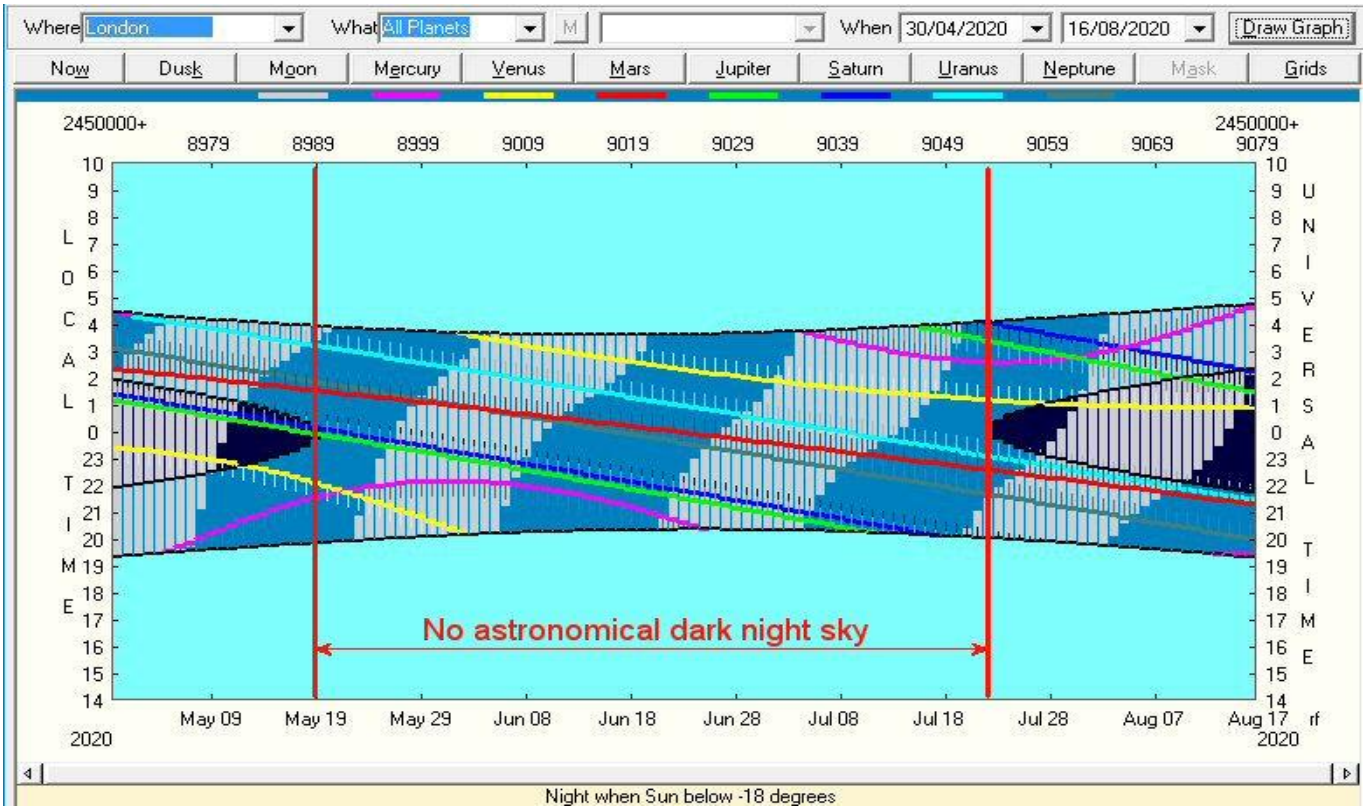
NEWBURY ASTRONOMICAL SOCIETY
MONTHLY MAGAZINE – JULY 2020

MIDSUMMER AND BEYOND



A Graphdark Chart showing the sky around midsummer

We have become used to the long days and short nights of summer but now we can start to look forward to the next Astronomy Session. The Newbury Astronomical Society normally holds meeting sessions from the beginning of September through to the end of June, with a break for summer in July and August.

The reasoning behind this is that it does not get dark during midsummer. So astronomical observing does become rather restricted during the summer. Mid summer day will be on 20th June (shortest night).

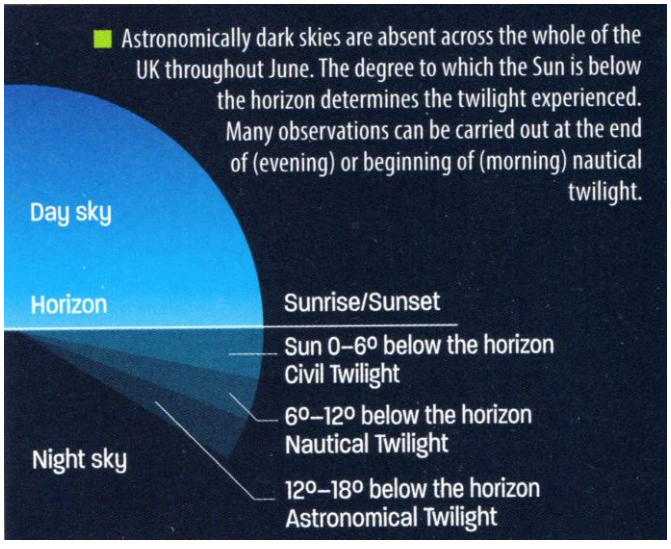


Chart showing the stages of twilight and darkness

The chart above was produced using Richard Fleet's Graphdark application. It gives a representation of the night sky mainly for observing the planets. As part of this it also graphically shows the sunrise and sunset times.

The chart shows daylight as light blue at the top and bottom. The curved black lines indicate sunset at the bottom of the band and sunrise at the top. The darker blue in the band indicates twilight and white shows when the Moon is in the sky. Black shows when the sky is completely dark and there is no Moon.

Dates are shown along the bottom and the time is shown up the sides of the graph. It can be seen that from 19th May until about 20th July there is no black so the sky is never completely dark (Night Sky) see the diagram opposite. Around Midsummer the Sun will only be about 15º below the northern horizon at midnight so between 23:24 and 02:40 we will be in Astronomical Twilight but not Night Sky (totally dark).

