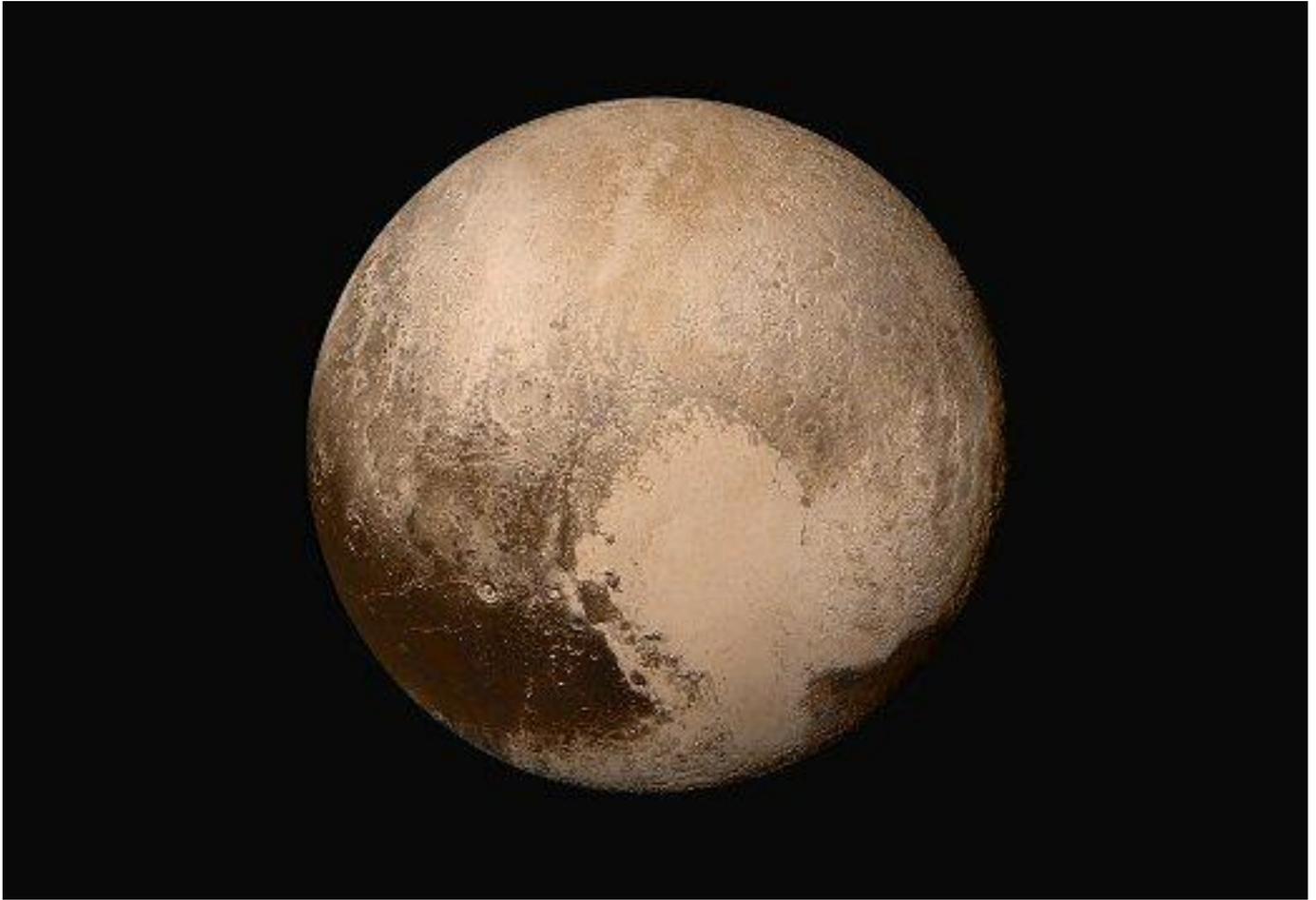


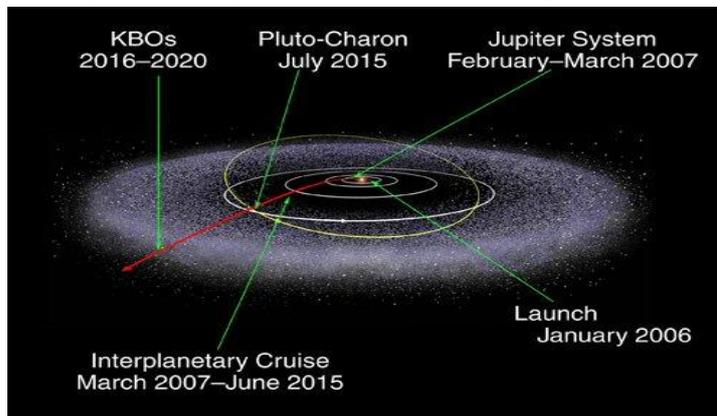
# NEWBURY ASTRONOMICAL SOCIETY MONTHLY MAGAZINE - SEPTEMBER 2015

## NEW HORIZONS ARRIVED SAFELY AT PLUTO ON 14<sup>th</sup> JULY



The first true colour image of Pluto from New Horizons

New Horizons was launched on 19<sup>th</sup> January 2006. On its journey to Pluto it swung past Jupiter for a gravity boost and conducted scientific studies in February 2007. After its closest approach on 14<sup>th</sup> July New Horizons is to head farther into the Kuiper Belt to examine one or possibly two of the, icy mini-worlds in that vast region, at least a billion kilometres beyond Neptune's orbit. Sending a spacecraft on this extended long journey will help to answer basic questions about the surface properties, geology, interior makeup and atmospheres on these remote icy bodies.



