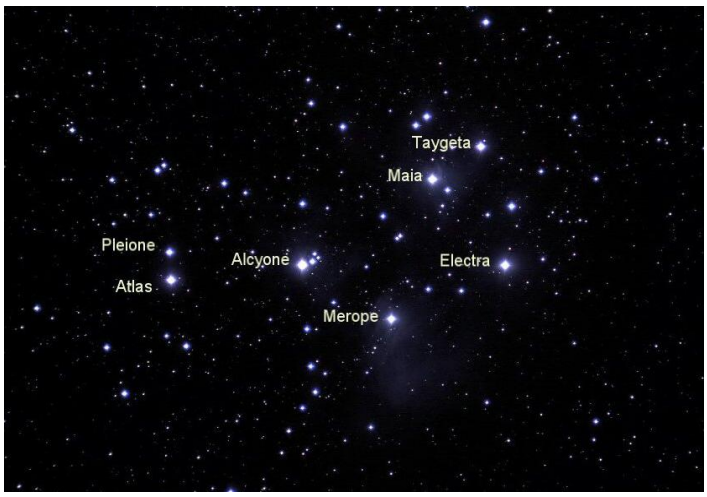
NEWBURY ASTRONOMICAL SOCIETY
MONTHLY MAGAZINE – APRIL 2018

FAIRWELL TO THE PLEIADES (The Seven Sisters)

The bright red star Aldebaran in the Hyades cluster and M45 the Pleiades (Seven Sisters)

The winter constellations are now disappearing over the western horizon but there is still a chance to see the most beautiful star cluster in our night sky. In the constellation of Taurus, is the beautiful Open Star Cluster known as the Pleiades. The cluster is officially named Messier 45 (M45) or the Seven Sisters. To the naked eye it initially appears to be a small smudge of light but when examined closer it can be seen to be a cluster of six or seven stars. (Under perfect conditions and with very good eyesight up to nine stars can be seen.) It is the most striking Open Cluster in the night sky that can be seen using just our naked eyes.



Messier 45 (M45) the Pleiades (Seven Sisters)

Most people with fairly good eyesight can see the brightest six stars in the cluster. Binoculars will reveal about forty bright stars and the view will be magnificent. In fact the best view is obtained using binoculars. A small short focal length telescope will also give a wonderful view but the whole cluster cannot fit into the narrow field of view of most telescopes. There are a host of smaller stars in the cluster that are too faint to be seen and identified in amateur astronomer's telescopes. It is thought there could be more than 1400 stars in total in the cluster.

All the stars were formed in the same nebula so they are all the same age, about 125 million years old and are located about 443 light years away from us. The stars are still close together but over millions of years they will gradually disperse and the cluster will disappear. It is thought that all stars are created in clusters and formed from Nebulae. This month will be our last chance to see this beautiful cluster before it disappears over the western horizon to appear again towards the end of the year.

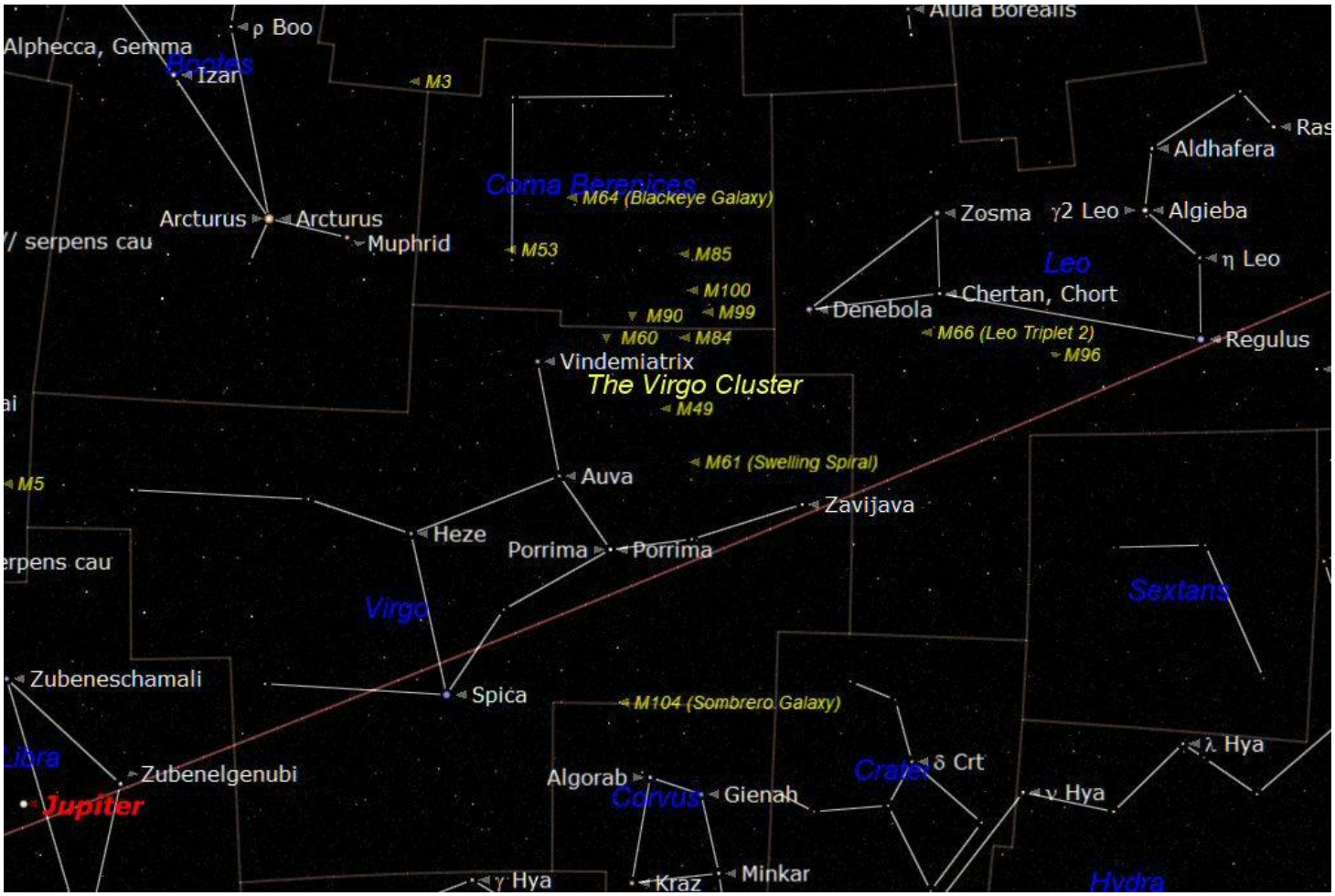
NEWBURY ASTRONOMICAL SOCIETY MEETINGS

4th May Members evening - Favourite Telescopes
Website: www.newburyastro.org.uk

NEXT NEWBURY BEGINNERS MEETING

18th April 50th Anniversary of 1st Moon Landing
Website: www.naasbeginners.co.uk

CONSTELLATIONS OF THE MONTH – Virgo and Coma Berenices



The constellations of Virgo (the Virgin) and Coma Berenices (the Hair of Berenices)

Spring time is regarded as the season of galaxies. This is because there is a group of Galaxies located between the constellations of Virgo, Coma Berenices and Leo. Leo was the constellation of the month in the March addition of this magazine. We saw then how Leo has four lovely bright (Messier) galaxies of its own, these are known as: M65, M66, M95 and M96. They can be seen on the chart above marked in yellow just below the shape of Leo the 'lion'.

