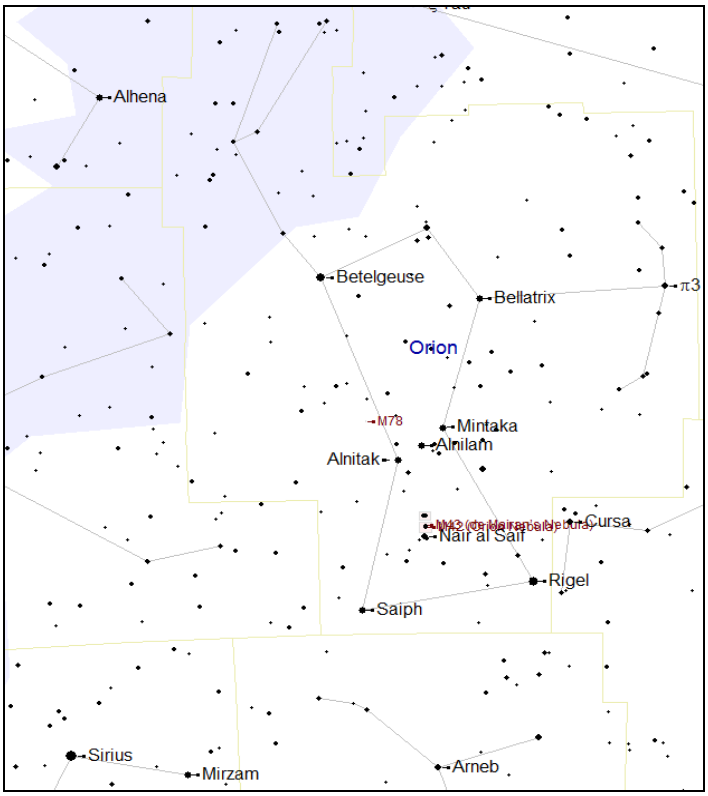
NEWBURY ASTRONOMICAL SOCIETY
BEGINNERS SECTION MAGAZINE – JANUARY 2011

ORION AND CANIS MAJOR



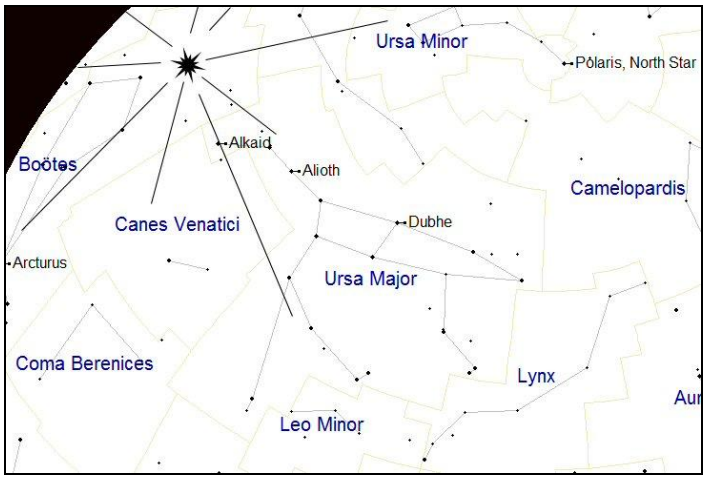
Beginning to move into the night sky from the east is the constellation of Orion (The Hunter). Orion will dominate the southern sky during January, February and March. Orion is featured on page 3 but the bright star to his lower left is his large hunting dog called Sirius which is also a very interesting star.

To find Sirius, follow the line of Orion's belt down for about six belt lengths and you will find a bright flashing star; this is Sirius. Sirius is the closest star that we can see from Britain, only 9 light years away, and is therefore our brightest star. It is a large hot white star but with a white dwarf companion. The White Dwarf, known as Sirius B, is the remains of a star like our Sun or perhaps a little larger. It has passed through the aging process described on page 3 referring to the fate of Betelgeuse in Orion.