The journey of New Horizons

When New Horizons flew past Pluto it was not possible for the team back on Earth to send control instructions to the craft because it was so far away so a different approach had to be taken. The exact position of Pluto was calculated while New Horizons sped along on its journey. Data from all the available images dating right back to the time when Pluto was discovered in 1931 were used in the calculations.

There was no way to carry out last minute course adjustment using onboard instruments so the cameras and other instruments on New Horizon were pointed at the point in space where Pluto should be according to the calculations. The instruments were even panned to point at Pluto as New Horizons streaked by. Live images could not be sent back because the antenna dish was used as a shield to protect the craft from impacts as it passed close to Pluto.

### NEXT NEWBURY ASTRONOMICAL SOCIETY MEETING

4<sup>th</sup> September The State of the Cosmos

Website: [www.newburyas.org.uk](http://www.newburyas.org.uk)

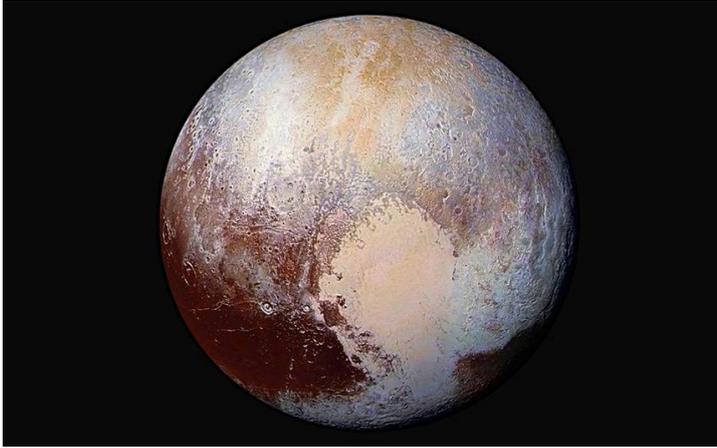
### NEXT NEWBURY BEGINNERS MEETING

16<sup>th</sup> September Starting in Astronomy and The Autumn Sky

Website: [www.naasbeginners.co.uk](http://www.naasbeginners.co.uk)

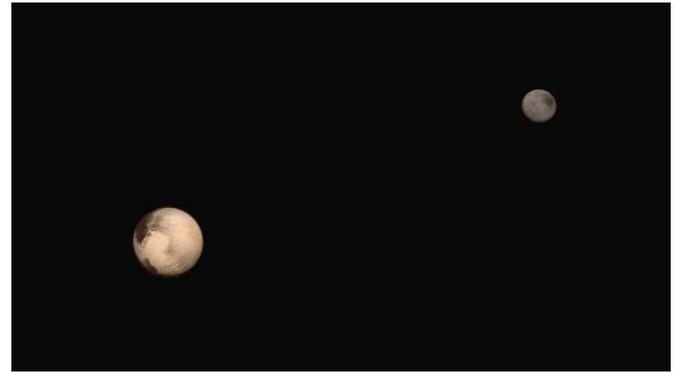
There was a long wait for a signal to tell all those waiting for news of the success or failure of the mission. New Horizon could not transmit and information while it was studying Pluto for two reasons. First the transmission and receiving antenna was being used as a shield to prevent any particles orbiting Pluto damaging the delicate instruments. Secondly the Plutonium power generator could only produce 200watts of power which was just enough to power one or two sets of instruments at a time with no power left for data return. All the gathered data was recorded onboard for transmission over a period of months after the encounter with Pluto.

As New Horizons hurtled past it was also able to take pictures of Pluto's moons. The first image below shows Pluto and its largest moon Charon (diameter 1207km).



An enhanced colour image of Pluto

New Horizons scientists used enhanced colour images to detect differences in the composition and texture of Pluto's surface. When the close-up images were combined with colour data, it painted a new and surprising portrait of the dwarf planet. The "heart of the heart," Sputnik Planum, was found to be a source region for ices. The two bluish-white "lobes" that extend to the southwest and northeast of the "heart" may represent exotic ices being transported away from Sputnik Planum. Four images from New Horizons' Long Range Reconnaissance Imager (LORRI) were combined with colour data from the Ralph instrument to create the enhanced colour global view above. The images, taken when the spacecraft was 450,000 kilometres away, show features as small as 2.2 kilometres.