NEWBURY ASTRONOMICAL SOCIETY MEETING

7th August Zoom meeting

Website: www.newburyastro.org.uk

NEXT NEWBURY BEGINNERS MEETING

16th July Saturn and Jupiter (Zoom meeting)

Website: www.naasbeginners.co.uk

TARGETING THE MOON IN SUMMER

The New Moon imaged on 24th May 2020 using a DSLR camera

With late evenings before sunset and short nights when the sky does not appear completely dark, it is a good time to have a look at the Moon. Another good reason is the warmer evenings and we may be enjoying the evening sunset outside anyway.

The Moon is the easiest astronomical object to observe and does not need any optical aid to start with. Just looking out for the elusive thin slither of the new Moon in the western sunset can be fun. As the Moon is 'Waxing' (growing into a thicker crescent) we can start to see some detail on the Moon's surface even with our 'Naked' (unaided) eyes. We call the dark patches 'Seas' but they are not water of course. A telescope is needed to see the details of the craters and other features on the Moon.

The crescent imaged a few days after New Moon

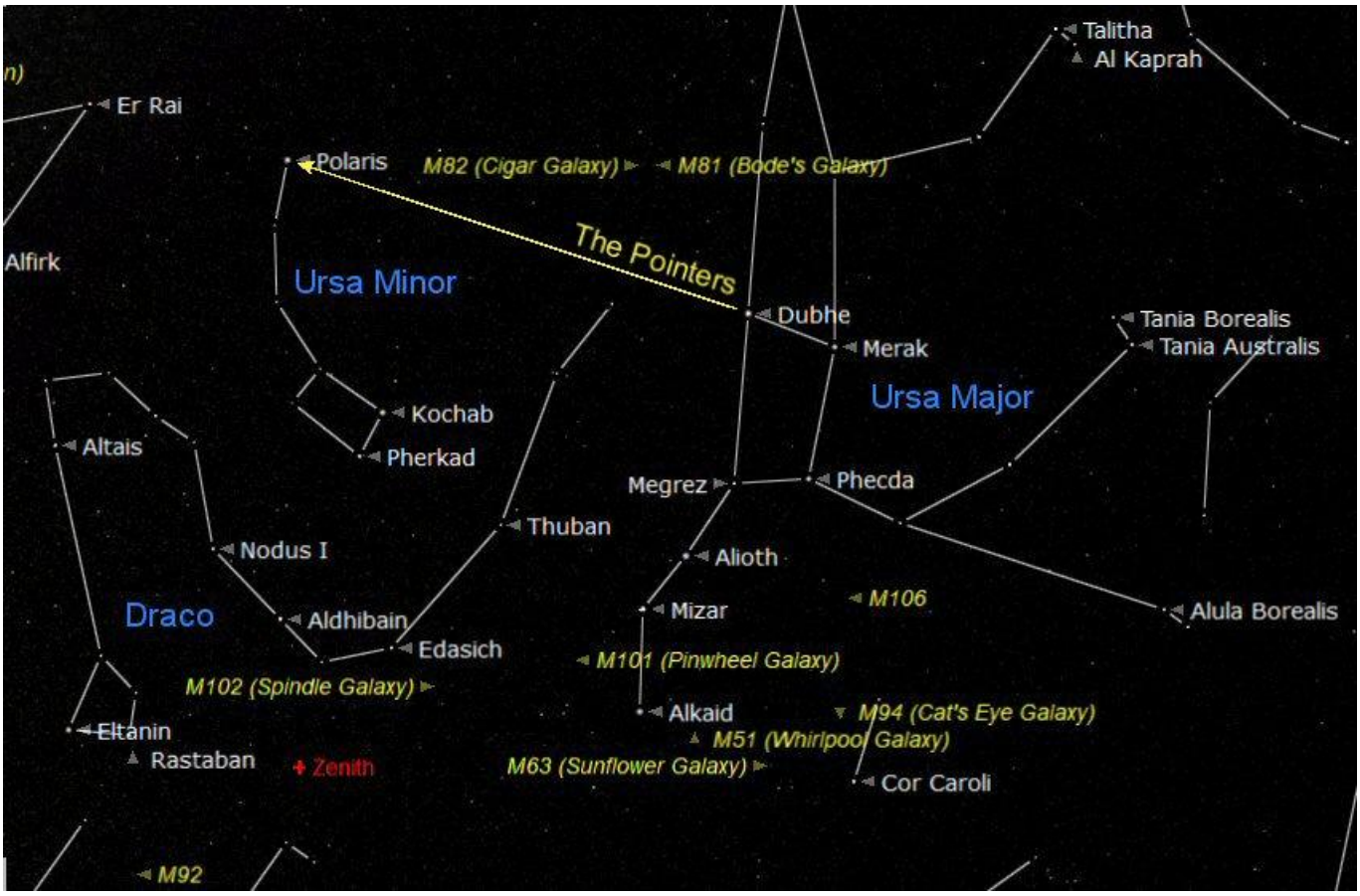
Craters and other features look best on the 'Terminator' (the line between sunrise and sunset on the Moon.

The Full Moon can look spectacular especially when it is rising in the east during the summer. It can look particularly spectacular when it is close to horizon. A full Moon always rises in the east as the Sun is setting in the west. So as the Moon rises over the horizon our eyes try to compare the size of the very distant Moon to the nearer features on the horizon. Our eyes are confused and try to relate the apparent size of the Moon to the features near the horizon and an optical illusion causes the Moon look larger.

The Full Moon imaged on19th April 2019

The 'Seas' look best at Full Moon but the Moon can look too bright so a pair of sun glass can take away the glare and help improve the contrast.

URSA MAJOR AND URSA MINOR



One of the Constellations of this Month is one of the best known of all the constellations and 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'.

