NEWBURY ASTRONOMICAL SOCIETY
BEGINNERS SECTION MAGAZINE – DECEMBER 2010

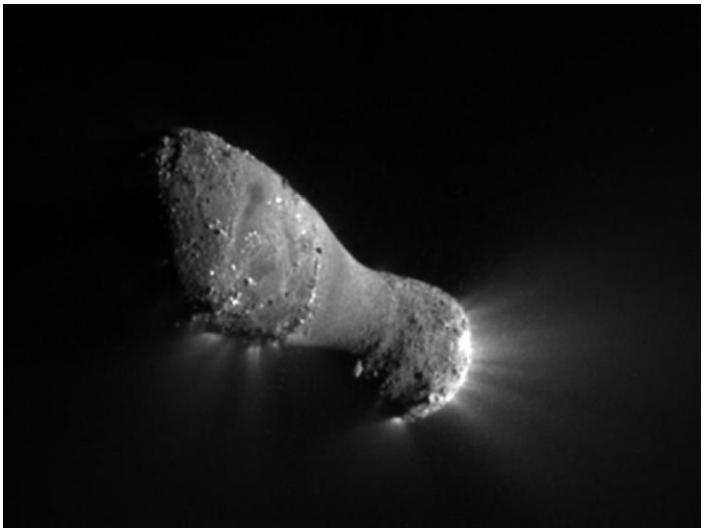
CLOSE ENCOUNTER WITH A COMET

NASA's Deep Impact probe successfully completed its second mission named EPOXI on Thursday 4th November. The EPOXI mission is an extension of the Deep Impact project that originally dropped a 400kg Copper impactor on to comet Tempel 1 in July 2005. With that mission complete and the flyby spacecraft still healthy, NASA authorised a four-year life extension to search for extra-solar planets and fly-by of Comet Hartley-2.

Comet Hartley-2 is an unusually active ball of ice and rock located more than 13 million miles from Earth. The car-sized spacecraft, left over from a dramatic 2005 impact mission, was aiming for a target point about 700 kilometres (435 miles) from the comet. The closest approach occurred at about 14:01 GMT.

The name EPOXI itself is a combination of the names for the two extended mission components. The first mission was for extra-solar planet observations and was called 'Extrasolar Planet Observations and Characterization (EPOCh)'. The second mission was the flyby of Comet Hartley-2, called the 'Deep Impact Extended Investigation (DIXI)'. The spacecraft itself was to continue to be referred to as 'Deep Impact.'

Flying past Comet Hartley-2 at a relative speed of more than 27,500 mph, the Deep Impact spacecraft was in autopilot mode to enable the probe to quickly pivot and keep the comet nucleus in view of the two onboard scientific cameras. One of the imagers was programmed to collect pictures of the comet's nucleus and coma. The other instrument was set to scan the comet in both visible and near-infrared light to provide data on the comet's core composition and texture.



A raw image of Comet Hartley-2 at closest approach

The image shown above seems to indicate that the comet was comprised of two main parts, both heavily cratered. There appears to be a smooth 'neck like' structure joining the two bodies together. It is not yet clear whether the two main bodies were separate bodies that moved together or a single body that split into two. The neck may be comprised of small particles pulled off the two main bodies by their extremely weak gravitational forces over millions of years.

