NEWBURY ASTRONOMICAL SOCIETY
MONTHLY MAGAZINE – SEPTEMBER 2018

STARTING OUT IN ASTRONOMY AS A HOBBY

September heralds the beginning of the new astronomy season, when the evenings begin to draw in and the sky is getting dark at a reasonable time. During the hot summer months it has been light until after 10:30 and the sky has not been completely dark even at midnight. Now we can get out for a good look at all the interesting sights of the night sky and still get enough sleep to get up in time for the things we need to do the next day. So this month we will consider what we need to start out in astronomy, what we can expect to see, where and how to find it.

When starting out in astronomy it is not necessary to have a telescope to enjoy wonderful views of the night sky. All that is needed is to go to a dark location away from the glare of street lights. Somewhere comfortable to sit will make the observing more enjoyable so a simple reclining garden chair or deckchair is ideal. A star chart is a worthwhile purchase to help find your way around the sky although a simple chart like the one on the back page of this magazine will do fine to start with.

Once the new astronomer has become familiar with the night sky and the interest has begun to develop it is worth considering obtaining a pair of binoculars or a beginner's telescope. Binoculars are not as expensive as a decent starter telescope and can be obtained second hand. They will enable many more objects to be seen.

BINOCULARS

Binoculars for astronomy should have an aperture (lens diameter) of at least 50mm but it must be said binoculars over 50mm do tend to be more expensive and heavier so 50mm is a good size to start off with. An aperture of less than 50mm will not gather enough light to give a really good view of the night sky. A magnification of 7x or 8x is the best but up to 10x can be used. The 10x may be difficult to hold steady but if mounted on a tripod or supported on a wall or fence they can be used. So look for a 7 x 50 or 8 x 50. What about cost? Normally the old adage 'you get what you pay for' is true. About £50 should provide a good quality pair but spend as much as you can afford.

The author's old 9 x 50 binoculars

STAR CHARTS

The beginner to astronomy is unlikely to have a large telescope and may have no equipment at all. This does not mean that observations cannot be carried out. A star chart is the only other equipment that may necessary to get started.

The 'all sky' chart included on the last page of this magazine can be used as a guide to the sky for the current month. More detailed charts are available from bookshops and astronomy specialist shops. Star atlases are also very useful but may be a little complicated for the beginner to astronomy.

A planisphere chart is very useful and can be obtained from W. H. Smith and other large book shops or can be bought through the adverts in popular astronomy magazines such as 'Astronomy Now'.

Another option is to use a computer planetarium application. There a number of good applications on the market but some can be quite expensive. A good option is to download a freeware sky chart application from the internet. A particularly good one is called 'Stellarium'.

SETTING UP

Make sure you start off dressed in warm clothes because once the cold has taken hold it is very difficult to warm up, even when extra clothes are put on. A small torch is needed to enable the chart to be read but this must shine only with a dimmed light. A small cycle rear light or torch with a piece of red plastic secured over the lens will give enough light but will not spoil 'night vision'. It takes about 10 to 15 minutes for our eyes to become fully adjusted to the dark but a flash from bright light will spoil night vision in an instant. If the torch is still too bright fix a piece of cardboard, with a hole in it, over the lens to reduce the light.

Next find a dark area away from lights. This may be difficult due to street lights but a strategically positioned screen made from a blanket or a garden umbrella may help. If all fails go out of town to a dark field or hill. If you are lucky enough to have an area in the garden that is sheltered from lights, a few comforts can be indulged. The first and most important would be a reclining chair to prevent neck ache from looking up for too long.

On the following pages we will consider some interesting things for the new astronomer to look for in the night sky and where to find them at this time of the year.

