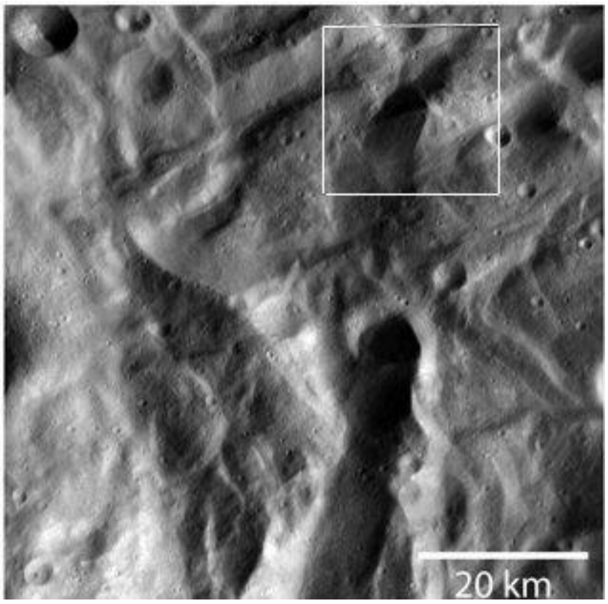
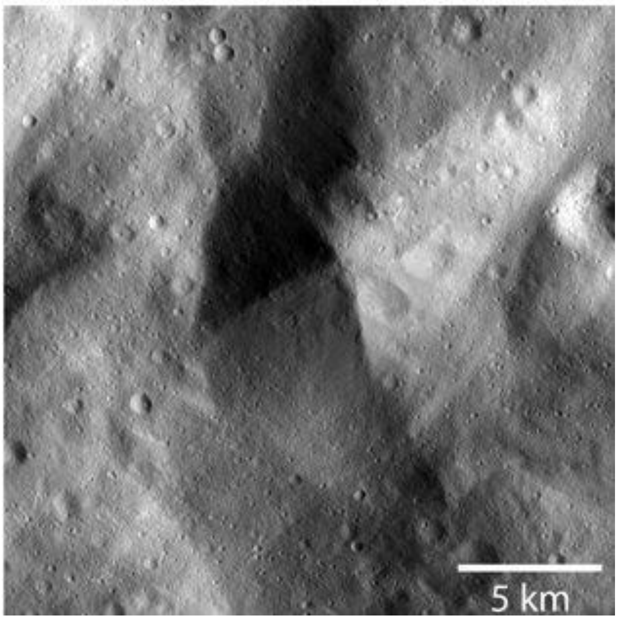
NEWBURY ASTRONOMICAL SOCIETY
BEGINNERS MAGAZINE - FEBRUARY 2012

LATEST IMAGES OF VESTA BY DAWN



High-Altitude Mapping Orbit (HAMO)

NASA's Dawn spacecraft has sent back the first images of the giant asteroid Vesta from its low-altitude mapping orbit. The images obtained by the framing camera show the stippled and lumpy surface. Images show detail never seen before adding to the curiosity of scientists who are studying Vesta for clues about the early history of the solar system.



Low-Altitude Mapping Orbit (LAMO)

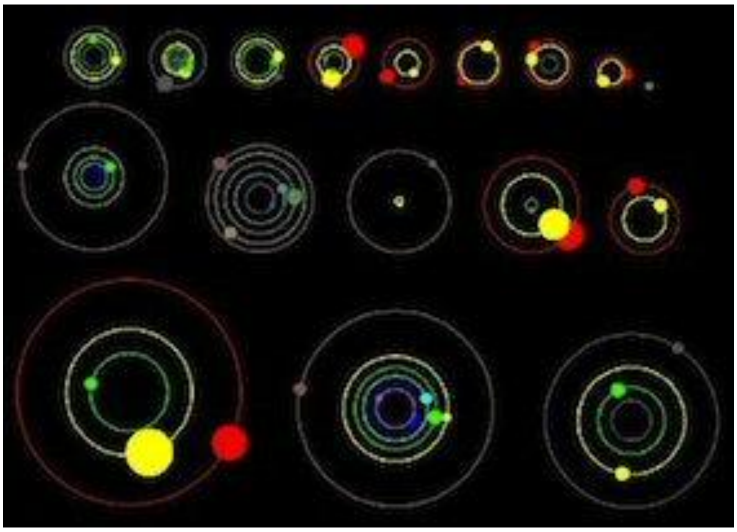
At this detailed resolution the surface shows abundant small craters and textures such as small grooves and lineaments that are reminiscent of the structures seen in low-resolution data from the higher-altitude orbits. This fine scale also highlights small outcrops of bright and dark material.