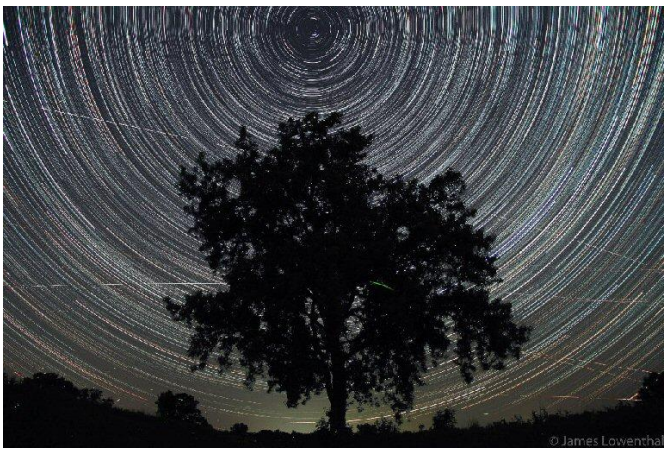
Ursa Major is almost overhead at this time of the year as can be seen by the chart on the last page. The point in the sky directly overhead of the observer is called the 'ZENITH' and is shown in red on the chart. The chart shows the sky as it will appear at 22:00 on 15th July.

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) and called the Little Dipper in the USA.

The sky 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.

SATURN THE RINGED PLANET

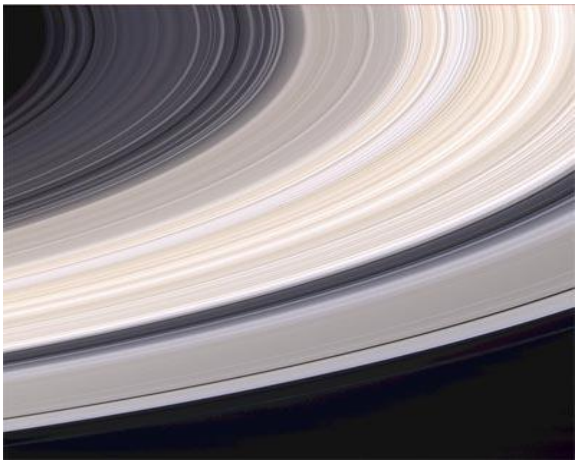
Saturn, with its magnificent ring system, is surely the easiest planet to recognise. Any poster or cartoon depicting a space scene will almost certainly have a planet with a ring system looking somewhat like Saturn. All the large outer planets also have ring systems but they are all feeble compared to Saturn's ring system.

Saturn imaged in 2003 with the rings wide open

Since the very early days of telescopic astronomy, Saturn appeared to have something odd about it. Galileo thought it sometimes looked as if it had 'ears' or handles like a jug. His first telescopes in the early 1600's were too small and primitive to see any detail clearly.

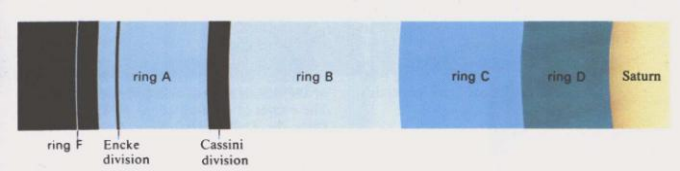
Galileo's sketches of Saturn with 'ears' 1610

In 1655 Christian Huygens recognised that Saturn had a ring. It wasn't until 1675 that Giovanni Cassini recorded seeing the gap in the rings that is now named after him. As the size and quality of telescope optics improved more detail could be made out. We generally think of Saturn as having 'a ring' but in fact it has a complex ring system comprised of hundreds of rings. Until the planet was visited by exploratory probes the finer details of the ring system could not be fully appreciated.



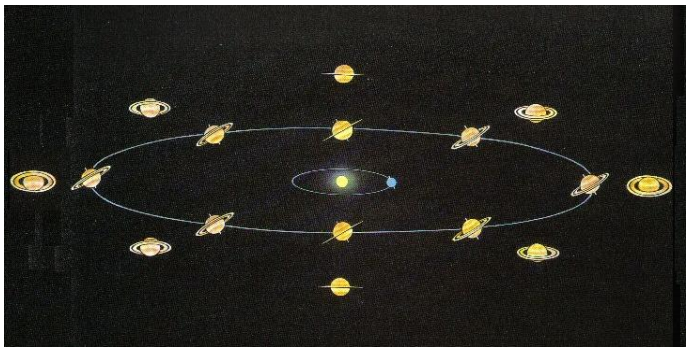
The rings imaged by the Cassini Probe in 2005

It has not been conclusively established how the ring system was formed. One theory is that a comet strayed too close to Saturn and the enormous gravitational forces pulled the comet apart. The lumps of water ice and dust were pulled into orbit around the giant planet. Until recently it was a mystery how the rings had lasted so long. Studies have estimated that the rings had been in existence for at least a million years and perhaps much longer. When the Pioneer II probe passed close to Saturn in 1979 it imaged two moons orbiting on the outside of the ring system. These moons named Pandora and Prometheus were found to be moving the particles in the rings and preventing them from straying out of their positions and falling on to the planet. They are consequently called Shepherd Moons.



The designations of the main ring divisions

Although the rings are permanent at least in terms of our lifetime they do appear and disappear over a periods of about 7½ years. This is because we on Earth view the rings from different angles as we and Saturn orbit the Sun. In 2003 we were looking at Saturn when it was tilted with its south pole towards us. As shown at the extreme left position in the diagram below. We were therefore able to see the ring system fully tilted. In this position we could see the underside of the rings wide open, as shown in the image in the previous column.