GEMINID METEOR SHOWER THIS MONTH

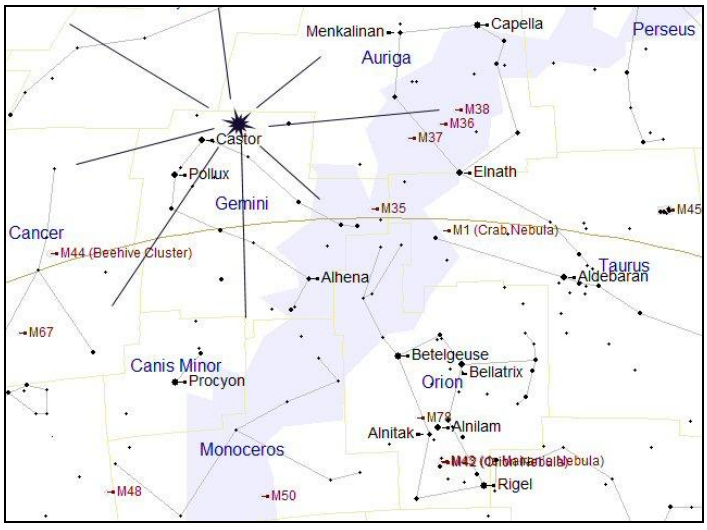
In the middle of this month, around 9th to 14th December, there will be a meteor shower known as the Geminid shower. The best time to watch for the meteors will be in the evening of 13th and the morning of 14th December when the shower should be at its peak. However some should be visible all night. The Moon will be a thin waning crescent and should 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. 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 so they often survive quite a long time when they enter Earth's atmosphere.

Also the Geminid meteors 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 the sky. See the chart below.

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 is located to the right of Castor. See the chart above.

THE NEXT BEGINNERS MEETING

15th December Nebulae (with observing if fine)

