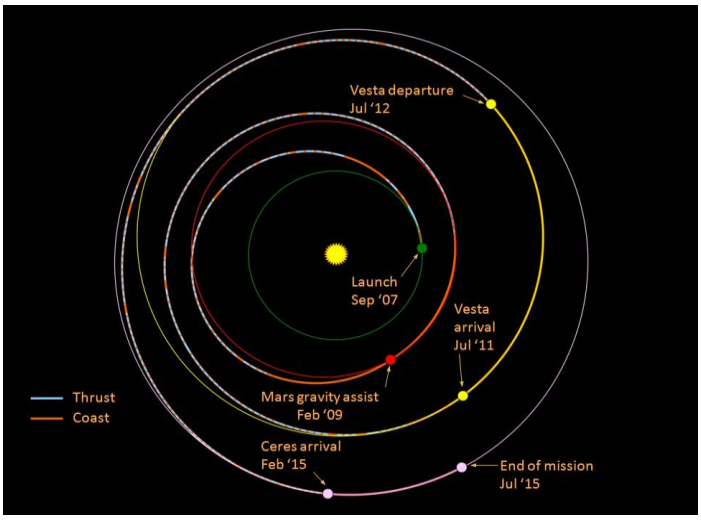
NEWBURY ASTRONOMICAL SOCIETY
BEGINNERS MAGAZINE - OCTOBER 2011

DAWN ARRIVES AT VESTA

In July this year a space probe named DAWN arrived at the giant asteroid (now recognized as a Dwarf Planet) Vesta. The probe was launched on 27th September 2007 to begin its long journey to the Asteroid Vesta then on to the largest of all asteroids Ceres.



The trajectory of Dawn

During its nearly decade-long mission, the Dawn mission will study Vesta and Ceres, celestial bodies believed to have accreted early in the history of the solar system. The mission will characterize the early solar system and the processes that dominated its formation.

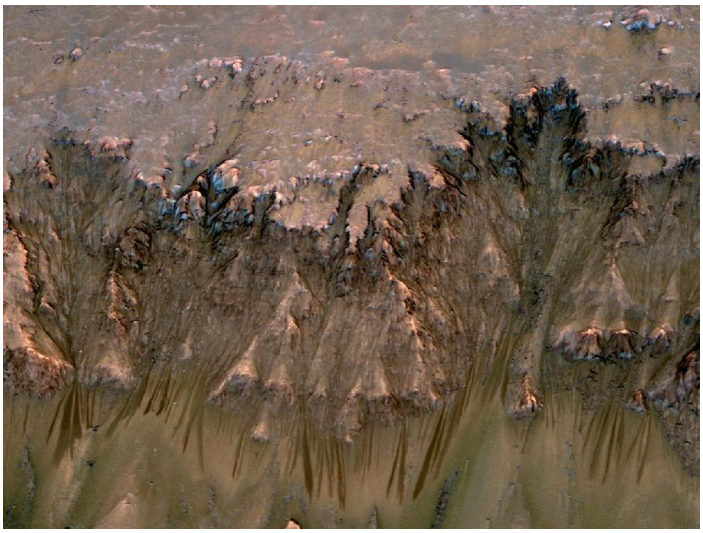
The asteroid Vesta and the recently categorized dwarf planet Ceres have been selected because both are thought to retain evidence of the conditions and processes that existed in the early formation of the solar system. These Dwarf Planets developed into two different kinds of bodies. Vesta is a dry, differentiated object with a surface that shows signs of resurfacing. It resembles the rocky bodies of the inner solar system, including Earth. Ceres by contrast has a primitive surface containing water-bearing minerals and may possess a weak atmosphere. It appears to have many similarities to the large icy moons of the outer solar system.

By studying both these two distinct bodies with the same instruments on the same spacecraft the Dawn mission hopes to compare the different evolutionary path each took as well as create a picture of the early solar system overall. Data returned from the Dawn spacecraft could provide opportunities for significant breakthroughs in our knowledge of how the solar system formed.

To carry out its scientific mission, the Dawn spacecraft will carry three science instruments whose data will be used in combination to characterize these bodies. These instruments consist of a visible camera, a visible and infrared mapping spectrometer and a gamma ray and neutron spectrometer. In addition to these instruments, radiometric and optical navigation data will provide data relating to the gravity field and thus providing valuable information about the bulk properties and internal structure of the two bodies.

MORE EVIDENCE OF WATER ON MARS

Fingers of dark material running down steep slopes in the warmest regions of Mars could be the result of salty water flows, say scientists interpreting repeat observations snapped by Mars Reconnaissance Orbiter's (MRO) powerful HiRISE camera.



The dark stripes, which are on the order of a few metres wide and several hundred metres long, were identified on several steep equator-facing slopes in the middle latitudes of the red planet's southern hemisphere. The features are different to the much wider gullies already seen on many cold, pole-facing slopes, and appear to fade during the winter months, reappearing in springtime. In some locations more than 1,000 individual flows have been identified, some of which had grown by more than 200 metres in just two Earth months. In one location the pattern was repeated over three Martian summers. Scientists suspect the flows might be briny. A high salt content would lower the freezing temperature of water because the observed temperatures could not melt pure water ice.

On Earth, where there is water, there is life, and NASA's mantra of "follow the water" to find life has stepped up a gear with this discovery. Evidence for ancient rivers and lakes exist all over Mars and sites which potentially host liquid brines will help in the quest to determine whether life exists, or once existed, on the planet. Frozen water is widespread and ice has been detected in freshly formed shallow impact craters and seen in trenches dug by the Phoenix Mars Lander near the planet's north pole. Furthermore, beads of droplets seen on Phoenix's landing struts were argued to be globules of brine-rich liquid. Landslides seen in gullies are also thought to have been facilitated by flowing water.