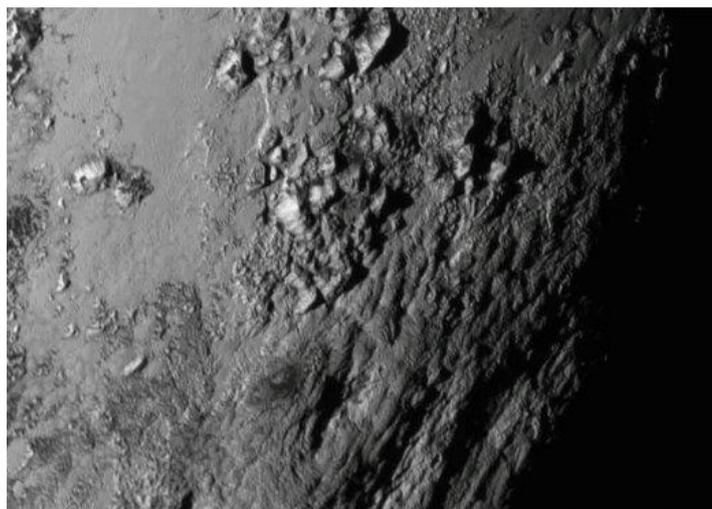


Pluto left with moon Charon right



A closer view of the largest moon Charon

Huge Canyons were seen on Pluto's largest moon Charon that appeared to be deeper than those on Earth. The canyon on the right limb shows how deep some of the canyons are. Pluto has four other smaller moons they are Styx (~20km), Nix (~32km), Kerberos (~30km), and Hydra (~10km). Nix and Hydra are shown in the composite image below.



The first close up image of the surface of Pluto

The first close-up look at Pluto showed ice mountains on Pluto about as high as the Rockies. What especially astounded the scientists was the absence of craters in the zoomed-in shot of Pluto above.



Two of Pluto's smaller moons Nix and Hydra

## A LUNAR ECLIPSE ON 28<sup>th</sup> SEPTEMBER

A Lunar Eclipse occurs when the moon passes through the shadow cast by the earth. This type of eclipse is more common than the Solar Eclipse simply because the shadow of Earth is larger than that of the Moon. As Earth orbits the Sun and our Moon orbits Earth, there are occasions when all three are aligned. A lunar eclipse will occur when Earth is between the Sun and Moon and the Moon passes through the Earth's shadow (see the left of the diagram below).

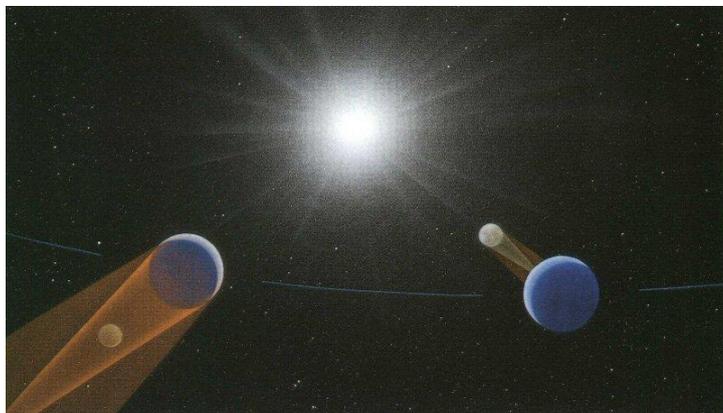


Diagram showing Lunar and Solar Eclipses

Lunar eclipses always occur at night, because the sunlight has to be shining on the opposite side of Earth (where it is daytime) to project the shadow on to the side of the Moon facing the night side of Earth. The Moon will also be full because it is in direct line with Earth but further out so looking from the dark side of Earth the bright side of the Moon will be seen fully illuminated by Sunlight.

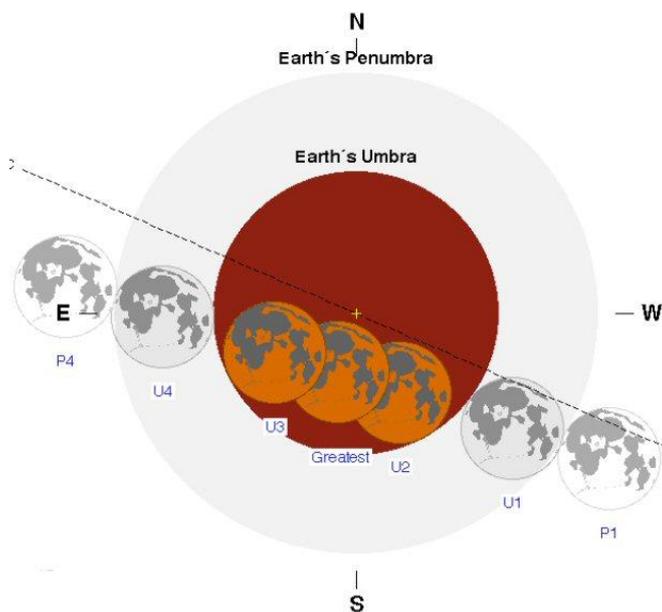
As the Moon moves into the Earth's shadow, the shadow will be seen to start moving across the face of the Moon from the left side as viewed from Earth. The edge of shadow is not as sharp as in a solar eclipse because of Earth's atmosphere. It will creep across the Moon until the whole surface is covered. Not all Lunar Eclipses are 'total'.

