moving sky.

So the two bears in our sky are quite important constellations. Ursa Minor because it hosts the North Celestial Pole and Ursa Major because it is used to help us to find Polaris with the North Celestial Pole close by. As Ursa Major is always somewhere in the night sky we can always use it as our starting point for finding our way around the sky.

A TOUR OF THE NIGHT SKY - JULY 2021



The chart above shows the night sky looking south at about 22:00 BST on 15th July. 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 Leo (the Lion), Virgo (the Virgin), Libra (the Scales), Scorpio (the Scorpion) Sagittarius (the Archer) and Capricornus (the Goat) rising in the east.

The constellation of Leo (the Lion) is moving over the western horizon. It is a very interesting constellation. It does actually look a little like a lion or the Sphinx in Egypt. Around and between Leo and the neighboring constellation of Virgo is a cluster of galaxies. Our Milky Way galaxy and our local group of galaxies are members of this larger group of galaxies called the Virgo Cluster. A medium sized telescope (150mm to 200mm) and a dark sky is required to see these faint objects.

Following Leo is the less obvious constellation of Virgo but it does have one fairly bright star called Spica. Virgo gives its name to a large cluster of Galaxies that is also spread over into the neighbouring constellations of Coma Berenices (Berenices' Hair) and into Leo.

To the north of Virgo is the bright orange coloured star called Arcturus in the constellation of Boötes. Arctaurus is a Red Giant star that is nearing the end of its 'life' as a normal star. It has used almost all of its Hydrogen fuel and has expanded to become a Red Giant, 25 times the diameter of our Sun. At the moment it shines 115 times brighter than our Sun but it is destined to collapse and become a White Dwarf.

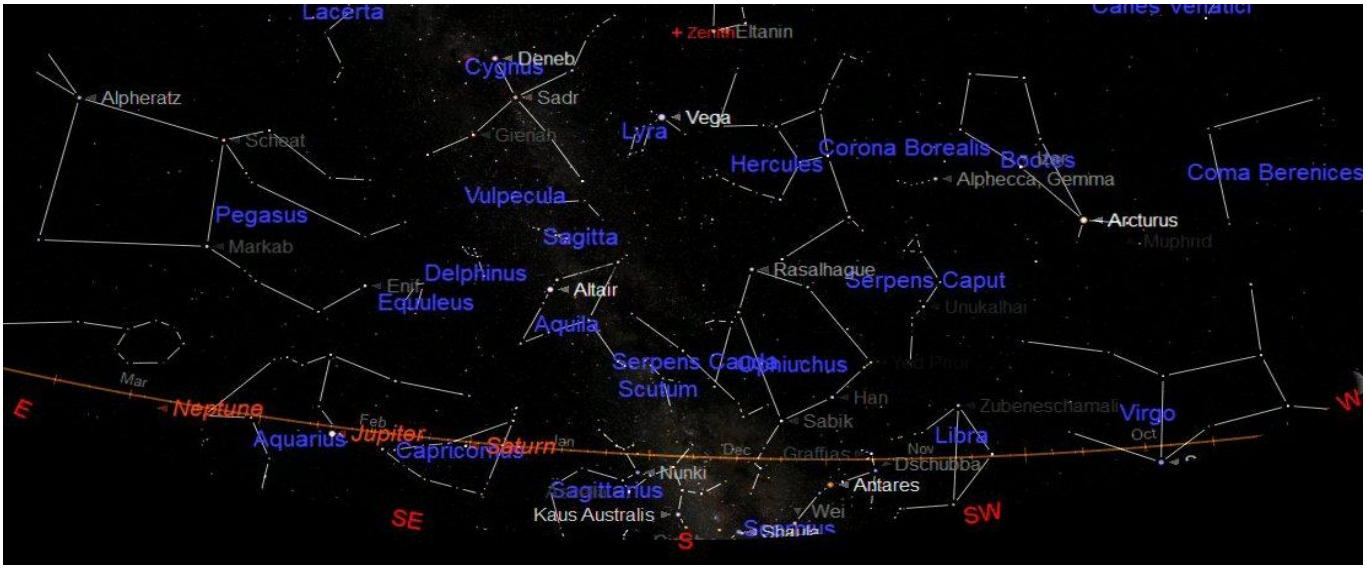
Higher in the south east is the constellation of Hercules (the Strong Man). Hercules has a rather distinctive distorted square shape, at its centre, called the 'Keystone'. This is due to its resemblance to the centre stone of an arch or bridge. The jewel of Hercules is without doubt is the Great Globular Cluster, Messier 13 (M13). M13 can be found in the western (right) vertical imaginary line of the 'Keystone'. It is just visible using a good pair of 9 x 50 binoculars. The spherical cluster, of about a million stars can be seen using a 90mm *f*10 telescope but will look even more impressive when using a larger telescope.