After passing through the red giant phase Sirius B had lost some of its mass when its outer layers were blown away to form a Planetary Nebula. This is the cloud of gas seen around a dying star like the one we see around M57, the Ring Nebula in Lyra. The Hydrogen fuel at the core had run out and the nuclear reactions that had powered the star stopped. Sirius B could not resist the forces of its own gravity and it collapsed. Although now only the size of Earth Sirius B weighs as much as a star and is therefore very dense. A cubic centimetre of material from Sirius B may weigh many thousands of tonnes. It has become a white hot, super heavy, fast spinning cinder.

Sirius B was not detected directly because it is very small and its light is drowned out by Sirius A. Its mass causes Sirius A to wobble and this is what gave its presence away. Because Sirius A and Sirius B have about the same mass they appear to rotate about their common centre of gravity and this causes both stars to wobble against the background stars.

QUADRANTID METEOR SHOWER



The radiant point of the Quadrantid shower

At the very beginning of this month, between 1st and 6th January, there will be a meteor shower known as the Quadrantids. The best time to watch for the meteors will be in the evening of 4th and the morning of 5th January when the shower should be at its peak. However some meteors should be visible all night. The Moon will be a thin crescent and should not spoil the view.

The origin of the Quadrantid meteor shower was unknown until Dec. 2003 when Peter Jenniskens of the NASA Ames Research Centre found evidence that Quadrantid meteoroids come from 2003 EH1, an asteroid that is probably a piece of a comet that broke apart some 500 years ago. Earth intersects the orbit of 2003 EH1 at a perpendicular angle which means we quickly move through any debris. That is why the shower is so brief.

Quadrantid meteors take their name from an obsolete constellation, *Quadrans Muralis*, found in early 19th-century star atlases located between Draco, Hercules, and Boötes. It was removed, along with a few other constellations, from crowded sky maps in 1922 when the International Astronomical Union adopted the modern list of 88 officially-recognised constellations. The Quadrantids were "re-zoned" to Boötes after Quadrans Muralis disappeared but kept their name, possibly because another January shower was already widely-known to meteor watchers as the 'Boötids'.

Weather permitting, the Quadrantid shower looks 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 80 per hour if we are lucky.