KEPLER DISCOVERS 26 NEW PLANETS

Scientists working on NASA's Kepler space telescope have announced that they have found 26 new planets orbiting 11 stars outside the solar system. The newly-discovered planets nearly double the number of confirmed planets detected by Kepler since its launch in 2009. The discovery also triples the number of stars known to harbour more than one planet.

The planet discoveries announced are all part of multi-world systems ranging in size from 1.5 times bigger than Earth to larger than Jupiter. One of the stars, named Kepler-33, has five planets slightly larger than Earth orbiting closer than Mercury to the sun. Ten of the 11 new planetary systems were identified with a new technique and without the aid of ground-based observatories which were previously necessary to verify candidate planets were real and not false positives. The observatory monitors the stars for dips in brightness an indication a planet could be passing in front of it.

Kepler is stationed in an Earth-trailing solar orbit and aims its one metre telescope toward the constellations of Cygnus and Lyra. It observes a 10-degree-wide field containing 4.5 million detectable stars. The telescope is focusing on approximately 156,000 stars for the purposes of its research. It can detect changes in the orbit of a planet due to the gravitational pull of neighbouring planets. The technique is called Transit Timing Variations or TTVs.



The image above shows an overhead view of the orbital positions of the planets in systems with multiple transiting planets discovered by NASA's Kepler mission. Image credit: NASA Ames/Dan Fabrycky, University of California, Santa Cruz

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THE NEXT NEWBURY BEGINNERS MEETING

15th February	Aurora Watch & Using a First Telescope
Website:	**www.naasbeginners.co.uk**

NEWBURY ASTRONOMICAL SOCIETY MEETING

2nd March	Recent amateur observations of Saturn
Website:	**www.newburyas.org.uk**

AURORA WATCH

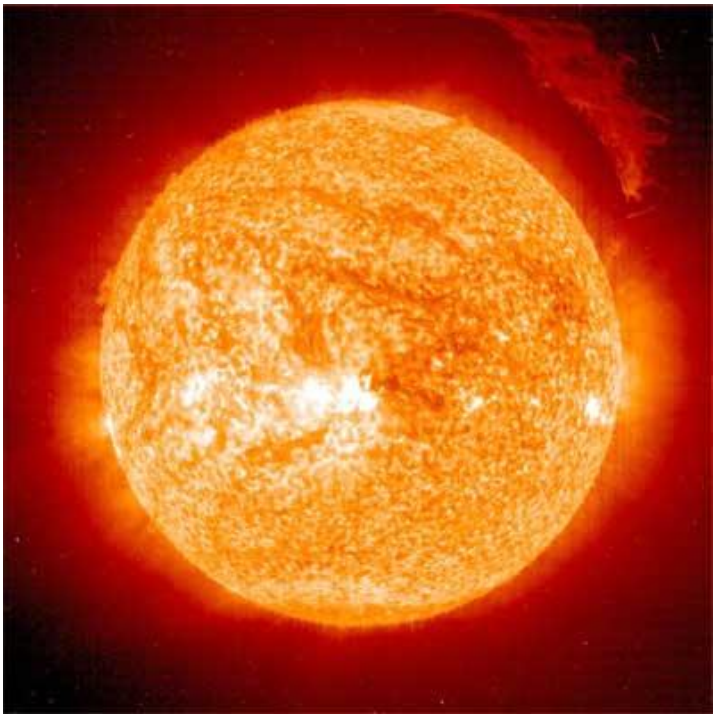
The aurora imaged by Richard Fleet in April 2000

The aurora is one of the most beautiful and mystical natural displays on Earth and people travel many hundreds or even thousands of miles to see it. The Aurora Borealis or the Northern Lights is the display seen in the northern hemisphere and the Aurora Australis is the southern counterpart. Aurorae (the plural of Aurora) appear as curtains of coloured light sweeping across the night sky. They occur in a circle centred on the north and south magnetic poles usually appearing at high and low latitudes around 1000 km from the poles. However at periods of high activity they can reach as far south of the north pole as central Europe and the southern equivalent.

The aurora develops when energetic particles ejected by the Sun interact with the atoms in Earth's atmosphere and cause the atoms to omit light at discrete wavelengths. Each element in the atmosphere (primarily Oxygen and Nitrogen) will therefore glow with a specific colour (red and green) the predominant colours seen in the aurora.

The Sun has an eleven year periodic cycle of increased activity caused by its magnetic field. The last period of maximum activity was around 2002 so the next maximum is due this year and through to 2013. As the Sun is made of gas, it is fluid and rotates faster at its equator than at the poles. Consequently the lines of magnetic force become tangled rather like a ball of string. After about 5 years the lines of magnetic force become so tangled they begin to break and cause intense turbulence on and above the surface. This causes Sun Spots and Coronal Mass Ejections (CME). CME's are like huge explosions that throw millions of tonnes of extremely hot and energetic particles off the Sun and into space.