Just moving into the eastern sky is the Summer Triangle that will begin to dominate the Summer Sky and is described in detail on page 3. The triangle is defined by three obvious bright stars: Deneb in the constellation of Cygnus, Vega in Lyra, and Altair in Aquila. The Milky Way (our Galaxy) flows through the Summer Triangle and passes through Aquila and Cygnus. The Triangle is bigger than may be expected but once it has been found it is very easy to find again.

The Summer Triangle is very easy to find so it is very useful to use as a starting place for finding our way around the night sky.

The Ecliptic is low in the sky during the summer months so the Moon and planets at appear close to the southern horizon. Saturn and Jupiter are starting enter the night sky but due to their low altitude will not be at their best for observation. The thick, murky and turbulent air will cause the planets to appear quite unsteady.

THE SOLAR SYSTEM - JULY 2021

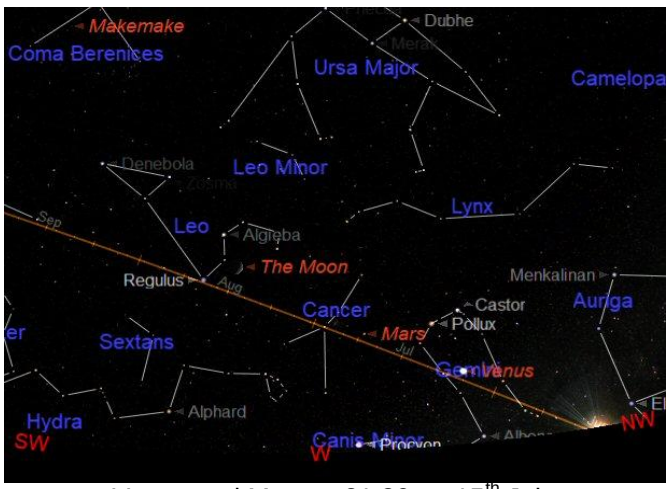


The planets at midnight on 15th July

The chart above shows the location of the planets along the Ecliptic. The sky has been darkened to make the planets visible. The planets to the west of the Sun (right) will be visible in the early morning sky before sunrise. The planets to the east of the Sun (left) will be visible in the early evening sky after sunset.

MERCURY will be in the early morning sky as the Sun is rising. It will be very difficult to find in the bright sky and will require a clear view to the western horizon.

VENUS will be visible in the early evening sky as soon as possible after sunset. It will be easy to find but will it require a clear view to the western horizon. Venus is emerging from its excursion behind the Sun when it was in 'Conjunction' with the Sun. It will appear at its smallest diameter and will be fully illuminated because it is still beyond the Sun from our point of view.



Venus and Mars at 21:30 on 15th July

MARS can still be seen in the evening sky after the Sun has set and the sky darkens. It is looking small at about 3.8 arc-seconds as Earth pulls further away. Mars sets at about 22:30 but will be moving ever closer to the south western horizon.

JUPITER will be rising in the east at about 22:30 and will be visible in the south east by midnight. Jupiter will be at opposition on 20th August. See page 8 for more advice on observing Jupiter.

SATURN will be rising in the east at about 22:00 but will be more difficult to observe than Jupiter in the turbulent air close to the horizon. The ringed planet rises just before Jupiter in the east. Saturn will be at its best this year on 2nd August when it will be at opposition and will be due south at midnight.