When we look in the direction of Virgo we are looking up and out of our Galaxy (the Milky Way). We are not looking through the main disc structure so our view it not obscured by the multitude of stars and thick clouds of gas and dust in our galaxy. With this clearer view out of the Milky Way we are able to see the other galaxies that surround our galaxy. Some of the brighter of these local galaxies called the 'Virgo Cluster' are marked in yellow on the chart above.

Virgo is located on the ecliptic (the imaginary line along which the Sun, Moon and planets appear to move across the sky). This means the Sun, Moon and planets can appear to pass through Virgo. Jupiter can be seen at the lower left of the chart above, just above the ecliptic in the neighbouring constellation of Libra.

Virgo is one of the 'Spring Constellations' because it enters the night sky in the early months of the year as it begins to rise over the eastern horizon in the evening. Most of its stars are not bright but Spica is the exception. It is a variable star with an apparent brightness (known as magnitude) that varies between +0.97 and -1.4. It is classified as the 16th brightest star in the night sky.

Spica is listed as a Spectroscopic Binary star. This means it is a double star but the two stars are so close together that they cannot be separated using a telescope. It was found to be a double star when the spectrum of the star's light was found to be the combined spectra of two different stars. The pair is so close together that the gravity has caused them to be elliptical (egg shaped) as the part of each star facing the other is pulled towards the other by their gravity.

The two Spica stars are both larger and hotter than our sun but are only 18 million kilometres apart. That is very close for stars. For comparison, Earth's distance from our Sun is 150 million kilometres. They are so close to each other that their mutual gravity distorts the stars to produce a bulge pulled towards the other as they whirl around. They orbit around their common centre of gravity in just four days.

An artist's impression of the Spica pair

GETTING TO KNOW OUR MOON

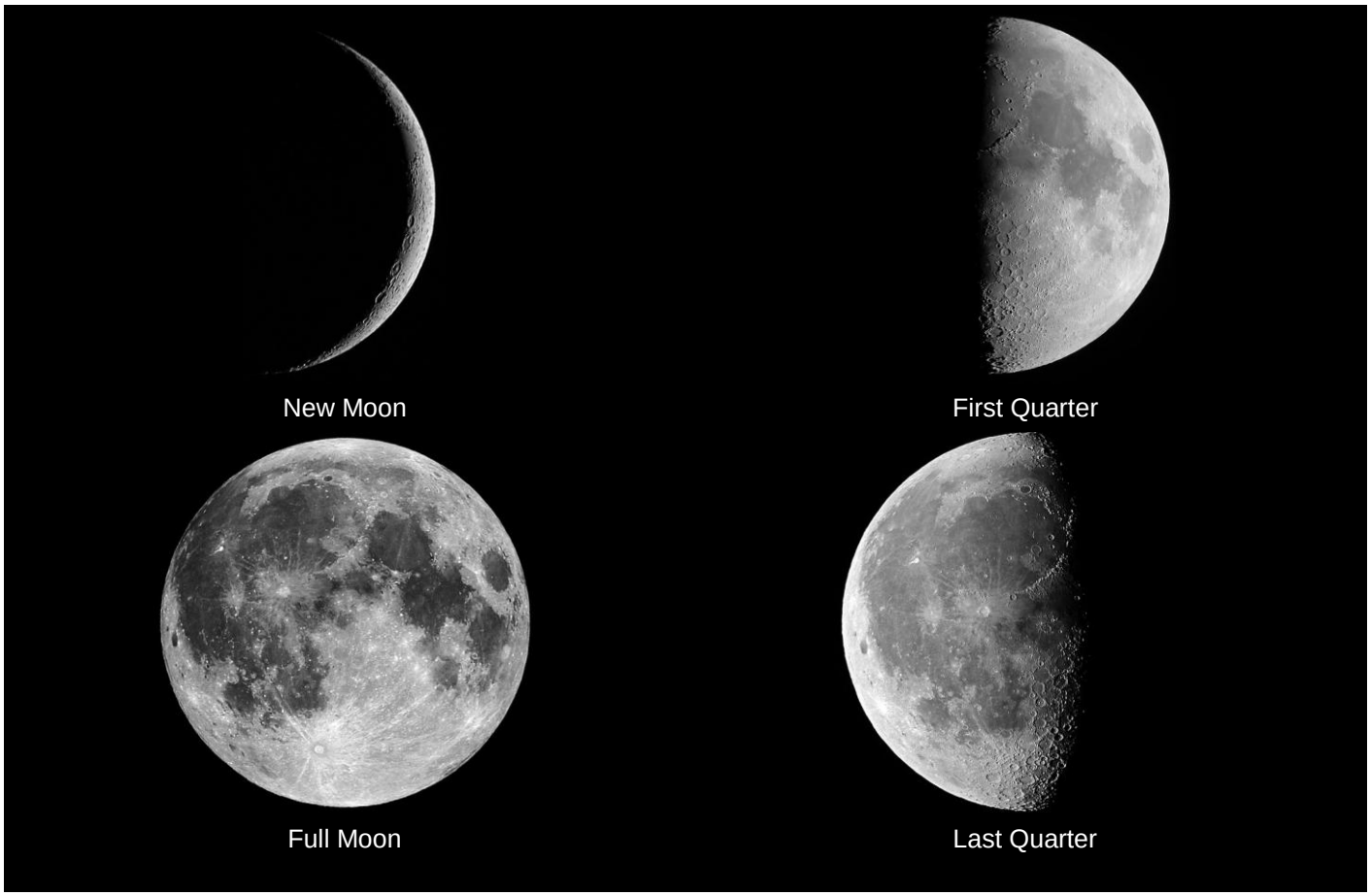


Chart showing the phases of the Moon

The images above show the four 'cardinal' phases of the Moon, known as: 'Quarters'. Each of the four quarters appears approximately seven days after the previous phase. So 'First Quarter' appears seven days after 'New Moon', 'Second Quarter known as 'Full Moon' appears another seven days later and 'Last Quarter seven days after Full Moon. The final quarter occurs seven days later when the Moon is in the same direction as the Sun and cannot be seen. This final quarter phase does not have a real name but is so close to the next New Moon that it is considered to be the same phase.