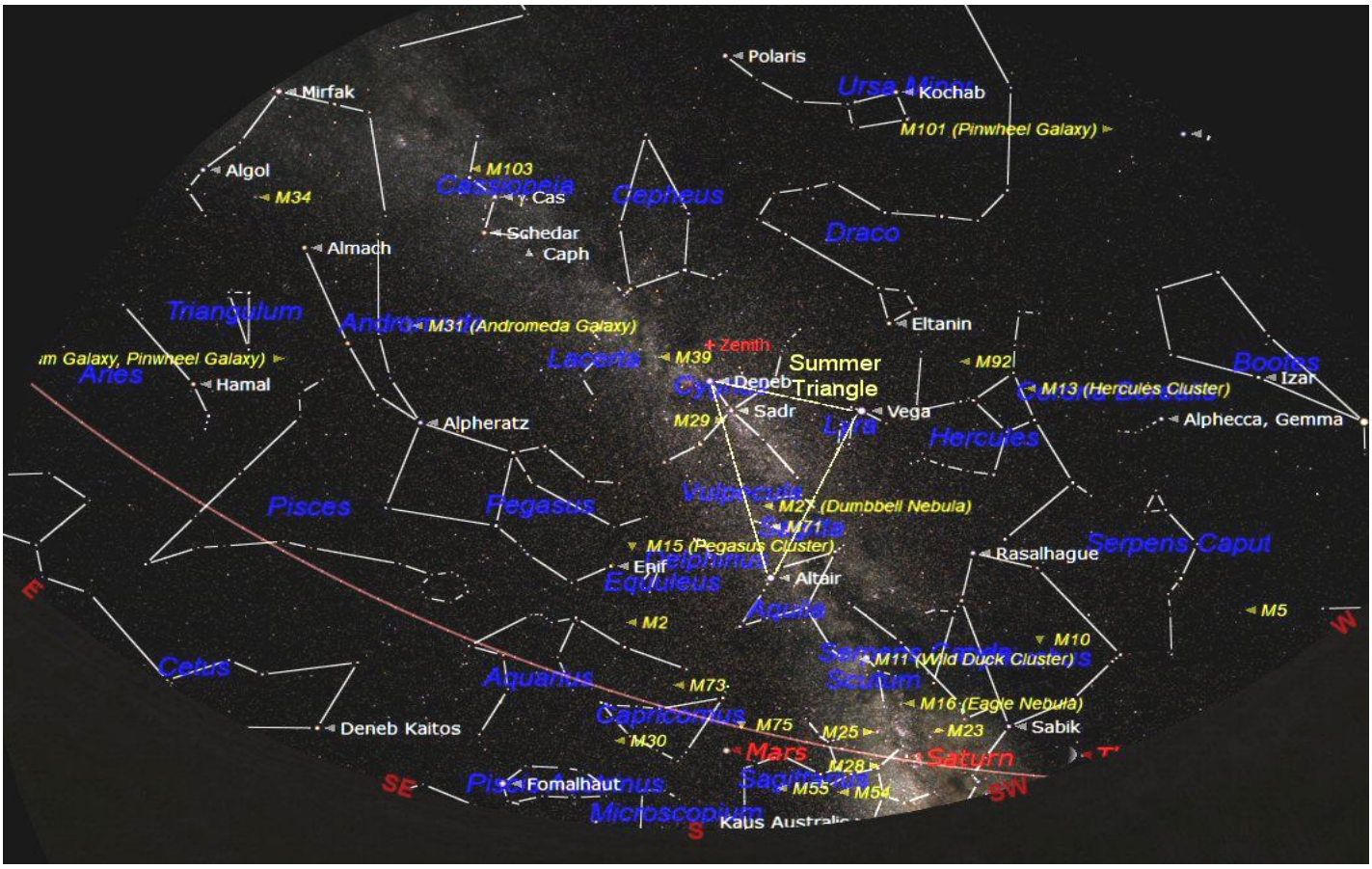
NEWBURY ASTRONOMICAL SOCIETY

7th September Zooniverse and the rise of the machines
Website: **www.newburyastro.org.uk**

NEXT NEWBURY BEGINNERS MEETING

19th September The Planet Mars
Website: **www.naasbeginners.co.uk**

A TOUR OF THE NIGHT SKY - SEPTEMBER 2018



The chart above shows the night sky looking south at about 22:00 BST on 15th September. West is to the right and east to the left. The point in the sky directly overhead is known as the Zenith or Nadir and is shown at the centre of the chart. The curved brown line across the sky at the bottom is the Ecliptic or Zodiac. This is the imaginary line along which the Sun, Moon and planets appear to move across the sky. The brightest stars often appear to form a group or recognisable pattern; we call these 'Constellations'.