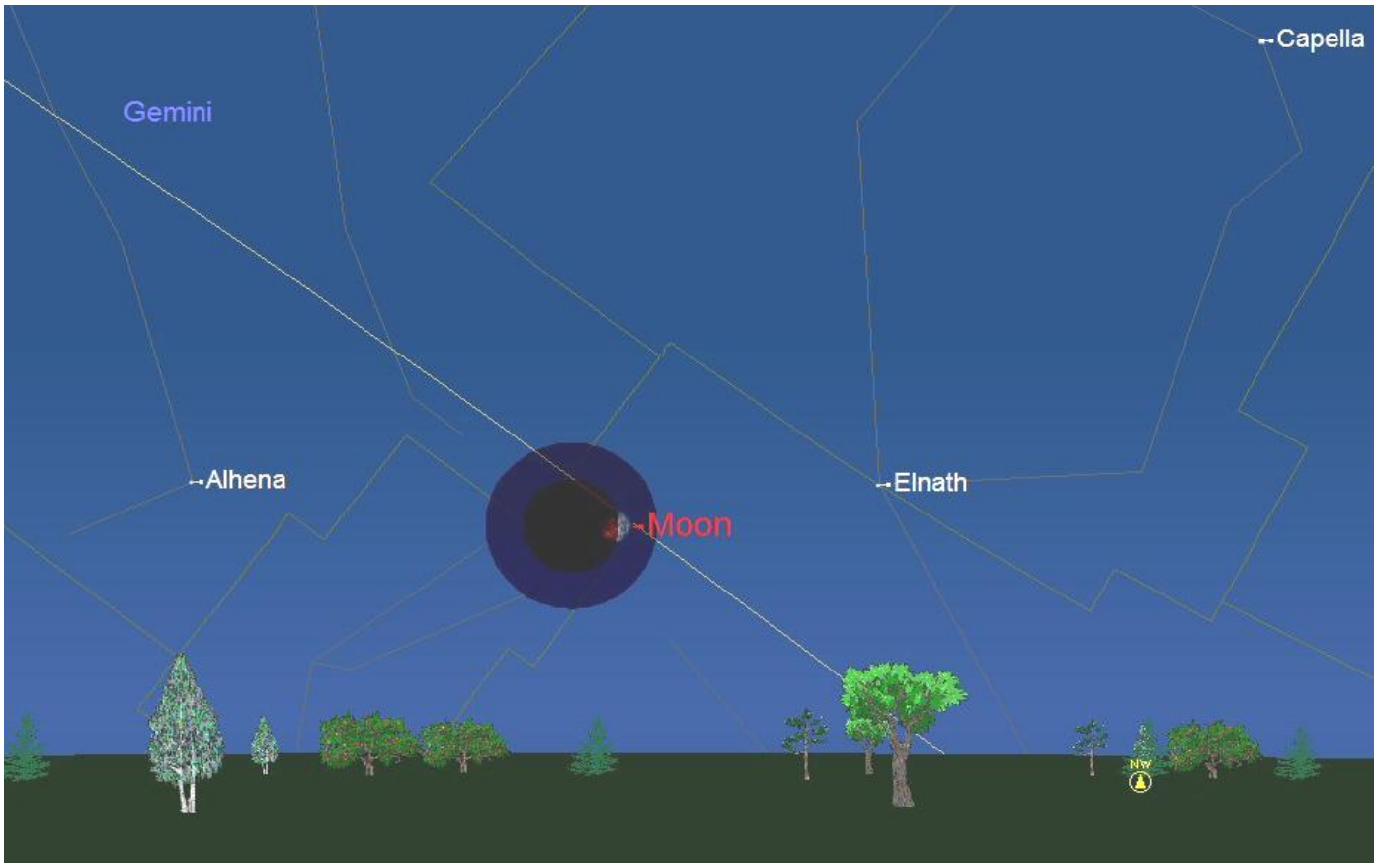
Website: **www.naasbeginners.co.uk**

NEWBURY ASTRONOMICAL SOCIETY MEETING

3rd December It's Only Rocket Science

Website: **www.newburyas.org.uk**

THE LUNAR ECLIPSE 21ST DECEMBER 2010



The lunar eclipse as totality begins at 07:30 on 21st December, low in the north east

In the early morning of Tuesday 21st December there will be a total Lunar Eclipse. These events go largely un-noticed by the general public most of whom are probably not even aware that the Moon is often eclipsed by the Earth's shadow.

At about 05:00 on Tuesday morning the Moon will enter the outer part of Earth's shadow known as the penumbra. The first phase, when the Moon moves through the penumbra, will hardly be noticeable. At about 06:45 the Moon will enter the Umbra, the inner and darker part of Earth's shadow. The curve of the edge of Earth will soon become apparent. As the shadow progresses across the Moon the comparative size of the Earth will be clearly seen.

At about 07:37 the Moon will be completely inside the umbra of Earth's shadow just as day breaks and the sky brightens. At this time the moon should almost disappear from view but this is not always the case; sometimes an amazing effect can be seen.

All the light falling on the Moon from the Sun should be blocked by Earth but some does get past. The thin surface layer of our atmosphere acts rather like a lens and bends some sunlight around the curved surface of Earth. As the light is bent the colours are separated in the same way that a prism separates light into the spectrum. The red part of the sunlight is bent more and is able to illuminate the surface of the Moon. Most of the remaining colours of the sunlight light miss the Moon so the surface becomes bathed in red light.

The effect can be quite spectacular as it was during the 2007 totality. The Moon appeared copper red and seemed to just hover in the clear cloudless evening sky. The effect does depend on the amount of dust and pollution in the atmosphere. Any recent volcanic eruptions can produce a stunning colour as in 2007. An early alarm setting and a clear view to the north west will be required to catch the event.

Lee Mcdonald caught this beautiful image in 2007

Chris Hooker captured this image at totality in 2007

GALAXIES, ISLANDS OF STARS IN SPACE

Galaxies are the largest formations or groups of individual stars that we know. All the stars we see in the night sky are part of a huge family of stars that form our galaxy which we call the Milky Way or 'the Galaxy' (with a capital 'G'). We see the nearest stars to us as individual stars but as we look at those further away they tend to merge into the fuzzy glow of the Milky Way. This effect is rather like standing in a pine wood, the trees nearest to us are seen as individuals but in the distance they merge into just a solid mass of trees.