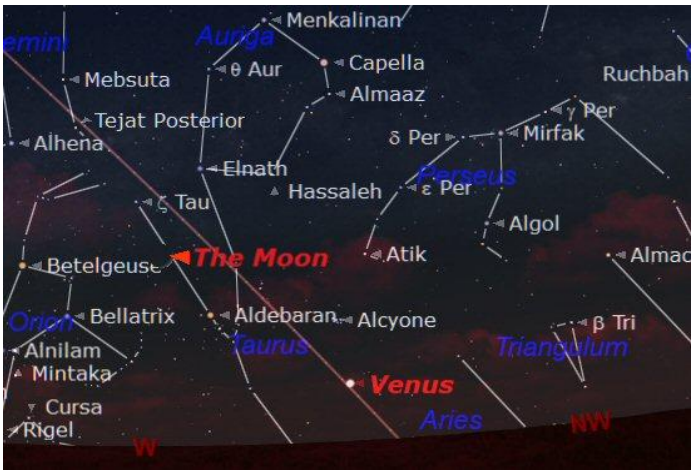
It is no coincidence that the phase cycle of the Moon takes one month to complete and there are twelve months in a year. This time period was named after the ancient term 'moonth' obviously referring to the time the Moon takes to orbit Earth. We will discuss different terms used for a number of aspects of the actual orbit later.

Our observations of the Moon can begin when the 'New Moon' is first seen in the sky. Some keen Moon observers like to spot the Moon at its very earliest appearance when it is a very narrow crescent. So this begs the question, Why do we get a New Moon?

For a start let's clear up one obvious point, the Moon is never new, it is over 4 billion years old and we see the same Moon every month. When the Moon is in direct line with the Sun in the sky we cannot see it. This is firstly because the sky close to the Sun is so bright we would not be able to see the Moon anyway. Also the side of the Moon facing the Sun is illuminated so the side facing us on Earth is in shadow and dark so we could not see it even if the sky around the Sun was not so bright.

As the Moon moves away from its conjunction (alignment) with the Sun it appears to be moving eastwards when viewed from the surface of Earth. This is because the Moon moves along its orbit anticlockwise when viewed from above the north pole. Therefore it appears to move from west to east (to the left) about 12° each day. Therefore one day (24 hours) after conjunction with the Sun the Moon will have moved 12° east (left) of the Sun.

The New Moon would normally not be visible until the 2nd or 3rd day after conjunction with the Sun. This is because the Moon is too close to the Sun and the sky is too bright. We would need to wait until the Sun is below the horizon to enable the thin crescent Moon to be seen in the darkening sky. It may be possible to see the New Moon on 18th April just after the Sun has set.



The position of the New Moon on 19th April at 20:30 BST

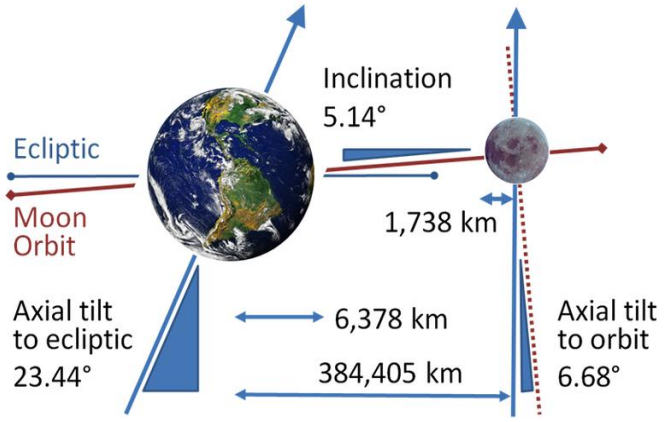
As the Moon continues to move from west to east around its orbit, more of the bright (day) side is revealed and the illuminated side appears as a wider crescent shape. When the Moon has reached approximately a quarter of the way around its orbit, in 7 days, it will appear as the 'Half Moon' or 'First Quarter'. The Half Moon will be located in the south as the Sun sets in the west.

After the first quarter, the crescent shape gives way to the shape known as the 'Waxing Gibbous' phase. This phase is produced when the Moon is positioned in its orbit where we can see between a quarter and all of the sunlit side (Full Moon). After 14 days the Moon is positioned directly opposite to the Sun the whole of the sunlit side is visible and we see the 'Full Moon'. The Full Moon will rise in the east as the Sun sets in the west.

As the Moon continues on its orbit around Earth, the dark half of the Moon begins to appear and the sunlit side begins to move out of view. This is called the 'Waning Gibbous' phase. After about 21 days, only the left half of the Moon appears illuminated which is called the 'Last Quarter'. The final phase is the 'Waning Crescent' as less and less of the sunlit side is visible from Earth. Finally after 28 days the Moon moves back into direct line with the Sun and none of the sunlit side is visible.

The Moon takes approximately one month to complete its orbit around Earth; this is where the unit of time we call the month was derived from. The Moon takes 27.32 days to complete one orbit which is called a Sidereal Month. However, because Earth is also moving around the Sun, the Moon actually travels further and takes slightly longer to complete its cycle from one new moon to the next. The actual period it takes is 29.53 days and this is called a Synodic Month or Lunar Cycle.

The Orbit of the Moon is tilted at 5.14° to Earth's orbit so eclipses do not occur every month. Most months the Moon passes above or below the Sun and only occasionally passes in front of the Sun. Solar eclipses always occur when the Moon is directly between Earth and the Sun and the dark side of the Moon is facing Earth. The opposite is the case for Lunar Eclipses. These occur when the Moon is on the opposite side of Earth to the Sun and passes through Earth's shadow. The Moon will always be full during Lunar Eclipses and they always occur at night. The diagram below shows the relative tilts of Earth and the Moon. It also shows the Earth – Moon average distance at 384,405 km and the equatorial radii of the two bodies.



Physical data of the Moon and Earth

We can only see one side of the Moon from Earth because the rotation of the Moon has been locked due to the gravity of Earth. However the Moon does rotate, once every Month, when seen from outside the Earth / Moon system. A number of factors enable us to actually see about 59% of the surface of the Moon in a process called 'Librations'.

The major part of the effect is due to the orbit of the Moon being slightly elliptical (oval). As the Moon passes through the major axis of its orbit (most distant) it moves slower around the orbit. This is rather like throwing a ball high into the air. As the ball rises it slows at the top of its arc then begins to accelerate as it falls back to Earth. The Moon slows as it moves further from Earth then accelerates as it is pulled back towards Earth. However the 27.32 day rotation time is constant causing the Moon to appears from Earth to rock back and forth as it moves around its orbit.

Other minor effects that allow a little more of the 'far side' of the Moon to be seen are due to the relative tilts in the orbits of Earth and the Moon. This allows us to see a little further over the poles of the Moon. When the Moon is at the lowest point on the tilt, the Moon appears slightly lower from Earth and we can see a little further over the top of the Moon. Conversely when the Moon is at the highest point on the tilt, the Moon appears slightly higher from Earth and we can see a little further around the bottom of the Moon.

