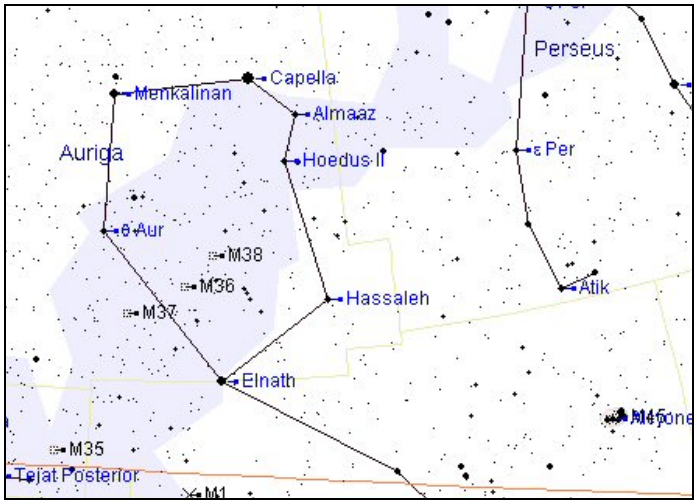
NEWBURY ASTRONOMICAL SOCIETY
BEGINNERS SECTION MAGAZINE – DECEMBER 2009

THE CONSTELLATION OF AURIGA

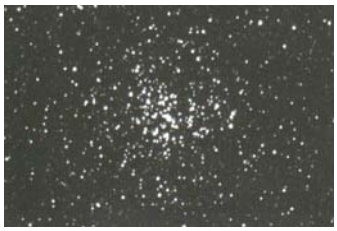


Auriga is quite easy to find, just find Cassiopeia then look below the 'W' shape and there is Perseus looking like a line of stars, follow the line to Auriga. See the chart on Page 6. Through binoculars there are clouds of stars, these are the stars in the arms of our galaxy 'The Milky Way' (shown shaded in the chart above). This is a good place to look for the Geminids (Page 1).

The bright yellow/white star Capella is the sixth brightest star in our night sky at magnitude +0.08. By mid winter it will be positioned directly overhead and will be very noticeable. Because it is so high in the sky it does not twinkle like the bright stars lower in the sky. Capella is actually a very close pair of massive G-class stars much too close to be separated in a telescope.

There are three beautiful Messier objects in Auriga, these are the Open Clusters M36, M37 and M38. These open clusters form a line through centre of the 'kite' shape of the main body of stars forming Auriga. There is actually a fourth and even more beautiful open cluster, M35, in this line but a little further away in the neighbouring constellation of Gemini. Open clusters are thought to be a physical group of stars that had formed in the same cloud of gas and dust. Over millions of years the young stars have blown away the remaining gas and dust to reveal the stars. Eventually the stars in the cluster will drift apart and the cluster will disperse.


M36


M37


M38


M35 in Gemini

GEMINID METEOR SHOWER THIS MONTH

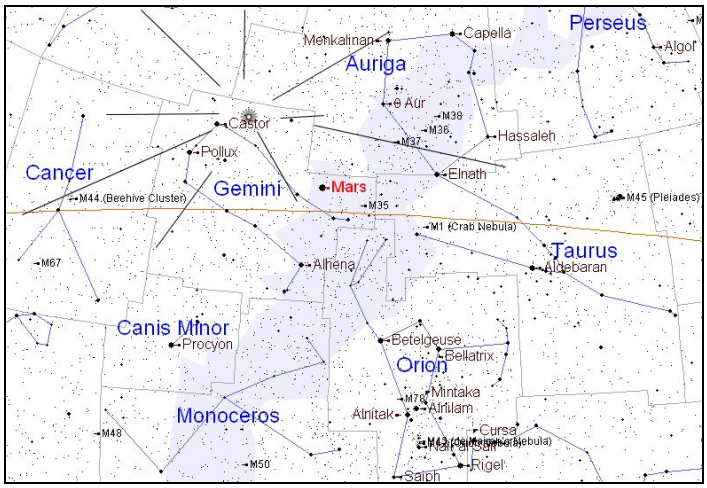
In the middle of this month, around 7th to 16th December, there will be a meteor shower known as the Geminid shower. The best time to watch for the meteors will be in the evening of 13th and the morning of 14th December when the shower should be at its peak but some should be visible all night. The Moon will be a thin waning crescent and will not spoil the view.