NEWBURY ASTRONOMICAL SOCIETY MEETING

7th October It's Only Rocket Science

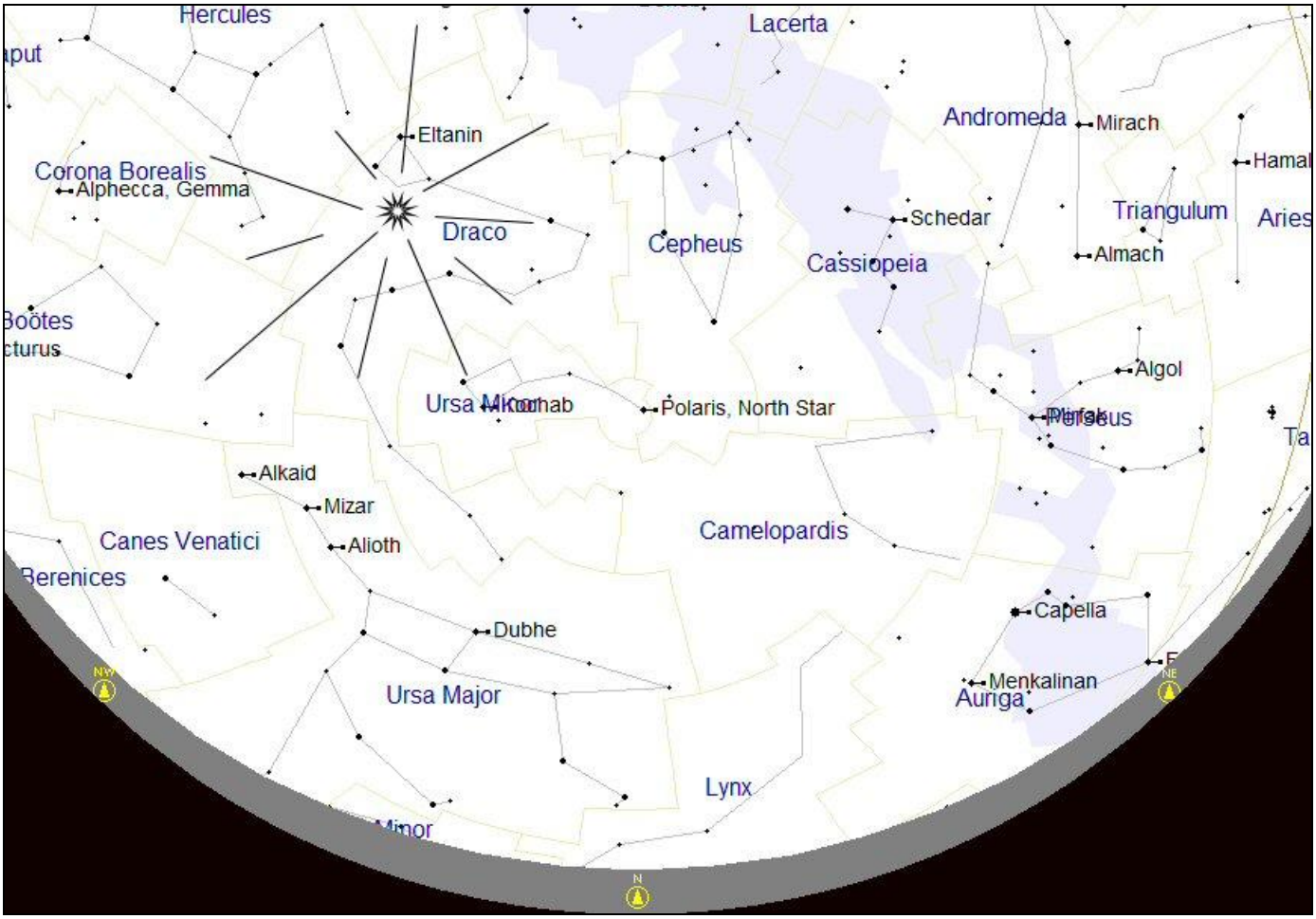
Website: **www.newburyas.org.uk**

THE NEXT NEWBURY BEGINNERS MEETING

19th October Observing Jupiter & Telescopes

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

THE DRACONID METEOR SHOWER



During the early evening of Saturday 8th October there will be a minor meteor shower called the Draconids. This shower is normally insignificant and goes un-noticed even by keen meteor watchers but this year may be very different. Some astronomers are predicting a short but very active shower.

Comet Giacobini-Zinner imaged in 1998

Like all meteor showers the Draconids originate from a passing comet. The comet that gives rise to the Draconids is called Giacobini-Zinner which is a short period comet that returns to sweep in close to the Sun every six years and four months. Its last visit was around 2006. Giacobini-Zinner has left a number of thicker filaments of meteoroids around its orbit.

Comets are large lumps of dirty ice, typically a few tens of kilometres across, that reside beyond the orbits of the main planets. There are millions of these objects out there, some up to the size of Pluto, quietly orbiting around the Sun at enormous distances. Occasionally one of these objects may be nudged out of its orbit by a close encounter with another object and may begin to move in towards the Sun. As a comet approaches the Sun the water and frozen gases begin to boil off and are blown away by radiation from the Sun. This gas and specs of dust that were imbedded in the ice produce the familiar twin tails we associate with comets.

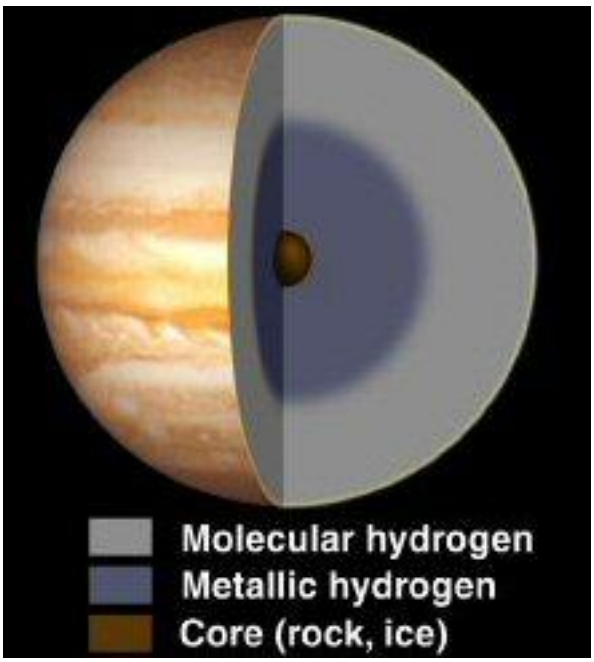
The dust particles continue on approximately the same orbit as the comet and form a filamentary trail. Meteor showers occur at the same time each year when Earth passes through the trail of particles left by the comet. Each comet leaves a trail producing meteors that appear to radiate from the same point in the sky so each shower is named after the constellation in which the radiant point is located. This shower radiates from a point in the constellation of Draco.

To observe the shower we do not need any special equipment, just our eyes. The best thing to do is to sit on a garden recliner chair that has been set up so that the observer can see the sky towards the north. Make sure there are no lights shining in your eyes. If there are lights then try to cover the light source or set up a screen to block the light. Look anywhere from the horizon to overhead. The best time to look out for the meteors will be from 19:00 to 21:00 on when Earth is expected to pass through a thicker filament of meteoroids.