Another effect that helps see the poles is the 23.44º axial tilt of Earth. Somewhere like the UK has a variation in 'relative height' of about 4000 km due to the change of position on the sphere of Earth from summer to winter. This gives us a slightly higher and lower vantage point from summer to winter

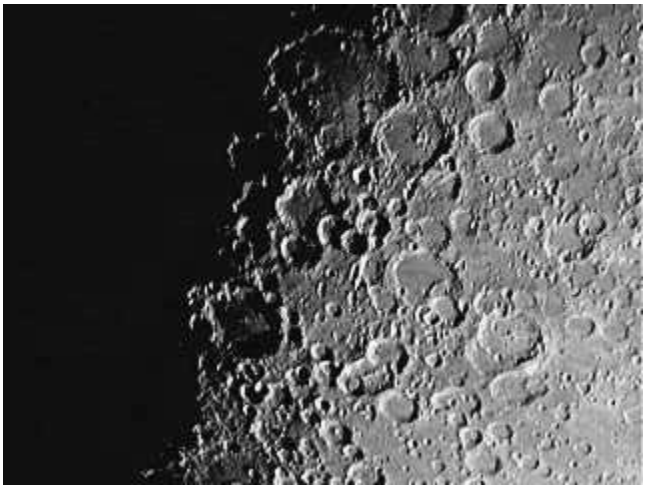
Many astronomers enjoy the challenge of looking for features that are normally hidden just over the edge of the Moon when they briefly appear thanks to the librations.

The 'far side' of the Moon had never been seen until early space flights took cameras around the Moon and transmitted the images back to Earth. Strangely the far side looks quite different to the near side. The far side has almost no Maria (seas) but does have an enormous multi ringed crater that looks like an eye. It is interesting to wonder what our ancestors would have made of this 'eye' like feature looking down from the sky, if it had been on the near side.

Observing the phases of the Moon does not need any optical aid and can be followed just using the naked eye. At full Moon the Maria (seas) can also be seen but to see the true shapes and some detail binoculars or a telescope must be used. Binoculars will reveal the shape of the Maria and allow the smaller Maria to be seen. A larger pair of binoculars will show the larger craters and mountain ranges.

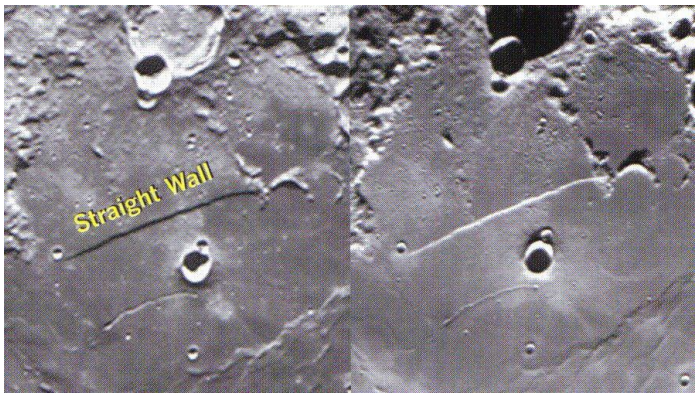
A small telescope will be needed to show any detail of the craters and the other interesting surface features such as Mountains, Cracks and ripples and rills on the smooth surfaces of the Maria. The Maria are very old giant impact craters that have filled with lava from below the surface when the interior was still molten.

Some areas of the Moon are more cratered than others. There are large areas that have so many craters that there appear to be no smooth areas at all. Other areas, particularly Maria, have almost no craters.

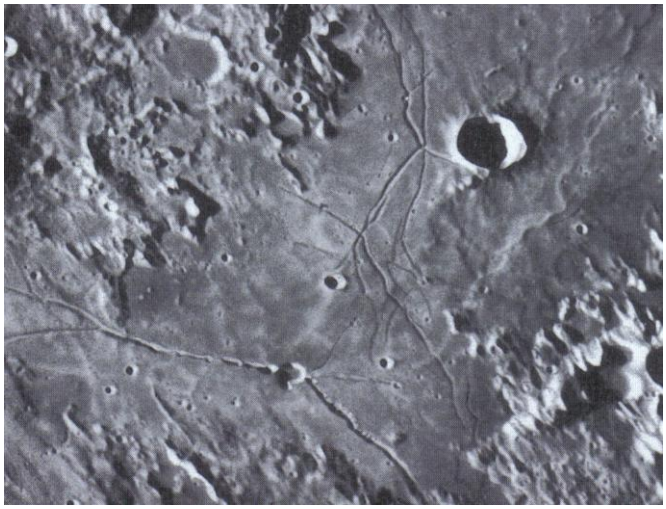


A heavily cratered area near the terminator image

There are also mountain ranges that are often named after mountain ranges on Earth. Most of these mountain ranges appear to be the walls of vast craters that have all but disappeared under ancient lava flows and the effect of later meteor impacts. There are however some that appear to be natural mountain ranges.

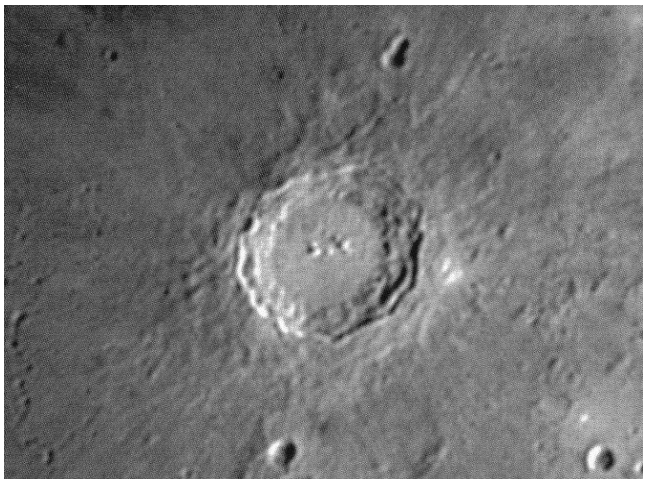


In the images above is a feature called the Straight Wall. This is a common type of feature known as a 'Rill' and appears to be a vast cliff face caused by a crack in the ground. In the left image the Sun is shining from the top casting a shadow towards the bottom but in the right image it is shining from the direction of the bottom so the cliff face is illuminated and there is no shadow.



Cracks and rills on a smooth surface

Craters are especially spectacular when viewed using a telescope (see the images below). Some of the larger craters may have terraced walls both inside and outside the main rim. There may even be smaller craters on the floor of the large crater or another crater may cut through the wall of a large crater. It is possible to work out the relative age of some craters. If one crater has cut through the wall of another then it must be younger than the one that has had its wall damaged.