THE NEXT BEGINNERS MEETING

19th January Double and multiple stars

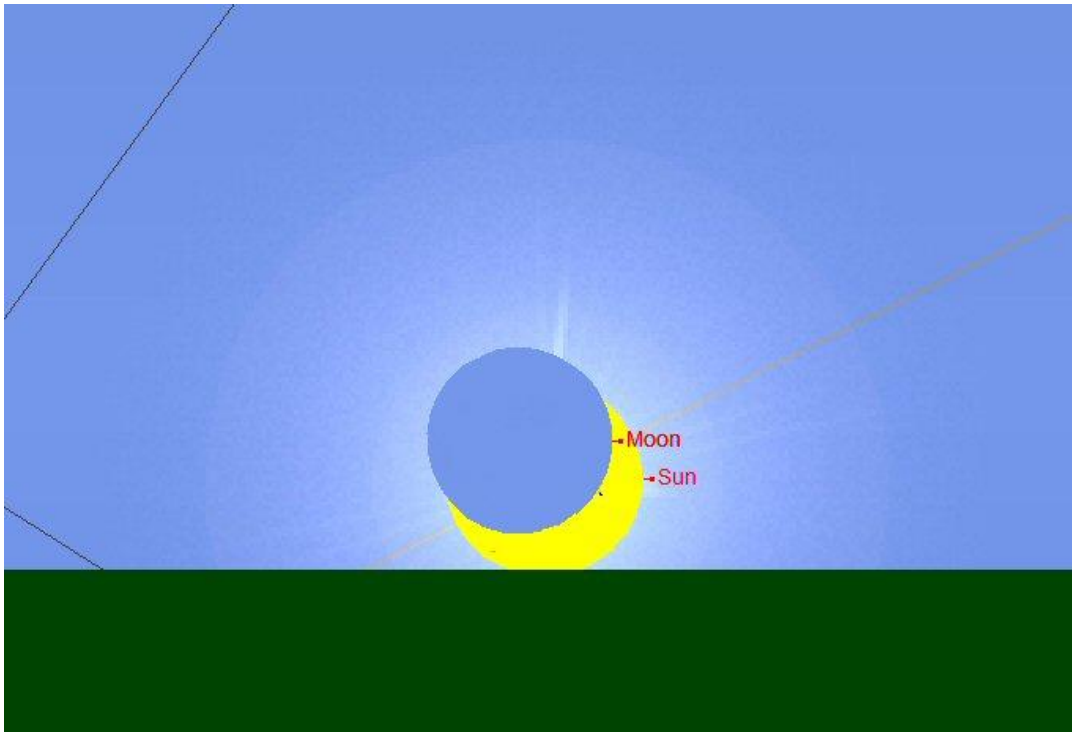
Website: **www.naasbeginners.co.uk**

NEWBURY ASTRONOMICAL SOCIETY MEETING

7th January The view from Saturn - Cassini

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

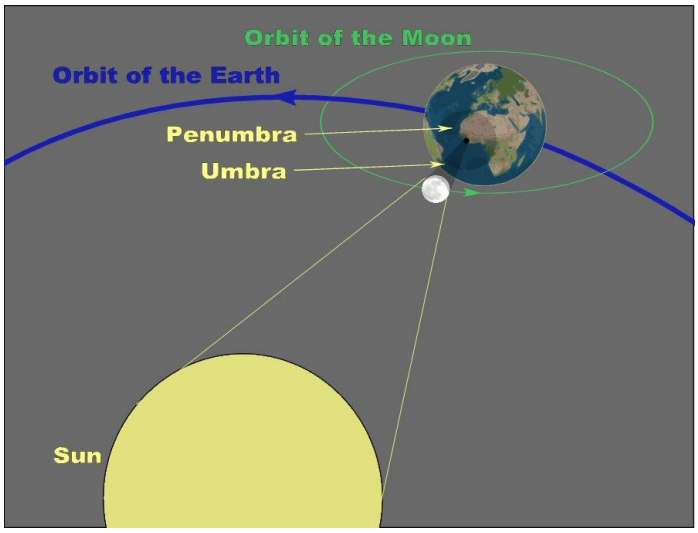
THE SOLAR ECLIPSE 4th JANUARY 2011



The partial eclipse as it may be seen when the Sun rises over the eastern horizon

In the early morning of Tuesday 4th January there will be a partial eclipse of the Sun at sunrise. It will require a clear view to the eastern horizon and a clear sky to see. The Sun will rise 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 above. The Moon will then slowly move away from the Sun.

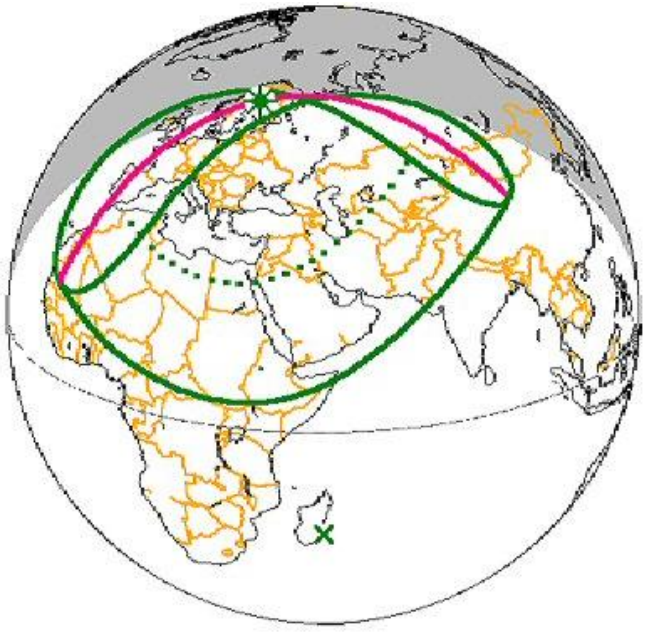
As the Moon passes between Earth and the Sun the Moon will cast its shadow on to the surface of Earth. By coincidence the diameters of the Moon and the Sun appear to be about the same size when viewed from Earth. The diameter of the Sun is about 400 times that of the Moon but the Moon is about 400 times closer so the two bodies appear the same size to us on Earth. The rays of light from the Sun (which is much larger than the Moon) that are blocked by the Moon form a conical shadow with its apex touching Earth. This creates the darkest central part of the shadow called the Umbra where there will be a total eclipse.