As Earth is much smaller than the Sun, it produces a shadow that is conical in shape as shown in the diagram above (left). When this shadow is projected on to an object it is called the 'Umbra' and from within the Umbra the Sun will be completely obscured. There is also a secondary shadow around the main conical shadow where the Sun is partially obscured this is known as the 'Penumbra'. When the Moon is within the Umbra it is the full shadow but when it is in the fainter Penumbra the shadow will be difficult to see.

The surface of the Moon at totality is never completely dark and takes on a reddish glow that can vary between orange to deep red. This is caused by sunlight passing through the atmosphere around the edge of Earth and being refracted on to the surface of the Moon. The red constituent of the sunlight is bent more and is focused on to the Moon most of the other wavelengths will miss the Moon. If there has been a recent volcanic eruption and there is a lot of smoke and ash in the atmosphere, the Moon will glow a deeper red. From the surface of the Moon, the solar eclipse must be a glorious sight. The bright disc of the Sun will gradually be covered by the dark silhouette of Earth. Then at totality the Sun will be replaced by a very thin ring of red light. This is sunlight shining through the thin layer of the atmosphere around the edge of the dark disk of the night side of Earth.

As the orbit of the Moon around Earth is tilted the Moon does not pass through Earth's shadow every month. It may pass above or below the main shadow (Umbra). If it only passes through the Penumbra the shadow will be almost indiscernible and will pass largely unnoticed.

The diagram below shows the path that the Moon will take as it passes through Earth's shadow. At position P1 the Moon starts to enter the Penumbra and a faint shadow will begin to cross the Moon. At position U1 the Moon enters the Umbra and the more obvious shadow will be seen on the left limb of the Moon. Between positions U2 and U3 the Moon will be completely inside the Umbra (Totality). At U4 it will have moved out of the Umbra and at P4 will have left the shadow altogether and the eclipse will be over.



The Total Lunar Eclipse will occur in the early morning of 28<sup>th</sup> September and will be visible from the UK.

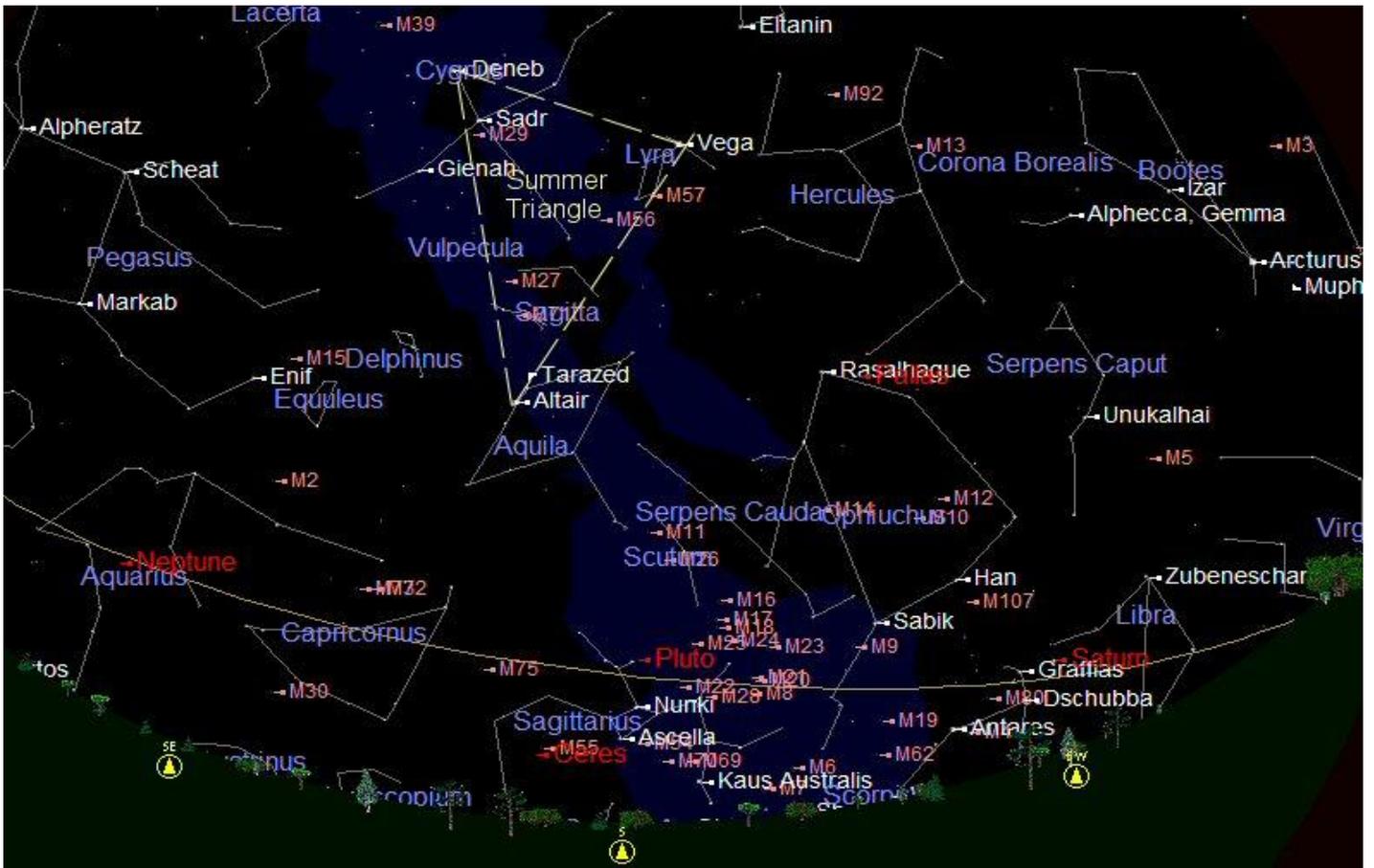
The times for the eclipse to be seen from Newbury are:

|       |                                 |    |
|-------|---------------------------------|----|
| 01:07 | Enters the inner shadow (Umbra) | U1 |
| 02:11 | Starts 'Totality'               | U2 |
| 03:23 | Starts to move out of Totality  | U3 |
| 04:27 | Clears the inner shadow (Umbra) | U4 |



The 2007 Lunar Eclipse imaged by Lee McDonald

## THE AUTUMN NIGHT SKY 2015



The chart above shows the night sky looking south at about 21:00 on 15<sup>th</sup> September. The sky has been darkened on the chart to allow interesting objects to be displayed because the sky will not be fully dark. West is to the right and east to the left. The curved line across the sky is the ecliptic. This is the imaginary line along which the Sun, Moon and planets appear to move across the sky. The constellations through which the ecliptic passes are known as the constellations of the 'Zodiac'.

Constellations through which the ecliptic passes are (west to east): Virgo (the Virgin), Libra (the Scales), Scorpius (the Scorpion), Sagittarius, (the Archer), Capricornus (the Goat) and Aquarius (the Water Carrier) with Pisces (the Fishes) just appearing over the south eastern horizon.

The summer constellations are still very much in full view and at centre stage in the south. The familiar formation of the Summer Triangle is shown in the chart above, on the charts on page 5 and the last page. The Summer Triangle is made up of the three bright stars: Deneb in the constellation of Cygnus (see Page 5), Vega in Lyra and Altair in Aquila. Messier 57 (M57) in Lyra is the beautiful 'Ring Nebula' which is the remnant of a star similar to our Sun that has reached the end of its time as an active star. There is another 'Planetary Nebula' within the Summer Triangle called M27 but it is 'Butterfly' shaped and can be seen using binoculars or a small telescope.

To the west (right) of the Summer Triangle is Hercules with its brightest stars marking out the shape of a 'keystone' (the central stone in a stone bridge or arch). The stars of the 'keystone' are not particularly bright but are worth searching out. Located on the western vertical side is the beautiful Globular Cluster Messier 13 (M13).

This is a compact ball of around a million stars. M13 is visible using a good pair of 10x50 binoculars but is best seen through a telescope.

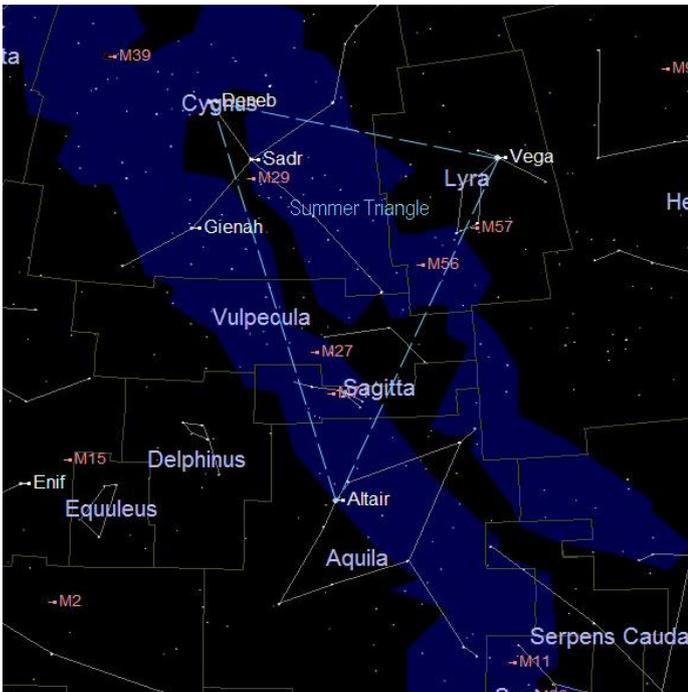
Further still to the west is Boötes which has a shape that resembles a triangular 'kite' with Arcturus at the lower point of the kite where the tail would be fixed. There are no bright interesting objects in Boötes but Arcturus is a Red Giant star and our fourth brightest star. It looks distinctly orange through binoculars or a telescope.

To the east (left) of the Summer Triangle is the Great Square of Pegasus. The square is probably larger than expected when being searched out for the first time. The 'square' can be used to judge the condition of the sky for observing. If four or five stars can be seen within the square then the conditions should be good, any more stars could indicate seeing may be very good. M15 in Pegasus is a very nice Globular Cluster.

By following an imaginary line through Deneb to Altair and on down to the ecliptic the constellation of Sagittarius can be found. Here there are many Messier objects to search out. Some are objects that can be seen using binoculars but look really beautiful through a telescope. M11 in the small constellation of Scutum is one of the best open clusters of the Messier objects to look at using binoculars. It is quite high above the horizon and its component stars are bright. The cluster is also known as the Wild Duck Cluster because to some observers the pattern of the stars does resemble a flying duck.