Don't forget to dress in warm clothes.

OBSERVING JUPITER

Jupiter is the largest of all the planets in our Solar System and is generally regarded as the 'King of the Planets'. It is over eleven times the diameter of Earth and has a volume larger than all the other planets put together. Unlike Earth and the other three inner planets, Jupiter has no solid surface because it is comprised almost entirely of gas, although it may have a small rocky and metallic core.



Section of Jupiter showing the main layer structure

The surface of the planet has many bands or 'belts' of different colours some of which can be seen even in a small telescope. These belts are mainly different shades of browns with variations from white through orange to chocolate brown. There are even reds especially in the famous Great Red Spot although it is in fact more pink than red. The Great Red Spot is a massive storm much larger than the size of the Earth. It has been raging since before the invention of telescopes and was observed by early astronomers using primitive telescopes nearly 400 years ago.

Jupiter imaged by the Hubble Space Telescope (HST)

Jupiter has been around throughout the summer months but has been hiding in the early morning sky. It has now moved into a much better observing position and at a much more convenient time. It is observable in the east almost as soon as it is dark but the view does get better as the evening progresses.

Jupiter is the fifth planet out from the Sun and has an orbit approximately 778 million km from the Sun (Earth 150 million km). Its diameter at the equator is 142,984 km (Earth 12,756 km). Its volume is large enough to swallow all the other planets. Despite being so large Jupiter rotates very fast, in fact, a day on Jupiter is equivalent to only 9.9 Earth hours. This is so fast that the centrifugal force of the spin causes the planet to bulge noticeably at its equator.

Jupiter was interesting last year because the South Equatorial Belt was missing; see the image below (South is at the top).

Jupiter imaged on 2nd September 2010 by Steve Harris

This has happened before but it was well worth having a look because it does not happen very often. The last time it happened was over 16 years ago. The Great Red Spot is normally embedded in the South Equatorial Belt but can be seen against nothing but white clouds in the image above. The moons in the image are Io closest to Jupiter and Europa further out.

Jupiter has many moons and more are being discovered all the time, more than 60 so far. Many are small and may be captured asteroids but four are large and easy to see in a small telescope. Galileo was the first person to have been credited with observing Jupiter using a telescope and discovered the four brightest moons that are now called the Galilean moons in his honour.

The Galilean Moons, particularly the inner two Io and Europa, move quite quickly and can be seen to change position hour by hour and even within 10 minutes when close to Jupiter. The orbits of the moons take take: (Earth days)

Io	1.77 days	Europa	3.55 days
Ganymede	7.16 days	Callisto	16.69 days

With a larger telescope it is possible to see the moons disappear and reappear or even see their shadows as they pass in front of Jupiter to produce an eclipse on the cloud tops. A computer planetarium application can be used to predict the times of the disappearance and re-appearance of the moons. It is easy to plot their positions from night to night or even hour to hour. The plots can then be compared to the computer application predictions.

Jupiter is the best of all the planets to observe with a small telescope of 100mm aperture or less. It is even possible to make interesting observations of the positions of the moons using a reasonably good pair of 10 x 50 binoculars. A telescope is required to see the coloured cloud bands. A small to medium sized telescope (100mm to 150mm aperture) could give a view something like the image shown below.

Jupiter and two of the Galilean Moons imaged in 2010

The Galilean Moons can be seen changing position to either side of Jupiter so it is good fun to track them from night to night or even through the night. Sometimes there may be only three moons visible when one is passing in front or behind the planet. They can be distributed in any pattern and may even all be gathered to one side at times.

A small telescope (100mm aperture) will be able to show details of some of the interesting features of the movements of the moons around Jupiter. Jupiter has a small tilt angle 3.07° compared to many of the other planets including Earth at 23.45°. Consequently its moons regularly appear to pass in front and behind the planet. This can make observing Jupiter very interesting.

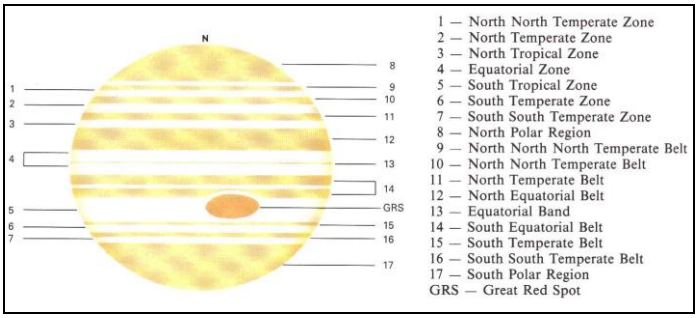
This year Jupiter has its south pole tilted towards the Sun almost as far as it can (about 3°) so it is summer in the southern hemisphere. A keen observer may just detect that the Belts and Bands appear to be slightly curved because of the tilt towards us. Remember most telescopes will show the south pole at the top of the view.

When a moon passes in front of a planet it is said to 'transit' the planet. Most computer planetarium applications will be able to predict these events very accurately. Using an accurate clock the event can be observed and the predicted timings checked. Using a high magnification (100x or more) the moon can be followed as it approaches the edge of Jupiter. As the gap between the moon and Jupiter closes the moon will eventually appear as a 'pimple' on the edge of the planet. The time that the 'pimple' finally disappears can be recorded. The time when the moon reappears on the opposite side of the planet can also be predicted and the timing checked in a similar way. It is very difficult to see the moon as it transits the bright surface of Jupiter but the shadow of the moon is quite easy to see. The [eclipse] shadow can also be predicted using a computer planetarium application. The passage of the shadow can be tracked and timed. See the HST image on page 3, Io can be seen just to the right of its eclipse shadow.

When a moon passes behind a planet it is said to be 'occulted' by the planet. Occultations can be followed in a similar way to transits. Moons can also disappear as they pass through the shadow cast by their planet. These events can also be predicted and observed. A rare event occurs when two moons appear to move close together or may transit in an even rarer event.

This year Jupiter will appear higher in the night sky than it has been for a few years. On the 29th October Jupiter will be at opposition. This means it will be directly opposite the Sun in our sky and will therefore be due south at midnight Greenwich Mean Time (GMT), 01:00 30th October British Summer Time (BST). When at opposition Jupiter will be 50° high and will be 50 arc-minutes in diameter and very bright. Jupiter always displays an almost full disc but can lose a tiny amount from the edge when it is at greatest elongation (at about 90° from the Sun as we view it from Earth). However as Jupiter is at opposition this month it will appear absolutely full. For these reasons Jupiter will be as good as it gets this month subject to clear skies.