The formation of the eclipse shadow

Around the Umbra is a lighter shadow called the Penumbra. Here the Sun is not completely covered by the Moon. Within the Penumbra only a partial eclipse will be seen. This eclipse will not be total anywhere in the world so what we may see from southern England will be about as good as it will get.

The best possible place to see the eclipse will be in Norway but it will still be partial and occur at sunrise. The chart below shows the extent of the eclipse and the path of greatest cover as the red line. It can be seen that the line does cross southern England.



The path of the partial eclipse

A special solar filter must be fitted to a telescope to view the eclipse, 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.

THE ORION NEBULA - BIRTHPLACE OF STARS

The constellation of Orion (The Hunter)

ORION is the most beautiful and one of the most interesting of all the constellations. During January, February and March it dominates the southern sky. Orion is named after a hunter in Greek mythology. In the image above, his skirt-like tunic is tied with a belt formed by three stars. A sword hangs from his belt and a club is held above his head with a shield in his other hand. Most of Orion's stars are actually grouped together. They are largely comprised of young stars formed from clouds of gas and dust distributed over the whole area of Orion. This area is like a stellar nursery about 1,300 light years from us. Some stars in Orion are very interesting.

BETELGEUSE is the bright red star at the upper left (left shoulder) of Orion. It is not a true member of the Orion group, being 470 light years away but just happens to be in the same line of sight. Betelgeuse is a Red Giant star about 900 times the diameter of our sun and appears distinctly orange, even to the naked eye. It is so large that the orbits of all our planets out to and possibly beyond Mars would fit inside it. Betelgeuse is a star coming to the end of its life and has become bloated and unstable so that it wobbles and pulsates like a water filled balloon. Having used up most of its Hydrogen fuel it struggles to continue its existence. Eventually in a few million years time it will finish its phase as a red giant and collapse into a White Dwarf (see the article about Sirius on page 1). During this process the outer regions of the star will become tenuous and eventually will be blown away into space to become a beautiful Planetary Nebula. At the same time the Hydrogen fuel that has powered Betelgeuse for millions of years will run out and energy production in the core will cease. Without the energy from the core pushing outwards the force of gravity pulling inwards will cause the remains of the star to be forced inwards and it will collapse to form a White Dwarf. It will still have the mass of a star but will be crushed down to the diameter of our planet Earth.

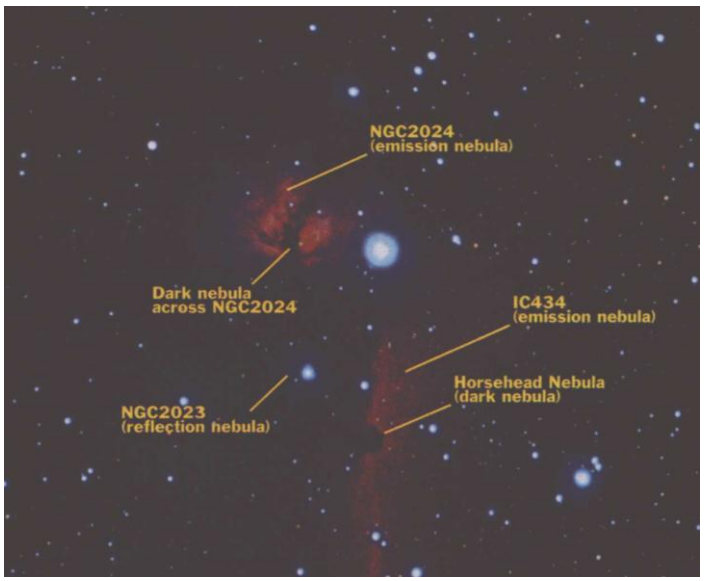
RIGEL is the bright white star at the bottom right of the figure of Orion. It is another giant star but is a very different giant to Betelgeuse. It is a young B type star about 50 times more massive than our Sun. With a surface temperature of about 9,000^{o}C and an absolute magnitude of -8.2 it is 60,000 times brighter than our Sun. It is a giant blue / white star which, because of its huge mass and strong gravity, is consuming its Hydrogen fuel at a ferocious rate so that it has become hyperactive. Rigel will be short lived and burn itself out very quickly, probably in just a few million years. It almost certainly will not develop into a red giant like Betelgeuse but end its life by destroying itself in a massive explosion. Rigel is so massive that it will be able to process the Helium produced from the fusion of Hydrogen in its core into heavier elements. It will create a layered core of all the heavier elements up to Iron. When a central core of Iron has been produced the star will explode and destroy itself in a Supernova collapse. At this moment all the elements heavier than Iron are created. Rigel is in fact the largest of a group of five stars, all orbiting each other. The stars in the Rigel system are true members of Orion and are 1,300 light years away.