The beautiful ringed planet Saturn is still visible as it moves towards the western horizon. It looks like a fairly bright yellowish star low in the south west, see page 6.

## THE SUMMER TRIANGLE

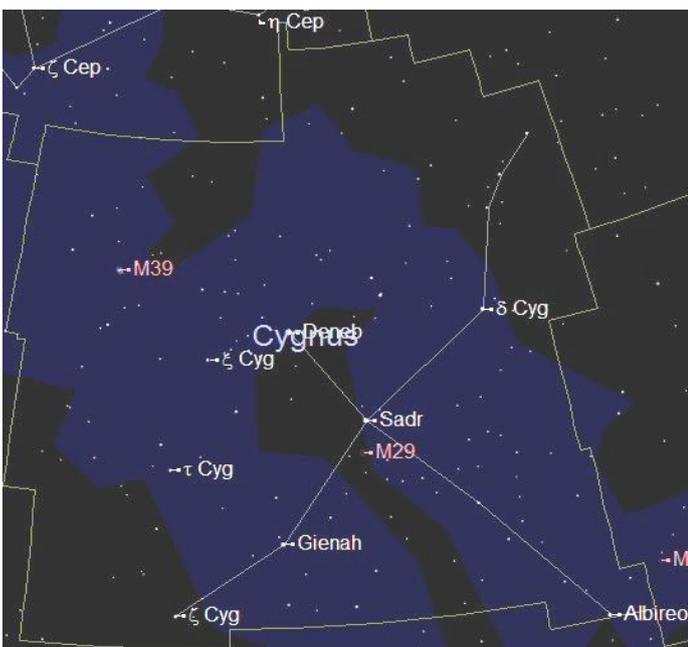


The Summer Triangle

The term 'Summer Triangle' was suggested by Sir Patrick Moore and has now become the best known feature of the summer night sky. The corners of the imaginary triangle are positioned on the three obvious bright stars: Deneb in the constellation of Cygnus, Vega in Lyra, and Altair in Aquila.

The Milky Way (our Galaxy) flows through the Summer Triangle and passes through Aquila and Cygnus. Above Aquila is the lovely little constellation of Sagitta (the Arrow) and to the east is Delphinus (the Dolphin) appearing to be leaping out of the water. See Aquila.

## THE CONSTELLATION OF CYGNUS

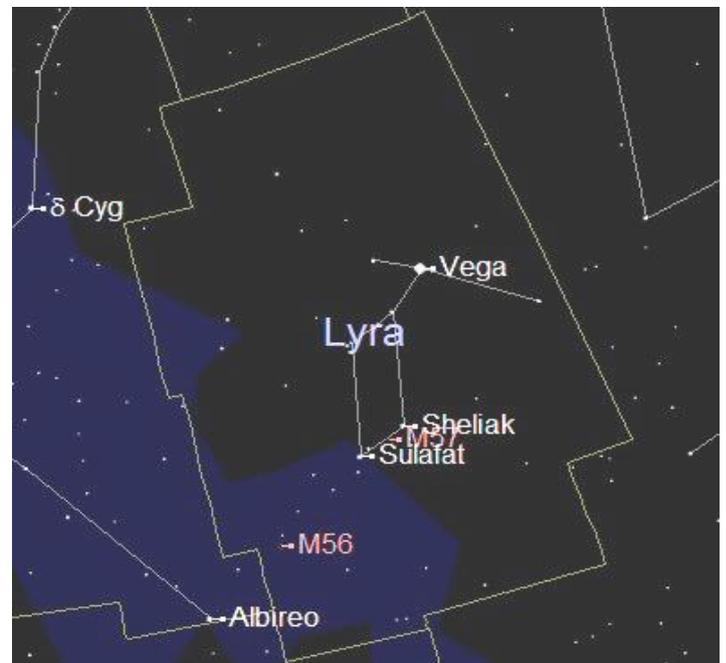


Cygnus (the Swan) does actually resemble the swan it is supposed to represent. We start at the bright star Deneb denoting the tail of the swan. From the fairly bright star Sadr the wings are spread out to each side and the long neck of the swan stretches on to Albireo.

Albireo can be seen as a beautiful double star when viewed through a telescope. One star is bright and gold in colour the other is a beautiful sky blue. This is not a true pair they just happen to be in the same line of sight although the blue star is much further away from us.