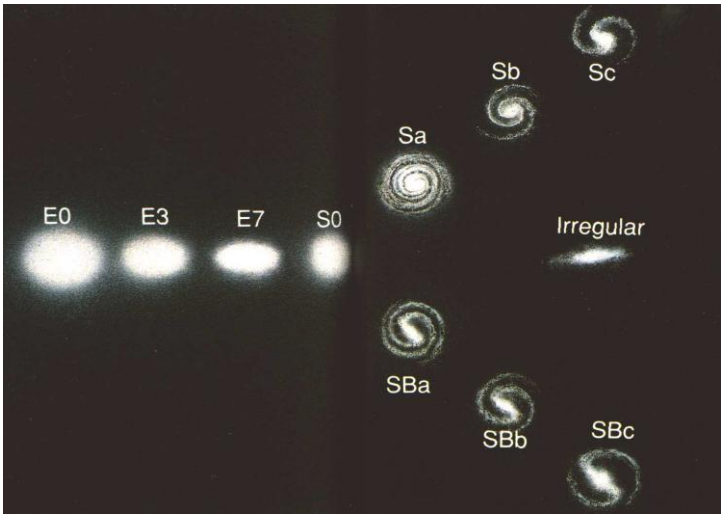
An artist's impression of the position of our Sun (arrowed)

Our galaxy forms part of what is known as the 'local group' of galaxies comprised of about 30 members. The local group is dominated by two large spiral type galaxies, ours and M31 the Great Galaxy in the Constellation of Andromeda which can be seen with the naked eye on a very clear night. The Milky Way has more than 200 billion stars and the Andromeda galaxy is about twice the size with about 400 billion stars. All the other members of the local group are smaller and many are located like satellites around the large spirals.

As amazing as it seems there are clusters of galaxies and even super clusters of clusters of galaxies. Billions of galaxies can be seen stretching out into the universe as far as our most powerful telescopes can see.

Part of the Milky Way seen from the Canary Islands

Galaxies are classified into four types, these are: Elliptical, Spiral, Barred Spiral, and Irregular. Elliptical galaxies are generally the largest and Irregulars the smallest. The great American astronomer Edwin Hubble (whom the Hubble Space Telescope is named after) devised a theory about how galaxies formed. The 'Y' shaped diagram that Hubble produced to demonstrate his theory is still used today to classify galaxies and is shown below.



Edwin Hubble's classification of galaxies

ELLIPTICAL GALAXIES

These are huge balls of stars do not have spiral arms and are elliptical (egg shaped). Many of these Elliptical Galaxies are the largest of all star groups, some having thousands of billions of stars. Elliptical Galaxies are classified according to how flattened they are, nearly round ones are known as E0 and sausage shaped ones E7. Most Elliptical Galaxies are far away and therefore appear very faint and need a telescope to see them. There are some indications that the giant elliptical galaxies grew from the collision of two or more smaller galaxies. There are indeed some galaxies which can be seen in the process of colliding and combining.

IRREGULAR GALAXIES

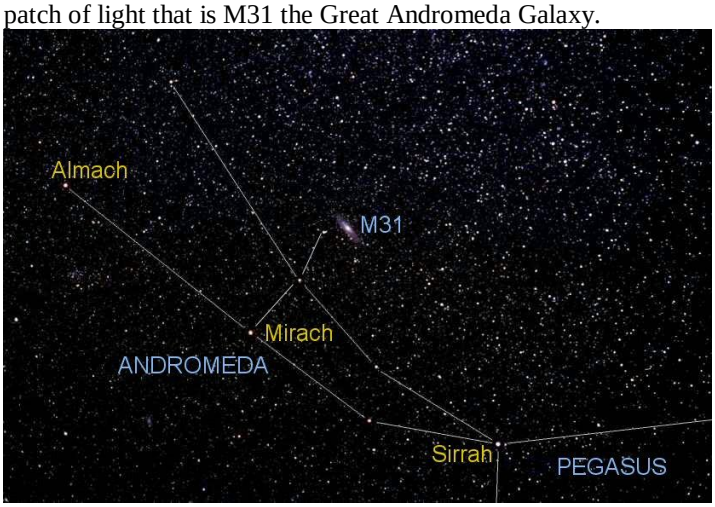
These galaxies are as the name implies large groups of stars but with no classifiable shape, in other words they may be any shape. Our spiral galaxy and the other close large spiral known as M31, or The Great Andromeda Galaxy, have smaller irregular galaxies associated with them as satellite galaxies. Two of the irregular galaxies associated with our galaxy can be seen from the southern hemisphere as islands broken off the Milky Way. These are known as the Large and Small Magellanic Clouds. There are other small galaxies within our spiral galaxy that have been pulled in by gravity and are in the process of being absorbed by the larger galaxy. We can also see the same process occurring in M31.