THE GREAT ORION NEBULA. Below the line of three stars of Orion's belt there is a vertical line of stars forming his sword (hanging below his belt). In the line of stars making up Orion's sword a hazy patch can be seen with binoculars or even with just the naked eye on a clear night. The hazy patch is known as M42 (Messier 42), The Great Orion Nebula. This Nebula is a gigantic cloud of Hydrogen gas mixed with other gases and dust from which new stars are being formed. Through a pair of binoculars the nebula looks like a small fuzzy patch in the line of stars. Seen through a telescope the cloud like structure can been made out. Swirls of gas and dust can be seen, some are lit up but some are dark and silhouetted against the illuminated clouds behind. The cloud is actually illuminated by the young stars forming in it. Most of the energy illuminating this nebula comes from a group of 4 stars known as the Trapezium. These stars have formed out of the gas and dust in the nebula; they are young, hot and very active.

M42, The Great Orion Nebula, as seen in a telescope

Much of the gas and dust in the nebula shines by reflecting light from the very young stars of the Trapezium in the centre of the nebula. Some gas also produces its own light because the radiation energy from the powerful young stars excites the gas atoms causing them to glow somewhat like a fluorescent light.

When a photon of ultraviolet light from the powerful young stars hits a gas atom it causes an electron to jump from its normal orbit to a higher orbit. After a short time the electron jumps back to its original orbit and emits a flash of light. The colour of this light is unique to the type of atom that has emitted it. For example Hydrogen always emits red light.



Some of the different types of nebula in Orion

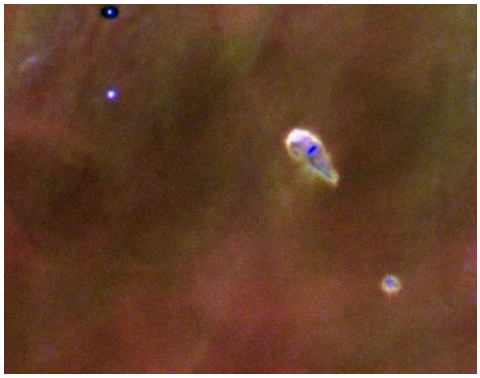
The Trapezium is a group of four very powerful young stars and smaller stars that produce most of the radiation to illuminate the nebula and is located in the bright area at the centre of the picture opposite. A small telescope will show the Trapezium as a small square of stars and will show some of the detail in the cloud. A larger telescope will bring out more of the detail in the cloud.

The Trapezium cluster superimposed on M42

M42 is the most is the most prominent Nebula in Orion but the whole area in and around Orion is full of vast gas clouds. Some of these clouds are illuminated by stars forming within them but there are huge areas where the gas is not illuminated and is therefore dark and mainly invisible. The most famous 'dark' nebula in Orion is the Horse Head Nebula shown below silhouetted against the illuminated gas behind. The Horse Head is not in M42 and is located close to the left (lower) star of Orion's belt. It is almost impossible to see visually.

The dark Horse Head Nebula

Within M42 the Hubble Space Telescope has imaged 'doughnut' shaped structures that have been identified as stars in the earliest stages of formation; these are called proto-stars.



Proto star discs seen in M42 by the HST

THE SOLAR SYSTEM THIS MONTH

MERCURY rises in the south east about an hour before the Sun at the beginning of the month and moves closer to the Sun as the month progresses. However it will be too close to the Sun and the 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. A telescope will show its crescent shaped phases.