The changing view of Saturn

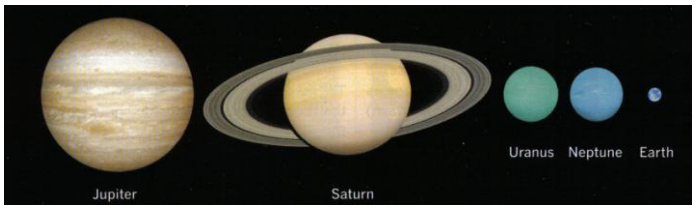
After 7½ years Saturn will have completed approximately a quarter of its 30 year long orbit around the Sun and will be at the lower position shown in the diagram above. Therefore in 2009 we were looking at Saturn side on. As the rings are very thin they disappeared almost completely for a few months. Over the next 7½ years the rings gradually opened out again until in 2017 we saw the top surface tilted towards us as show in the position at the right of the diagram.

The closing sequence will continue until 2025 when we will again view the rings side on as shown at the top position in the diagram. Eventually in 2032 Saturn will return the same position it was in 2003. The rings will be tilted towards Earth and wide open again. The rings are looking good at the moment, even in a small telescope (100mm aperture). Over the next few years they will appear to close again. In 2025 the rings will be edge on and difficult to see even using larger telescopes.

Saturn is the second largest planet in our Solar System after Jupiter. The planet itself is 120,000 km in diameter at the equator but is flattened to 108,000 km at the poles due to its rapid rotation. Although Saturn is 10 times the diameter of Earth it rotates on its axis (1 day) in only 10 hours 14 minutes. The rings are 275,000 km (170,000 miles) across but mostly are less than a hundred metres thick. To put this in perspective, the ring diameter is almost the same as the distance from Earth to the Moon.

Simulation of Saturn at the distance of the Moon

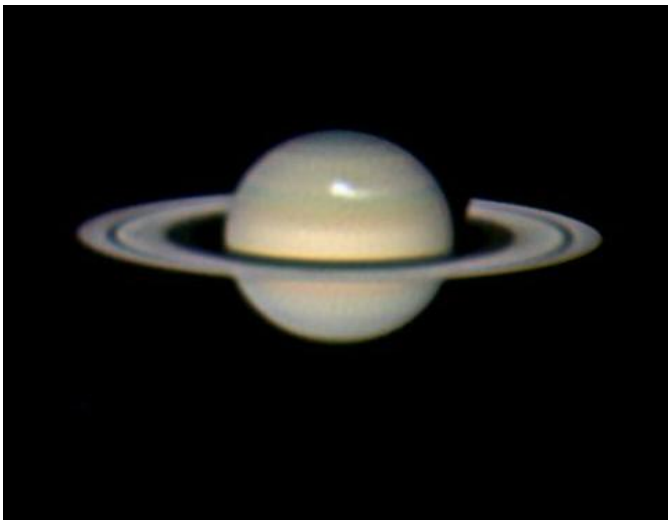
The rings are made up of millions of small pieces of mainly water ice and possibly some rocks varying in size from a few millimetres to a few metres across.



The sizes of the giant outer planets compared to Earth

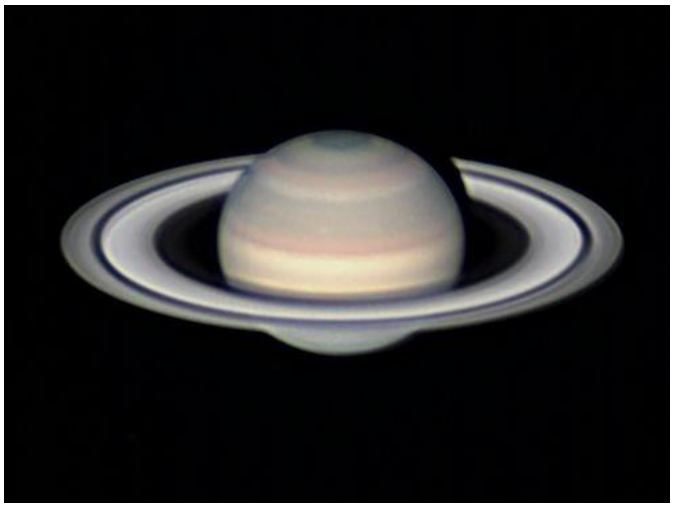
Like Jupiter, Saturn is a gas giant planet. This means it has no solid surface that a probe craft could land on. The majority of the planet (90%) is made up of Hydrogen gas with 10% Helium and traces of Ammonia and Methane.

Despite being 1.4 billion kilometres from the Sun, huge summer storms erupt in the hemisphere facing the Sun. In 2011 the Cassini Probe observed a storm break out and spread all the way around the planet. The cloud markings are generally not as distinct as those on Jupiter but the storms are just as violent.



A storm appeared on Saturn in 2011

Saturn currently has its north pole tilted about halfway towards us so the rings also appear tilted towards us. The rings are half opened up to give us a fairly good view of the top of the rings. The image below was taken to show how the ring system appears when tilted much more towards us making the rings look wider compared to the previous image taken in 2011.



Saturn imaged by Anthony Wesley NASA in 2013

On a really good clear night it is possible to see the Cassini Division in the ring. This is shown as the dark division in the rings in the image above. A smaller telescope will probably be able to show the division to the right and left of the planet but the portion to the front of the planet may be difficult to see. This effect is evident in the image below taken in 2012. This image gives a good impression of what Saturn may look like this month when seen through the eyepiece of a fairly large telescope.

Saturn imaged by Steve Harris in 2012

The Cassini Division can be difficult to see even in a larger telescope when the seeing conditions are poor. The images above show the shadow of the planet on the rings behind the planet. This is visible in a medium sized telescope. However Saturn is very low in the sky this year and will be at Opposition on 20th July. Opposition occurs when Earth overtakes Saturn so that Saturn and Earth will be aligned with the Sun positioned directly behind Earth. At opposition light from the Sun casts Saturn's shadow on to the rings directly behind the planet so we cannot see it. Those with a larger telescope may be able to watch the shadow slowly disappear up to 20th July and then gradually reappear.

OBSERVING SATURN

Saturn can be seen with our 'naked' eyes as a bright and slightly yellow looking star. This year it is very close to much brighter Jupiter so that will help to find the ringed planet. A pair of binoculars will show Saturn looking brighter and that it is not a star as it will appear slightly 'fuzzy' but the ring system will not be visible.