The type of meteor that occurs in showers usually originates from a comet and is much more common than the 'Fireballs' that originate from asteroids. However the Geminid shower is thought to originate from an asteroid known as 3200. This means the meteorites (the particles moving through space) are probably made of rock or metal and last quite a long time when they enter Earth's atmosphere.

The Geminid meteors also enter the atmosphere comparatively slowly at about 35 km/second compared with other showers that enter at up to 75 km/second. As a result of this slower entry and a more robust make up the Geminid meteors tend to appear slower and their trails across the sky are longer.

Because the constellation of Gemini is above the horizon from early evening, the meteors can be seen for most of the night and in almost any part of the sky. By midnight the constellation will be almost due south and high in a moonless sky.

Weather permitting, the Geminid shower looks very promising this year and will be worth waiting up for if the sky is going to be clear. If you are intending to have a look remember to wrap up warm before you go out because you will soon feel very cold and that will spoil your enjoyment of the shower. Make yourself comfortable in a garden chair and spend at least half an hour looking. There might be up to 100 per hour if we are lucky.



The radiant of the shower is located just to the right of Castor, the right hand star of the Gemini twins. See the chart above.

NEWBURY ASTRONOMICAL SOCIETY BEGINNERS

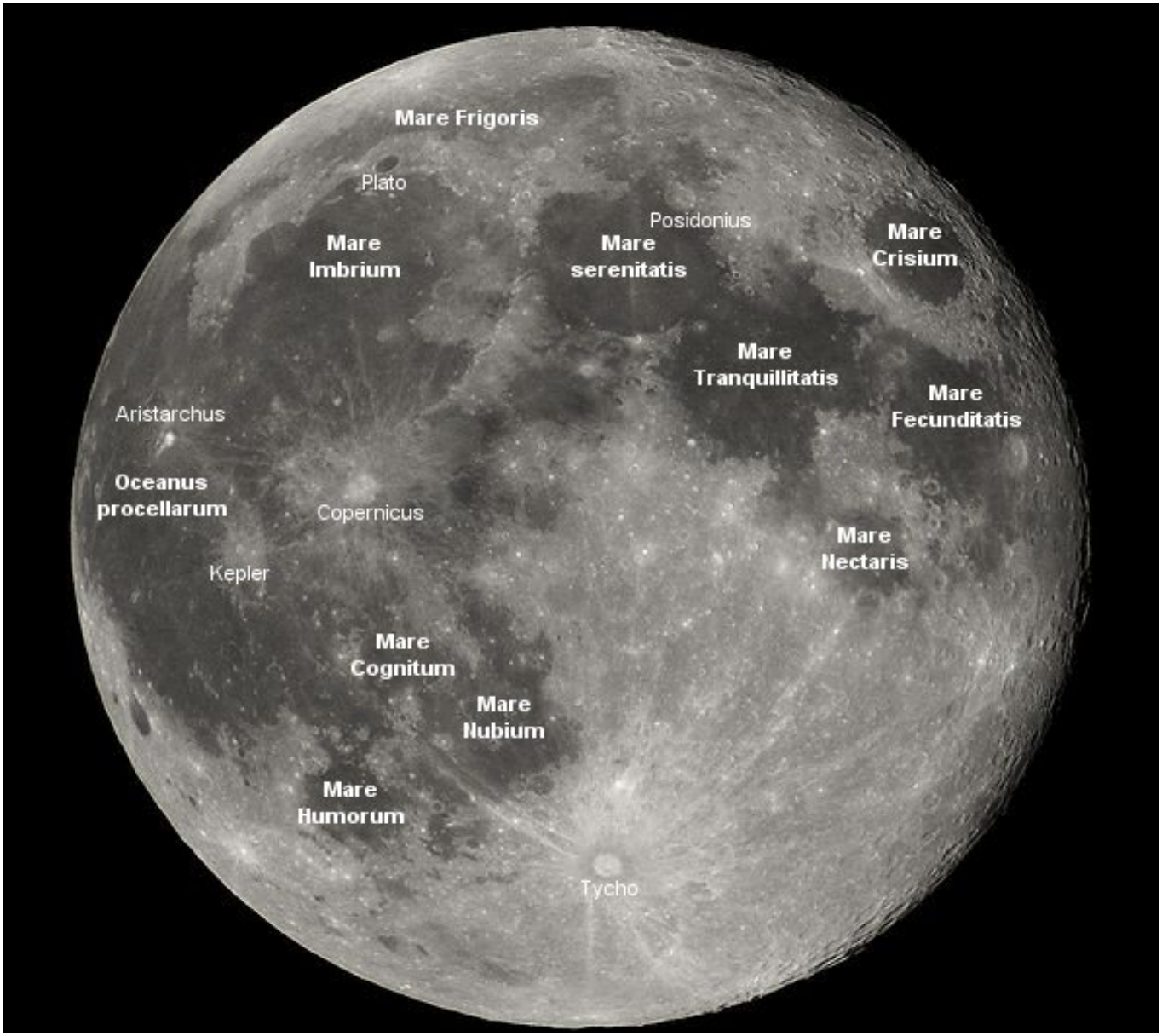
20th January Using a WEBCAM with a Telescope