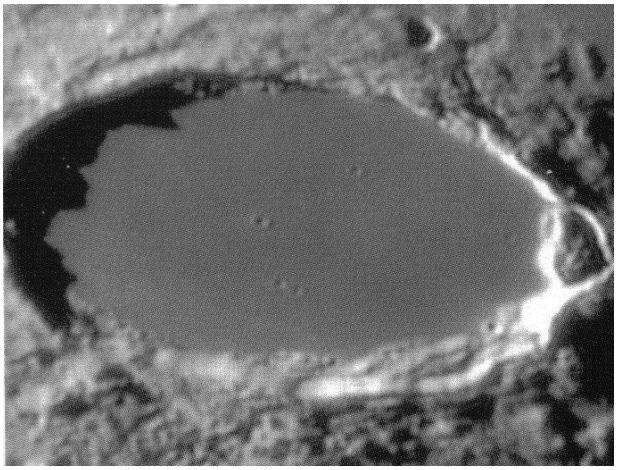


Copernicus showing the terraced walls and central peaks

Other craters have radial lines called rays stretching for many hundreds of kilometres where debris was thrown out by the impact when these craters were created.

Crater Tycho showing the prominent ray structure

Other interesting things to look for are smaller craters inside larger and impacts that have created craters on top of earlier craters.



The lava filled Crater Plato with the shadow of the rim

INTRODUCTION TO OBSERVING THE MOON

The Full Moon

The Moon is the brightest and largest object in the night sky so it is inevitable that it is usually the first thing a beginner to astronomy as a hobby will choose to observe. This is actually a good plan because it is the easiest target to find and has many interesting things to see. It is also a great target to use when familiarizing ourselves with a new telescope and aligning the finder scope.

One of the great advantages of starting with observing the Moon is that it can be done using almost any telescope. One slight disadvantage is the Moon can be very bright especially when using a larger telescope to observe the full Moon or even half Moon. This is not really a problem because there are two ways to overcome this minor problem. We can use a Moon Filter to reduce the glare (see page 7) or we can fit a mask over the end of the telescope. Many telescopes are supplied with a Dust Cap used to cover the open tube and keep dust out. Most Dust Caps are supplied with a Moon Cap that can be removed from the Dust Cap to create a mask that will reduce the amount of light entering the tube. See below.

Dust Cap fitted

Moon Cap removed

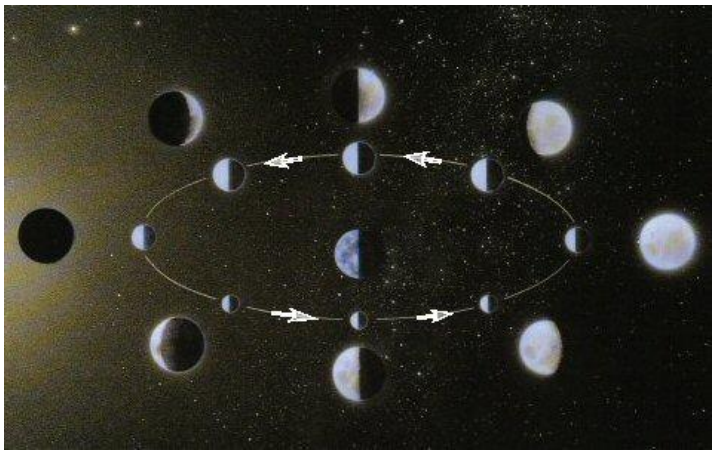
Binoculars can be used to observe the Moon and will provide a good overview of the Moon but they do only have a low magnification. A pair of binoculars will be marked with the 'magnification' and 'aperture' (diameter of the main lens) of the instrument in the form: 9x50. This example means the binocular has a magnification of 9 times and an aperture of 50mm. To see detail on the Moon surface needs a magnification of at least 25 to 30 times so it is obvious a telescope is required.

A new telescope is usually supplied with two eyepieces. These are small microscopes that fit into the telescope focusing unit to magnify the image produced by the telescope. The eyepieces supplied are usually marked: 25mm and 10mm, this is the focal length. The higher the number the lower magnification the eyepiece will provide. The magnification of the Moon can be calculated by dividing the focal length of the telescope by the focal length of the eyepiece being used. For example Telescope focal length 1000mm and eyepiece focal length 10mm will produce: 1000 ÷ 10 = 100x.

Observing should be started using a low power eyepiece (the 25mm) this will produce a magnification (based on the previous example) 1000 ÷ 25 = 40x. This will provide a good overall view of the Moon. When a part of the Moon is selected for more detailed observation the eyepiece can be carefully replaced with the 10mm to increase the magnification to 100x. If further magnification is required the Barlow Lens supplied can be used to double the magnification of each eyepiece. Fitting the Barlow will magnify (1000 ÷ 10) x 2 = 200x.

Perhaps one of the first things to do to help explore the Moon is to obtain a Moon Map. These can be obtained from most astronomy dealers and can be purchased on line. Books can also be purchased that will provide charts and detailed guidance about the interesting things to look for on the Moon. Another option is to use a computer application on a laptop. A good option is Virtual Moon Atlas that can be down loaded free.

The key thing about observing the Moon is to choose the best time to see feature to be studied. The reason for this is to do with the illumination of the surface of the Moon by the Sun. We know the Moon has phases caused by its movement around Earth on its monthly orbit. Each evening of every month we have a different view of the Moon and we see its shape change from a thin crescent to full Moon then a return to a thinner crescent after full Moon.



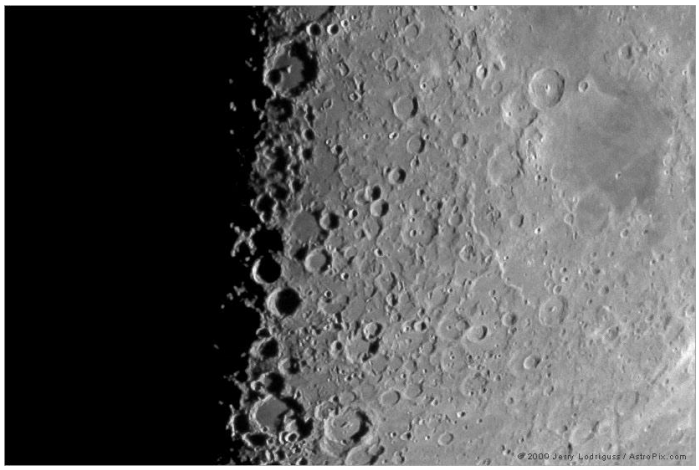
The phases of the Moon (Sun is off to the left)

In the diagram above the Sun is shining from the left. The inner Moon images demonstrate the orbit of the Moon around Earth and shows how the Moon is illuminated by the Sun. The outer Moon images show the view of the Moon as seen from Earth. From Earth the same side of the Moon is always facing us so the Moon appears not to rotate for us. However if viewed from the Sun the Moon can be seen orbiting around Earth and as it orbits it would appear to rotate once on every orbit. This means over the course of one orbit (about 29.5 days) the whole surface of the Moon will be illuminated at some time. In other words for a given point on the Moon, a day will last for one half of the month and it will be night for the other half of the month.