The particles ejected from the Sun as a CME are thrown into space at speeds of up to 2 million miles per hour.

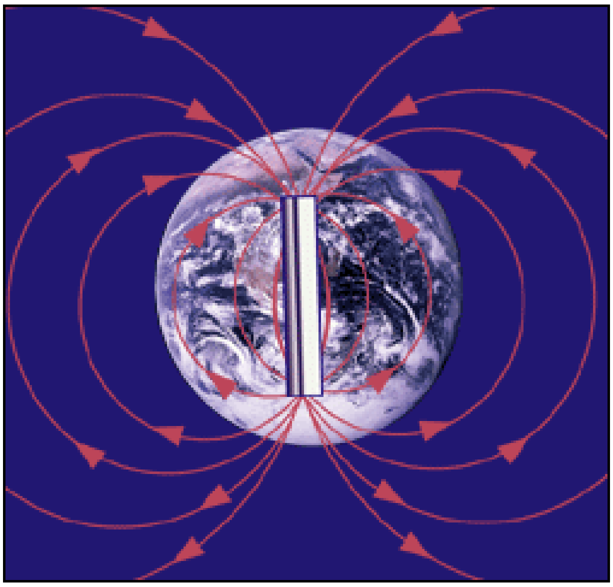


A Coronal Mass Ejection (CME) top right

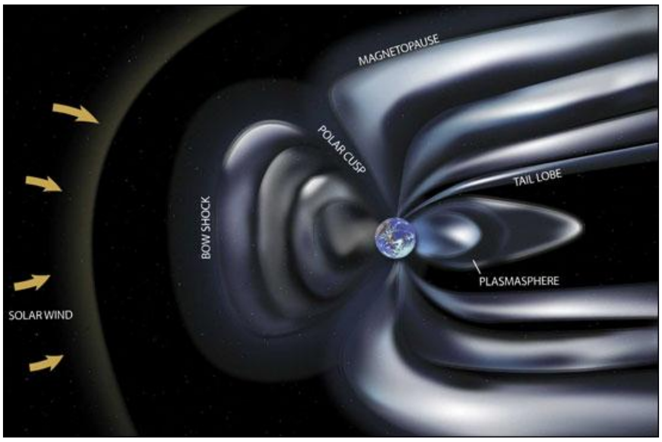
If the ejection occurs on the part of the Sun that is facing Earth then the cloud of hot particles will travel towards Earth and arrive in about two to three days.

The particles that make up a CME are so hot they become a special form of matter that is known as Plasma. The Sun's plasma is so hot that the most energetic charged particles can escape from the Sun's gravity and fly away out into space. We call this plasma the solar wind because it blows out away from the Sun and past the planets, interacting with their magnetic fields and atmosphere if they have one. Along with the solar wind comes the Sun's magnetic field, which reaches out to beyond the orbit of Neptune.

Fortunately for us, Earth has a strong magnetic field created by its massive Iron core. Just like the familiar Iron magnet Earth has a magnetic north and south pole. Lines of magnetic force extend out from the poles and loop around to link up with the other pole.



Charged particles and magnetic fields influence each other. The solar wind which is made up of charged particles blows past Earth's magnetosphere the shape of the magnetic field changes from the dipole magnetic field to a plasma-swept magnetosphere. This looks more like someone's hair that has been blown in the wind. The interaction between the Sun's plasma wind and Earth's magnetosphere is known as the Sun-Earth Connection.



The side of the magnetosphere getting hit by the solar wind is called the 'dayside magnetosphere' because it is facing the Sun. The part of the magnetosphere that stretches back as though it were streaming away from the Sun with the solar wind is called the magnetotail.

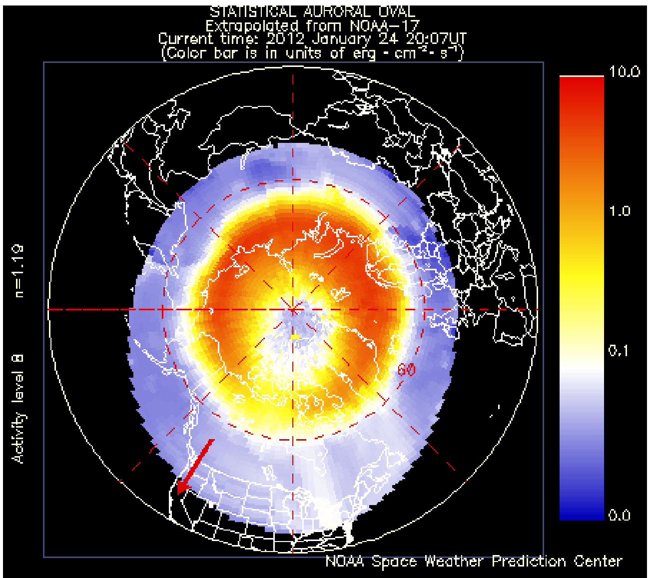
Following the arrival of a CME, a disturbance in space called a 'Geomagnetic Storm' can be triggered. These geomagnetic storms cause intense aurora displays that can sometimes be visible from the UK.