Constellations through which the ecliptic passes this month are Sagittarius (the Archer), Capricornus (the Goat), Aquarius (the Water Carrier), Piscis (the Fishes), Aries (the Ram) and Taurus (the Bull) is about to rise over the eastern horizon.

Just disappearing over the south western horizon is the constellation of Sagittarius (the Archer). It is really a southern constellation but we can see the upper part creep along the horizon during the summer. The central bulge of our galaxy (the Milky Way) is located in Sagittarius so the richest star fields can be found in the constellation. Many interesting deep sky objects are here along with the planets Saturn and Mars this year.

The summer constellations are still prominent in the night sky lead by Hercules (the strong man). Following Hercules is the Summer Triangle with its three corners marked by the bright stars: Deneb in the constellation of Cygnus, Vega in Lyra, and Altair in Aquila. The Summer Triangle is very prominent and can be used as the starting point to find our way around the night sky. See the following pages. The Milky Way (our Galaxy) flows through the Summer Triangle passing through Cygnus, down to the horizon in Sagittarius.

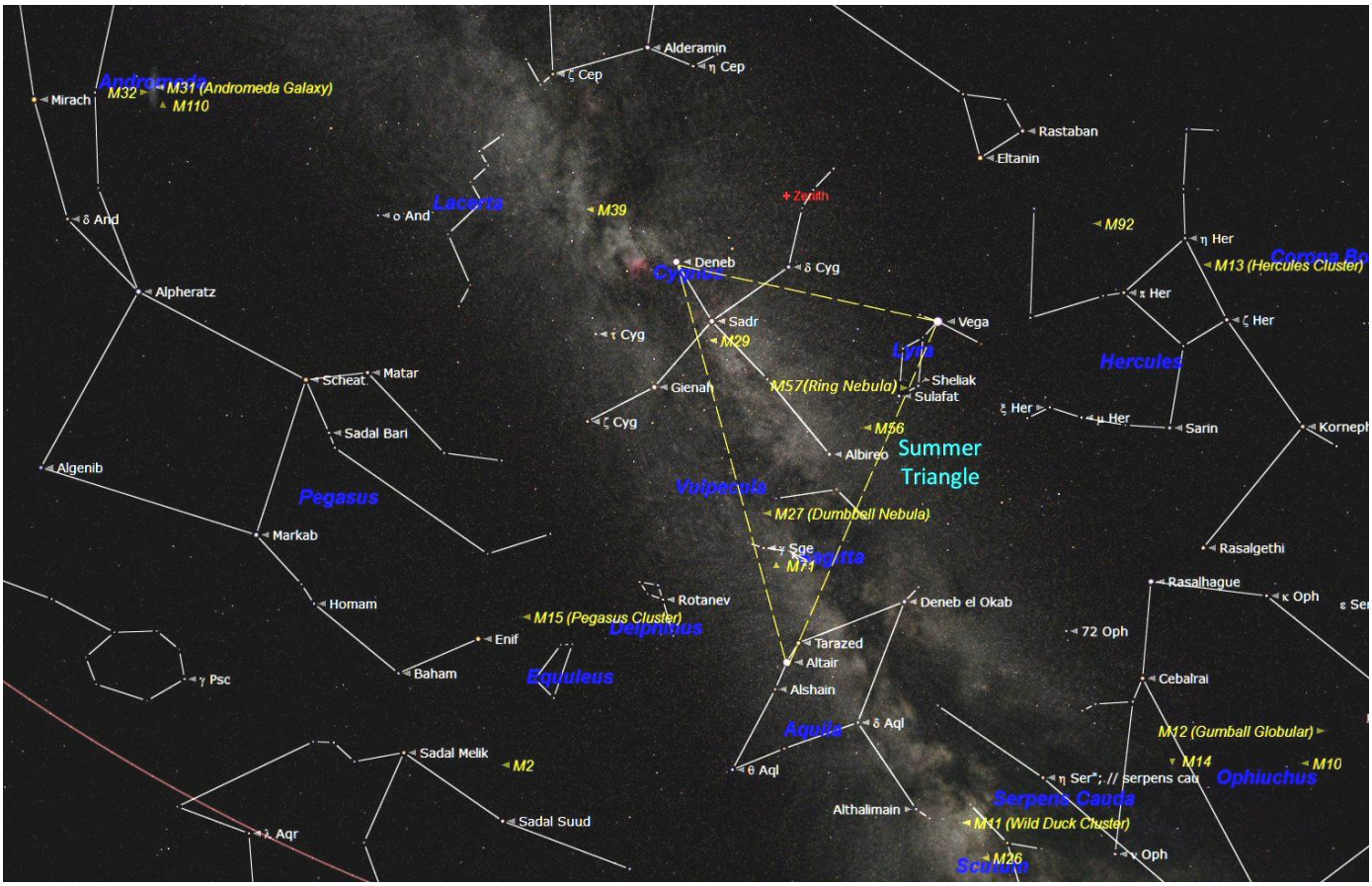
The Milky Way flows north from the Summer Triangle through the rather indistinct constellation of Lacerta (the Lizard), past the pentagon shape of Cepheus and on through the 'W' shape of Cassiopeia (a Queen).

