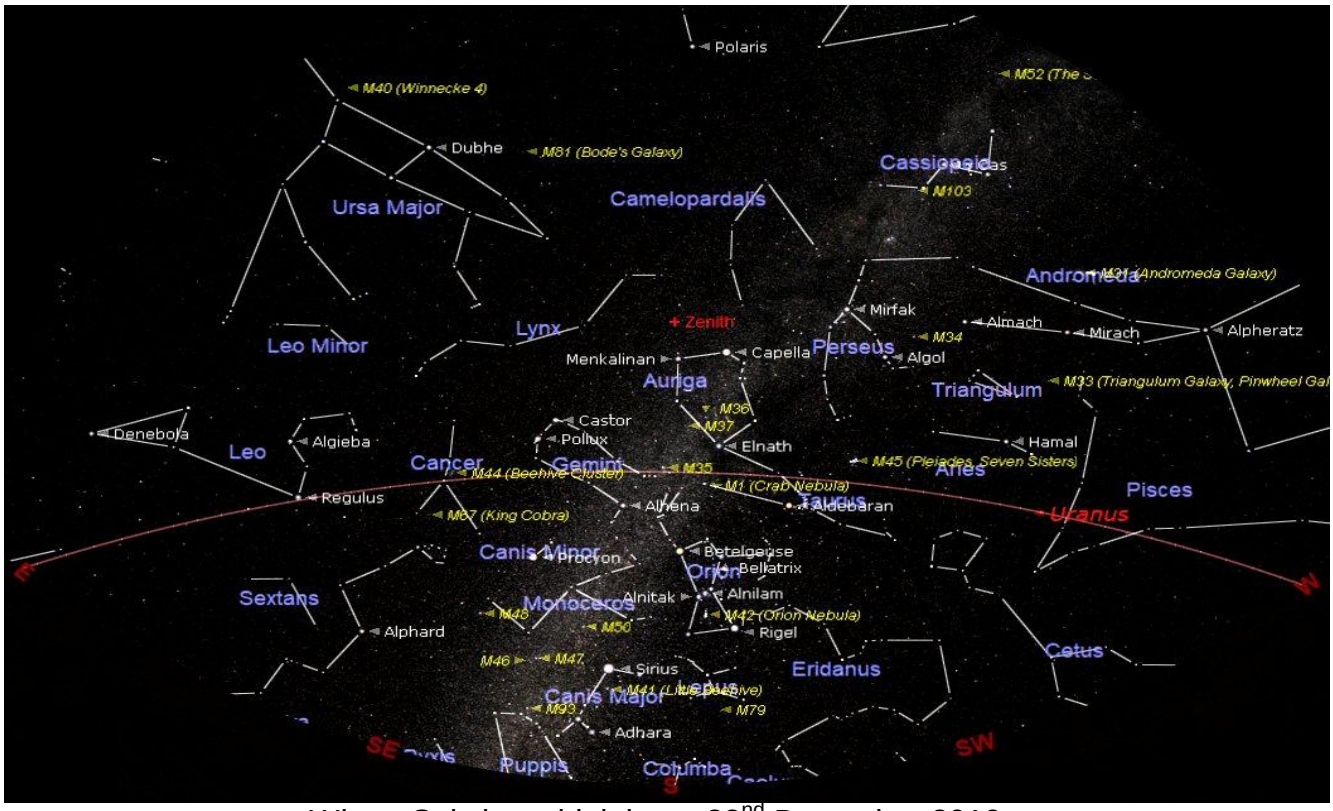
# NEWBURY ASTRONOMICAL SOCIETY
# MONTHLY MAGAZINE – FEBRUARY 2020

## OUR VIEW OF THE NIGHT SKY AS IT CHANGES THROUGH 2020



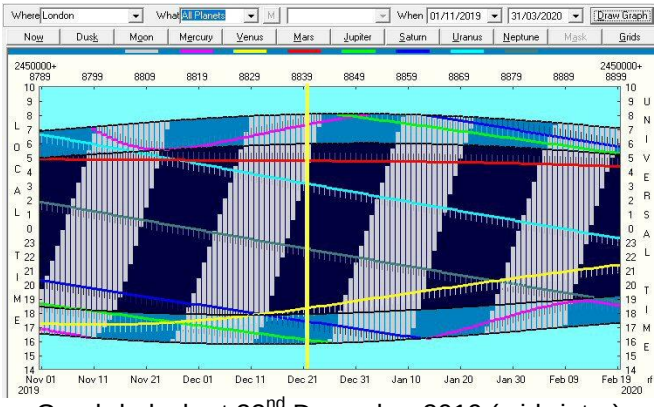

Winter Solstice midnight on 22nd December 2019

This month we will be looking at the night sky as it will appear during the seasons of this year 2020. The sky changes from night to night but it is almost undetectable however it is quite noticeable from month to month. This change is due to Earth's movement around the Sun. So as we move around our orbit we see a changing view as the night sky is passing by.

The chart above shows the sky as it appeared at nearly midnight on the night of the Winter Solstice (Midwinter day) 22nd December 2019. The red cross in the upper centre marked 'Zenith' is the point in the sky directly overhead. Along the bottom of the chart are the points of the compass, on the horizon, from East on the left through South in the centre and West on the right.

At the very top of the chart is the star Polaris in the constellation of Ursa Minor (the Little Bear). Polaris is also known as the North Star or the Pole Star. It is located at the point in the sky where the northern axis of rotation of Earth points. This means all the objects, in the sky, appear to rotate about this point every 24hours (as Earth rotates once a day). We call this point in the sky the Celestial Pole. Polaris always appears (by eye) to be stationary and located to the north of our Zenith so it is called the 'North Star'.

The following pages will show the Spring, Summer, Autumn and Winter night skies with a sky chart and a Graphdark chart. The Graphdark chart will show if the planets are observable and if the Moon is in the sky. It also shows when the sky will be dark for observing.




Graphdark chart 22nd December 2019 (midwinter)

The Graphdark chart shows the time on the vertical scale and the days along the bottom. The light blue is daylight, dark blue dusk. Black is fully dark with white bands showing when the Moon is in the sky. The coloured lines show when the planets are in the sky and the 'added' vertical yellow line shows 22nd December 2019 the day of the Winter Solstice.