## THE CONSTELLATION OF LYRA

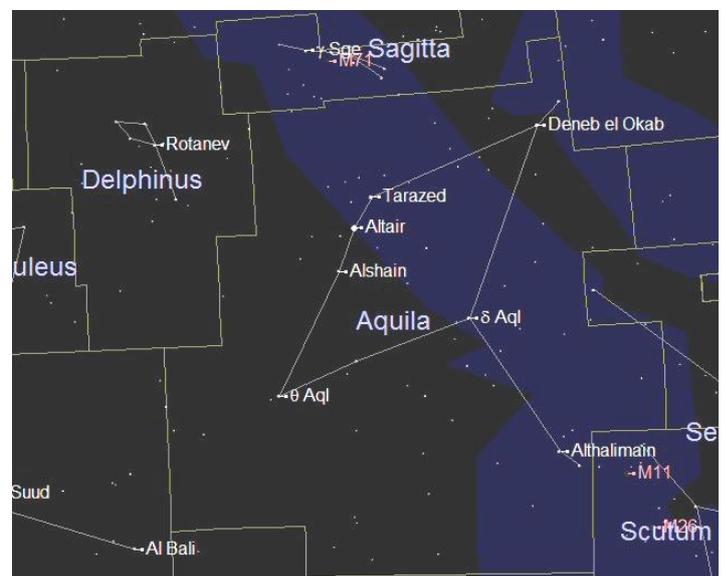
The constellation of Lyra (the Harp) is located to the west (right) of Cygnus but is much smaller. To the south east of the very bright star Vega is a lozenge shaped asterism comprised of four stars.



Between the two lower stars: Sulafat and Sheliak is the Messier object M57. This is a 'Planetary Nebula' which has nothing to do with a planet. It is in fact a dying star similar to our Sun but older. The star had used most of its Hydrogen fuel and expanded into a Red Giant. After passing through that phase it collapsed to become a White Dwarf surrounded by a bubble of gas and dust. It looks like a small 'smoke ring' when seen through a telescope.

## THE CONSTELLATION OF AQUILA

The constellation of Aquila (the Eagle) completes the bottom corner of the Summer Triangle. The bright star Altair has a fainter star above and below it.



## THE SOLAR SYSTEM THIS MONTH

**MERCURY** is not observable this month.

**VENUS** is now a morning object rising about three hours before the Sun at about 03:30 BST. It is very large with a diameter of 48 arc-seconds at the beginning of the month and 36 arc-seconds by the end of the month. It appears as a thin crescent widening through the month.

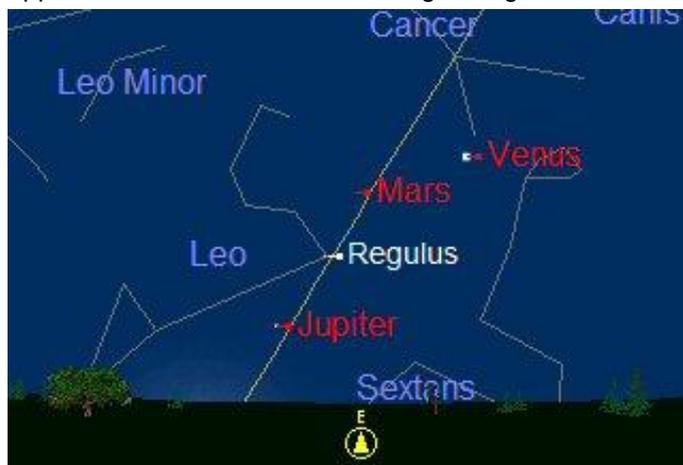


Chart showing Venus at sunset

Venus is just moving out from Inferior Conjunction when it passed between Earth and the Sun on 15<sup>th</sup> August. As it moves further out from the Sun it will also be moving further away from us and will therefore appear smaller. However as it gradually gets smaller it will develop into a wider crescent shape so its brightness will remain almost the same at about magnitude -4.5. Venus will reach its greatest western elongation (and will appear 'half Moon' shaped) on 26<sup>th</sup> October when it will be at its greatest apparent distance from the Sun.



Venus as it will appear on 15<sup>th</sup> September

**MARS** is an early morning object rising at 04:00 about three hours before the Sun. It will be close to Venus which will help in finding it. Mars appears small at just 3.8 arc-seconds and quite faint at magnitude +1.8.

**JUPITER** is also an early morning object rising over the eastern horizon at 06:00 at the beginning of the month and 04:45 by the end of the month. It starts to be worth looking out for at the end of the month but it will require a good clear view to the eastern horizon. Jupiter appears large at 30 arc-seconds and bright but it will be lost in the morning twilight by about 06:00.

**SATURN** is now moving closer to the western horizon. This month will be the last chance this year to see the beautiful ring system almost fully opened up in the evening sky. At the moment, the north pole of Saturn is tilted towards us at an angle of about 24.5° so we can see the top of the ring system. It will reach its maximum tilt in 2017 then the rings will begin to close again. Unfortunately Saturn has been very low in the southern sky this year so it has not been at its best observing position but it was still very impressive.



Saturn imaged in March 2015 by Efrain Morales

**URANUS** rises in the east at about 20:00 and will be due south at 02:40. It will be in a good position for observing by about 23:00.