At the top, centre of the chart above is the fairly faint constellation of Ursa Minor (the Little Bear) also called the Little Dipper by the Americans. Although Ursa Minor may be a little difficult to find in a light polluted sky it is one of the most important constellations. This is because Polaris (the 'Pole' or 'North Star') is located in Ursa Minor. Polaris is the star that is located at the approximate position in the sky where an imaginary line projected from Earth's north pole would point to. As the Earth rotates on its axis, the sky appears to rotate around Polaris once every 24 hours. This means Polaris is the only bright star that appears to remain stationary in the sky as Earth rotates every 24 hours.

To west of the Summer Triangle is the constellation of Hercules (the strong man). The main feature forming the asterism (shape) of Hercules is the misshapen square at its centre known as the 'Keystone' due to its resemblance to the central stone of an arch. Located in the right vertical side of the 'Keystone' is the most impressive 'Globular Cluster' known as Messier 13 (M13). This can be seen in a modest telescope as a beautiful ball of about a million stars. See page 6.

To the East of the Summer Triangle is the constellation of Pegasus (the Winged Horse). The main feature of Pegasus is the square formed by the four brightest stars. This asterism (shape) is known as the Great Square of Pegasus. The square is larger than might be expected but once found is easier to find again.

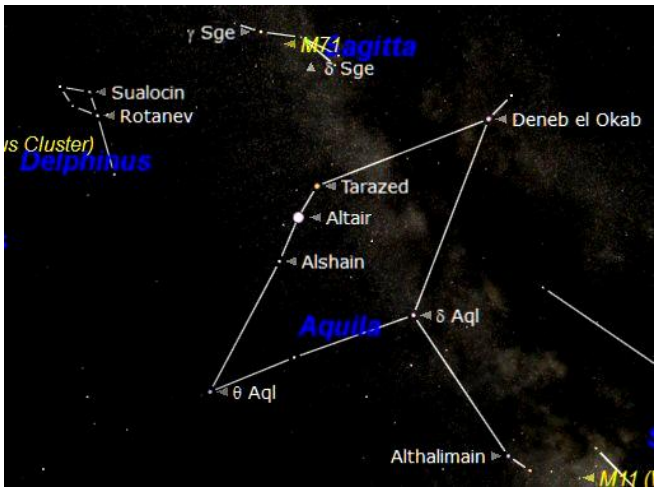
EXPLORING THE SKY IN AND AROUND THE SUMMER TRIANGLE



There is still time to search out the Summer Triangle and the interesting objects in and around it. 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. See the chart above.