Although most of the plasma of the solar wind is diverted around the magnetosphere, geomagnetic storms can produce energetic particles inside the magnetosphere. These particles are diverted by the magnetic field around the magnetosphere and down towards Earth's poles.

When particles reach the top of the atmosphere they soon run into molecules in the air. The collision stops the incoming particle and causes the air molecule light up. The same system is used on a much smaller scale in a Cathode Ray Tube (CRT) television set. Here a beam of electrons from the back of the tube hits phosphorus on the inside of the screen and makes it light up. The light given off in the top of the atmosphere is visible from the ground if it is dark enough. The lights are known as the *aurora borealis* (northern lights) in the northern hemisphere and the *aurora australis* in the southern hemisphere.

When the solar wind is quiet and the magnetosphere is undisturbed, the aurora only occurs near the magnetic poles. Many people assume that you need to be near the pole to see an aurora but when the solar wind and the magnetosphere are disturbed the aurora can expand, brighten and move towards lower latitudes. The ring around the pole where an aurora may occur is called the *auroral oval*. Disruption from a coronal hole may cause the auroral oval to expand over the north of Europe. However a large CME can expand the auroral oval over the entire UK and even further towards the equator. These very rare events give the best chance of seeing an aurora over southern England.

The best way to see an aurora if it occurs is to watch the news and weather on the television. Even better is to regularly visit websites that monitor the activity of the Sun and give forecasts of the likelihood of seeing an aurora. One of the best websites is www.spaceweather.com.



A Spaceweather image showing aurora on 24th January

The image above shows the aurora activity on 23rd and 24th January 2012 when a large CME hit Earth. A good aurora display was seen in Scotland and North England.

OBSERVING WITH A TELESCOPE FOR THE FIRST TIME

The telescope referred to in this article – A Skywatcher Startravel 102.

First and very important is to dress to keep warm even on a mild night. The cold can soon begin to spoil the evening if it is not kept out from the start.

If possible the telescope should be set up on a paved area as this prevents the tripod legs sinking into soft ground and avoids slipping in the dark. It would also be preferable to have the telescope overlooking a grassed area because there will be less heat turbulence from the grass. The edge of a patio or on a path would be a good position.

Brick walls and buildings close to the observing position can retain heat from sunshine during the day and cause heat convection currents in the cold night air. Moving air currents can cause shimmering and degradation of the image.

Avoid lights that shine directly on to the observing position especially from the south. If there are unavoidable lights then set up a screen using canes and sheets or towels to prevent the light shining directly into the observer's eyes.

Set up at least 30 minutes before the intended observing start time. This gives the telescope time to cool down to the ambient temperature and produce good images.

Keep the dust cover on the telescope until it is time to start observing. It will help to avoid dew forming on the lens of a refracting, Schmidt-Cassegrain or Maksutov telescope.

Make sure all the equipment that might be needed is to hand before starting. This is to avoid going indoors and spoiling the night vision. It takes about 20 minutes for our eyes to fully adapt to the dark but less than a second to lose it.

If a star chart is to be used only use a fairly dim red light or else the long sought after full dark adaptation could be lost.

If possible use a chair at the telescope it is more comfortable and steady. It is more difficult to stand still to look through the eyepiece than it is to sit still especially for prolonged periods.

It is useful to make an observing plan before starting to observe. Notes of what is intended to be observed can be in the form of written notes or as a chart with notes. This avoids trying to think about what to look at next. This will not be necessary if it is planned to observe the Moon or one of the planets. It is well worth getting a planetarium application for your computer to check out what is available to look at from night to night.

Now it is time to think about setting the telescope up ready for observing. In the previous column it was suggested that the telescope is set up about 30 minutes before stating serious observing. This means it should be put outside at least even if not set up correctly at that time. It takes this time for the telescope to cool down to the ambient temperature outside. Differential temperatures can cause degradation of the image and the telescope will not perform as well as when it has acclimatised.