NEWBURY ASTRONOMICAL SOCIETY MEETING

8th January True Story of the Isaac Newton Telescope

For all the latest news, don't forget to visit the website on: **www.naasbeginners.co.uk**

THE MOON

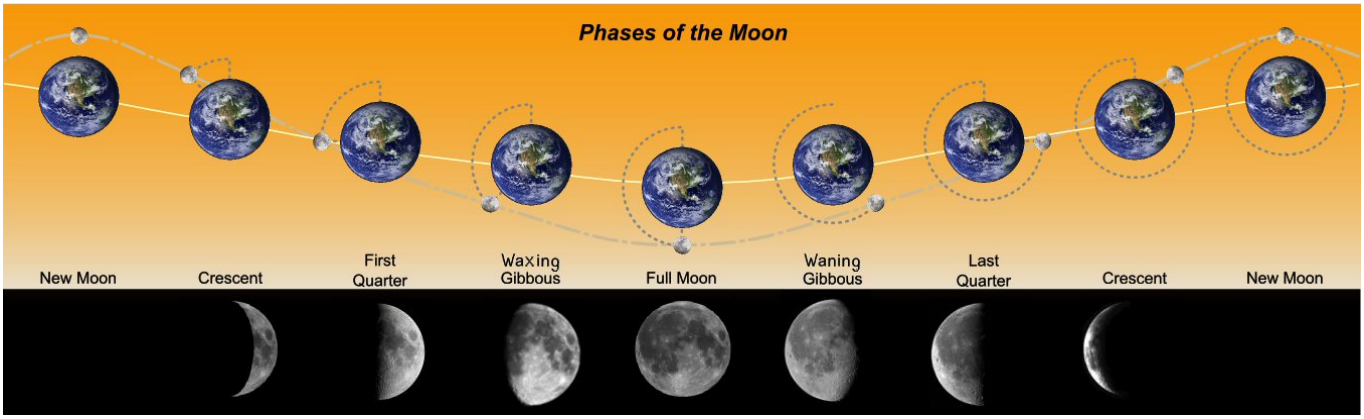


The Full Moon Showing the Seas (Maria) and Large Craters

For a beginner to astronomy, the Moon is an excellent place to start. It is large, bright, easy to find and covered in interesting things to see. It may still be necessary to locate the Moon using the finder but a seasoned observer may be able to find it straight away without using the finder. The full Moon is most impressive to the naked eye but is probably least rewarding through a telescope. At full Moon the Sun is shining straight down on the surface and casts very few shadows. The best time to see specific features is as the terminator (the line between light and dark) passes over those features. The full Moon is so bright that it may be uncomfortable to the eye in a telescope. Filters can be bought and attached to the eyepiece to reduce the brilliance and improve contrast. A cheaper option is to make a cardboard mask to cover the end of the telescope tube. Into this mask a hole of about 30 to 50mm can be cut to reduce the amount of light entering the telescope.

Depending on the conditions, high magnifications can be used. First centralise the object or region of the Moon to be observed using a low power eyepiece then carefully replace the eyepiece with a higher magnification (shorter focal length) eyepiece and refocus if necessary. The object will appear larger and more detail will be seen. As the magnification is increased the size of the hole in the mask may have to be increased to allow more light into the telescope to improve the contrast.

Maria (singular, mare) or seas are not seas at all, they are large areas that have been covered by molten rock in the distant past but later than the main crater forming era. To the naked eye the maria appear as darker patches but through a telescope they are seen as relatively smooth plains with a sprinkling of craters. The Moon does not rotate, as seen from the surface of Earth, and keeps the same face towards us. A terminator will therefore cross over a feature twice every month. On the terminator it will be sunset or sunrise so the shadows of features such as crater rims, mountains and valleys will be elongated. This gives a greater perspective and contrast to the features so they appear three dimensional with much more detail. The centres of craters are very interesting especially if they are the type filled with lava. What appears to be a smooth surface is actually rippled and fractured due to contraction as the lava cooled. Many features seen on lava fields on Earth can be found in these craters on the Moon.