SPIRAL GALAXIES

Like our galaxy the Milky Way, many galaxies have spiral arms. Some have arms like curved spokes in a wheel, some gently curved, some tightly wrapped around the central ball. Others have what looks like a straight bar of stars extending out from the central ball with the spiral arms attached to ends of the bar, these are the Barred Spiral Galaxies. The class is preceded by S' for Spiral and 'SB' for Spiral Barred. Spiral and Barred Spiral galaxies are further divided into three subdivisions a, b and c depending on how tightly the arms are wound. They are therefore referred to as Sa, Sb and Sc or SBa, SBb and SBc. The Great Andromeda Galaxy is our closest spiral neighbour and can even be seen with the naked eye on a very clear night and from a dark location.

The good news for the beginner to astronomy is some of the brighter galaxies are within the grasp of amateur telescopes but the bad news is they do need a moderate sized telescope to see most of them. There are four naked eye galaxies including our own Milky Way. The others are M31 the Great Spiral Galaxy in Andromeda and the Large and Small Magellanic Clouds which can only be seen from southern latitudes.

M31 can be seen from the UK as a small fuzzy patch of light but does need a dark clear sky. It is quite easy to find using binoculars and is well place at this time of year. The easiest way to find M31 is to first locate the Great Square of Pegasus. It is quite easy to find on a clear dark night high in the west. The square is actually larger than expected but once found it is much easier to locate again. Once the square is found the pointer to Andromeda is the top left star of the square which is named Sirrah. Strangely Sirrah is officially not part of Pegasus but the first and brightest member of Andromeda and designated as Alpha (α) Andromedae. From Sirrah follow the rather obvious line of stars to the left (east). Locate the second star in the line which is shown as Mirach on the chart below. From Mirach follow a slightly fainter line of stars to the north (above) Mirach to the second star. Just to the right of this star is the faint fuzzy patch of light that is M31 the Great Andromeda Galaxy.



The position of M31 in Andromeda

The chart above gives an approximate naked eye view of M31 in Andromeda although somewhat clearer than can be hoped to be seen with the naked eye. However a pair of binoculars will enable the galaxy to be seen easily. A small telescope will show a cigar shaped hazy patch with a brighter spot in the middle. Larger telescopes will show it more clearly but photographic imaging is required to reveal its true nature as shown in the image below.

M31 The Great Spiral Galaxy in Andromeda

M31 is positioned almost edge on to our point of view but even at this angle the spiral arms can be seen in photographic images. Our Milky Way galaxy is estimated to be around 100,000 light years in diameter but M31 is larger at about 170,000 light years across. M31 is so far away that its light takes in excess of 2¼ million years to reach us. This makes it the most distant object that can be seen with the naked eye. It is also speeding towards us and will collide with the Milky Way in about five billion years.

M31 and our galaxy are the largest in our local group but there are 30 or so other smaller members. One of these is the beautiful face-on spiral M33 known as the Triangulum Galaxy.

M33 in the constellation of Triangulum

Despite being quite large in the sky M33 is difficult to see because it is face on to us. Its light is spread over a larger area so its surface brightness is reduced compared to a side on view such as we have with M31.