So the two Moon images on the left show the Moon positioned between the Sun and Earth. From Earth the dark side of the Moon is facing towards us so we cannot see it. As the Moon moves around its orbit some of the illuminated side begins to appear and we see the Moon as a New Moon (the growing crescent is called 'waxing'). After about seven days the Moon would reach the lower middle point of its orbit and half of the illuminated side of the Moon is visible from Earth, this is called 'First Quarter'. After a further seven days the Moon will have reached the right side of the diagram and the whole of the Moon facing Earth is illuminated so we call this the Full Moon.

A further seven days takes the Moon to the upper position on the diagram where the opposite side to the 'First Quarter' is illuminated, we call this 'Last Quarter'. The final phase (called waning) is rarely seen by people who sleep normal hours. This is because the Moon does not rise until after midnight in the east. The crescent becomes thinner as it draws closer to the Sun to start another New Moon.

The line between the light side (day) on the Moon and the dark side (night) is known as the Terminator. The Terminator after New Moon and up until Full Moon is the sunset line and the terminator after Full Moon until New Moon is sunrise on the Moon. On the terminator the Sun casts long shadows as it does on Earth. Shadows near the terminator give relief to the lunar terrain and produce an almost 3D perspective. So it is always best to observe an object when it is in the daylight near the Terminator.



Craters on the Terminator

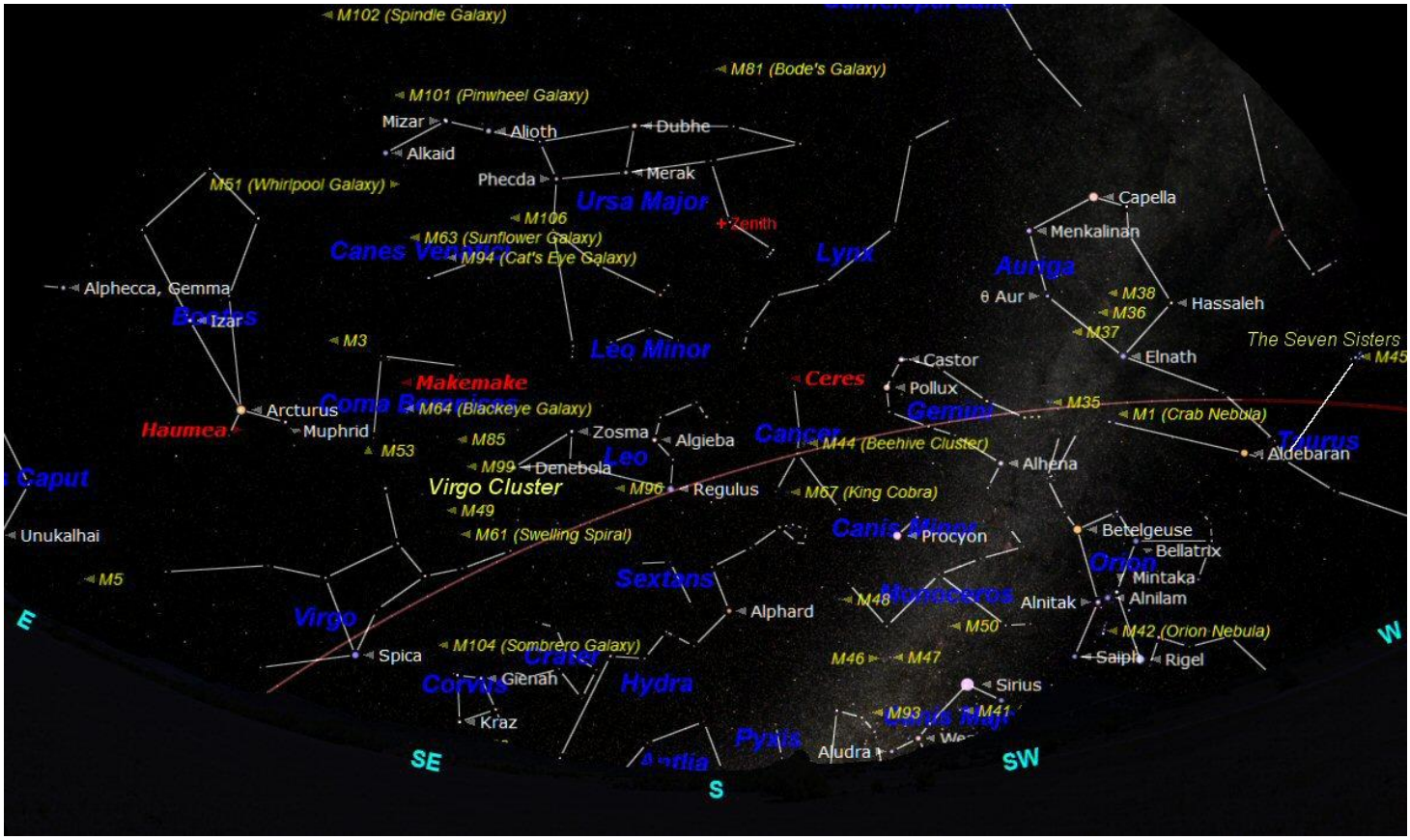
There are two ways of deciding what to observe on particular evening. The first is to check your Moon chart on the evening to see what is best placed, close to the terminator, at that time. If a computer generated chart is used a copy can be printed and used to identify all the things of interest on that observing session.

The other option is used when a particular feature is to observed or studied in detail. On this occasion it might be better to use the star chart to find which evenings would be best to see this feature. Depending on the particular feature it may be possible to predict two or three evenings when it is close to the terminator and good for observing. Then hope for a clear sky on one of those evenings.

Using a Moon Filter can make looking at the Moon more comfortable and give the Moon more contrast to improve the view. There are two types of Moon Filter: a simple set darkening type that has a fixed light reducing glass. The second type is an adjustable Polaroid Moon Filter. This type has two Polaroid glasses that can be rotated to align or misalign the polarity of the two glasses. This filter has the ability to adjust the amount of light it allows to pass through the filter. Most types of filters can be attached to an eyepiece by screwing them into the thread on the eyepiece mounting barrel as shown below.

A Polaroid Moon Filter fitted to an eyepiece

THE NIGHT SKY - APRIL 2018



The night Sky April 2018 at 21:00 BST

The chart above shows the night sky looking south at about 21:00 BST on 15th April. 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 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 constellations through which the ecliptic passes are known as the constellations of the 'Zodiac'.

Constellations through which the ecliptic passes this month are: Aries (the Ram), Taurus (the Bull), Gemini (the Twins), Cancer (the Crab), Leo (the Lion) and Virgo (the Virgin) just appearing over the eastern horizon.