In the diagram above the mechanism that produces the phases of the Moon is shown. To understand the diagram we must imagine the Sun is positioned way off the top of the diagram. The Sun will therefore be illuminating the upper half of Earth and of the Moon. Now we must imagine we are looking at the Moon from the surface of Earth. In the left hand view the side of the Moon furthest from Earth is illuminated by the Sun therefore the dark side will be facing Earth and the Moon will not be visible. As the Moon begins to move anti-clockwise around Earth, a small part of the bright side will start to appear on the right of the Moon. This is called 'The New Moon'. Gradually more of the bright side is revealed and the illuminated side appears as a wider crescent shape. After about four days the Moon will look like the second image at the bottom of the diagram.

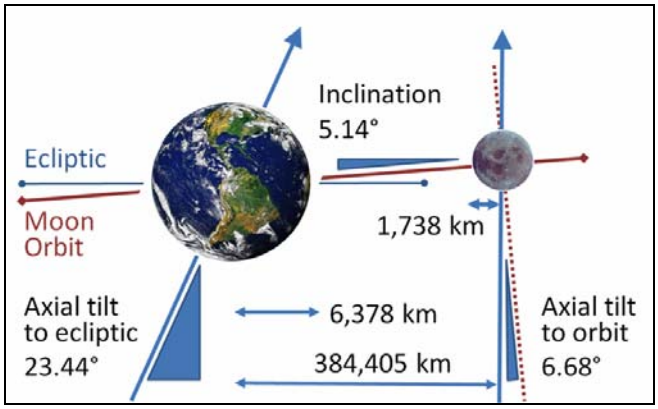
When the Moon has reached approximately a quarter of the way around its orbit the it will appear as the 'Half Moon' or 'First Quarter'. After the first quarter the crescent shape gives way to the shape known as the 'Waxing Gibbous' phase. This phase is produced when the Moon is positioned in its orbit where we can see between a quarter and all of the sunlit side of the Moon. When the Moon is positioned directly in line with Earth and the Sun the whole of the sunlit side is visible and we see the 'Full Moon' as shown in the middle image.

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 20 days, only the left half side 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 as the Moon moves back into direct line with Earth and the Sun 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 takes slightly longer to complete its cycle from one new moon to the next new moon. The actual period it takes is 29.53 days and this is called its Synodic Month or Lunar Cycle.

The Orbit of the Moon is tilted at 5.14° 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 in Earth's shadow. The Moon is always full 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.