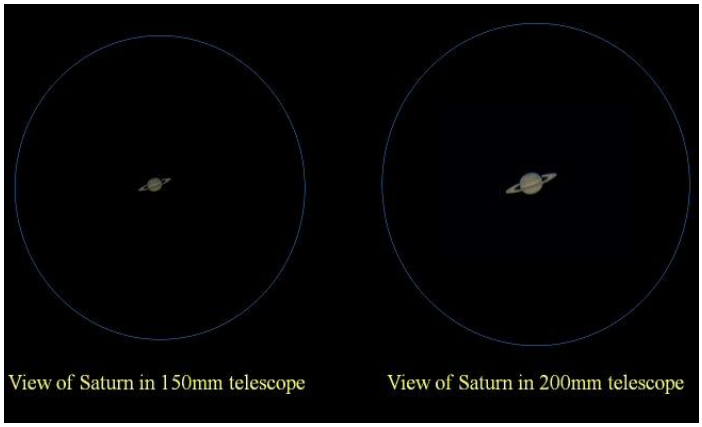
Saturn is one of the most beautiful and impressive objects to look at through a telescope and really does have the 'Wow!' factor, when seen using a larger telescope. Even using a small telescope the ring system can be made out but a high magnification is required on any telescope. For many people their first sight of Saturn was the thing that encouraged them to buy their first telescope.

During recent months the sky has been graced with the magnificent views of Jupiter the 'King of the Planets' and Saturn close together in the morning sky. In some ways our expectations of observing Saturn could be diminished by the stunningly bright and colourful views of Jupiter that we have been accustomed to. Jupiter is much more impressive than Saturn for a number of reasons.

First Jupiter is bigger than Saturn. Jupiter is 142,984 km in diameter and Saturn is 120,536 km but this is not the full story. Saturn is also about twice as far away from the Sun compared to Jupiter. Jupiter orbits at 778 million km whereas Saturn's orbit is 1429 million km from the Sun. This means that Saturn receives only a quarter of the amount of light, per square metre, that Jupiter receives.

The greater distance of Saturn also means that the amount of light that we see reflected back from Jupiter is four times that reflected by Saturn. In total this means that Saturn not only appears much smaller but is also more than 16 times fainter than Jupiter. So that is the bad news but this is compensated for by the magnificent ring system of Saturn that does add a little to the brightness and can be seen even in smaller telescopes.

Saturn can be seen in a smaller telescope of the sort that a beginner to astronomy might have been advised to buy as a first telescope by experienced astronomers. This sort of telescope would be a 100mm refractor or a 150mm reflector with a focal length of about 1000mm. A high magnification must be used and on a good clear and still night the view will be very rewarding. The picture below shows the sort of image that can be expected in one of these first telescopes along with an example of the view through a larger aperture telescope and with a longer effective focal length.

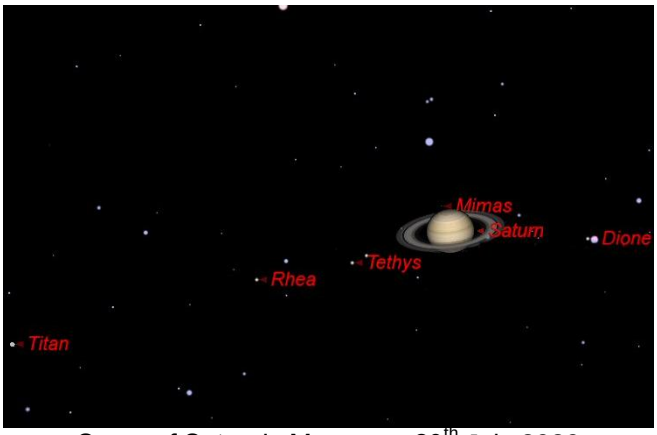


The view through a 150mm and a 200mm telescope

As with all targets, finding Saturn with a telescope starts with locating the planet with the finder. Next use a low power eyepiece (e.g. 25mm) and centralise Saturn in the field of view of the main telescope. Carefully remove the low power eyepiece and fit a high power (10mm) eyepiece into the focuser. Again centralise the planet and adjust the focus until the image is as clear as possible. If Saturn is observed earlier in the evening the image may be difficult to focus due to air turbulence close to the horizon or above roof of a nearby house. The image should improve slightly as Saturn rises a little higher in the sky and as the telescope cools.

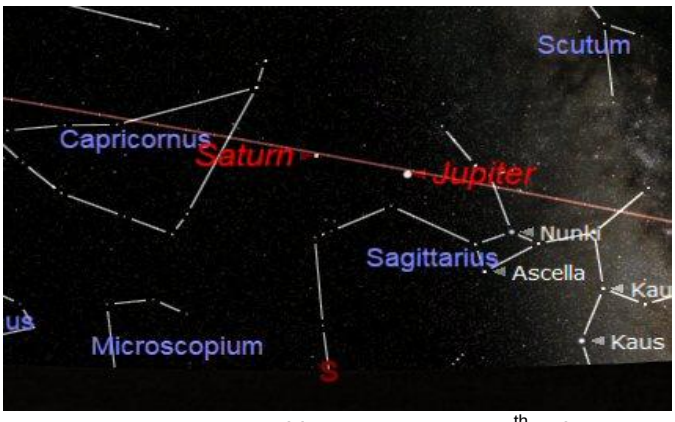
If the seeing conditions are good it may be possible to remove the high power eyepiece and fit a Barlow Lens into the focuser and then refit the high power eyepiece into the Barlow. The focuser will need to be moved in about a centimetre to compensate for the Barlow then refocused. The Barlow will have the effect of doubling the magnification of the eyepiece and therefore double the size of Saturn.

Up to six of Saturn's moons may be visible, distributed around the planet. The largest moon Titan is the easiest to see. Some of the others may be difficult (but possible) to see in a smaller telescope. On a good clear night it may be possible to see Titan and two or even three others in a 90mm refractor or a 113mm reflector. The other two will need a larger telescope to see.