The Milky Way (our Galaxy) appears to rise up from the southern horizon. It continues up through the constellations of Monoceros, Orion, Gemini, Auriga, Perseus and into Cassiopeia (just off the top right of the chart).

This time of year (Spring) is sometimes referred to as the season if the galaxies because it is the best time to look for galaxies. A larger telescope is required to see any of the galaxies except M31 the Great Spiral Galaxy in the constellation of Andromeda. M31 can be seen using a smaller telescope or even a good pair of binoculars. It is unfortunately disappearing over the western horizon this month and cannot be seen.

There are many galaxies in the Virgo Cluster that is centred on the space between the constellations of Leo, Virgo and Coma Berenices on the center left of the chart. This time of the year is a good time to look for galaxies. It is time when we are looking up and out of the spiral structure of our galaxy so we have a clearer view of the deep sky. Some of the Virgo Cluster galaxies are shown on the chart above. They are marked with their Messier number in yellow.

Orion is still prominent the evening sky and is easy to find in the south western sky. The familiar shape of Orion the Hunter is followed across the sky by his hunting dogs Sirius and Procyon.

To the north of Orion are the fairly obvious constellations of Taurus and Gemini. To the north west and sitting astride the ecliptic is the constellation of Taurus (the Bull). The Taurus asterism (shape) looks like a squashed cross 'X'. At the centre of the cross is a large, faint and dispersed Open Cluster, the Hyades. It has the bright Red Giant star Aldebaran in the centre. The real beauty of Taurus is the naked eye Open Cluster M45 the Pleiades, or the Seven Sisters. See page 1.

To the north of Taurus is the constellation of Auriga with its beautiful bright star Capella. A good pair of binoculars will just reveal a line of three Open Clusters listed in Charles Messier's Catalogue as M36, M37 and M38. They can be seen as small patches of light through binoculars but do require a telescope to see as clusters.

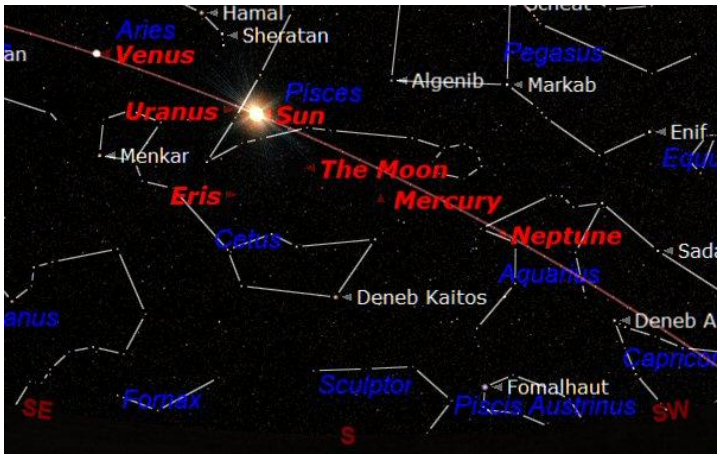
Following Taurus along the ecliptic is Gemini (the Twins). The twin stars Pollux and Castor are easy to find. There is a lovely Messier Open Cluster M35 in Gemini just off the end of the line of stars emanating from the bright star Castor. Castor is a double star when seen in a telescope.

To the east of Gemini is the faint and rather indistinct constellation of Cancer (the Crab). The asterism (shape) of Cancer looks quite uninteresting. However the Open Cluster Messier 44 (M44) 'Praesepe' or the 'Beehive Cluster' looks beautiful and like a swarm of bees around an old style straw hive, when seen using binoculars.

Following Cancer is Leo (the Lion) which was the 'constellation of the month' last month. Leo is shown in more detail on page 2.

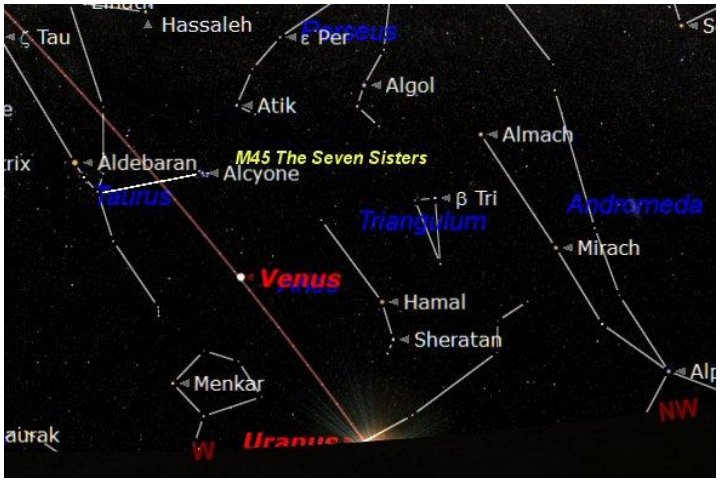
THE SOLAR SYSTEM APRIL 2018

MERCURY rises at 05:00 at the beginning of the month and 04:00 by the end of the month. It will be very difficult to see in the brightening pre-dawn sky.



Mercury, Venus , Uranus and Neptune at Midday

VENUS is visible in the west as the Sun sets and is very bright at magnitude -3.9. The telescopic view is not very good because Venus is on the opposite side of the Sun and appearing small. It will become larger but narrower over the next few months. It still requires a Moon filter to reduce the dazzling and sparkling effect and improve the appearance while it is low in the sky. See the chart below.

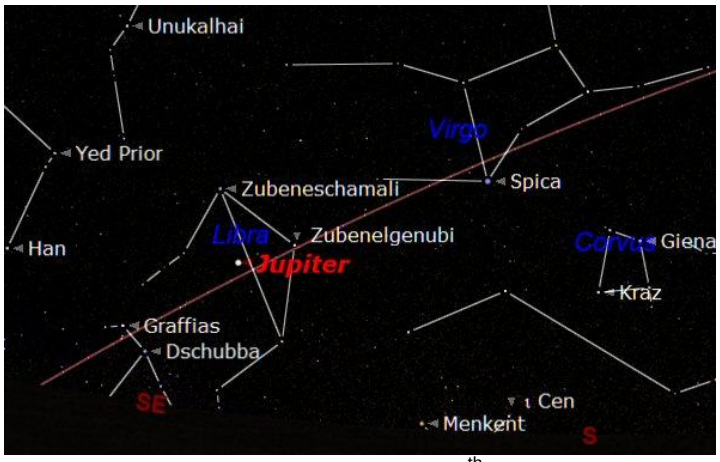


Venus in the west at 20:00

MARS will rise in the south east at 02:00, following Jupiter but will be lost in the brightening sky by 04:00. The Red Planet still appears small at 9.5 arc-seconds in diameter but will brighten to magnitude -0.2. Mars is low and in the turbulent air but is starting to look larger. Earth is gaining on Mars as the two planets move around their orbits.