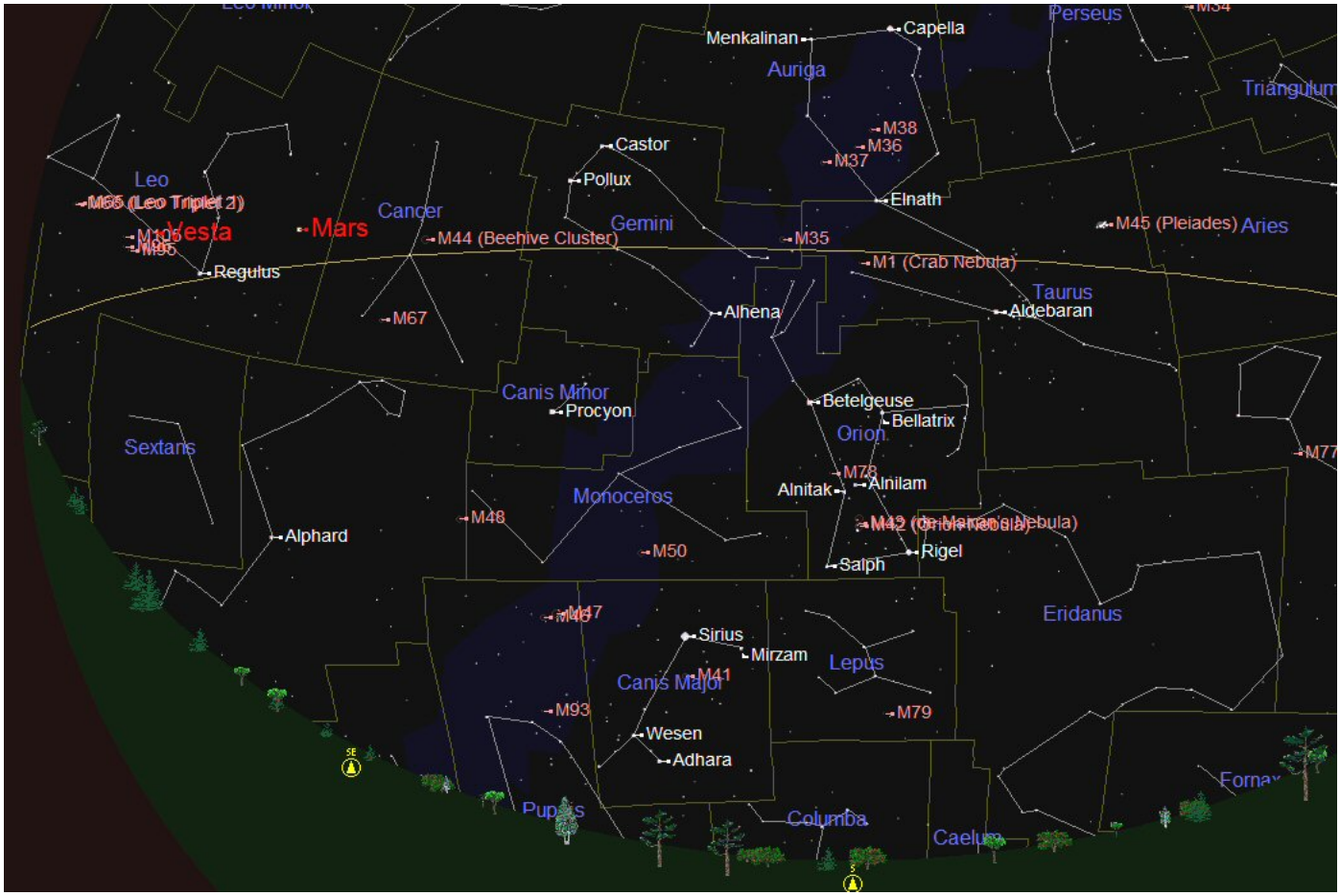


Physical data of the Moon and Earth

Craters are especially spectacular on the terminator because sunlight will illuminate the outside of one wall and the inside of the wall on the other side of the crater, with the opposite side of each wall in shadow. Some craters have a central peak and may have terraced walls. Other craters have radial lines called rays stretching for many hundreds of miles where debris was thrown out by the impact of the meteor. Other interesting things to look for are craters inside larger craters and impacts that have created craters on top of earlier craters. There are double and even triple crater systems.

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.

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 have almost none, while some craters appear to have been filled with lava and have smooth dark floors.



INTERESTING THINGS TO FIND THIS MONTH

The chart above shows the southern night sky as it will appear at about midnight in the middle of December. Earlier in the evening all the objects shown will appear further to the east (left) and later they will appear further to the west (right). This is due to the rotation of Earth. (See the chart on page 6).

The winter constellations are now centre stage with Orion dominating the southern sky. The ecliptic is shown as the orange line arching across the top of the chart. This is the path that the Moon and planets follow across the sky. The planet Mars is shown to the East (left) and slightly above the ecliptic.