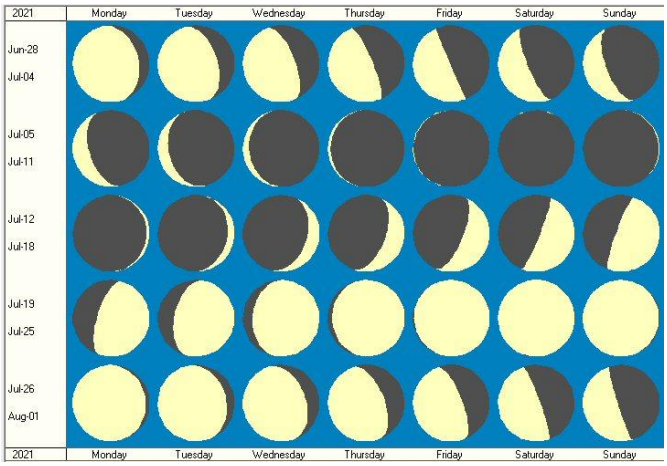
URANUS will not be observable this month as it will mainly be in the sky during daylight. This month it will rise at midnight and set at about 15:45.

NEPTUNE will be just visible this month to the east of Jupiter (see chart). It will be difficult to see in the brightening morning sky as it is only magnitude +7.8.

THE SUN

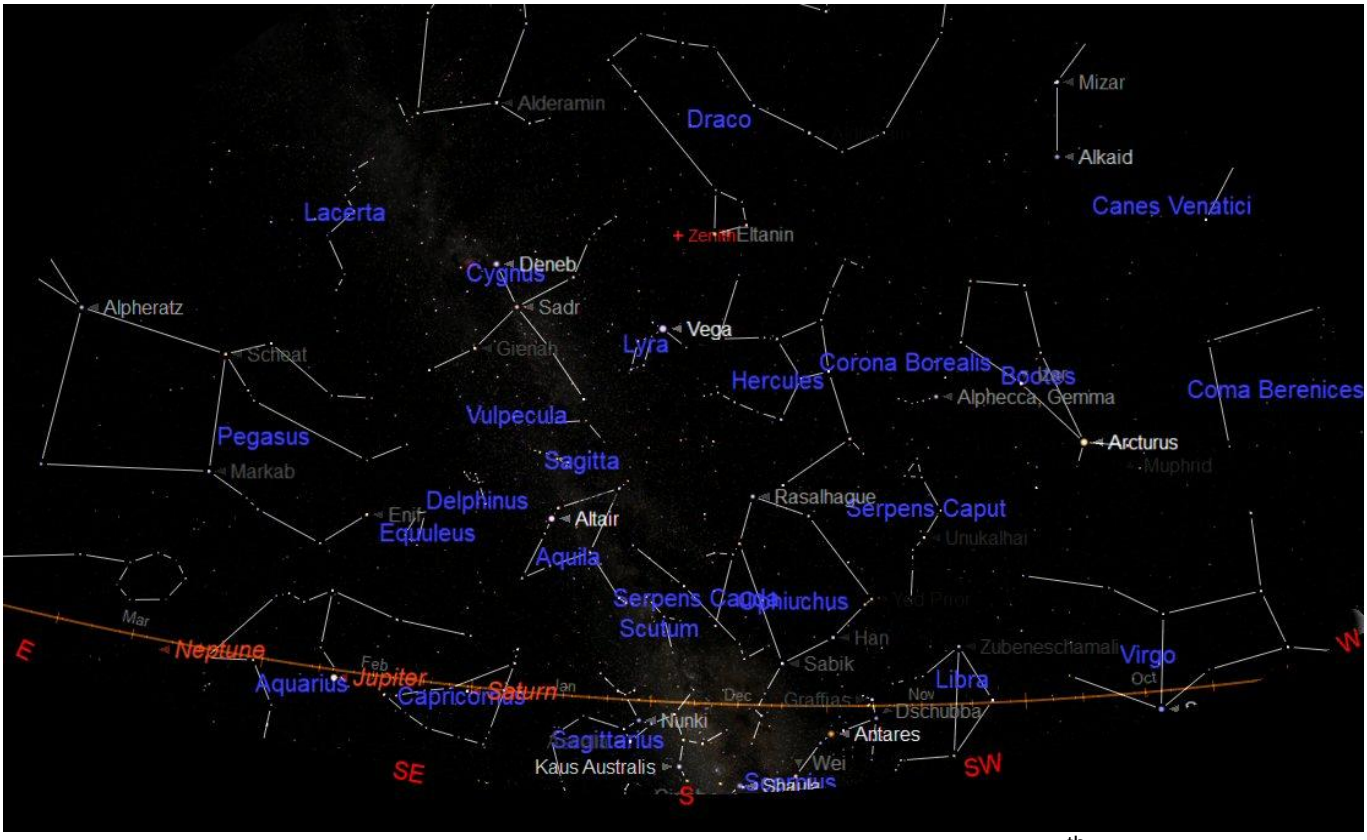
The Sun rises at about 04:50 at the beginning of the month and 05:20 by the end. It sets at 22:20 at the beginning of the month and 21:00 at the end of the month. It reached its highest point in the sky on 21st June which was the Summer Solstice. There have been a few small Sunspots during June.