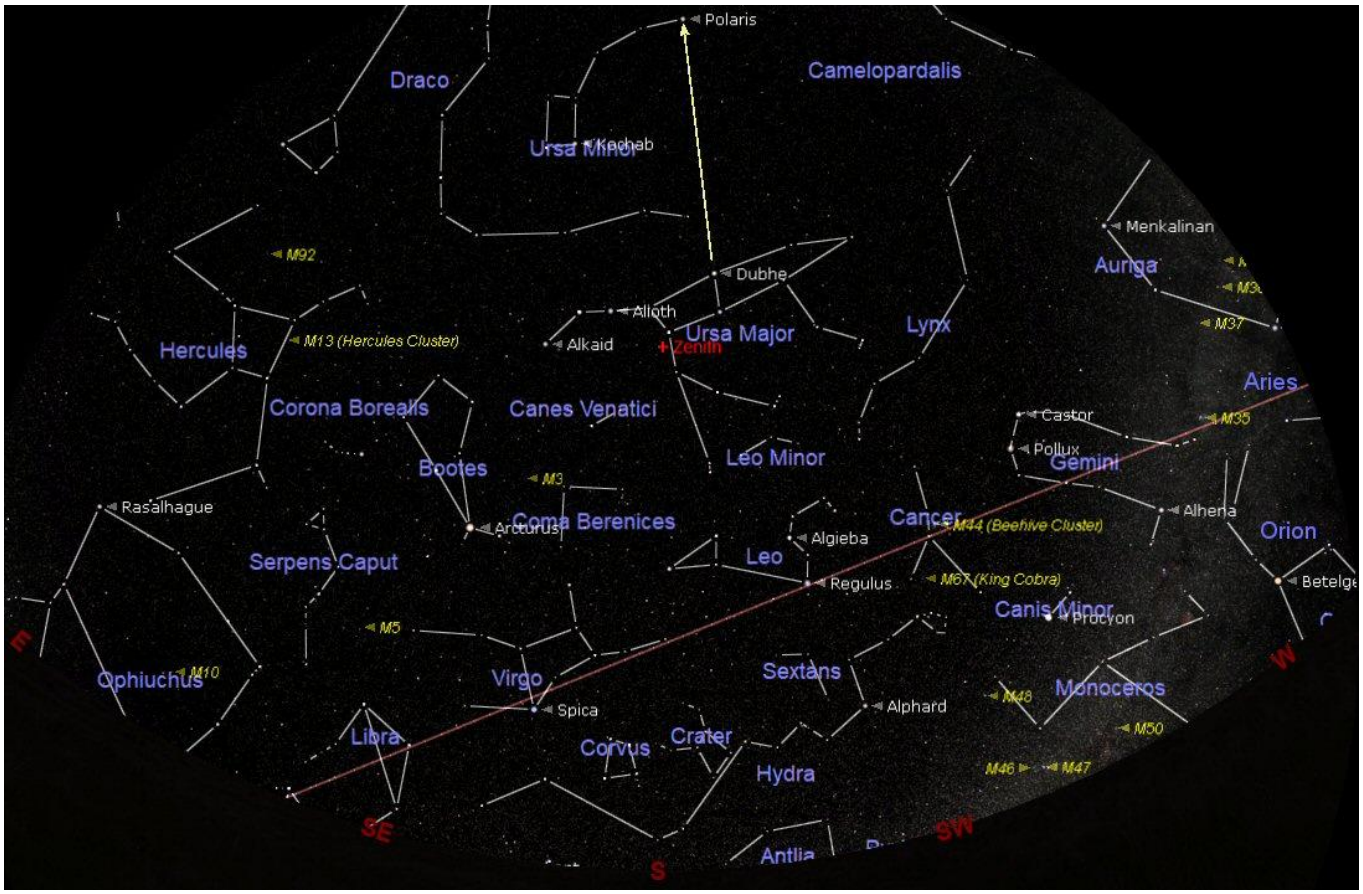
**NEWBURY ASTRONOMICAL SOCIETY MEETING**

7th February A bit of a Marathon
Website: **www.newburyastro.org.uk**

**NEXT NEWBURY BEGINNERS MEETING**

19th February Large scale structure of Universe
Website: **www.naasbeginners.co.uk**

# THE SPRING NIGHT SKY 2020




Spring Equinox at midnight on 21th March 2020

We have moved on three months from the chart shown on page 1. The 22nd December 2019 was the day of the Winter Solstice. This was the midwinter day of 2019 so it had the shortest day at just eight hours long and the longest night at sixteen hours long. So on that day the Sun was at its lowest altitude over the southern horizon at midday 12:00 GMT.

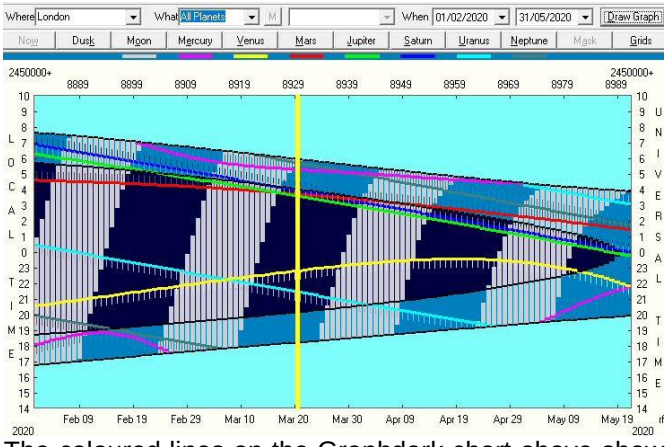
With the Sun at its lowest point at midday means the Moon and any planets could be at their highest point in the night sky at midnight. The orange coloured line across the lower part of the chart is the Ecliptic or the Equator of the Solar System. Because our planet is tilted over at an angle of 23.4º the Ecliptic appears tilted to us. The Ecliptic is the imaginary line along which the Sun, Moon and planets appear to move across the sky every 24 hours as Earth rotates on its axis.

The point in the northern sky where Earth's northern axis appears to point (the Celestial Pole). It is close to the star Polaris in the constellation of Ursa Minor (the Little Bear). This is why we also refer to Polaris as the Pole Star and as it is always north of the Zenith (the point in the sky directly overhead) it is sometimes called the North Star. Being so close to the north Celestial Pole the whole sky appears to rotate around Polaris every 24 hours as Earth rotates. So Polaris is the only star in the sky that appears to be stationary.

Polaris is easy to find by using the two 'pointer stars' in the 'saucepan shape' of Ursa Major (the Great Bear). Using the two stars at the opposite end of the saucepan furthest from the handle, project an imaginary line up out of the pan and it will point the way to Polaris. It is the brightest star in a rather empty area of the sky.