Detailed setting up procedure was discussed in the Previous issue of this magazine so it is assumed that this has already been done. However some setting up is required every time before starting to observe. The two basic setting up operations are aligning and levelling the telescope assembly. If simple optical observing is to be carried out, approximate levelling and alignment will be good enough. If astro-imaging is to be attempted more accuracy will be required and this will be covered in later articles.

First we must check the alignment of the finder. Fit a low power eyepiece (20mm or 25mm) into the focuser unit. Locate a bright star or planet and aim the telescope at this object. Look along the telescope tube, release the clutches and roughly align the telescope on the object. Gently move the telescope around while looking through the eyepiece until the object appears. Lock the telescope clutches. Use the slow motion drives to centralise the object in the eyepiece. Look through the finder and use the adjusting screws to centralise the object. Re-centralise the object in the main telescope and adjust to centralise in the finder again. When alignment is complete the finder is ready to use.

Alignment can be carried out using a magnetic compass or position the telescope so that the Right Ascension (RA) axis of the mounting is pointing approximately towards the Pole Star – Polaris (See Page 8 to find the location of Polaris). Levelling can be achieved using a bubble level gauge placed on the tripod leg spreader or other flat surface on the assembly. Raise the tripod legs to the required height. Place the bubble level gauge in position in a north / south alignment. Adjust the legs until the bubble is centralised. Reposition the bubble level gauge east / west and adjust the legs. Repeat until level is achieved.

For very approximate alignment (if no drive motors are fitted) a compass can be used to check the polar alignment. Loosen the hand-nut that secures the mounting to the tripod (see the image in the next column). Rotate the mounting until the RA axis is aligned with the north point of the compass needle. Re-tighten the hand-nut that secures the mounting to the tripod. Any misalignment can be compensated for using the drive knobs when tracking an object as it appears to move across the field of view.

Finer alignment can be achieved by carefully aligning the telescope on Polaris. The mount must first be levelled. Check that the RA angle adjustor is correctly aligned on 51.5°.

The RA angle adjustment mechanism on an EQ1 Mount

With the telescope tube pointing south (align with the compass) lower the telescope tube until it looks level with the ground. Position a bubble level gauge on top of the tube (it can be secured using elastic bands, Velcro or adhesive tape). Adjust the telescope tube until it is horizontal as shown by the bubble being central in the gauge and lock the Dec. Check the Declination (Dec) dial and confirm that 38.5° is aligned with the indicator pointer. Release the Dec lock and raise the telescope tube until 90° is indicated on the dial. Look through the finder (which is now rather inconveniently up-side-down) and Polaris should be positioned in the view of the finder.

The Declination (Dec) Indicator Barrel

The telescope pointed at Polaris and with diagonal rotated

NOTE The setting angle of 38.5° is the latitude setting for Newbury UK (51.4° rounded t0 51.5°) subtracted from 90° to give the angle between our horizon and Celestial Equator. This angle is actually -38.6° below the celestial Equator and where our telescope tube should be horizontal.

Centralise Polaris in the finder as follows: Loosen the hand-nut that secures the mounting to the tripod (see the picture below). Rotate the mounting until the Polaris is centralised east / west. Re-tighten the hand-nut that secures the mounting to the tripod.

The mounting securing hand nut

Loosen the locking device on the RA angle adjustment mechanism (this may be a clamp or a 'lock-nut' on the adjusting screws (see the picture in the previous column). Screw the adjusting screws in or out to raise or lower the RA until Polaris is centralised north / south then lock RA adjuster. (This may be necessary if the RA dial is not very accurate.)

Support the Diagonal (the 90° mirror on the focuser) and loosen the securing screws. Rotate the diagonal through 180° and tighten the securing screws (See the image at the top of this column). This will allow the focuser to be accessed and fit a low power eyepiece (20mm or 25mm) into the focuser. Polaris should be in the field of view. Finer alignment adjustment can be made by centralising Polaris in the field of view of the eyepiece by repeating the adjustments outlined using the finder but this should not be necessary for optical observing. Return the telescope tube to face south and remove the bubble levelling gauge.

For the first observing session it is a good idea to start with Moon if it is around. It is large and bright and is therefore easy to find. The Moon may well be out of focus and may even be so far out of focus that appears as just a bright light. Rotate the focuser knob in one direction and then the other until the Moon appears clearer.

The focusing unit showing adjusting Knobs

Look at it for a few seconds then make small adjustments to the focus until it is perfectly clear. It will be necessary to adjust the RA drive every few minutes to bring the Moon back into the field of view. It will move quite quickly across the field of view due to the rotation of Earth on its axis. The Moon is very bright especially if it is between half and full. To lessen the glare it is possible to cut down the amount of light entering some telescopes by fitting the dust cover and removing the small cap to allow a less light to enter the telescope.