JUPITER is now a good late evening and early morning object. It rises over the eastern horizon at about 21:00 and will be observable in the south east from 23:00. 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 is also observable in the early morning sky in the south until the sky brightens. It actually sets in the west at 07:00 at the beginning of the month and at about 05:30 at the end of the month. However the sky will be bright before then as the Sun rises at around 05:00 so it will be best before 04:00. At this time Saturn and Mars will also be observable in the south east.



Jupiter at midnight on 15th April

SATURN will be visible in the brightening dawn sky close to the south eastern horizon. The ringed planet rises at about 01:00 this month, this about 4 hours before the Sun. The view of Saturn will not be good this year as it will be close to the horizon. It is observable in the south east from 02:30 until the sky begins to brighten at about 04:00 which is about an hour before sunrise.

URANUS will not be observable this month as it is too close to the Sun. See the Mercury chart in the previous column.

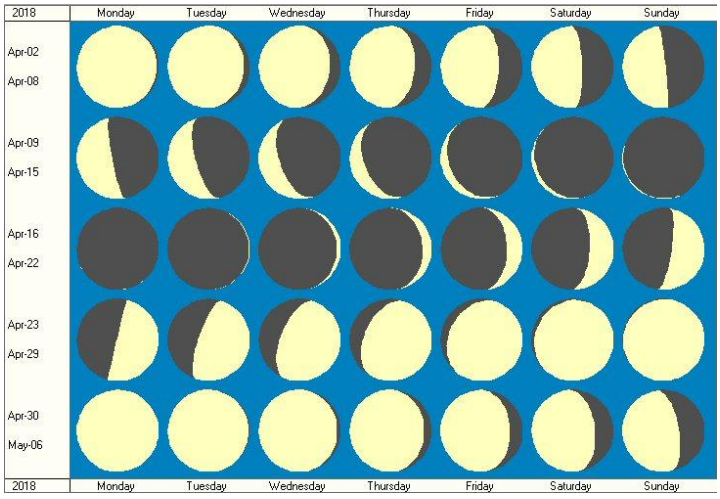
NEPTUNE will not be easily visible this month as it rises over the south eastern horizon at 04:00 so it will be in the brightening sky before the Sun rises at 05:00. See the Mercury chart in the previous column.

THE SUN

There have been virtually no sunspots to see over the last few months as the active phase of the Solar Cycle is over.

The Sun rises at 05:30 at the beginning of the month and at 04:40 by the end of the month. It will be setting at 18:40 at the beginning and 19:30 at the end of the month. Any 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 APRIL



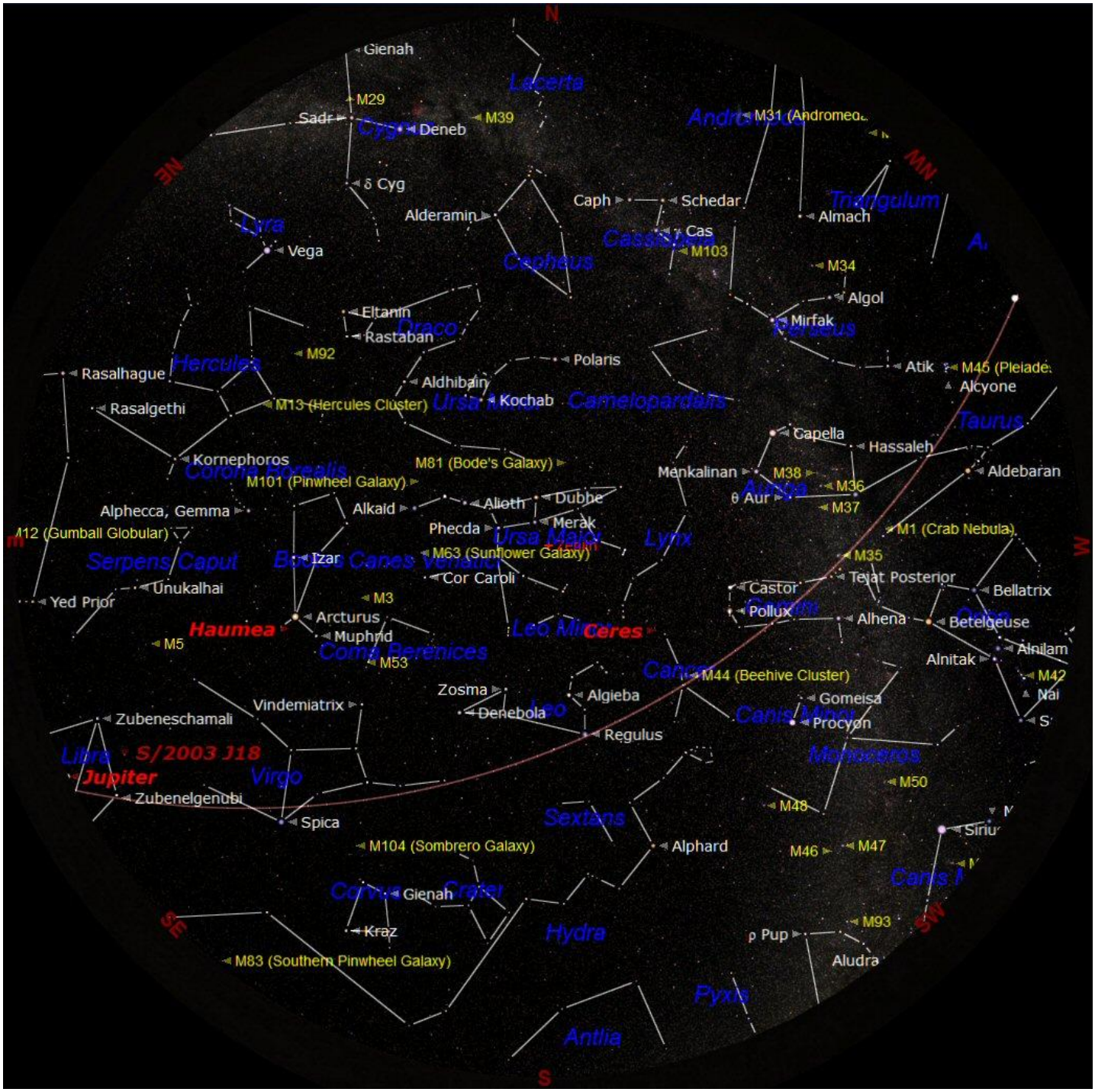
Last Quarter will be on 8th April

New Moon will be on 16th April

First Quarter will be on 22nd April

Full Moon will be on 30th April

THE NIGHT SKY THIS MONTH



The chart above shows the whole night sky as it appears on 15th April at 21:00 (9 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 10 o'clock BST at the beginning of the month and at 8 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 almost directly overhead. 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. Mars, Jupiter and Saturn will be in the early morning sky.