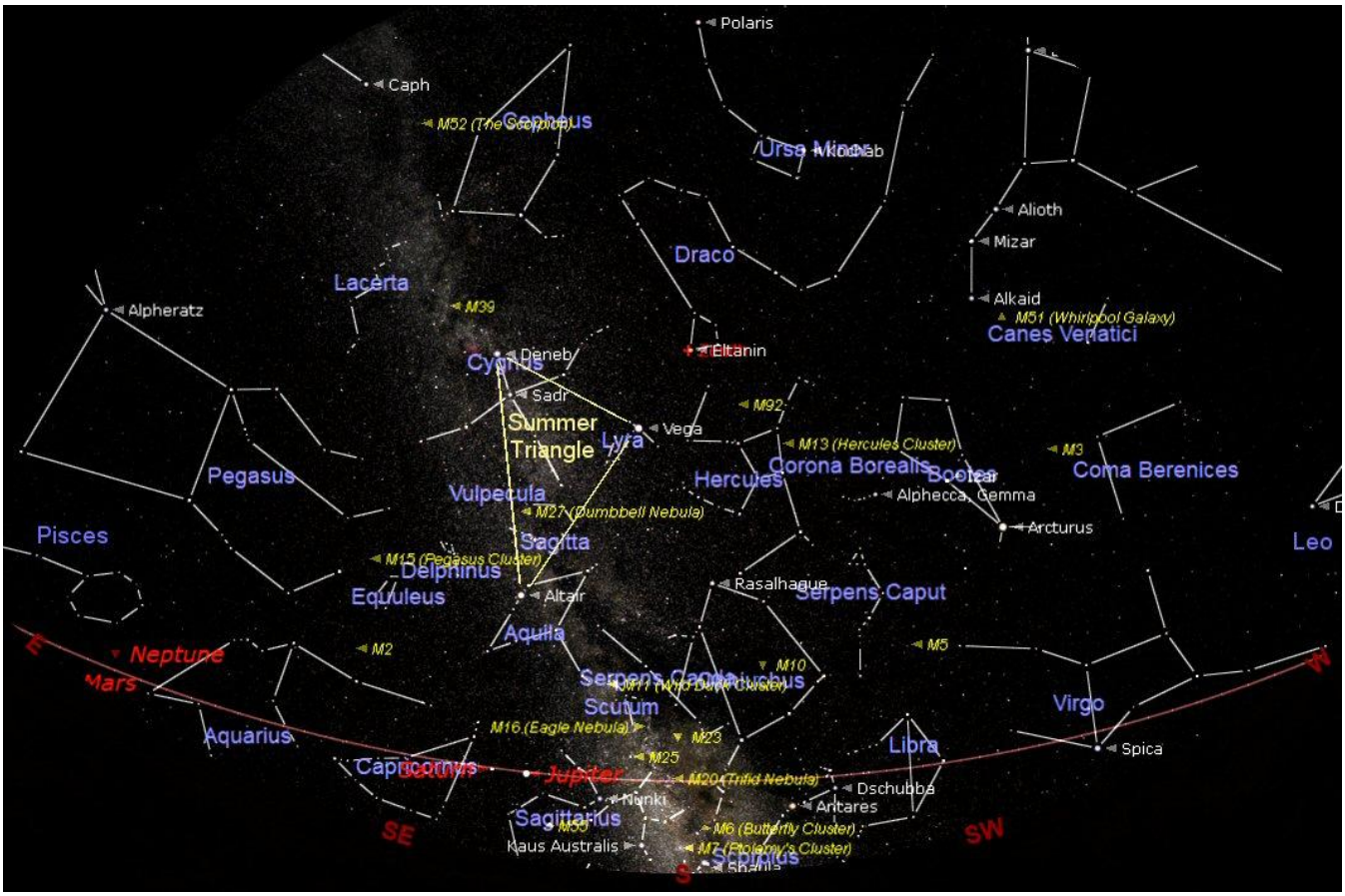
The chart above shows the night sky on the 21st March 2020 which is the Spring Equinox. This is the time halfway between midwinter and midsummer. On this day the Sun will be directly overhead on Earth's equator. For us in the north it means our day and night are the same length, 12 hours.

On the chart above there are no planets shown at midnight on 21st March but on the Graphdark chart below we can see where the planets are in the sky.




The coloured lines on the Graphdark chart above show when the planets are visible in the sky. Venus (yellow) is visible until midnight. Mars (red), Jupiter (green) and Saturn (blue) will all be rising before the sunrise. Uranus (light blue) will be setting early in the evening. Mercury (pink) and Neptune (dark green) will be very difficult to see in the brightening morning sky at the top of the chart. There will be no Moon on the 21st March (the added vertical yellow line) as indicated by the black band across the chart.

# THE SUMMER NIGHT SKY 2020




Summer Solstice at midnight on 20th June 2020

We have now moved on to the summer months and to the Summer Solstice on 20th June 2020. The Summer Solstice is the day when the Sun reaches its highest point in the southern sky at midday 12:00 GMT (13:00 BST). This also means the 21st June will be the longest day of 2020 at sixteen hours long and it will be the shortest night with just eight hours.

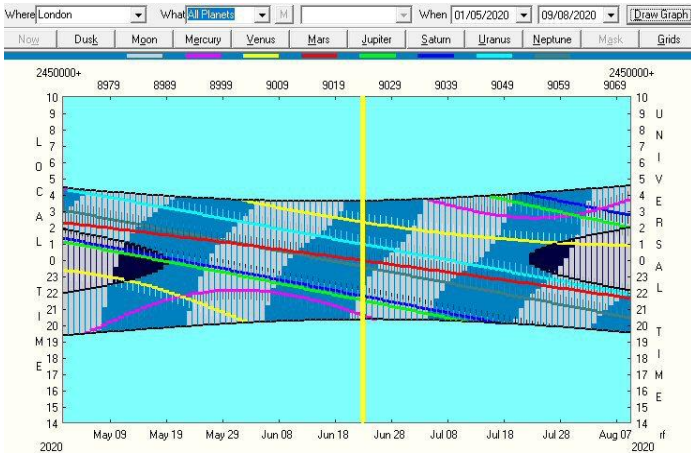
As the Sun will be at its highest at midday the ecliptic will be at its lowest in the south at midnight. Consequently the planets will be very low in the sky and just above the southern horizon as they appear to move along the Ecliptic. The Moon will also appear to move along this imaginary Ecliptic line and will also appear very low in the sky.

With the Moon appearing so low in the sky, during the Summer, we get an optical illusion that makes the Moon look much larger than it really is. This is especially noticeable when the Full Moon is just rising over the eastern horizon (and the Sun is setting in the west).

Our eyes become confused when familiar objects on the horizon, such as hills and trees are compared to the size of the Moon. The hills appear smaller when they are in the distance but the Moon being much further away always appears the same size. Our eyes try to compare the Moon to the size hills and our brain assumes the Moon is much larger. We now call this optical illusion the 'Super Moon'.

This time of the year will not be good for observing the planets and the Moon when they are so low in the sky. The air close to the horizon is turbulent and denser so the image is usually unstable.

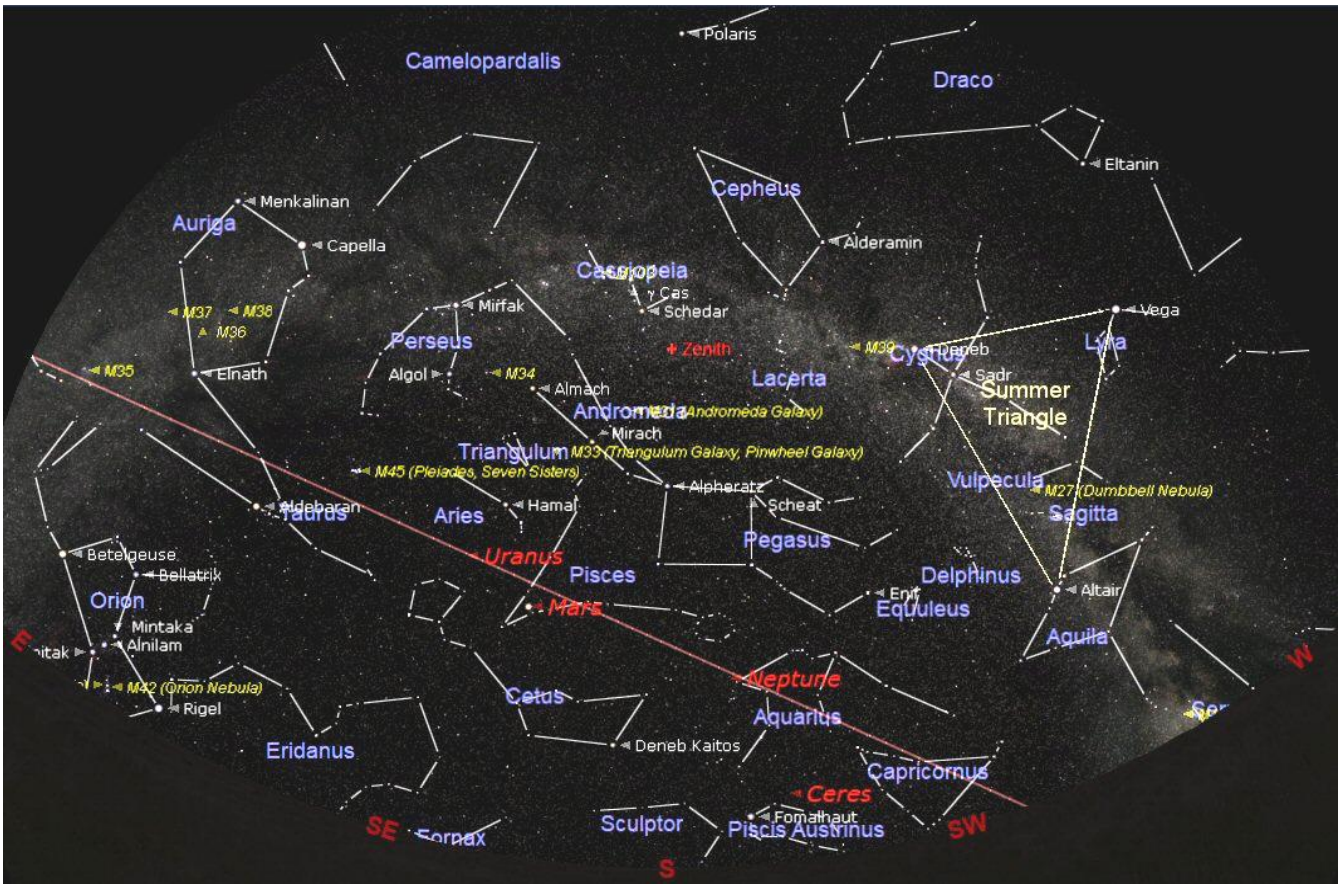
The summer sky is spectacular with lots of things to see and it is warmer and more comfortable for observing. However the nights are shorter and the sky does not become completely dark. This unfortunately reduces the contrast when trying to observe faint deep space objects such as Galaxies and Nebulae (shown in yellow above).