The Dust Cap fitted but with the small cap removed

Once the focuser adjustment has been completed have a good look at the Moon and the many features it has on view. Look especially near the 'Terminator' the dividing line between the light (daytime) side and the dark (night) side. Here the shadows are long and pronounced because it is sunset or sunrise. This makes features like craters and mountains stand out with greater relief and look almost three dimensional.

Use the RA and Dec knobs to move the image around the field of view to get used to the way the telescope is moved. Move the Moon out of view then use the finder to re-centralise it.

When a little experience has been gained in moving the telescope around it is time to 'up' the magnification. Using the RA drive move the Moon back across the field of view so it can drift across the full field of view. Carefully release and remove the low power eyepiece and fit a higher power (10mm). Look into the eyepiece and re-focus if necessary. The objects in the field of view will now appear twice as large and more detail will be seen.

The disadvantages are: the Moon will appear to wobble more and it will move twice as fast across the field of view. We can't do anything about the wobble due to the movement of air in our atmosphere but we can help. To lessen the wobble of the telescope use this technique to track the feature as it moves across the field of view. Move the feature as far as possible to the side where it starts the drift and let it drift right across without touching the telescope until it reaches the other side. This stops much of the wobble created by the observer.

Another hint here is: put the eyepiece that is not being used in your pocket, preferably a trouser pocket to keep it warm. This helps to stop condensation forming on the lens when you next use it.

The next objects to look out for are the planets. Jupiter, Venus, Mars and Saturn are the easiest to find and the most spectacular. They are also perfect for aligning the finder. Jupiter is the best for detail, it is large (for a planet) and colours can be seen in the cloud belts. The four bright moons can be seen to move noticeably during one observing session. Saturn is impressive because of its magnificent ring system. The rings will be visible using a 90mm telescope and possibly a 70mm telescope with a focal length longer than 700mm.

Venus is very bright and easy to find but the view of the surface of this white cloud covered planet is bland. To make up for this Venus does show phases much like our Moon. When it first appears in the evening sky it is difficult to observe because it is close to the Sun and close to the western horizon. At this time the planet is on the other side of the Sun to us and therefore appears small but displays a nearly full disc. Venus gradually moves further out from the Sun and begins to catch up with Earth. The size of Venus appears to grow as it gets closer but its phase narrows. Eventually it moves back towards the Sun as it begins its pass between Earth and the Sun to reappear as a morning object. At this time it is at its largest apparent diameter and its narrowest crescent phase. As a morning object it then becomes smaller and the crescent shape widens until it appears almost full as it moves back around the far side of the Sun.

Mars is quite small compared to Venus and Jupiter and appears about the same size as Saturn. It can appear quite a lot larger when Earth and Mars are at their closest approach. They were last at the closest point in their orbits in 2003 but will not be at their closest again until about 2019. This year as we pass Mars we will be almost as far as possible apart so Mars will appear quite small even at closest approach in March.

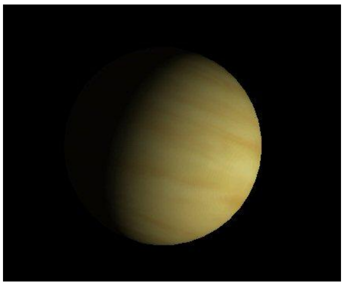
The outer planets Uranus and Neptune are quite difficult to find but it is possible to see Uranus in a 100mm telescope and Neptune in a 120mm. However they appear as rather fuzzy blue stars.

The technique used to find planets is similar to finding the Moon. Use the finder and a 20mm to 25mm eyepiece to initially find the planet. Then change to a 10mm or less eyepiece to see more detail. If supplied remove the 10mm eyepiece and fit a Barlow into the focuser. Insert the 10mm eyepiece into the Barlow and re-focus. This effectively doubles the eyepiece magnification.

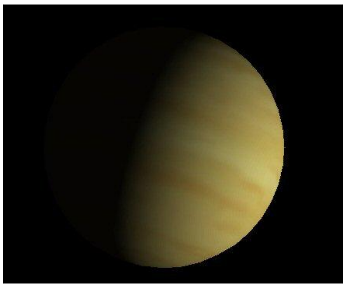
THE SOLAR SYSTEM THIS MONTH

MERCURY rises at 07:45 on 1st February, 07:40 on 15th and 07:24 on 30th it will be visible low in the south west just before sunset later in the month. It will reach superior conjunction on 7th February then move eastward away from the Sun. It will be observable in the last week of February close to the western horizon. Mercury will be difficult to see and will need a clear view to the south western horizon.