THE MOON PHASES DURING JULY



Last Quarter will be on 1st July
New Moon will be on 10th July
First Quarter will be on 17th July
Full Moon will be on 24th July
Last Quarter will be on 31st July

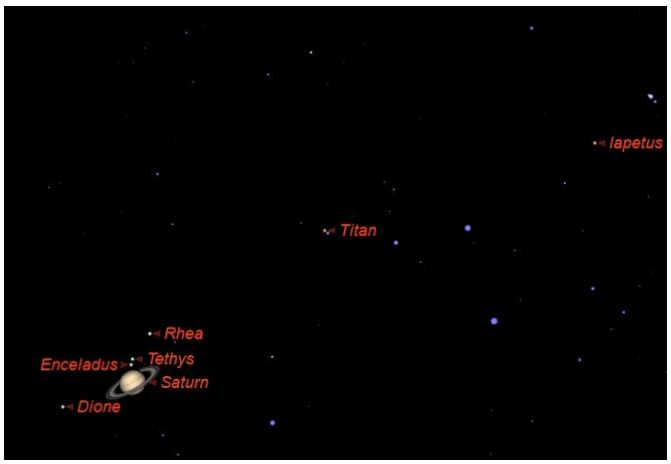
OBSERVING JUPITER AND SATURN - JULY 2021



The planets Jupiter, Saturn (and Neptune) at midnight on 15th July

The two brightest 'superior' (outer) planets Jupiter and Saturn are starting to return to the night sky. Saturn rises over the eastern horizon at about 22:00 around the middle of the month but will not be high enough for observing until an hour or so later. It will need a clear view to the eastern horizon because it will be low and close to the south eastern horizon. Trees and neighbour's houses are likely to be blocking the view.

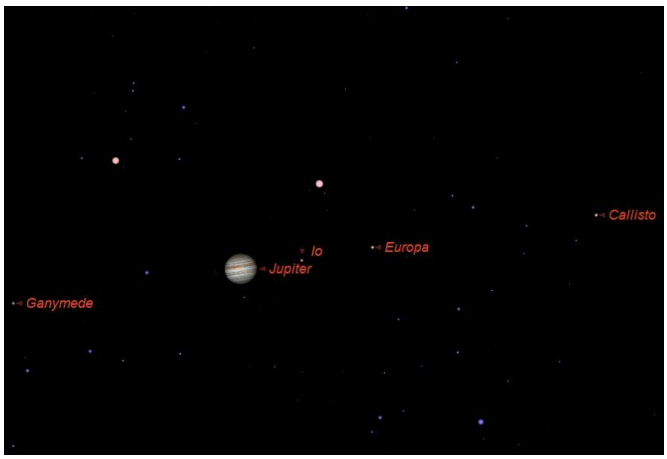
SATURN requires a small to medium sized telescope (90mm to 120mm) to see the ring system and the brightest moons. However the view will be rather unsteady due to the murk and turbulence close to the horizon.



Saturn and its brightest moons on 15th July

The two or three brightest moons will be visible using a 90mm aperture telescope (with some difficulty) but a 120mm or larger telescope will be required to see another 3 or 4 fainter moons. The ring system will be discernible but colours and detail will be difficult.

JUPITER appears larger and brighter than Saturn because it is only half the distance away from us – 778.3 million km compared with 1429 million km.