For those who are lucky enough to have a larger telescope a closer study of the features in Jupiter's cloud system can be achieved. The darker bands on the clouds are known as 'Belts' and the lighter ones known as Bands. The belts and bands numbered 12 to 14 in the diagram below are the most prominent and can be seen using a small telescope. A larger telescope is needed to make out the details of the other bands.



The cloud markings on Jupiter

The Belts and Bands are zones of higher and lower atmospheric pressure. The lighter coloured 'Bands' are regions of rising gas caused by convection of heat from the core of Jupiter. The darker 'Belts' are regions of falling gas and are approximately 20 kilometres lower in altitude than the Bands. In the regions where the Belts and Bands meet huge storms are created. A larger telescope will allow some of detail of the storm patterns to be seen.

The most famous feature in the cloud system is the 'Great Red Spot'. This huge storm has been raging for at least 347 years. We know this because it was recorded by astronomers in 1664 using some of the earliest telescopes. The Great Red Spot does change in colour and shape but it is always there. Its colour may fade from its normal pink to almost white when it may almost disappear. The colour is thought to be caused by Phosphorus welling up from deep in Jupiter's atmosphere.

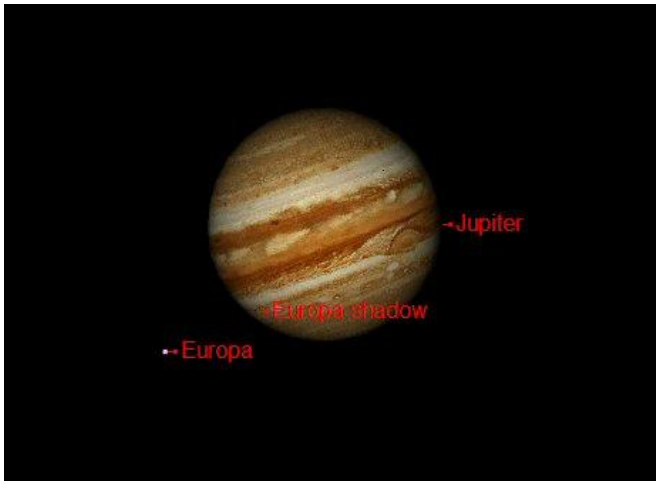
The Great Red Spot is not the only storm feature to be seen. There are white spots and even mini red spots. These tend to be transient and last from a just few days or weeks but others may persist for up to fifty years. Spots can combine with other spots as they move along the boundaries between the Belts and Bands. Some larger spots have even been swallowed up by the Great Red Spot.

One of the major attractions of observing Jupiter is that its rapid rotation (9.9 Earth hours) allows a whole rotation of the planet to be observed over the course of one night on Earth. The Moons, especially the two inner most Io and Europa can be seen to move noticeably over short periods especially when they are close to the planet. Io orbits Jupiter in just 1.77 Earth days and Europa takes 3.55 Earth days. So Jupiter is a very dynamic and interesting object to look at and can give hours of exciting and breathtaking views of what is truly the 'King of the Planets'.

Jupiter is always worth just looking at to take in it great beauty and mystique but there are plenty of times during the month to have a special look. The following events will be especially worth looking out for: [Approximate times shown in BST]

3rd October

21:00 to 23:45 Europa's shadow crosses Jupiter followed by Europa itself 22:40 to 01:00 (See image below)



Europa approaching Jupiter and its shadow starting transit

6th October

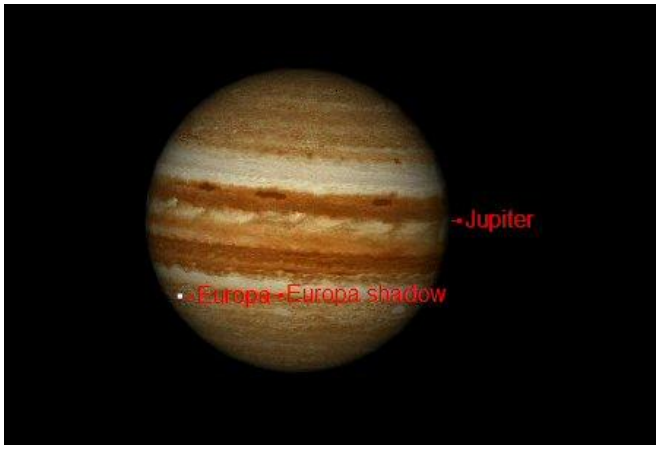
20:51 – Ganymede Emerges from occultation.

22:45 to 00:45 Io shadow followed by Io 23:15 to 01:18

Ganymede moving away with Io and shadow in transit

11th October

00:00 to 02:21 Europa shadow followed by Europa in transit 00:57 to 03:15

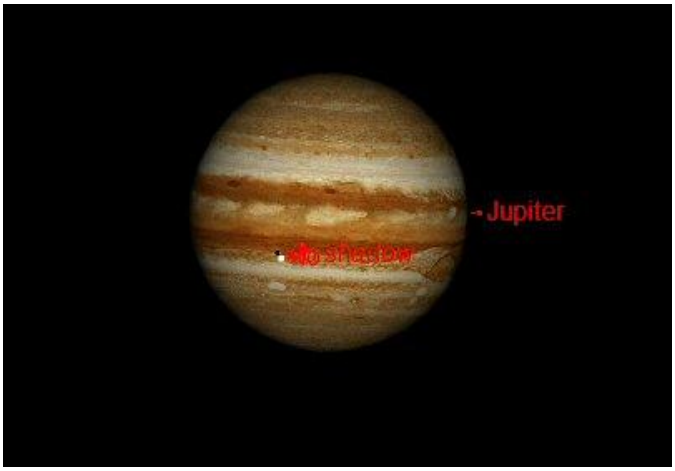


Europa and its shadow in transit

The shadow of the moons in transit during the following events will appear very close to the moon. This is because when Jupiter is at or near opposition the shadow will appear to be located directly below the moon.