VENUS rises over the eastern horizon at about 09:00 on 1st February, 08:30 on 15th and 08:08 on 30th and will be observable in the south west at sunset this month. It will be very bright at magnitude -4.2 and high in the south western sky. Seen through a telescope its waning phase will be changing from 'three quarter full' to half full. Although the phase will be getting narrower the brightness will remain about the same. This is because Venus is approaching us on Earth and therefore appears to be getting bigger. Through the month it will increase in size from 15 arc-seconds to 17.7 arc-seconds. Venus can look very bright through a telescope so it is worth fitting the dust cover to the telescope and removing the small cap to reduce the glare and to get a better image.

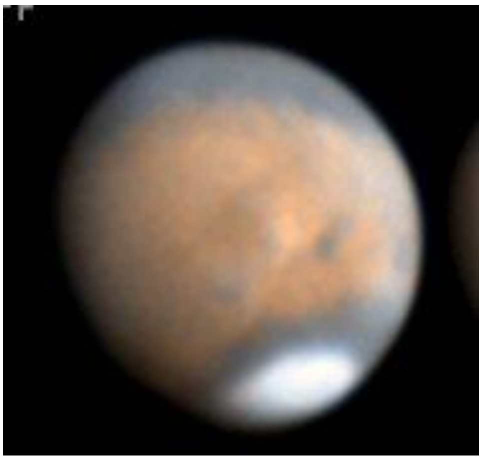


Venus on 1st February



Venus on 29th February

MARS rises at 19:58 on 1st February, 19:05 on 15th and 18:05 on 30th. It is still only 13 arc-seconds in diameter and therefore appears quite small even in a larger telescope. It is observable after about 22:00 in the constellation of Leo. It is just about big enough now to show some detail on the surface and the south pole ice cap is quite easy to make out. Mars will be at opposition on 3rd March. This means Earth will be overtaking Mars and Mars will be at its closest approach to Earth. As the orbit of Mars and Earth are elliptical the Earth distance varies from one approach to another. In the 2003 approach Earth was at its furthest out from the Sun in its orbit. Mars however was at its nearest to the Sun position. Therefore the two planets were at their closest to each other. In 2003 the two planets were only 35 million miles apart. This year they are more like 60 million miles so Mars will look a lot smaller than it did in 2003 when it was 25.1 arc-seconds.



Mars imaged by Damian Peach 23rd November 2011

JUPITER rises at 10:00 on 1st February, 09:25 on 15th and 08:50 on 30th. It will be high the south west at sunset and close to Venus. Jupiter will be observable in the constellation of Aries until about 23:00 when it sets over the western horizon. The giant planet is now past its best for this year but is still well worth having a look at. The image below shows Jupiter with the moon Io which had just crossed the face of Jupiter in a 'Transit'. Io's shadow can be seen in transit producing an eclipse on the clouds tops. This image was taken using a simple web camera attached to a Meade telescope.

Jupiter and moon Io imaged on 15th January 2012

SATURN rises at 23:33 on 1st February, 22:50 on 15th and 22:15 on 30th so it will be observable to the early riser in the east close to the bright star Spica in the constellation of Virgo.

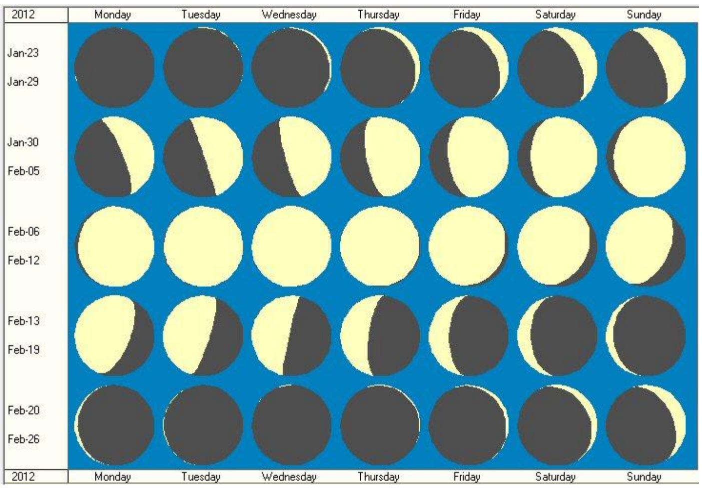
URANUS rises at 08:26 and will be observable as soon as it is dark until about 20:30 this month when it sets in the west. A telescope will show Uranus looking like a rather fuzzy blue tinted star in the constellation of Pisces.

NEPTUNE rises at 07:29 and is no longer observable.

THE SUN

There is plenty of activity on the Sun with a good measure of sunspots and prominences.