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

JUPITER is still in a very good position in the south west as the sky darkens but it will be setting in the west at about 21:00. 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 (in transit) it may cast its shadow on the surface of Jupiter producing an eclipse shadow. The chart below shows the approximate positions of the four moons **I**o, **E**uropa, **G**anymede and **C**allisto at around 20:00 (8 o'clock) throughout the month of January. The highlighted dates indicate eclipses during the evening. There may be occasions however when the moons may pass through Jupiter's shadow and not be visible.

1	G• E• I• C• ●J
2	C• G• E• ●J I•
3	C• J● •I G• E•
4	C• •I J● •E G•
5	C• •E J● •I G•
6	C• •I J● •E •G
7	C• •G J● •I E•
8	•G C• •E •I J●
9	G• C• •E J● •I
10	I•●J •G •C •E
11	I• ●J •E •G C•
12	E• ●J •I •G C•
13	I• ●J•E •G C•
14	G• ●J •I •E C•
15	G• I• •E ●J C•
16	G• •E ●J •I C•
17	C• I•●J •E G•
18	C• •E ●J •I G•
19	C• E• ●J •I •G
20	C• I• E•●J •G
21	C• G• ●J •I E•
22	C• G• I• E• ●J
23	C• G• E• ●J I•
24	C• I• •G ●J E•
25	C• ●J •I •E •G
26	•E C• J●•I •G
27	E• •I ●J •C G•
28	•G ●J •I E• C•
29	•G •I J●•E C•
30	•G E• ●J •I C•
31	G••I ●J •E C•

SATURN rises over the eastern horizon at about 01:00 in the beginning of the month and 23:00 at the end of the month. It will be well positioned due south at 06:00 by mid month. The rings are opening out now after being closed up and almost disappearing last year. Saturn will be looking much more like we expect when it is in a better position in spring next year.

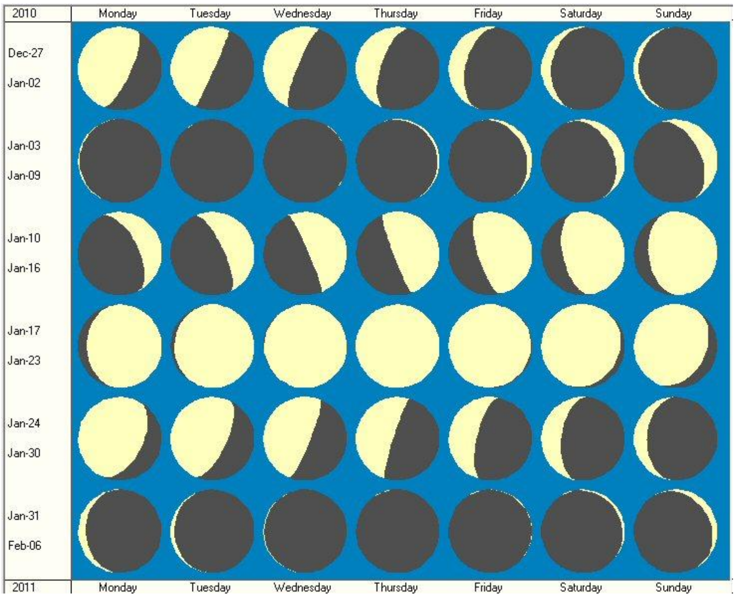
URANUS is just to the west (right) of Jupiter throughout the month and is in a very good position to make it easy to find in a 100mm to 150mm telescope.

NEPTUNE is in a good position this month and can be found perhaps with some difficulty in the south west during early evening.

METEORS. There is a meteor shower at the beginning of this month known as the Quadrantids. It will be active between 1^{st} and 6^{th} January. The best time to watch for the meteors will be in the evening of 4^{th} and the morning of 5^{th} January when the shower should be at its peak. See page 1 for more details.

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.