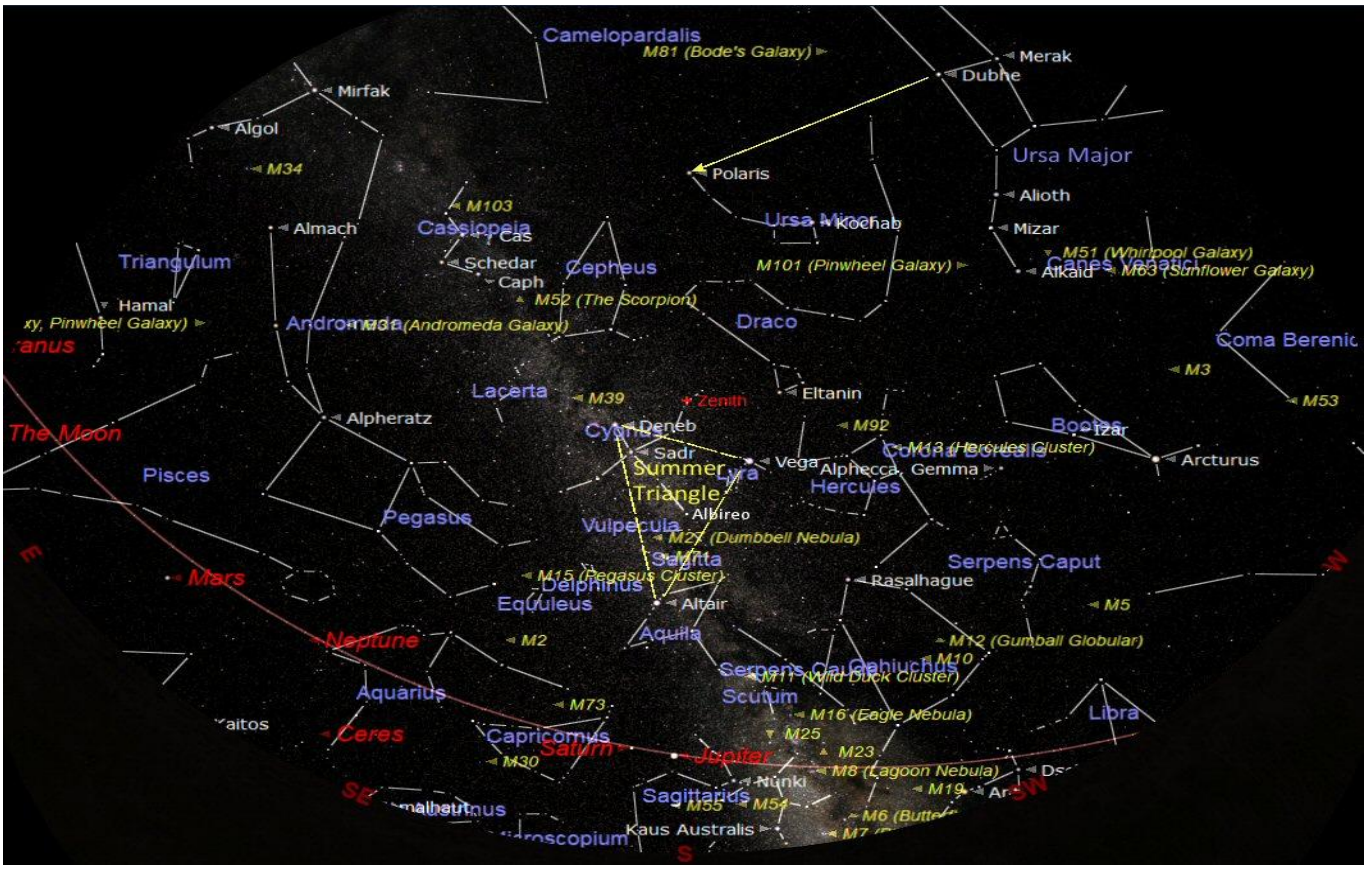
Some of Saturn's Moons on 20th July 2020

The chart below shows the position of Saturn and Jupiter on 20th July. At 22:00 BST (23:00 GMT) and is the exact time when Earth will be overtaking Saturn. For about one hour the rings will brighten because the sunlight will be reflected directly back towards the Sun and Earth. This is called the Seeliger Effect and worth look out for.



Saturn at Opposition at 22:00 on 20th July

THE NIGHT SKY – JULY 2020



One of the Constellations of this Month is one of the best known of all the constellations and is certainly one of 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' and appears larger in the sky than might be expected.

Ursa Major is almost overhead at this time of the year as can be seen by the chart above. 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).

The sky rotates around Polaris once a year due to Earth's orbit around the sky. Polaris can always be found by 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 two pointer stars that are called Dubhe and Merak in Ursa Major.