29th October

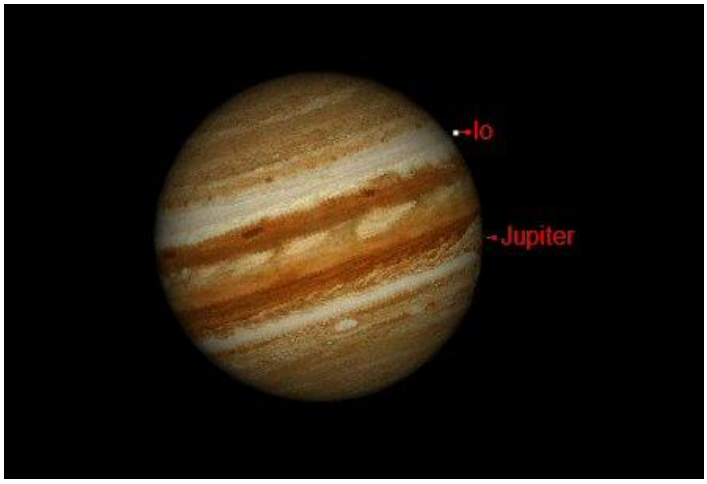
22:50 to 01:00 Io and Shadow are in transit



Io and shadow close together

30th October

20:02 to 22:10 Io occultation

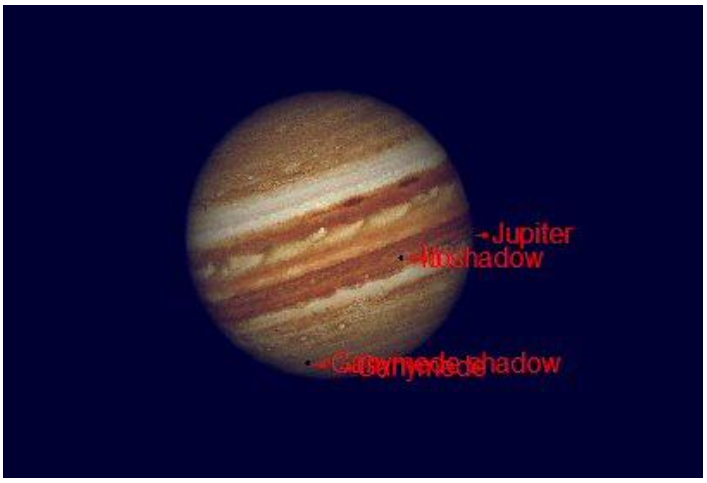


Io about to be occulted by Jupiter

31st October

18:40 to 20:15 Ganymede and its shadow in transit

Io and its shadow are also in transit at this time



Ganymede and Io with shadows in transit

TELESCOPE JARGON

ALT AZIMUTH A type of telescope mount that has a vertical axis (Azimuth) and a horizontal axis (Altitude). Both axes need to be moved to track an object through its apparent arc across the sky.

APERTURE The diameter of the main objective. This normally is used to describe the size of the telescope.

BARLOW A lens unit inserted into the focuser that effectively doubles or trebles the magnification of the eyepiece.

DECLINATION The up / down movement on an equatorial.

DEWSHIELD A tube fitted to the open end of the telescope to help reduce dew forming on the lens.

DOBSONIAN A very simple and cheap telescope mounting usually used with a Newtonian reflecting telescope tube.

EQUATORIAL MOUNT A type of telescope mount that has one axis tilted to point at the celestial pole. By using this design of mount an object being observed can be tracked by moving just one axis. A must for astro - photography.

EYEPIECE A small microscope fitted to the telescope to magnify the image formed by the main optic.

FINDER A small telescope fitted to the main telescope to help find the object to be observed. A finder has a wide field of view and low magnification and is often fitted with cross hairs.

FOCAL LENGTH The distance from the objective to the point where the image is formed.

FOCAL RATIO The ratio obtained by dividing the focal length of the objective by its diameter, usually written as f (number).

FOCUSER or FOCUSING UNIT The holder for the eyepiece. It carries adjusting knobs to make minor adjustments to the position of the eyepiece to give correct focusing.

GOTO This is a computerised drive system fitted to some modern telescopes. It enables the telescope to automatically find and track thousands of objects in its database.

LIGHT GRASP The amount of light that a telescope can direct into the observers eye (the bigger the better).

MAGNIFICATION The ability to increase the apparent size of the object using different eyepieces. A short focus eyepiece produces higher magnification, calculated by dividing the focal length of the main optic by the focal length of the eyepiece: 1000mm ÷ 10mm = 100x magnification.

MAKSUTOV A complex design of telescope that, through an optical trick, produces a very long effective focal length in a short tube. These are very good for planetary observation.

NEWTONIAN A simple reflecting telescope designed by Sir Isaac Newton. (See opposite column).

OBJECTIVE The main light gathering optical unit of a telescope, the large lens or mirror.

REFLECTOR The type of telescope that uses a mirror as its main optic, usually called a 'Reflecting Telescope' or 'Reflector'.

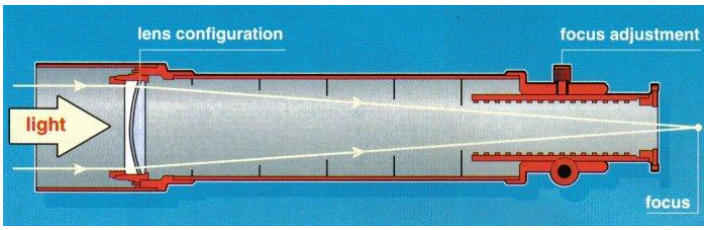
REFRACTOR The type of telescope that uses a lens as its main optic, usually called a 'Refracting Telescope' or 'Refractor'.

RIGHT ASCENSION (RA) The rotational movement on an equatorial. The axis that is tilted to align with the Earth's pole.

SCT (SCHMIDT CASSEGRAIN TELESCOPE) A complex design of telescope that, through an optical trick, produces a long effective focal length in a short tube.

REFRACTING TELESCOPES

All refracting telescopes use a glass lens as their primary focusing unit. This lens is normally made up from two or more lens elements to produce a clearer image and reduce colour distortions caused by refraction as explained below.

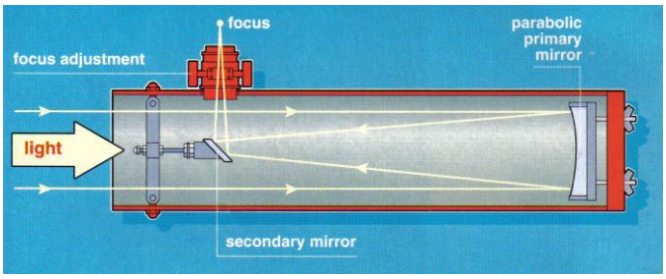


Lenses use the property called REFRACTION to change the direction of rays of light and direct them towards a desired position. Refraction occurs when light passes between two different transparent materials such as glass, air and water.