It can be seen from the Graphdark chart above that the black bands depicting the dark nights between the Moon light white periods is now shown just blue. This is because from mid May until the end of July the Sun is only just over the northern horizon and the sky remains light with blue sky in the north and does not appear black.

Venus (yellow) is now visible as the Morning Star after 3 o'clock and until the Sun rises in the east. Mars (red), Jupiter (green) and Saturn (dark blue) and Neptune (dark green) will all be visible most of the night. Uranus (light blue) will be visible after midnight and until sunrise. Mercury (pink) will not be visible.

# THE AUTUMN NIGHT SKY 2020




Autumn Equinox at midnight on 22nd September 2020

We now move into the Autumn night sky and the Autumn Equinox on 22nd September. The chart above shows the night sky on the 22nd September 2020 which is the Autumn Equinox. This is the time halfway between midsummer and midwinter. On this day the Sun will be directly overhead on Earth's equator. For us in the north it means our day and night are the same length 12 hours. As the Sun sets over the horizon the sky darkens as Twilight. When the Sun is more than 18º below the horizon the sky will be Astronomically Dark.

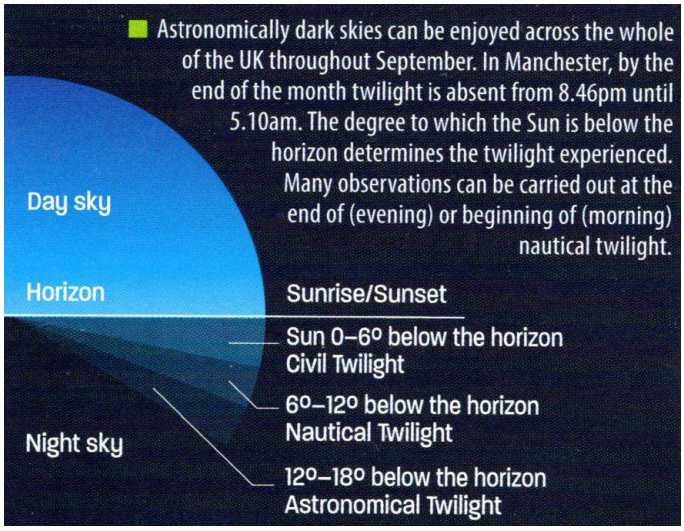
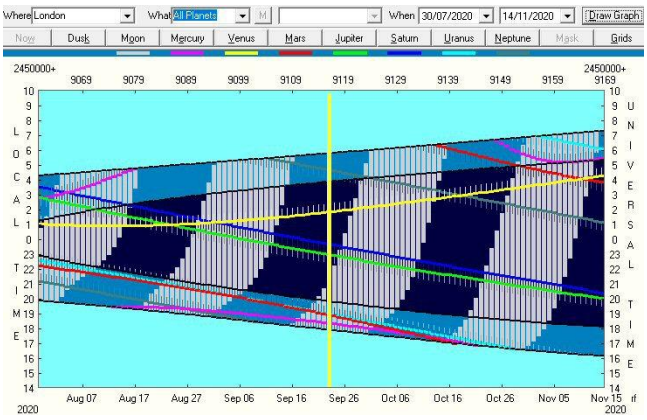



Diagram showing Astronomically Dark Sky

The Summer Triangle is still prominent and easier to see as the evenings are getting dark earlier. The Sun will be setting at about 19:00 BST (18:00 BST). British Summer Time ends on 25th of October 2020.

The Summer Triangle is moving towards the western horizon but will still be well positioned for use as a very good starting place to explore the night sky.