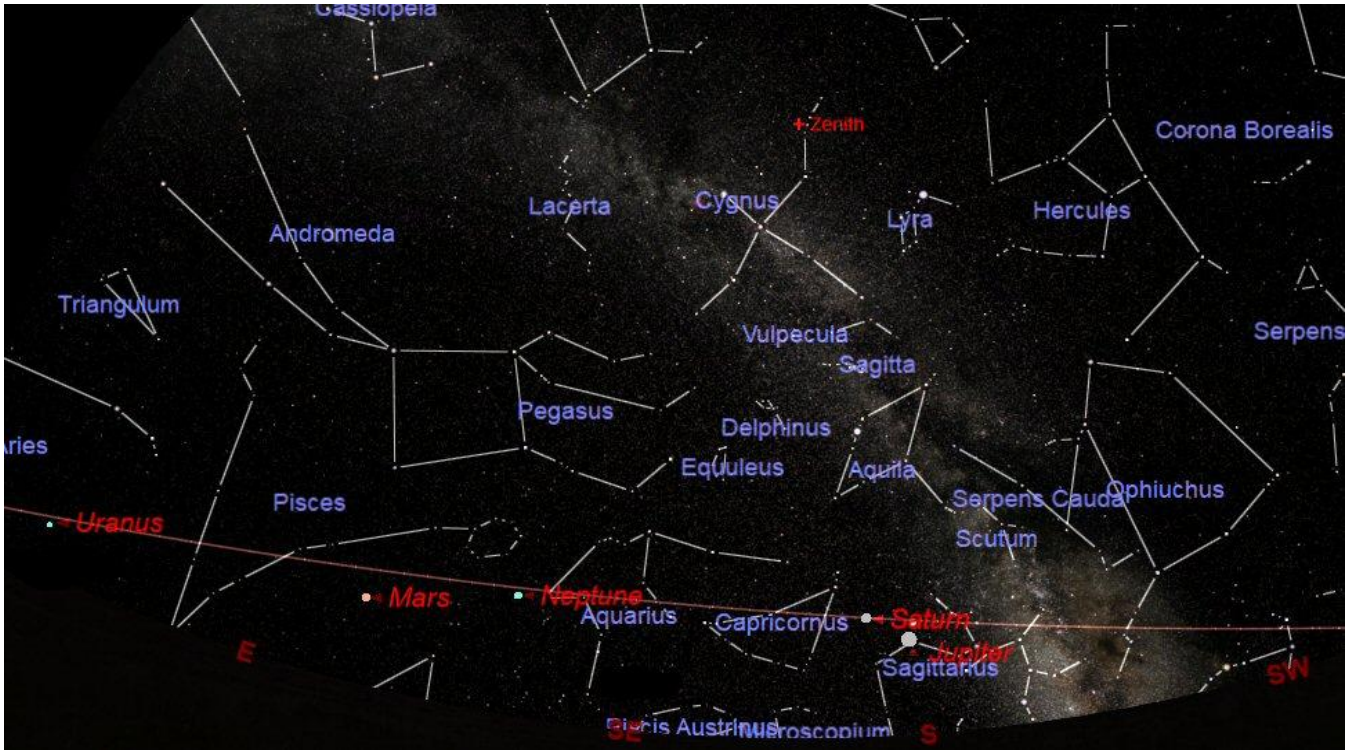
Our planet Earth rotates around the North Celestial Pole once a day (24 hours). As Earth rotates the sky appears to rotate above us. As the sky appears to rotate, Ursa Major and the other constellations will appear to move around the North Celestial Pole in an east to west direction. It will appear to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

The summer sky is dominated by the 'Summer Triangle' first identified by Sir Patrick Moore. The corners of the triangle are marked by the stars Deneb in Cygnus, Vega in Lyra and Altair in Aquila. Albirio in Cygnus can be seen as a beautiful double star when viewed through a telescope. One star is bright and gold in colour the other is fainter and distinctly blue. This is not a true pair they just happen to be in the same line of sight. Although the blue star is much bigger and brighter than the golden coloured star it is a lot further away from us.

The constellation of Lyra (the Harp) is located to the west (right) of Cygnus but is much smaller. The most obvious feature of Lyra is the very bright star Vega that is located the top right corner of the Summer Triangle. Vega is the fifth brightest star in our sky with a magnitude of +0.4. It is located at a distance of 25.3 light years from us and is thought to be 3.2 times the diameter of our Sun and 58 times brighter. The main asterism (shape) of Lyra is composed of a line of three stars with Vega in the centre and a group of four fainter stars that form a parallelogram shape that is known as the 'Lozenge'.

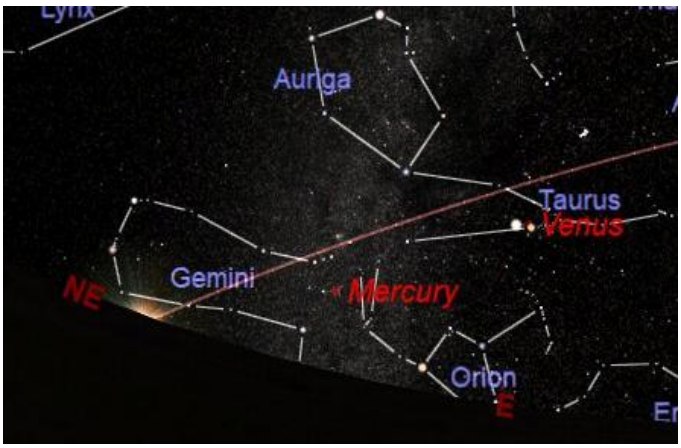
Between the two lower stars: Sulafat and Sheliak is the Messier object M57. This is a 'Planetary Nebula' which has nothing to do with a planet. It is in fact a dying star that was similar to our Sun but older. The star had used most of its Hydrogen fuel and expanded to form into a Red Giant. After passing though that red giant phase it gently collapsed to become a White Dwarf. The very thin outer mantle of the red giant drifted away into space as the star collapsed. The white dwarf is now surrounded by a bubble of gas and dust. It looks like a small 'smoke ring' when seen through a telescope but can't be seen using binoculars. What we are seeing in M57 is what the last gasps of our Sun will be at the end of its existence as a normal star in about five billion years time.

THE SOLAR SYSTEM JULY 2020



The night sky at 01:00 showing the positions of the planets

MERCURY will be difficult to see in the bright sky before sunrise on the north eastern horizon. See the chart below.



Mercury and Venus at sunrise on 15th July

VENUS will be very low in the east as the sky brightens before the Sun rises and will not be easy to observe.

MARS rises at midnight and looks small as it is still a long way from Earth. See the chart at top.

JUPITER rises over the eastern horizon at about 21:30 and will be observable in the south east. A pair of binoculars will reveal the four brightest of Jupiter's moons, Io, Europa, Ganymede and Callisto. A small telescope will allow the moons to be seen very clearly. Jupiter will be observable in the early morning sky until the sky brightens at about 04:00. For more details about Jupiter see the June magazine.