We would expect that the curving nature of spiral arms is caused by the rotation of the disc and governed by the laws of motion. The simple mechanics of rotation would dictate that the inner parts of the galaxy should rotate faster than the outer parts causing the outer parts to trail behind but this is not the case. Mysteriously the whole disc rotates almost as if it was a solid body. This indicates that there loop around each other and finally is an enormous amount of invisible mass within the rotating disc. This is now thought to be an unknown form of material that we call 'Dark Matter'. There appears to be around five times as much invisible dark matter as there is normal matter in the discs of galaxies.

The curving spiral arms are actually caused by a shock wave of star formation. As gas in the disc collapses under the influence of gravity stars burst into life. Star formation sends shock waves through the disc promoting further star formation and more shock waves. The shock waves take longer to move around the outer regions so the shock wave becomes curved. The blue and red regions in the image of M33 show where star formation is taking place.

There are other galaxies that can be seen using a modestly sized telescope of 100 to 150mm. The best are: M65, M66, M95 and M96 in the constellation of Leo. These are not as big and bright as M31 but well worth searching out. Another face-on galaxy is M51 located in Canis Venatica but easier to find following the handle of Ursa Major. This is a face-on galaxy that has been in collision with another smaller galaxy. Over the next few hundred million years the two galaxies will probably loop around each other and finally merge. M51 does need a larger telescope and a dark sky to see it in detail.

THE SOLAR SYSTEM THIS MONTH

MERCURY rises shortly after the Sun at the beginning of the month and is not observable. It then passes through conjunction with the Sun and will re-emerge to rise before the Sun at the end of the month. However it will be too close to the Sun and to the south eastern horizon for any useful observing this month.

VENUS rises over the eastern horizon at about 05:00 in the middle of the month and is visible as a bright star in the early morning sky until about 07:30 when the sky brightens.

MARS has now disappeared over the south western horizon and will not be visible until it reappears as a morning object next year.

JUPITER is in a good position in the south eastern sky as the Sun sets. By 16:30 it will be visible in the south east. It will be setting in the west at about 23:30. Jupiter is worth a long look even in a small telescope or binoculars. The four brightest moons change position from night to night. A larger telescope may show the moons pass behind or in front of the planet. When a moon passes in front of the planet it may cast its shadow on the surface of Jupiter producing an eclipse shadow. The image below was taken using a webcam mounted in place of the eyepiece of a 300mm Meade LX200 telescope.

Jupiter with Io producing an eclipse shadow on 11th November

SATURN rises over the eastern horizon at about 03:00 in the beginning of the month and 02:00 at the end of the month. The rings are opening out now after being closed up and almost disappeared last year. Saturn will be looking much more like we expect when it is in a better position in spring next year.

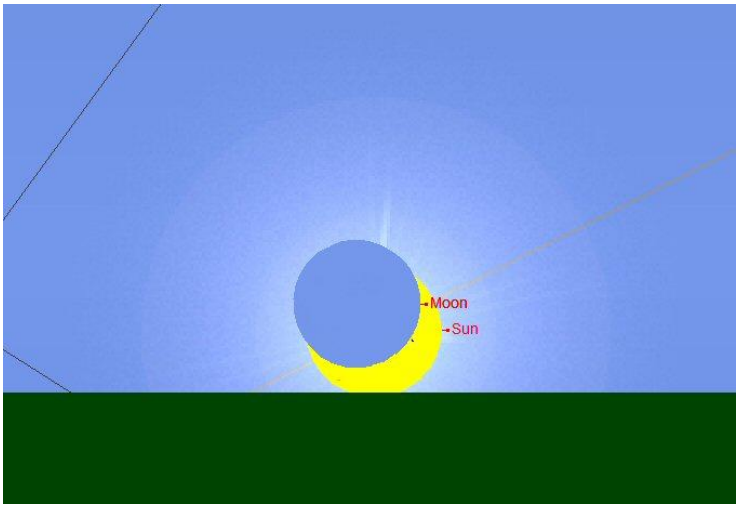
URANUS is close to Jupiter throughout the month and is in a very good position to make it easy to find. Uranus is just 51 arc seconds to north east (above and left) of Jupiter; this is only just short of two Moon diameters away. Uranus will appear as a rather smudged looking blue star. Once centred in a telescope use a higher magnitude eyepiece and possibly a Barlow to zoom in and a small blue disc will be seen.