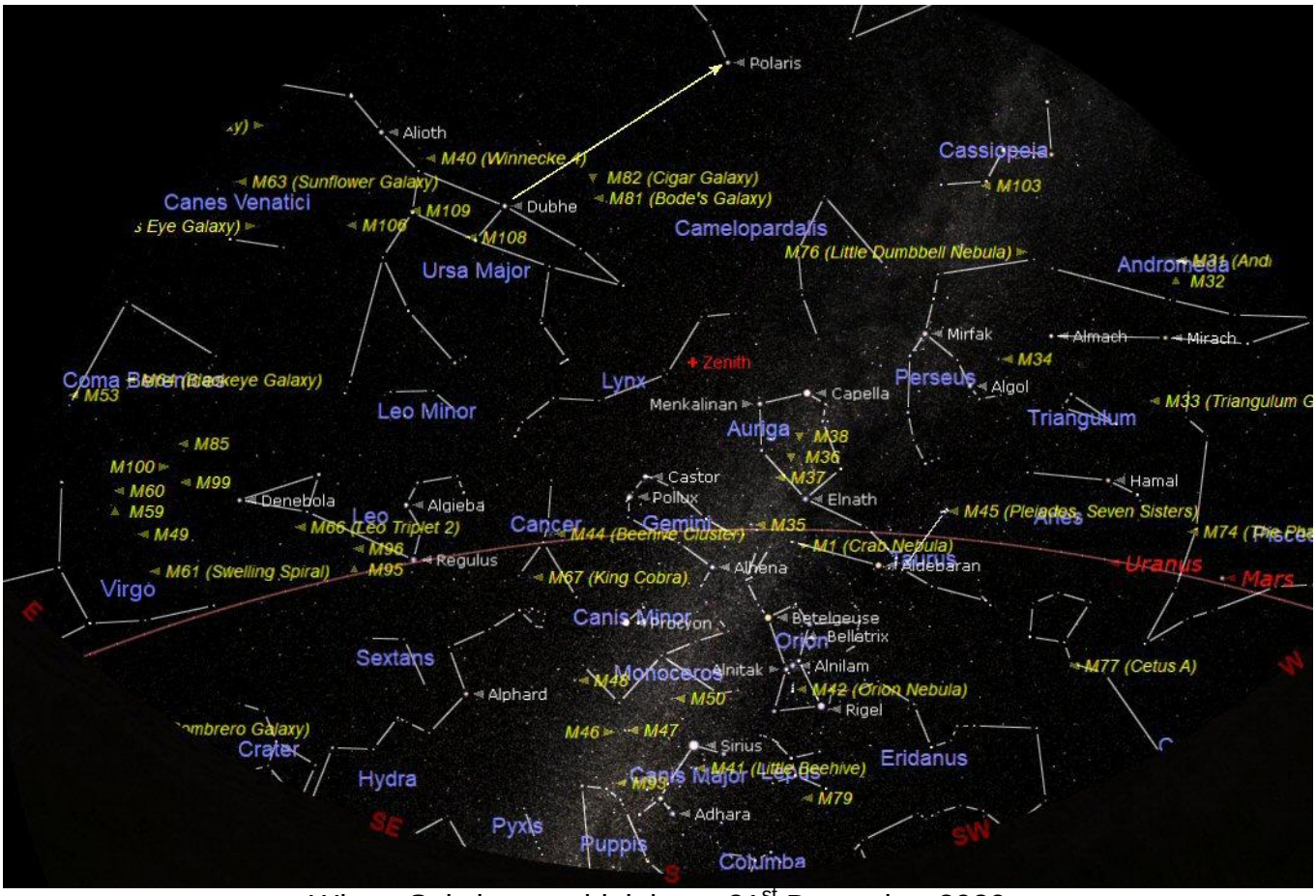



The Graphdark diagram above shows the black band crosses the 22nd September (vertical yellow line) to indicate no Moon after midnight. So the Moon will be setting in the west in the early evening but it will be below the horizon after midnight.

Venus (yellow) will be visible after midnight and setting in the west. Jupiter (green) and Saturn (blue) will all be visible up to midnight. Mars (Red), Mercury (pink) and Uranus (light blue) will be very difficult to see in the evening twilight (bottom of the chart). Neptune (dark green) will also be very difficult to see in the brightening morning sky (top of the chart).

The beautiful winter constellation of Orion is beginning to rise over the eastern horizon and can be seen at the lower left (east) on the sky chart above.

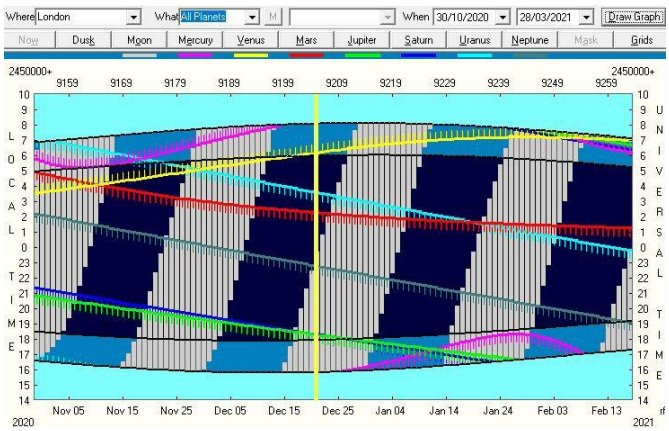
# THE WINTER NIGHT SKY 2020




Winter Solstice at midnight on 21st December 2020

The chart above shows the night sky as it will appear at midnight for the Winter Solstice on 21st December 2020. The Milky Way (our Galaxy) can be seen stretching across the sky from the southern horizon up through the constellations of Gemini, Auriga, Perseus and Cassiopeia to the north western horizon. A dark sky with no light pollution is required to see the Milky Way well but it can be seen even in built up areas on a good clear night and away from lights.

The winter constellations Taurus, Gemini, Cancer, Leo, Virgo and of course Orion are now in full view. This is the best time of the year for observing the night sky. It is dark for sixteen hours and the sky may be as dark as it can be, away from the light polluted towns and cities. On the downside the weather can be unkind to astronomers at this time of the year and unfortunately the planets will not be best positioned this year.




The Graphdark chart at the foot of the previous column shows the positions of the planets through November, December, January and February 2021. Venus (yellow) is low but observable as a large in diameter but narrow crescent in the east before sunrise. It will be better observed from the end of Autumn when it is smaller in diameter, a wider crescent and will be higher in the sky.

Mars (red), Uranus (light blue) and Neptune (dark green) will be observable from early evening until after midnight. Jupiter (green) and Saturn (Blue) will be setting over the western horizon at sunset. Mercury (pink) will not be observable during this period.

This winter period and the late Autumn period is the best time for searching out the faint but very interesting deep sky objects. These are objects that reside outside and far beyond the boundary of our Solar System. Among these objects are Star Clusters, Galaxies and Nebulae (gas clouds in space). Some of these interesting objects are shown marked in yellow print on the chart above.

Some of the best of these deep space objects are listed in the Messier Catalogue of Deep Sky Objects and are prefixed with the letter 'M'. The best Messier star clusters are M45 (the Seven Sisters) in Taurus, M44 in Cancer, M35 in Gemini and M36, M37 and M38 in Auriga. M44, M45 are best seen using binoculars but are also visible to the 'naked eye'.

The brightest Galaxy is Messier 31 (M31) known as the 'Great Spiral Galaxy in Andromeda' or the 'Great Andromeda Galaxy'. This galaxy is similar to our Milky Way Galaxy, is 2.4 million light years away and is just about visible to the naked eye on a clear dark night.

# WHAT IS A QUASAR?

An artist's impression of what a Quasar might look like

A **quasar** is an extremely luminous Active Galactic Nucleus (AGN), in which a super-massive black hole, with mass ranging from millions to billions of times the mass of the Sun, that is surrounded by a gaseous accretion disc. As gas in the disc falls towards the black hole, energy is released in the form of electromagnetic radiation which can be observed across the electromagnetic spectrum. The power radiated by quasars is enormous: the most powerful quasars have luminosities of many thousands of times greater than a galaxy such as our Milky Way.

The term *quasar* originated as a contraction of **quasi-stellar** *[meaning star-like]* **radio source.** Quasars were first identified during the 1950s as sources of radio-wave emission with an unknown physical origin. When identified in photographic images, at visible wavelengths, they resembled faint star-like points of light. High-resolution images of quasars, particularly from the Hubble Space Telescope, have demonstrated that quasars occur in the centre of some galaxies and that some host-galaxies are strongly interacting or merging galaxies.

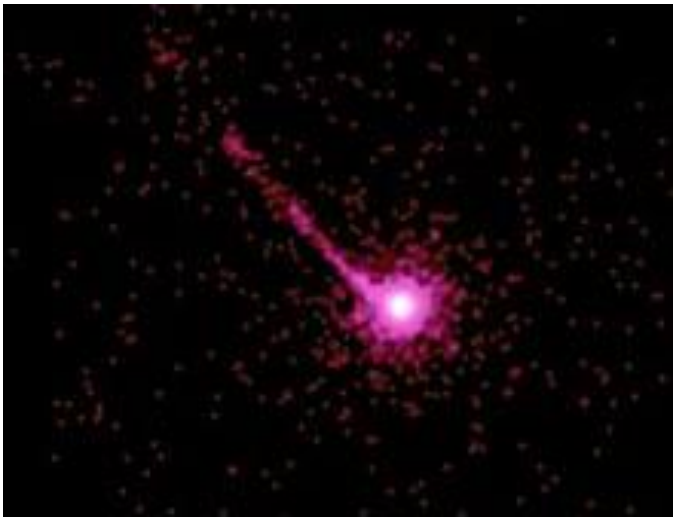
As with other categories of AGN, the observed properties of a quasar depend on many factors. These include the mass of the black hole, the rate of gas accretion, the orientation of the accretion disk relative to the observer, the presence or absence of a jet and the degree of obscuration by gas and dust within the host galaxy.