SATURN will be visible in the late evening sky rising over the eastern horizon at 22:00 at the beginning of June and 20:30 at the end of the month. Both of the gas giants will be in the thick, murky and turbulent air close to the horizon. Saturn will be observable, in the south, through the rest of the night until sunrise. See page 6.

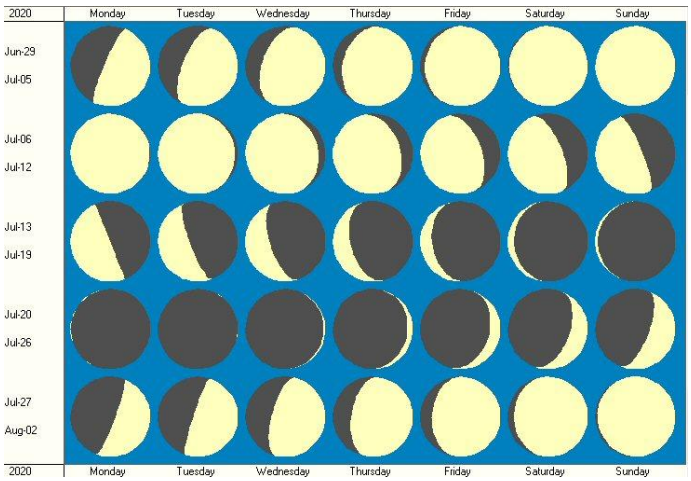
URANUS will not be easy to see this month as it will be close to the southern horizon in the early hours before sunrise. It will require a clear view to the eastern horizon and the alarm to be set very early.

NEPTUNE will not be easily visible this month as it will also be close to the southern horizon in the early hours of the morning. Being close to Mars will help find it.

THE SUN

The Sun rises at about 05:00. There was a small sunspot last month, the first for quite some time. Activity on the Sun can be followed live with day to day images of the Sun by visiting the very good SOHO website at: http://sohowww.nascom.nasa.gov/.

THE MOON PHASES DURING JULY



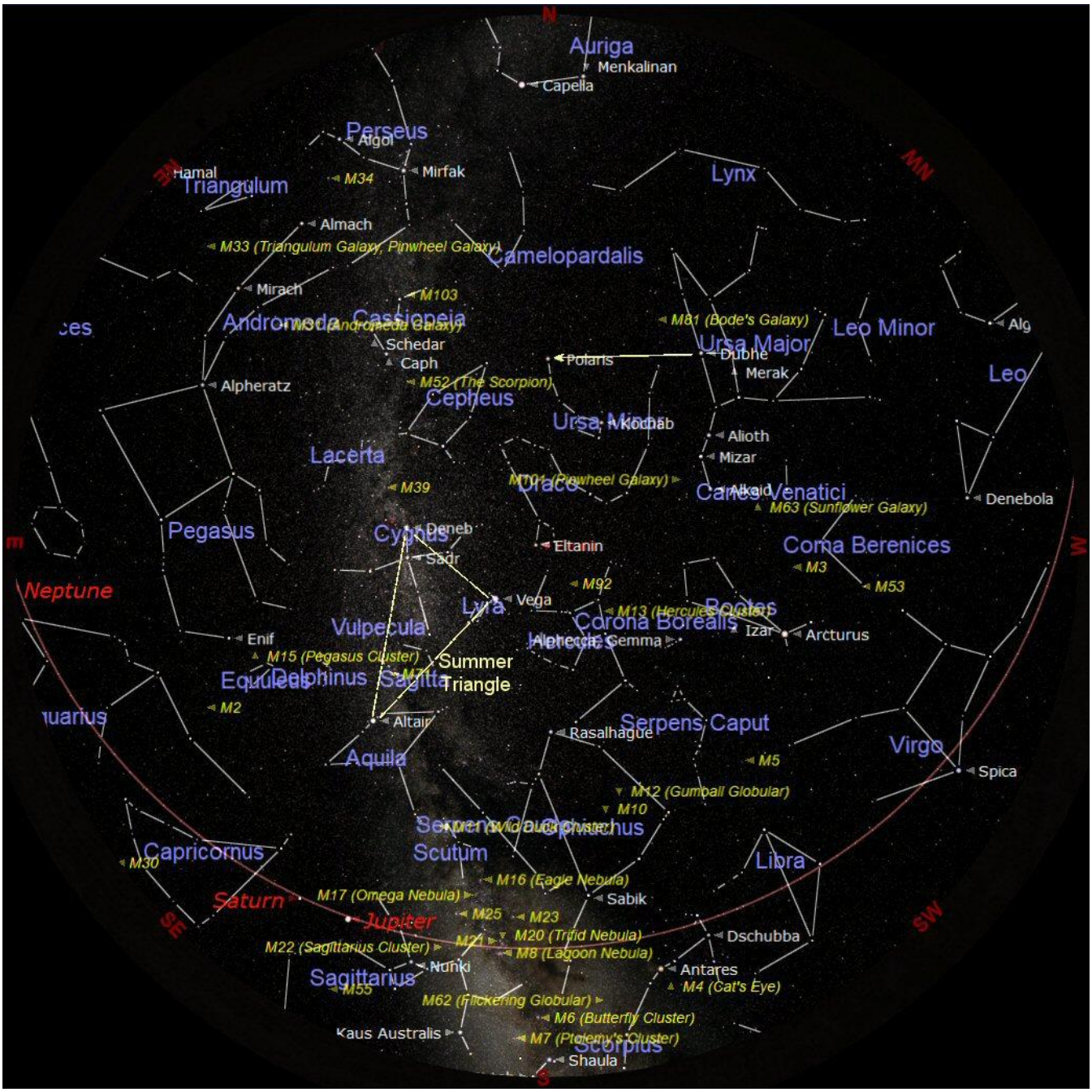
Full Moon will be on 5th July

Last Quarter will be on 13th July

New Moon will be on 20th July

First Quarter will be on 27th July.

THE NIGHT SKY – JULY 2020



The chart above shows the whole night sky as it appears on 15th July 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 high in the 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: Jupiter, Saturn, (Mars and Neptune early morning).