NEPTUNE is in a good position this month and can be found, perhaps with some difficulty, due south at about 16:30.

THE SUN has an eleven year cycle of increasing sunspot activity. The period of maximum activity has been very sparse until months ago. However a number of good sized spots appeared during November.

A special solar filter must be fitted to a telescope to view the Sun or alternatively the image can be projected on to a screen. **DO NOT LOOK DIRECTLY AT THE SUN AS IT WILL CAUSE BLINDNESS EVEN WHEN ECLIPSED**.

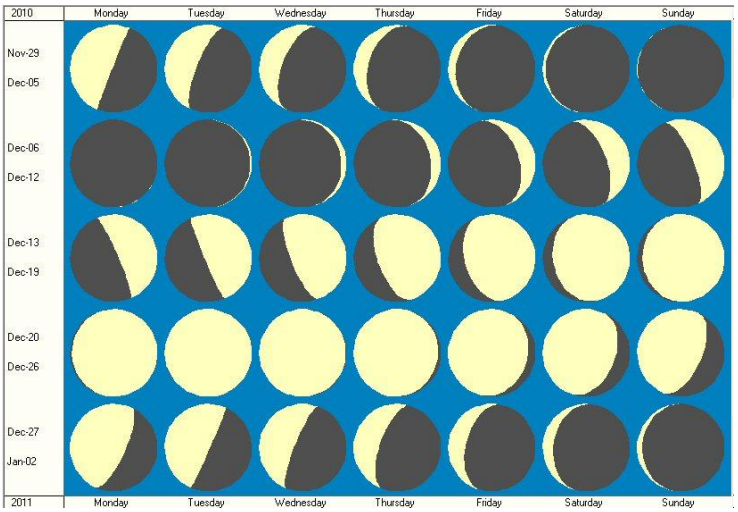
There will be a partial Solar eclipse visible from the south of England on Tuesday 4th January. The eclipse will occur at sunrise and will require a clear view to the eastern horizon. The Sun will rise over the horizon partially eclipsed by the Moon. As the Sun appears over the horizon at about 08:15 it will appear as a crescent similar to the view shown below. More in next month's magazine.



THE MOON is always a good target for binoculars or a small telescope. It is also the first object for a beginner to go for because it is large and bright. During the late summer and early autumn the Moon has been skirting along just above the horizon but it is now beginning to rise higher in the sky. When using a telescope it may be useful to fit a mask over the end of the telescope to reduce the glare caused by too much light. The dust cover on some telescopes may have a smaller cap fitted which can be removed and the dust cover left in place as a mask. Alternatively a cardboard mask can be made and fitted.