When light passes, at an angle, through the surface of a block of glass the angle is changed. As the light re-emerges through the opposite side of this material its angle will be changed again back to its original angle. To utilise this phenomena lenses are produced with a curved surface so when parallel rays of light meet the surface it will present an angled surface to each ray. The paths of all the rays hitting the lens will be bent towards the centre line of the lens. As the light emerges from the back face of the lens it is again bent. If the back surface is convex the same as the front surface then the light will be bent even more towards the centre line of the lens.

REFLECTING TELESCOPES

A Newtonian is the simplest type of reflecting telescope. Below is the layout of the optics of a Newtonian tube assembly. The Newtonian configuration is the simplest layout and therefore generally the cheapest of all the reflecting type telescopes. Used with the simple Dobsonian mounting this type of telescope can make a very useful and cheap option for a first telescope at around £200 for a 150mm (6″) instrument.



Light from a distant object enters the open tube and is reflected back up the tube by a parabolic (concave) mirror. Because the mirror is curved the light is focused into a point where an image is formed. To enable the observer to study the image without blocking the light entering the tube, a second small 'flat' mirror is mounted at an angle of 45° at the top of the tube to direct the light out through a hole in the tube. A focusing unit is fitted to the hole to hold and adjust the eyepiece. The eyepiece is a simple microscope used to magnify the image formed by the mirror. Using a variety of eyepieces with different focal lengths, higher or lower magnifications can be obtained.

There are other variations of the reflecting telescope layout such as the Cassegrain. This design replaces the flat angled secondary with a small convex mirror that redirects the light back down the tube and through a hole in the centre of the Primary Mirror where the eyepiece is mounted.

WHAT TELESCOPE SHOULD I LOOK FOR?

Before looking at the range of telescopes that is available, consideration should be given as to what the telescope is to be used for. This is the most important consideration of all. The worst possible choice is the one that never gets used. The telescope that is too complicated or too cumbersome to set up will spend its time at the back of a shed or garage and never be used. The first telescope should be easy to set up, easy to use yet give impressive views of the sky.

First we must consider some of the physical characteristics of a telescope and how they affect our requirements.

The main specifications for a really useful first telescope should be: a minimum aperture of at least 100mm for a refractor or 150mm for a reflector and 1,000mm focal length for each. This combination will provide enough light grasp and permit a high enough magnification to see detail on the brighter planets.

One of the most important attributes for an astronomical telescope is the 'light grasp'. This is an expression used by astronomers to describe the process of the main optic directing light from a distant object into the eye. The pupil of a young human eye is about 7mm in diameter when fully adapted to the dark. This is equivalent to 38 square millimetres (38mm²). A 100mm diameter telescope has an aperture area of 7,854mm². It is therefore capable of directing up to 206 times as much light into the eye of the observer. Put another way it will enable the observer to see objects about 200 times fainter than could be seen with the unaided eye. So a larger aperture will allow even fainter objects to be seen.

The focal length is also important. The FOCAL LENGTH is effectively the length of the telescope. It is measured as the distance from the main optic to the point where the image is formed. A short focal length will give a wide field of view but the objects in the field of view will appear small. A long focal length will give a narrow field of view (small area of sky) but the objects in view will appear larger. Short focal lengths are best for looking at star fields and larger objects. Long focal lengths are most suitable for small objects and studying fine detail, for example on the Moon and the planets.

Magnification, strictly speaking, is not an attribute of the telescope it mainly depends on the eyepiece being used. A telescope of a specific focal length will produce an image of a specific size and this cannot be changed. For example a telescope of a certain focal length may produce an image of the full moon 10mm in diameter. A longer focal length will produce a larger image and a shorter focal length will produce a smaller image. The eyepiece is then used, much like a microscope, to magnify that image. A larger image to start with will allow the eyepiece to produce a higher magnification.

A long focal length 25mm (low power) eyepiece used on a 1000mm telescope will produce a magnification of 1000 ÷ 25 = 40x. A short focal length 10mm (high power) eyepiece used on the same 1000mm telescope will produce a magnification of 1000 ÷ 10 = 100x. However the same eyepieces used on a 1500mm focal length telescope (that naturally produces a larger image) will have magnifications of: 1500 ÷ 25 = 60x and 1500 ÷ 10 = 150x.

To summarise, if the craters on the Moon or the cloud bands on Jupiter are to be studied then a telescope with an effectively long focal length should be sought. A shorter focal length telescope will be more suited to wide field views of the stars. A good all round first telescope should have a focal length of around 1000mm to 1200mm.

REFRACTING TELESCOPES

A first telescope must be easy to use, portable enough to move around and set up and be within a modest budget. The budget available is important but if possible at least £230 should be spent on a new telescope or the pro-rata amount for a second hand instrument (say £100 for a telescope that costs £250 new). **Avoid the models that are sold in high street stores as they tend to be poor quality**.

Some of the best manufacturers to look out for are:

MEADE, CELESTRON, ORION, SKY WATCHER, TAL, KONUS and BRESSER. Suppliers of these telescopes can be found in the adverts in popular astronomy magazines such as 'Astronomy Now' and 'Sky at Night'.

There now follows a few examples for consideration.

The Skwatcher Evostar 102

This telescope represents the ultimate first refracting scope for the beginner. It has an aperture of 102mm and a focal length (FL) of 1000mm. It is supplied with the tripod, two eyepieces, even a camera adaptor. The MRP is about £269.

The telescopes in this range are:

Evostar – 90	90mm	FL 900	£199	A little small (ok)
Evostar – 102	102mm	FL 1000	£269	Perfect
Evostar – 120	120mm	FL 1000	£349	A bit expensive
Evostar – 150	150mm	FL 1220	£549	Big & expensive

Most manufacturers listed above have a similar range. The telescopes in these ranges are typically supplied on a tripod and with an equatorial mounting. They usually have two eyepieces (25mm and 10mm) and sometimes include a Barlow Lens (see page 6). All are supplied with a 90° Star Diagonal. This is a mirror set at 45° to direct the image into a comfortable position for viewing through the eyepiece.

The smaller examples are usually supplied with a 30mm aperture finder whereas a 50mm would have been better but this can be upgraded later. There are other telescopes at 60mm to 70mm aperture that are not bad if only a small budget is available (£60 to £100). Their capability is really limited to observing the Moon and the moons of Jupiter.