The phases of the Moon in January 2011:



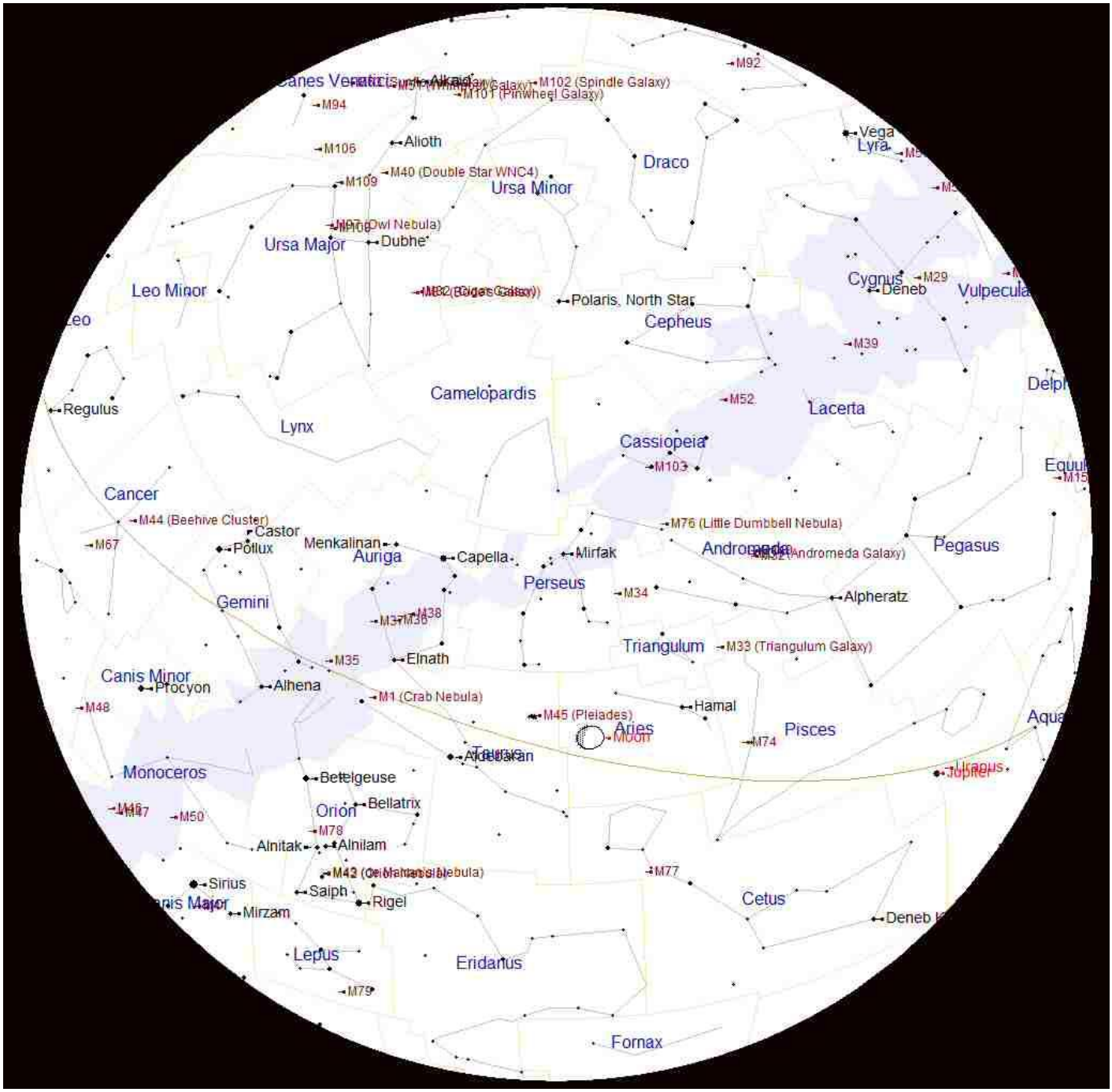
THE SUN has an eleven year cycle of increasing sunspot activity. The period of maximum activity has been very sparse until a few months ago. However a number of large spots appeared during December 2010.

Sunspots imaged on 5^{th} December by Steve Harris

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.

THE SKY THIS MONTH



The chart above shows the night sky as it appears on 15th January 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 north eastern 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.