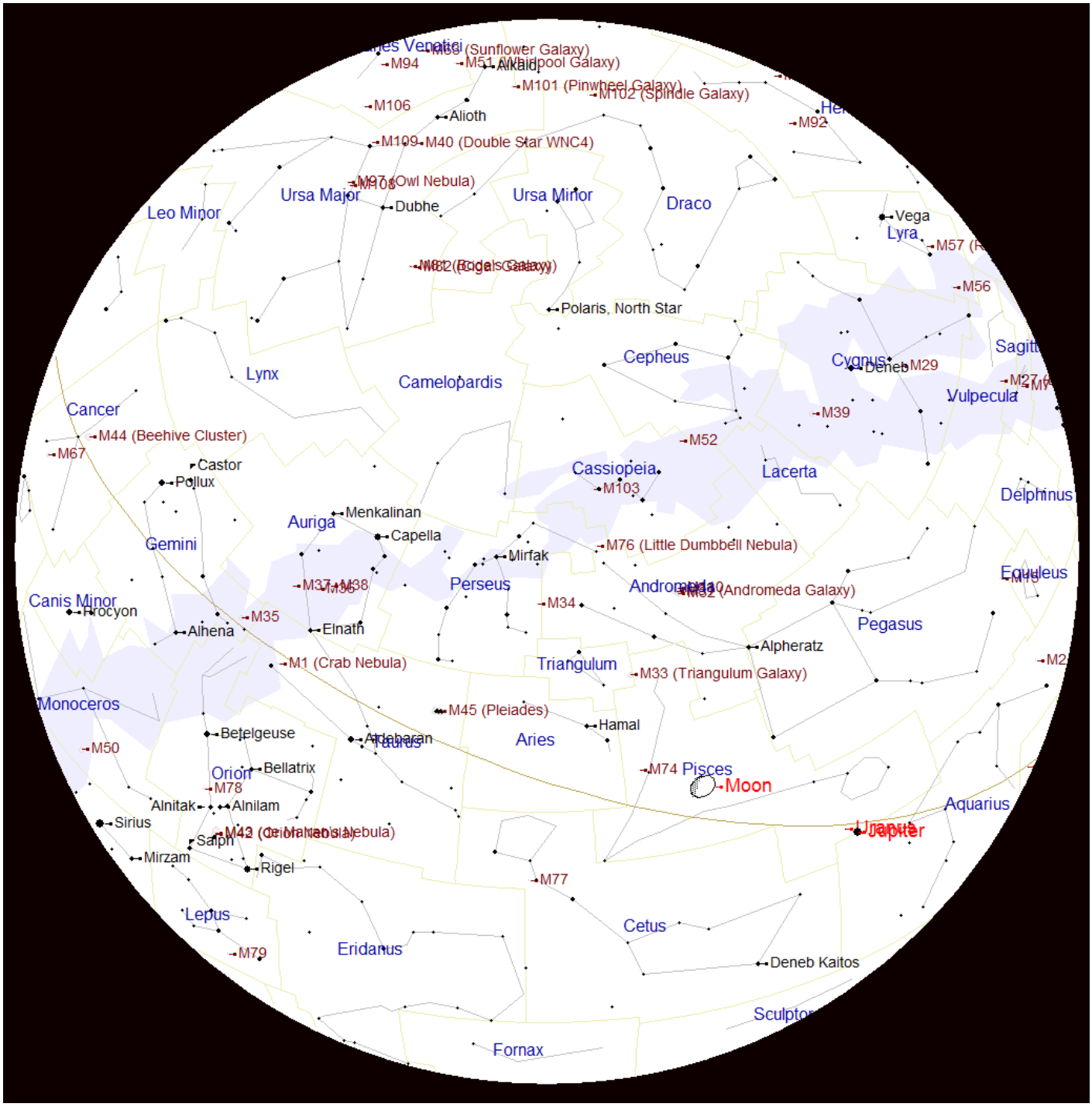
The best time to observe objects is when they are on the 'Terminator' (the line between light and dark). This is best because the objects are in the position of sunset and cast long shadows that give relief to the features. At full moon the Sun is shining straight down so there is no shadow and features are difficult to see.

The phases of the Moon in December 2010:



METEORS. There is a major meteor shower this month. It is the Geminids that can be seen between December 9th and 14th with a noticeable peak on night of the 13th. See page 1 for more details.

THE SKY THIS MONTH



The chart above shows the night sky as it appears on 17th December at 9 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 10 o'clock GMT at the beginning of the month and at 8 o'clock GMT at the end of the month. 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.

The planets observable this month are: Jupiter, Uranus and Neptune. Saturn and Venus are observable just before sunrise.