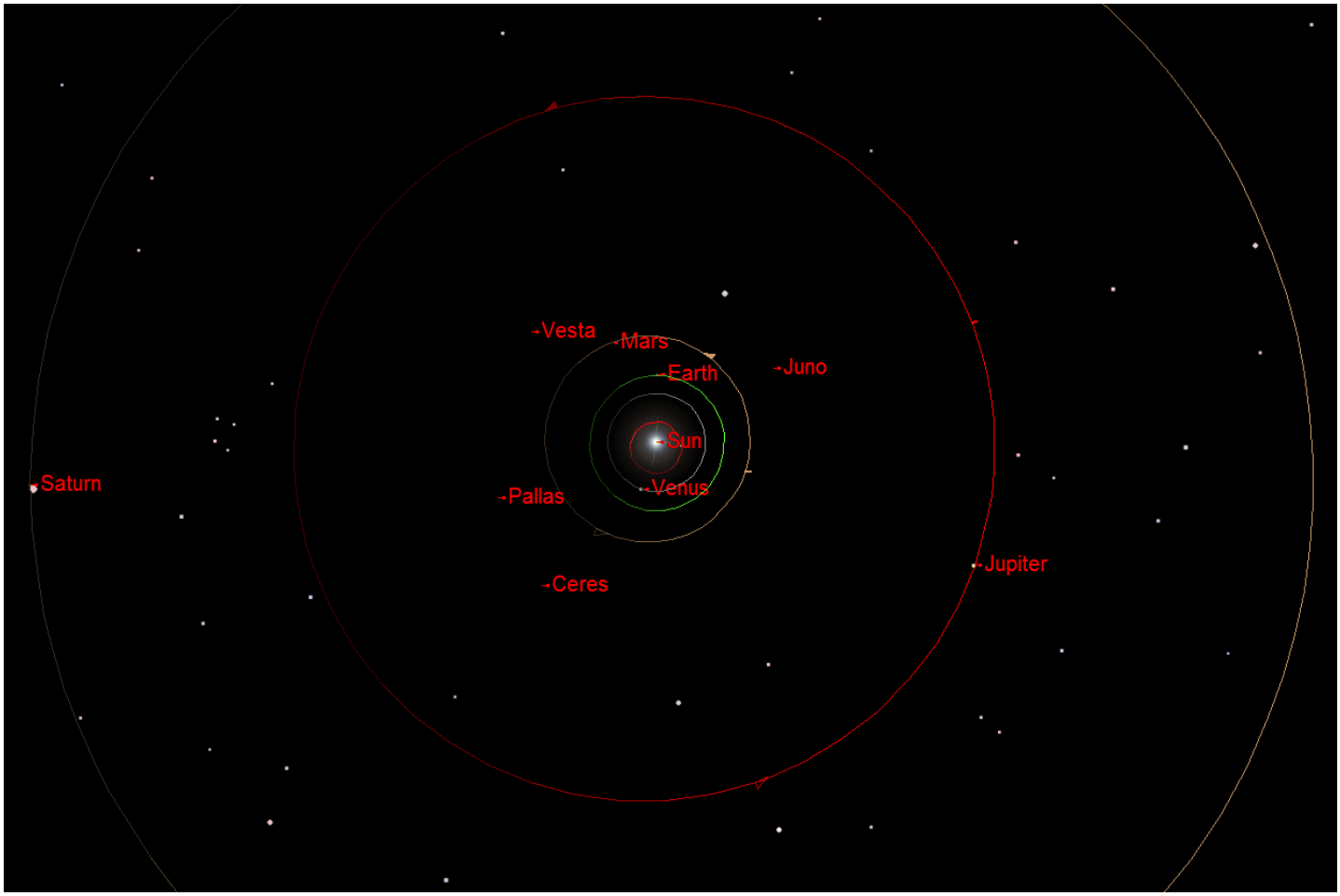
The southern sky is dominated by the familiar constellation of Orion the Hunter. Look for the straight line of three bright stars that make up Orion's Belt. Orion is a large constellation made up from seven bright stars. At Orion's left shoulder is the red giant star Betelgeuse which appears distinctively orange especially when seen using binoculars. This star has the largest diameter of all the stars close to us. At the bottom right of Orion's tunic is the bright white super giant star Rigel. This is a hot massive star producing thousands of times the energy of our Sun. Below the three stars of Orion's belt is a vertical line of stars known as Orion's Sword. When using a pair of binoculars the sword is seen as a beautiful line of stars. Imbedded in the line is M42, The Great Orion Nebula. M42 can just be seen with the naked eye. A telescope will reveal the four stars of the 'Trapezium'. These very young stars have formed in the nebula and are now illuminating it with their powerful radiation.

Following an imaginary line down to the south east from Orion's belt a bright sparkling star will be seen. This star is Sirius in the constellation of Canis Major, Orion's larger Hunting Dog. Sirius is the closest star that we can see from this country at just 8.8 light years distance which is why it appears so bright. Sirius has a very small but very dense unseen white dwarf companion this is a collapsed dead star once like our Sun.

Located to the north east of Orion is the constellation of Gemini 'The Twins'. The two bright stars Castor and Pollux represent the mythical twins. Castor is interesting because a telescope will show that it is actually a twin star itself. The two stars have magnitudes of +1.9 and +2.9 and are separated by 3 arcseconds. The two stars orbit each other about their combined centre of gravity every 470 years. There is a third star known as 'Castor C' 72 arcseconds away and it too is a member of the Castor system. Interestingly each of the three stars in the Castor system is a very close double star in its own right, making this a six star system.