The matter accreting on to the black hole is unlikely to fall directly in. It will have some angular momentum around the black hole that will cause to collect into an accretion disc. Quasars may also be ignited or re-ignited when normal galaxies merge and the black hole is infused with a fresh source of matter.

In fact, it has been suggested that a quasar could form when Messier 31 (M31) the Andromeda Galaxy collides and merges with our own Milky Way galaxy in approximately 3 to 5 billion years time.

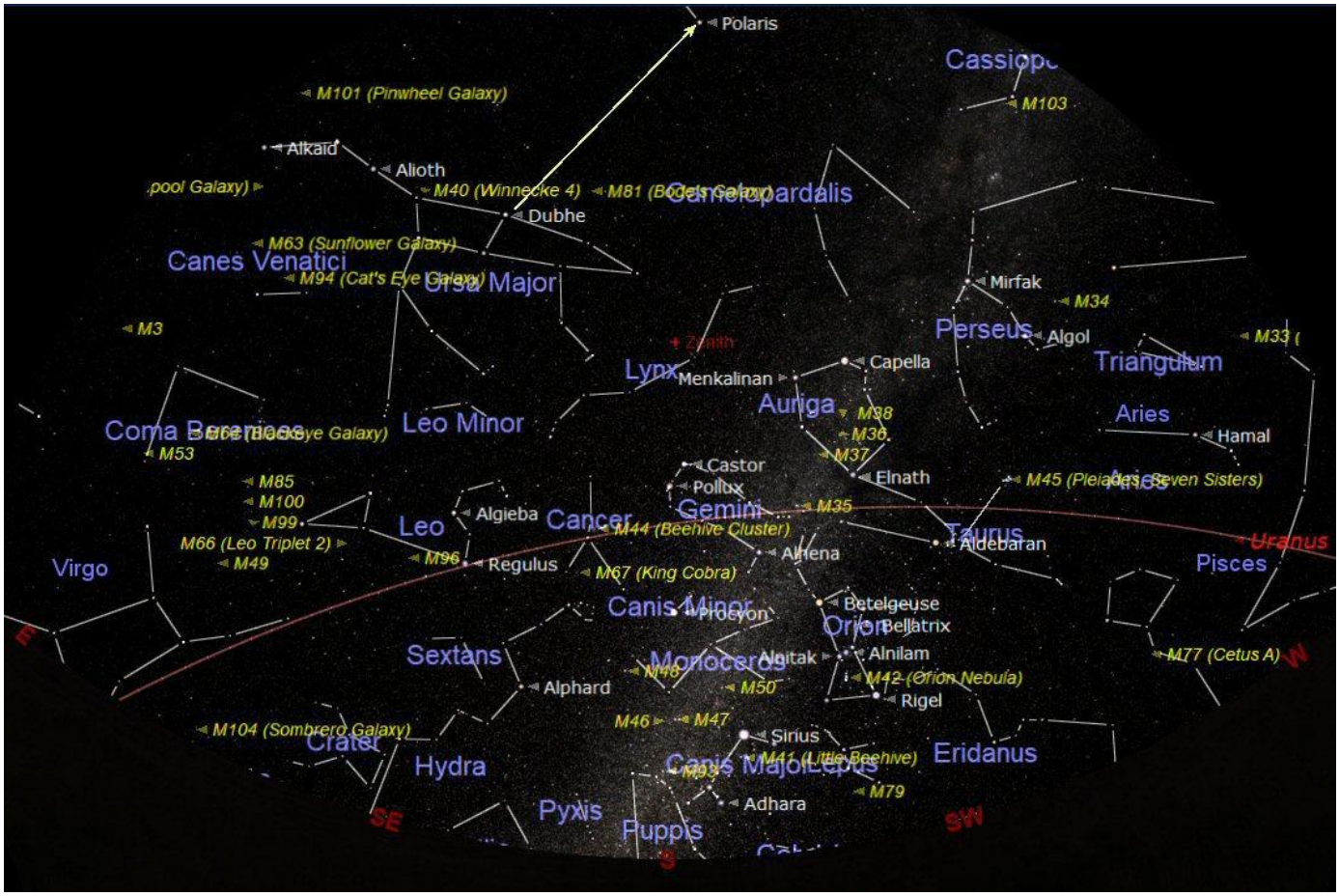
Light and other electromagnetic radiation cannot escape from within the event horizon of a black hole. The energy produced by a quasar is generated outside the black hole, by gravitational stresses and immense friction within the material nearest to the black hole, as it orbits, accelerates and falls inward into the Back Hole.

The intense luminosity of quasars results from the accretion discs of central super-massive black holes. This can convert between 6% and 32% of the mass of in falling material into energy as compared to just 0.7% for the Nuclear Fusion process that dominates the energy production in Sun-like stars. Central masses of $10^5$ to $10^9$ solar masses have been measured for the Black Holes that power quasars and they are all very distant.



An actual image of a distant Quasar with a jet

# A TOUR OF THE NIGHT SKY - FEBRUARY 2020




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

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

Just disappearing over the south western horizon is the constellation of Aquarius (the Water Carrier) followed by Pisces (the Fishes). The planet Uranus is in Pisces and can be found in the early evening using binoculars.

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

Following Taurus along the Ecliptic is the constellation of Gemini (the Twins). The two brightest stars in Gemini are Castor and Pollux that are named after mythological twins and they are so alike they do look like twins. There are lines of fainter stars linked to Pollux and Castor and extending to the south west (down to the right). There is a lovely Open Cluster called Messier 35 (M35) just off the end and above the upper line of stars emanating from the star Castor. M35 will need a telescope to see well.

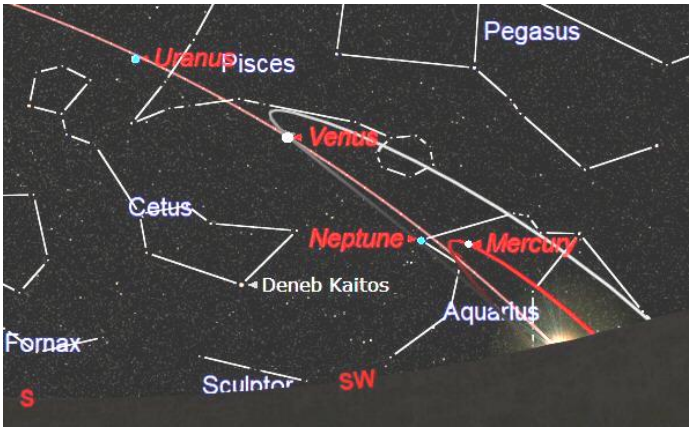
Following Taurus along the Ecliptic is the rather faint constellation of Cancer (the Crab). It does need a dark and unpolluted sky to see with the naked eye. In a good sky the faint stars can be seen and a nice Open Cluster of stars at its centre. The cluster is called Messier 44 (M44) or 'the Beehive Cluster' because of its resemblance to an old straw built beehive with a swarm of stars looking like bees around it. It looks best using binoculars.

Following Cancer along the Ecliptic is the constellation of Leo (the Lion). It does actually look a little like a resting male African lion but perhaps more like the Sphinx in Egypt. Below Leo are some relatively bright galaxies M65, M66, M95 and M96 but they do need a telescope to see them. The sky around Leo and particularly between Leo and Virgo hosts a cluster of nearby galaxies. Our Galaxy (the Milky Way) is actually a member of a small local group of galaxies that forms part of this larger cluster of galaxies.