**NEPTUNE** rises in the east at about 18:45 so will be visible all night.

### THE SUN

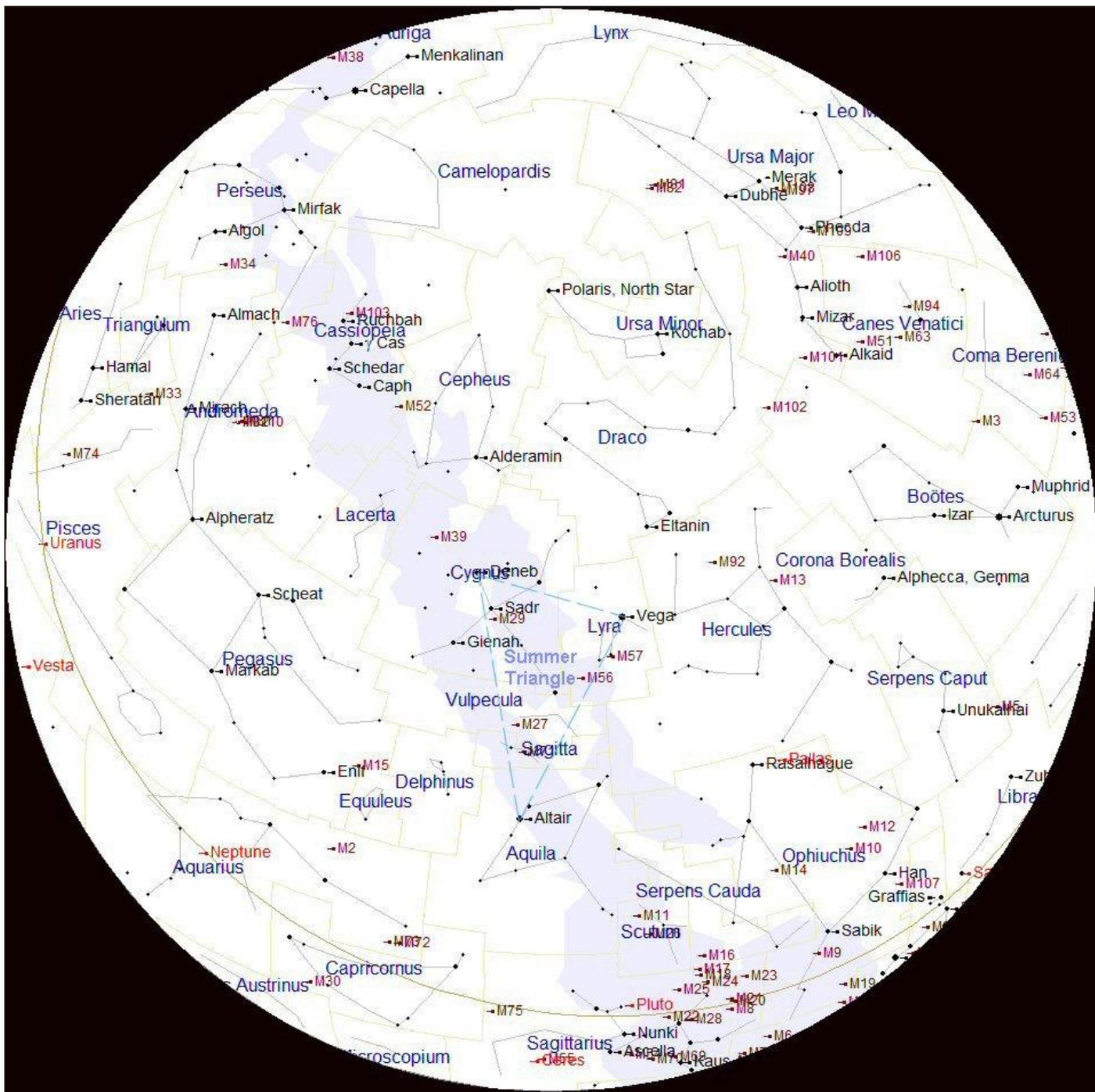
The Sun rises at about 06:30 mid month and sets at about 19:15. Sunspots and other activity on the Sun can be followed live and day to day by visiting the SOHO website at: <http://sohowww.nascom.nasa.gov/>.

### THE MOON PHASES IN SEPTEMBER 2015

| 2015   | Monday | Tuesday | Wednesday | Thursday | Friday | Saturday | Sunday |
|--------|--------|---------|-----------|----------|--------|----------|--------|
| Aug-31 |        |         |           |          |        |          |        |
| Sep-06 |        |         |           |          |        |          |        |
| Sep-07 |        |         |           |          |        |          |        |
| Sep-13 |        |         |           |          |        |          |        |
| Sep-14 |        |         |           |          |        |          |        |
| Sep-20 |        |         |           |          |        |          |        |
| Sep-21 |        |         |           |          |        |          |        |
| Sep-27 |        |         |           |          |        |          |        |
| Sep-28 |        |         |           |          |        |          |        |
| Oct-04 |        |         |           |          |        |          |        |
| 2015   | Monday | Tuesday | Wednesday | Thursday | Friday | Saturday | Sunday |

Last Quarter will be on 5<sup>th</sup> September  
 New Moon will be on the 13<sup>th</sup> September  
 First Quarter will be on 21<sup>st</sup> September  
 Full Moon will be on 28<sup>th</sup> September

## THE NIGHT SKY NEXT MONTH - SEPTEMBER



The chart above shows the night sky as it appears on 15<sup>th</sup> September at 10 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 11 o'clock BST at the beginning of the month and at 9 o'clock BST at the end of the month. The stars also appear to move 15° (360° 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 west. 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 50° 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 observable in the night sky: Saturn, Neptune and Uranus.