To the east of Gemini is the constellation of Cancer (The Crab). It is a fairly faint constellation and may be a little difficult to locate. However it is well worth search out using binoculars for within its boundaries is the beautiful open cluster M44. This cluster is known by the name of Praesepe or 'The Beehive'. It is a well scattered cluster and best seen using binoculars. It has a house shaped asterism with fainter stars scattered around which does give the impression of an old straw beehive with bees buzzing around it.

Further to the east is the constellation of Leo the Lion. This is one of the few constellations that does look like what it has been named after. With a little imagination it does look like a lion sitting in the same position as the Sphinx in Egypt. Leo has a number of interesting stars and some bright galaxies that deserve a visit with a telescope. However the main interest in Leo this year is the presence on the planet Mars within its boundaries. Mars will not be particularly close to Earth this year and will appear quite small. It will however reach a good altitude and will be in clear sky above the murk and mist close to the horizon. A telescope should show the more distinct markings on the surface and may even show the polar ice caps. Even a small telescope will show the reddish disc.



THE PLANETS THIS MONTH

The chart above shows the Solar System as it would appear looking down on the north pole of the Sun. From our vantage position on Earth we can see Jupiter setting over the western horizon in the early evening. As Earth turns on its axis Mars will come into view over the eastern horizon at about 10 o'clock in the evening followed by Saturn at about midnight. Mercury is hidden behind the Sun until the end of the month and Venus is moving towards the Sun over the eastern horizon.

MERCURY will move out from behind the Sun at the end of the month and be visible low on the western horizon in the evening.

VENUS will be lost in the glare of sunrise low in the east.

MARS rises in the east at 21:58 at the beginning of the month and by 19:30 at the end of the month. It still appears small but will be in a good position in the south east by about midnight. By 04:00 it will appear like a bright reddish star high in the south. A small telescope will be required to see its small 11 arcsecond reddish coloured disc. A larger telescope will shown some of the more distinctive surface markings and the white polar ice caps. Mars has two moons but they are too small to see even with a telescope.

JUPITER sets over the western horizon at 20:30 so will be at its best from sunset until about 8 o'clock. However it will be low in the southern western sky located in the constellation of Capricornus. The four brightest moons Io, Europa, Ganymede and Callisto will be visible even in a small telescope and are very interesting to observe. The moons often pass in front of Jupiter in a transit and may cast a shadow on the planet causing an eclipse. Eclipses will become more difficult to see as the planet creeps ever closer to the south western horizon.

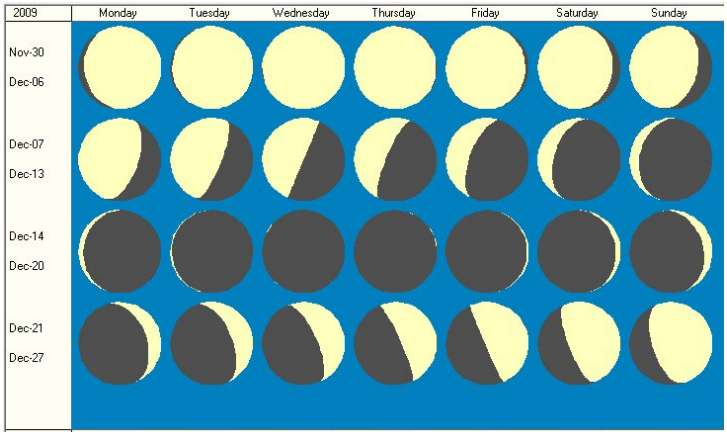
SATURN Rises at 00:20 by the middle of the month and will be high enough for viewing by 02:00 and very well placed in the south by 06:00. The ring system is just starting to open out again after appearing edge on for most of this year. It will be a couple of years before it returns to its full glory. Saturn's moon Titan will be visible in a 100mm telescope.

URANUS is fairly well placed in the south at 18:00 in the constellation of Pisces. A telescope of over 100mm aperture gives Uranus the appearance of a slightly out of focus small blue disc.