To the south of Taurus and Gemini is the spectacular constellation of Orion (the Hunter). Orion dominates the southern sky and is one of the best known constellations and hosts some of the most interesting objects for us to seek out. See the January issue of this magazine.

# THE SOLAR SYSTEM THIS MONTH (also see the next page)

**MERCURY** will be observable this month in the west as soon as the Sun sets. The innermost planet will be at Greatest Eastern Elongation (furthest position from the Sun, see the red orbit below) on 10th February. Mercury is small but quite bright although its brightness is rather overwhelmed by the brightness in the sky from the setting Sun. It is best seen using binoculars but we must wait until the Sun has disappeared over the horizon before sweeping the sky using binoculars to find Mercury.




Mercury, Venus, Uranus and Neptune at sunset

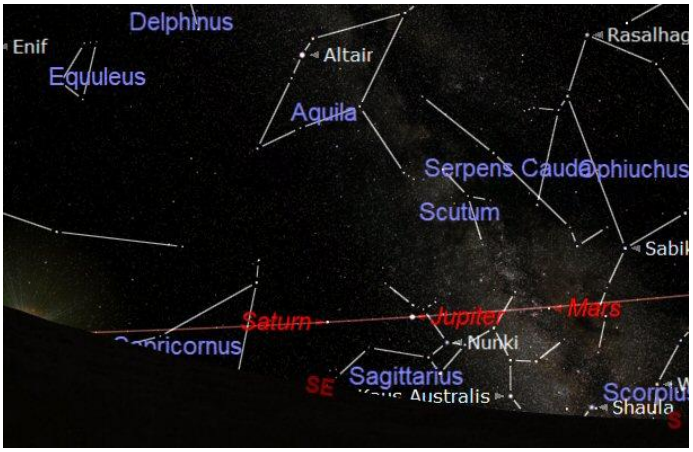
**VENUS** has been moving out from behind the Sun. See the gray orbit arc on the chart above. The fainter section (below the elliptic) shows the section Venus has moved along and the brighter section is the part of its orbit it will be moving along during the next few months. So Venus is looping out from behind the Sun and moving towards us. It will soon appear to be moving back towards the Sun, following the brighter gray orbit arc. Venus will become a narrower crescent shape but will appear to become larger in diameter as it moves closer to us.

Venus how it will appear on 15th February

**MARS** will be observable (with difficulty) this month low in the east before sunrise. Mars is still a long way from us on the other side of the Solar System so it looks small at just 5.1" (arc seconds). See the chart in next column.

**JUPITER** is moving away from the Sun in the early morning sky in the east. It will be very low in the sky and looking rather disappointing in the dirty and turbulent air close to the horizon. See the chart in the next column.

**SATURN** will be low in the south east as the sky brightens and the Sun rises over the eastern horizon. Saturn is very low and in the murky and turbulent air close to the southern horizon. It will be in the bright dawn sky and will require a clear view to the eastern horizon. It may still just be possible to see the ring system although it will appear unstable due to the air movement close to the horizon. See the chart below.




Mars, Saturn, Jupiter at Sunrise on 15th February

**URANUS** will be visible during the evening using a small telescope as a slightly fuzzy blue, star like, object. A larger telescope with a magnification of 100x or more will show it as a small blue/green disc. See the chart opposite.

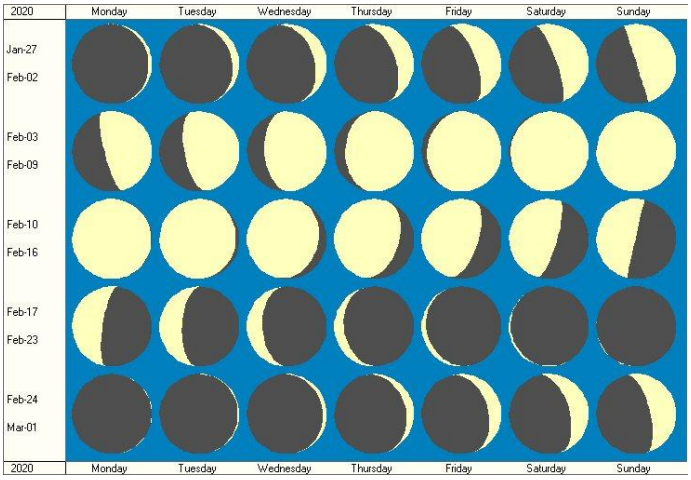
**NEPTUNE** is now moving towards the western horizon. A medium sized telescope (100mm to 150mm) will be needed to show Neptune as a small blue/green disc using a magnification of 150x but it is small and difficult to find. See the chart opposite.

## THE SUN

There was one small sunspot visible at the end of January even though we are in the inactive phase of the Solar Cycle. No other sun spots have been seen since early last year and that was just one fairly large one.

The Sun rises at 07:30 GMT at the beginning of the month and at 06:50 GMT by the end of the month. It will be setting at 16:50 GMT at the beginning and 17:35 GMT by the end of the month. Sunspots and other activity on the Sun can be followed live and day to day by visiting the SOHO website at: http://sohowww.nascom.nasa.gov/.