The details of these telescopes can be checked out on the websites and can be purchased through mail order. They do need to be assembled but this is generally an easy task.

REFLECTING TELESCOPES

Reflecting telescopes are generally cheaper than the equivalent sized refracting telescope. This is because they use a mirror as the main optic and not a more expensive lens. A mirror only has one surface to be ground and polished but the typical refractor, that has two or sometimes three lens elements, has four or six surfaces to be ground and polished.

The cheapest and simplest reflecting telescope is a Newtonian tube assembly (see page 6) mounted on a Dobsonian mount. The mount is a simple Alt azimuth with a turntable for rotation and a trunnion for up and down movement. These are very easy to set up and simple to use.

Because the Newtonian has a secondary mirror at the top of the tube there is a small loss of light so a 150mm will give a just slightly brighter image than a 100mm refractor.

The150mm FL 1220mm Celestron Starhopper £230

Other models in this range:

Starhopper	200mm (8″)	FL 1220mm	£335
Starhopper	250mm (10″)	FL 1270mm	£559
Starhopper	300mm (12″)	FL 1500mm	£949

Most manufacturers listed previously have a similar range.

A major advantage, beside the cheapness, of the Dobsonian is its simplicity of use. It just needs to be placed down on a flat surface and it is ready to use. A finder scope is attached to the main tube to help find a desired object. Once the object is located in the main telescope it can be tracked by moving the tube gently, up or down and around while looking through the eyepiece to keep the object central.

The Newtonian tube assembly can also be fitted to an equatorial mounting. This does make the telescope more expensive but can make it easier to track objects across the sky. The combination gives the advantage of a large aperture telescope on a mount that can easily be driven to track objects. Most Dobsonian telescopes use a fairly long focal length tube assembly whereas a shorter focal length is generally favoured for the equatorially mounted Newtonian.

Celestron C8-N 200mm FL 1000 Equatorial Newtonian

Models in this range:

Celestron C8N	200mm (8″)	FL 1000mm	£299
Celestron C10-N	254mm (10″)	FL 1200mm	£639

Most manufacturers listed previously have a similar range.

The small GOTO computerised telescopes are very good optically but are notoriously difficult to set up. They need to be levelled, set to face north, the time and date entered and the location coordinates entered. The computer then selects two bright stars for the telescope to be aligned on. Once aligned the computer will automatically find and track thousands of objects stored in its memory.

Meade ETX90 PE £499

These telescopes have an advanced optical system known as a Maksutov-Cassegrain. This system uses curved mirrors and a lens to extend the effective focal length to an amazing 1250mm. At 90mm aperture, its light grasp is small for this focal length so deep sky objects are faint and difficult to see. However it does give beautiful views of the brighter planets and the Moon.
Celestron have a similar model, the Nextstar 4 at £340.

THE SOLAR SYSTEM THIS MONTH

MERCURY rises at 07:30 on 1st October, 08:32 on 15th and 09:24 on 30th but will be close to the rising Sun to be observable.

VENUS rises over the eastern horizon at about 09:00 in daylight and will not be observable this month.

MARS rises at 01:09 on 1st October, 01:03 on 15th and 00:55 on 30th but is still only 5 arc-seconds in diameter and too small to be observable.

JUPITER rises at rises at 19:19 on 1st October, 18:37 on 15th and 17:55 on 30th. It will be low in the east at sunset but will be observable for the rest of the night in the constellation of Aries. Jupiter reaches opposition on 29th October. This means it will be directly opposite to the Sun in our sky and will therefore be due south at midnight Greenwich Mean Time (GMT), 01:00 30th October British Summer Time (BST). On the night of 29th the Sun will be on the opposite side of Earth as we look at Jupiter. The 'King of the Planets' will be at its best observational position for this year on 29th. Jupiter is featured month on pages 3, 4 and 5.

SATURN rises at 07:44 on 1st October, 07:11 on 15th and 06:39 on 30th but will be in daylight and so will not be observable.

URANUS rises at 17:29 and will be observable all night this month. It was at opposition (due south at midnight GMT) on 26th September and so will slightly past its best. A telescope will show Uranus looking like a rather fuzzy blue tinted star in the constellation of Pisces.

NEPTUNE rises at 16:29 and will be observable all night this month. It looks rather like Uranus in a telescope but smaller and fainter. It is located in the constellation of Aquarius.

Dwarf planets **CERES** and **VESTA** will be visible in the southern sky this month. These are the two largest objects in the asteroid belt. More about the space craft 'Dawn' and Vesta in December.

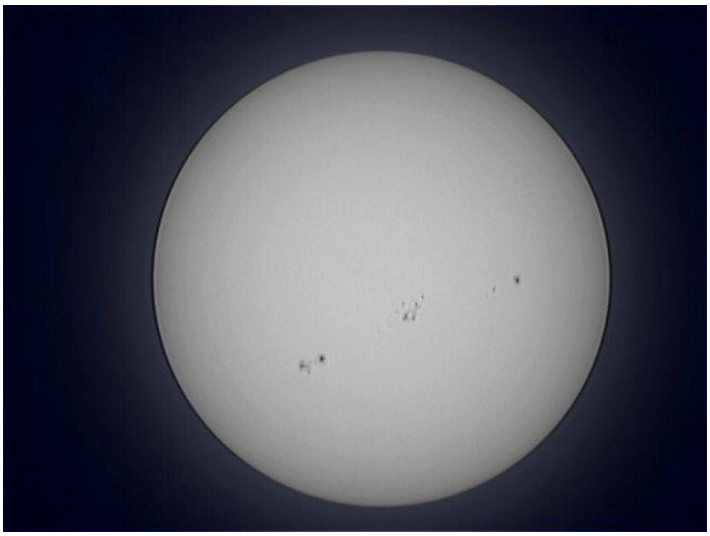
METEOR SHOWERS

See Page 2 for details of the Draconid Meteor Shower.

The Orionid Shower peak will be on the night of 21/22.