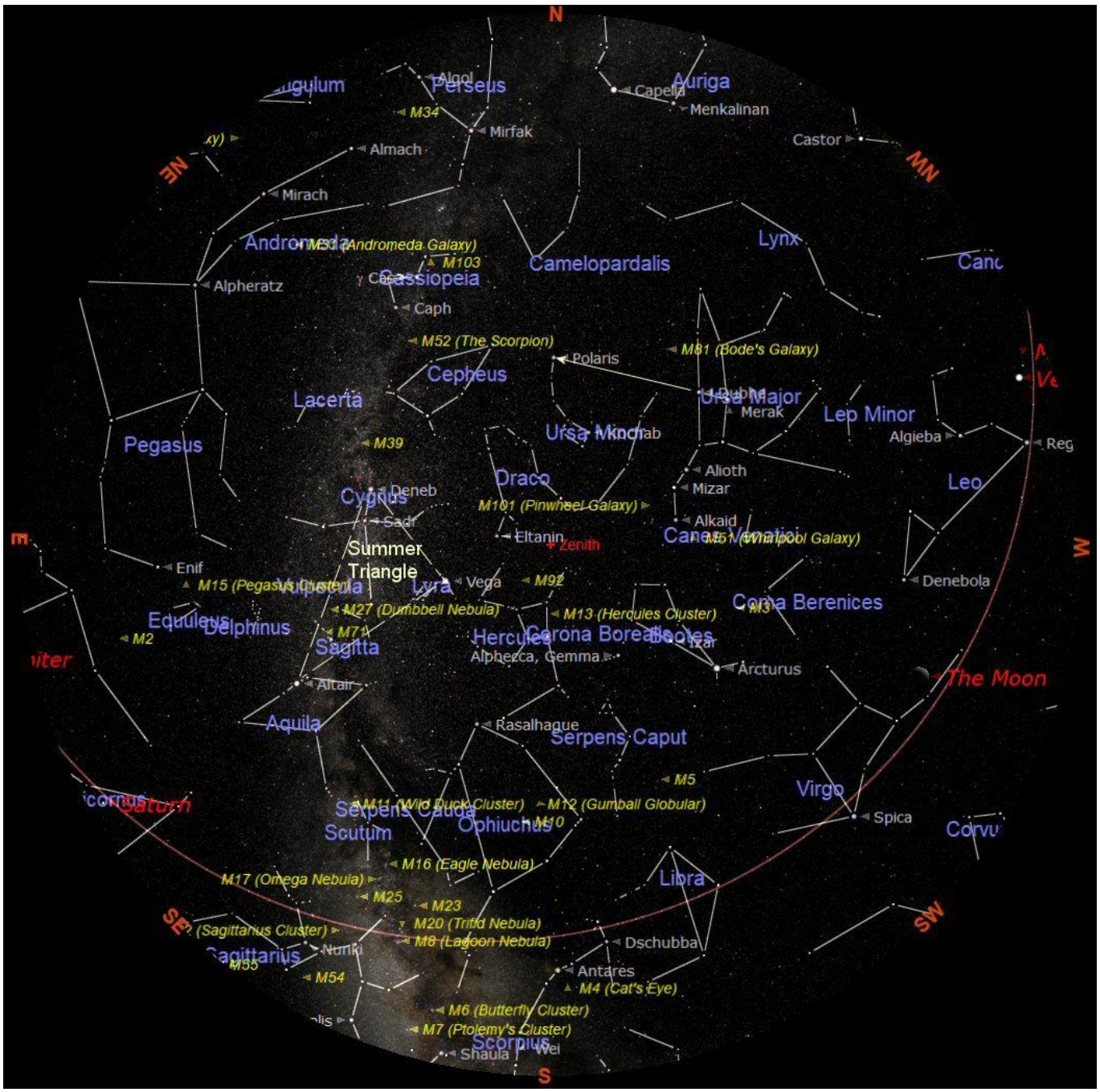


Jupiter and its brightest moons on 15th July

Jupiter rises at about 22:30 in the east. Good quality telescopes will reveal the cloud bands on the surface of Jupiter. The four brighter moons Io, Europa, Ganymede and Callisto will also be observable. As with Saturn, the view will not be good due the unsteady air, murk and turbulence close to the horizon.

It is however very interesting to follow the movement of the four Galilean moons from night to night and even during the course of one observing period. When the inner moons Io and Europa move close to Jupiter they can be seen to move in short periods of time. They can watched as they approach Jupiter and disappear in front (a transit) or behind (an occultation) of the planet. The times of these events can be predicted using a planetarium application on a PC or laptop.

THE NIGHT SKY – JULY 2021



The chart above shows the whole night sky as it appears on 15th July at 22:00 (10 o'clock) 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 9 o'clock BST at the beginning of the month and at 11 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 high in the North West. 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: Venus and Mars with Saturn and Jupiter after midnight.