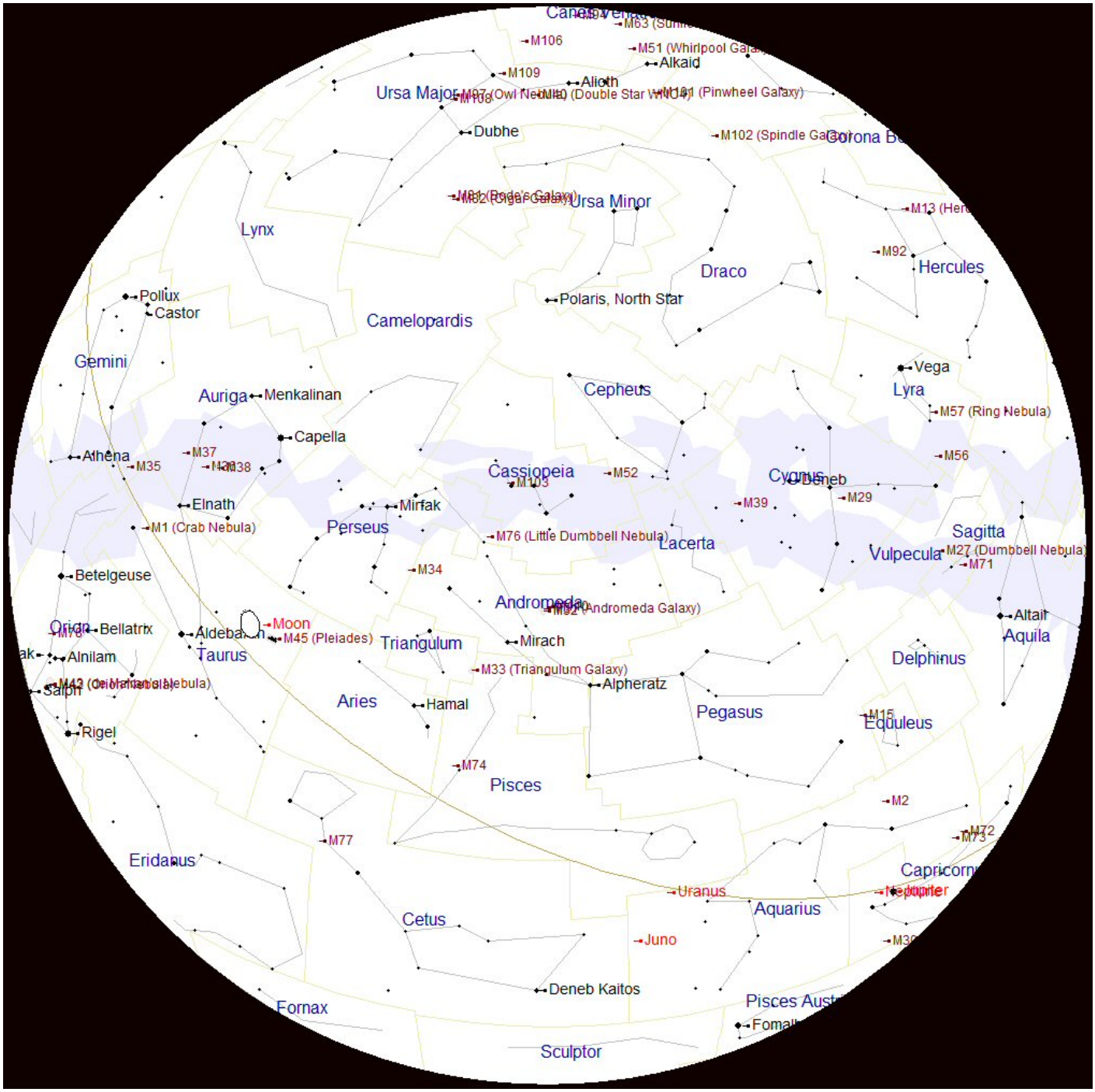
NEPTUNE is well placed close to Jupiter in the constellation of Capricornus. Viewed through a telescope of over 100mm aperture it appears as a slightly out of focus blue star.

SUN is still very quiet but some small prominences have been seen recently. To see these 'flame like' features around the edge of the Sun requires a telescope with a very special Hydrogen α filter.

MOON The phases of the Moon this month (Full 2nd December):



THE SKY THIS MONTH



The chart above shows the night sky as it appears on 1st December at 10 o'clock Greenwich Mean 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 9 o'clock GMT at the middle of the month and at 8 o'clock GMT at the end. Due to the Earth rotating once every 24 hours, the stars also appear to move 15º (360º divided by 24) each hour from east to west.

The centre of the chart will be the position in the sky directly overhead. 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 close to the northern horizon. 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.