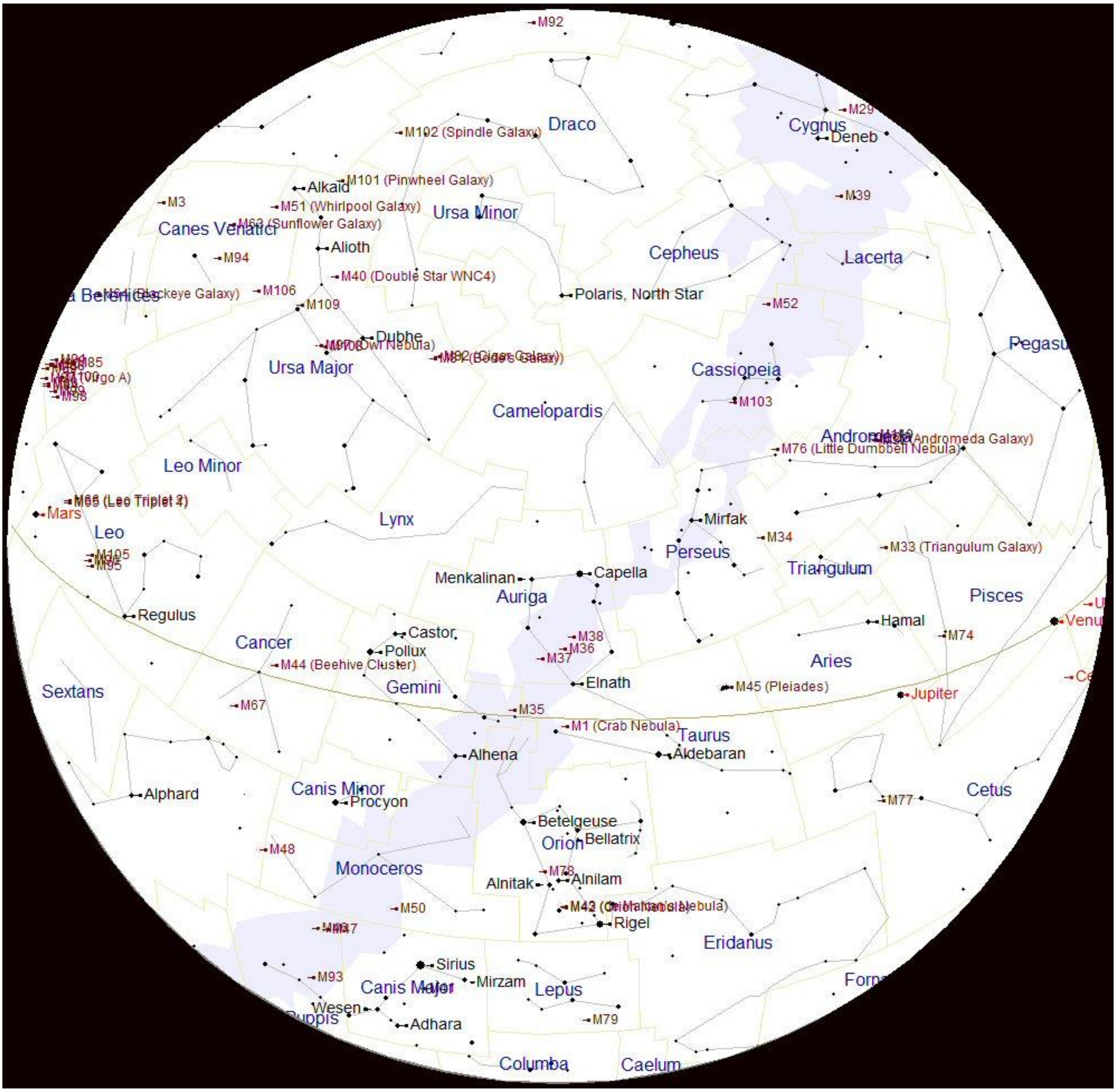
THE MOON's PHASES THIS MONTH



METEORS SHOWERS

There are no meteor showers this month.

THE NIGHT SKY THIS MONTH



The chart above shows the night sky as it appears on 15th February at 9 o'clock in the evening 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. 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 in the north east. Look for the distinctive saucepan shape, four stars forming the bowl and three stars forming the handle. Follow an imaginary line, up from the two stars in the bowl furthest from the handle. These will point the way to Polaris which will be to the north of overhead at about 50º above the northern horizon. Polaris is the only moderately bright star in a fairly empty patch of sky. When you have found Polaris turn completely around and you will be facing south. To use this chart, position yourself looking south and hold the chart above your eyes.