## THE MOON PHASES IN FEBRUARY



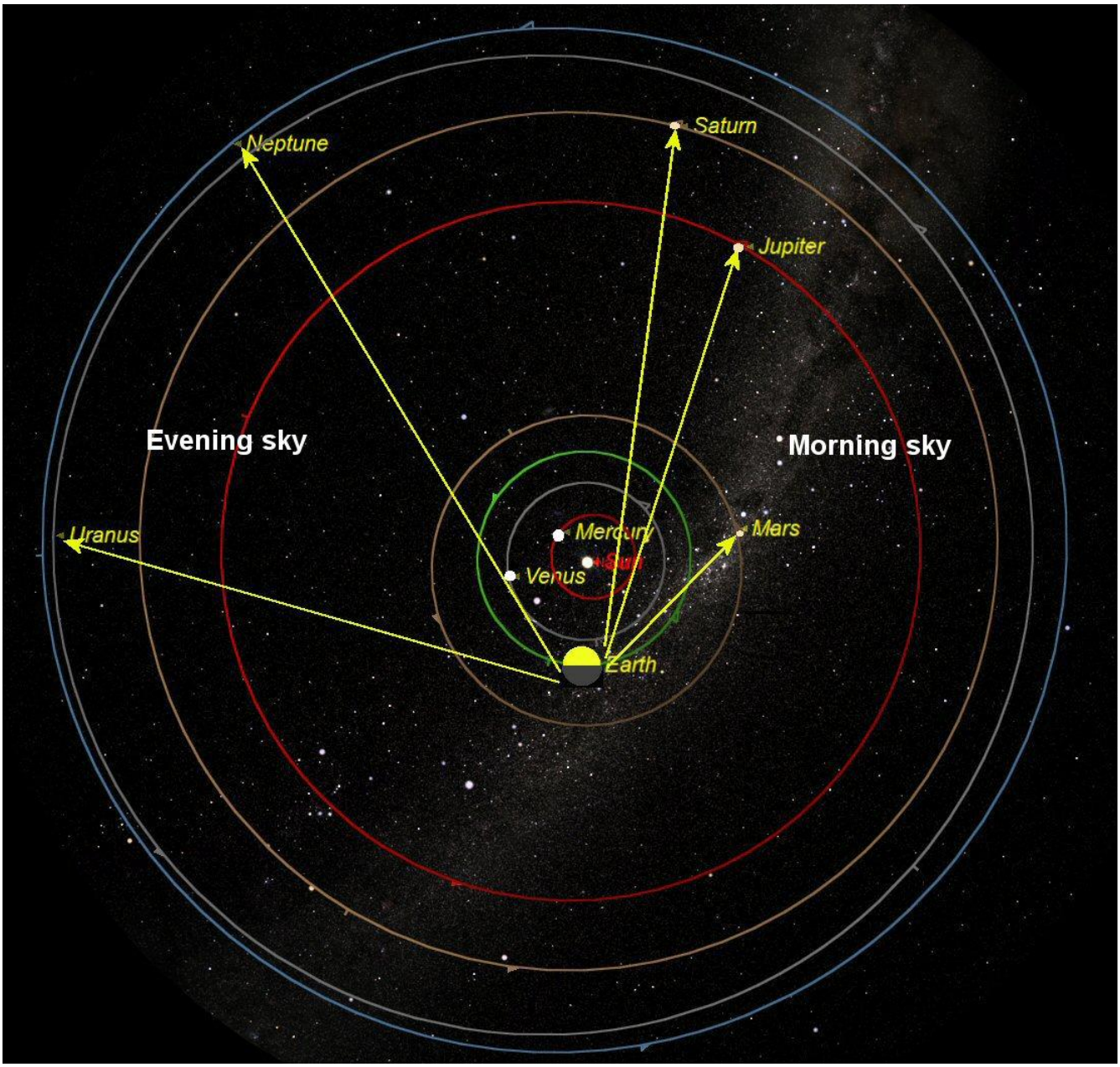

First Quarter will be on 2nd February

Full Moon will be on 9th February

Last Quarter will be on 15th February

New Moon will be on the 23rd February

# WHERE ARE THE PLANETS THIS MONTH?




The location of the planets when viewed from Earth

The chart above shows the location of the planets around our Sun in their true positions as seen from Earth. The sky is shown as it was on 28th January 2020. This is because there was a conjunction (coming together) of the planets Venus and Neptune.

Earth is rotating (once per day) in an anticlockwise direction as seen from our viewpoint looking at the chart. The yellow side is day and the black is night so the point on the left between day and night is sunset and on the right is sunrise.

As an observer, at sunset (left), moves into the dark and looks to the west Venus is seen shining brightly over the western horizon. In the same line of sight but much further away is Neptune. It is much fainter than Venus but appears very close to it. Mercury can just be seen lower and in the glare of the setting Sun. The planet Uranus appears in the southern sky to our observer. As Earth rotates these planets will appear to move towards the west and set during the evening.

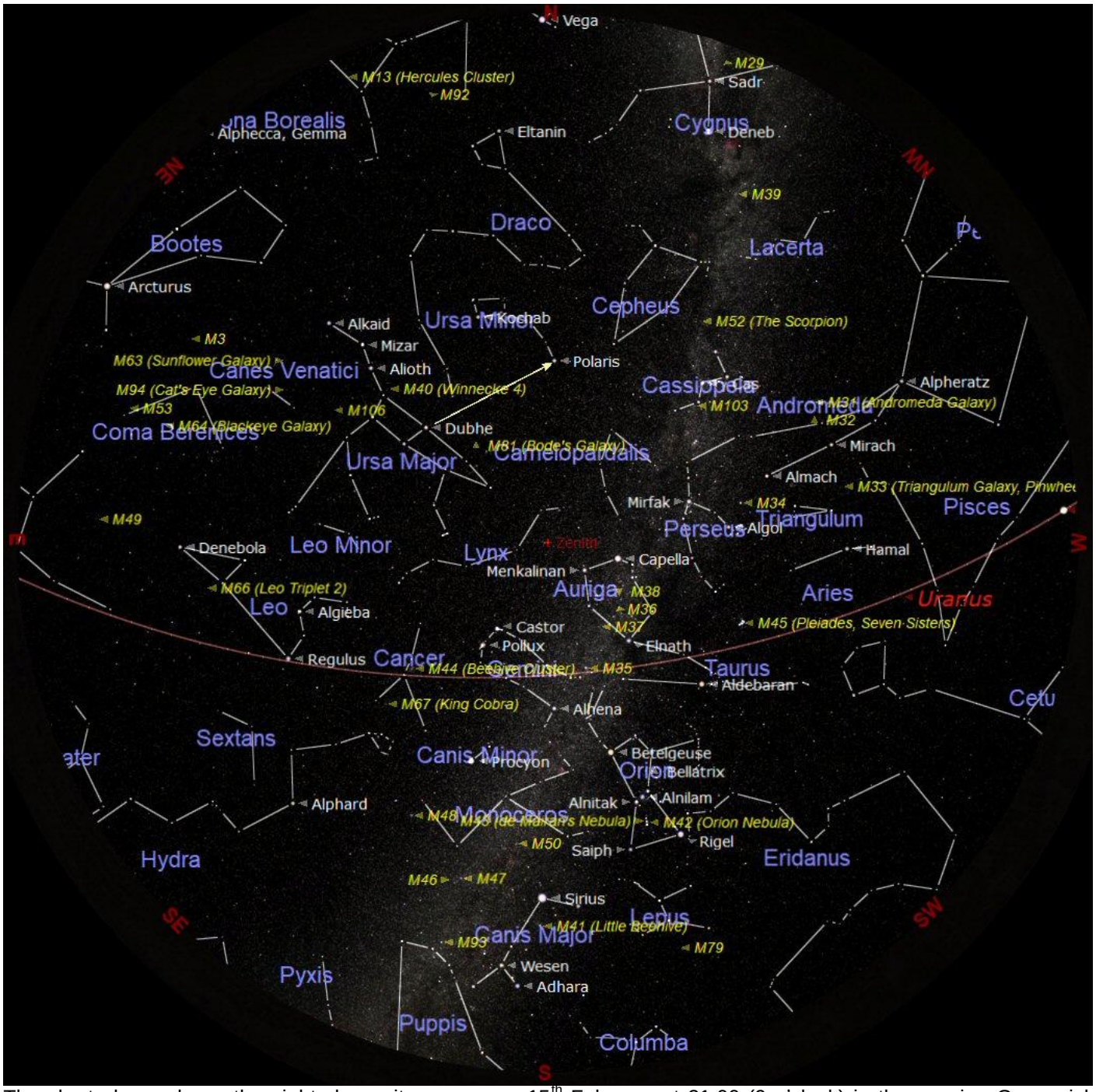
Through the night the dark sky will appear to move from east (left) to west (right) as Earth rotates. As our observer approaches dawn, on the right side of Earth on the chart, Mars will be seen to rise over the eastern horizon followed by Jupiter and Saturn (hidden in the glare) of the Sun rising over the horizon.

Mars, Jupiter and Saturn will be in the daytime sky moving across the sky from east to west ahead of the Sun as it moves across the sky. These planets will set over the eastern horizon before the Sun sets over the horizon at sunset. The planets will be very difficult to see in the bright daytime sky with the fainter planets Mars and Saturn being virtually impossible to see.

The outer planets will be in virtually the same locations shown above during early February but the inner planets Mercury and Venus will have moved noticeably, see the charts on the previous page.

The diameters of the orbital lines of the outer planets Saturn, Uranus and Neptune have been shrunk to allow all the planets to be seen on this same chart.

# THE NIGHT SKY THIS MONTH




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

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

Planets observable: Uranus. Venus is observable in the very early evening with Mars and Jupiter early morning.