THE SUN

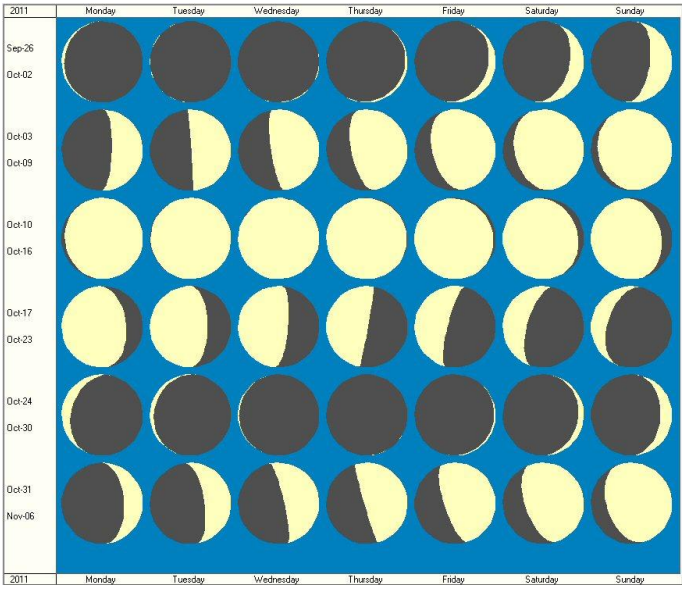
The Sun has begun to show signs of enhanced activity at last. It had some impressive looking sunspots during September and produced a night of Aurora that was seen as far south as southern England.



The Sun with a good display of sunspots

THE MOON

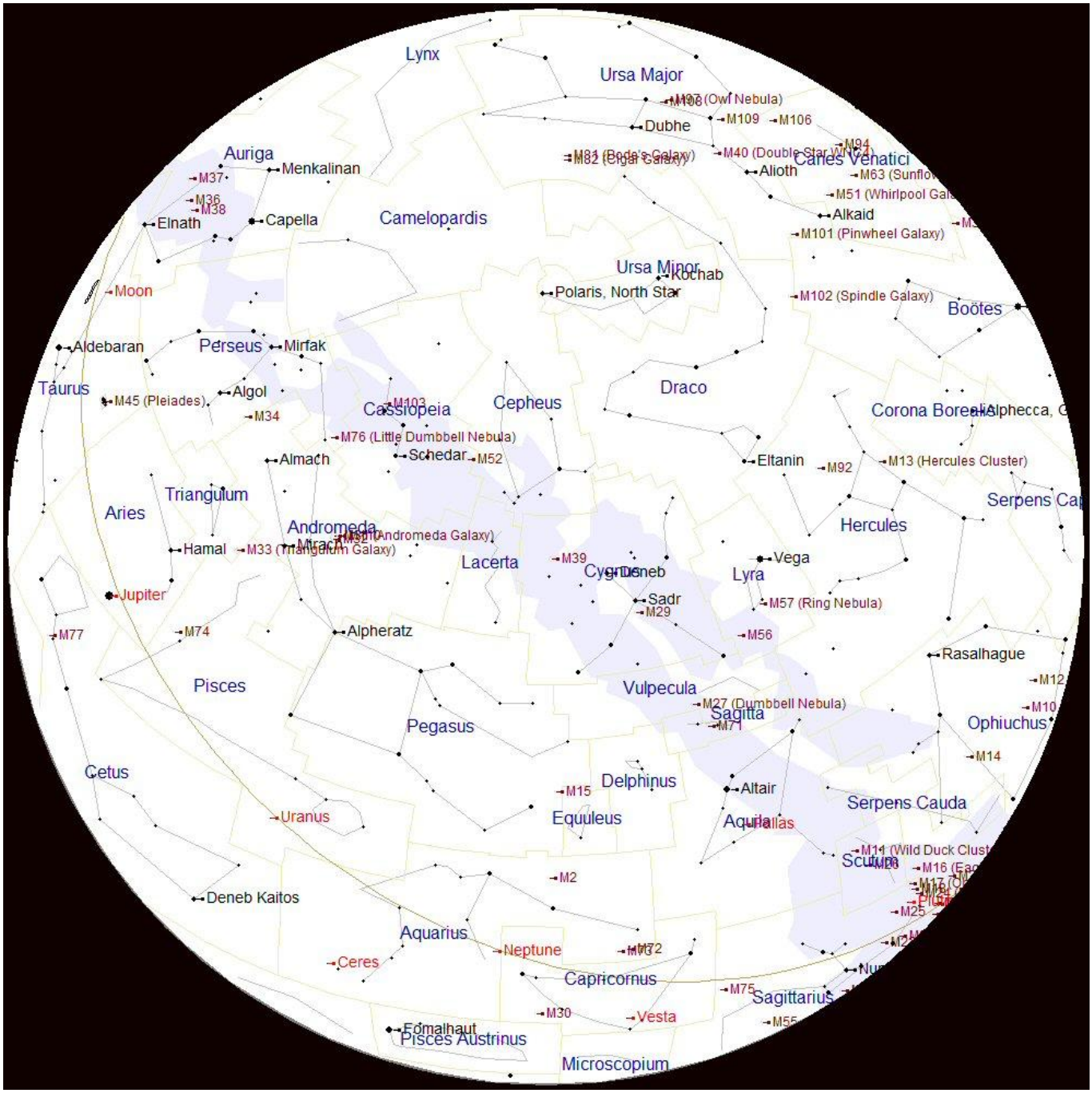
The Moon has been creeping along the southern horizon during early autumn but is now starting to move higher and into clearer air. The best time to observe the Moon is the periods from 'New Moon' through to just after 'First Quarter' (half Moon) [up until about 6th October] and from just before 'Last Quarter' [about 18th October] to the end of the phase. During the period 7th October to 17th October the Moon is too bright for telescopic observing. However this can be overcome by fitting a Moon Filter to the eyepiece being used. The filter will lessen the glare and improve the contrast and allow the Moon to be observed right through full Moon.



The Phases of the Moon this month

Most detailed views can be obtained when the feature to be studied is on or close to the 'Terminator'. The terminator is the boundary between the light side (daytime) and the dark side (night) on the Moon. The terminator is the position on the Moon surface where it is either sunrise or sunset. As on Earth shadows are longer at sunrise and sunset so objects close to the light side of the terminator are viewed in greater relief. Some of the most impressive views are where a mountain top on the edge of the Moon is still illuminated by the Sun while the bottom of the mountain is in shadow. . Craters can be seen much clearer when close to the terminator because the dark shadows show the features in almost 3D like relief.

THE SKY THIS MONTH



The chart above shows the night sky as it appears on 15th October at 9 o'clock in the evening 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 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.

Planets in the morning sky are: Mercury and Mars Planets in the night sky are: Jupiter, Uranus and Neptune.

The planets not visible this month are: Venus and Saturn