THE CONSTELLATION OF AQUILA (the Eagle)

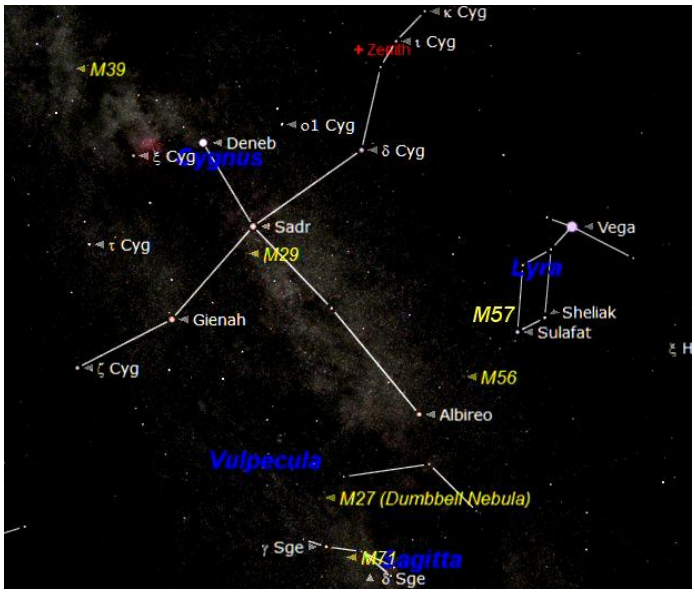
The constellation of Aquila (the Eagle) is found at the bottom corner of the Summer Triangle. There are no interesting objects in Aquila but the one bright star, Altair, has a fainter star above and below it that makes it quite easy to find.



The constellation of Aquila

THE CONSTELLATION OF CYGNUS (the Swan)

The constellation of Cygnus (the Swan) is located at the top of the Summer Triangle. The brightest star in Cygnus is Deneb which denotes the upper point of the Summer Triangle and represents the Swan's tail. The wings spread from the star Sadr and the head is marked by Albireo. Deneb is one of the largest and brightest stars in our vicinity in our galaxy the Milky Way and is classified as a Supergiant. It is about 25 times more massive than our Sun and has a diameter 60 times that of our Sun. It is located 3000 light years away. As it is so much larger than our Sun it consumes its Hydrogen fuel much faster and consequently shines 60,000 times brighter.



The constellations of Cygnus and Lyra

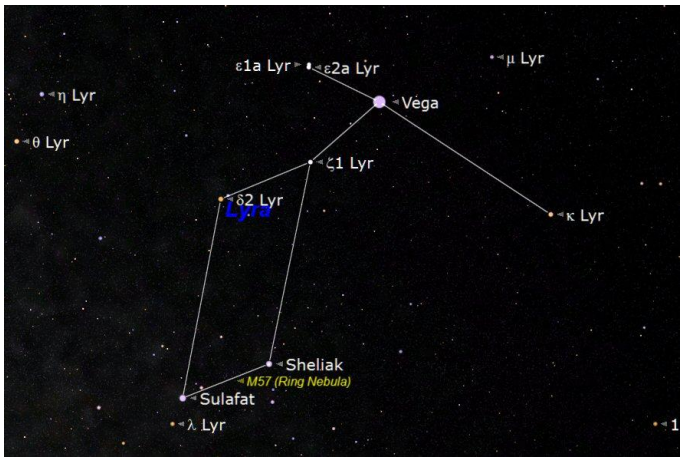
Cygnus (the Swan) does actually resemble the swan it is supposed to represent. We start at the bright star Deneb which marks the tail of the swan. From the fairly bright star Sadr the wings are spread out to each side and the long neck of the swan stretches on to Albireo.

Albirio can be seen as a beautiful double star when viewed through a telescope. One star is bright and gold in colour the other is fainter and distinctly blue. This may not be a true pair they just happen to be in the same line of sight. Although the blue star is much bigger and brighter than the golden star it is a lot further away from us. This type of double star is much rarer than a pair of stars that are associated, linked by their common gravity and orbiting a common centre of gravity.

The double star Albireo in Cygnus

THE CONSTELLATION OF LYRA (the Harp)

The constellation of Lyra (the Harp) is located to the west (right) of Cygnus but is much smaller. The most obvious feature of Lyra is the very bright star Vega that is located the top right corner of the Summer Triangle. Vega is the fifth brightest star in our sky with a magnitude of 0.4. It is located at a distance of 25.3 light years from us and is thought to be 3.2 times the diameter of our Sun and 58 times brighter. Inferred detectors on the IRAS satellite have detected a ring of dust around Vega that may indicate planets are forming around the star.



The constellation of Lyra (small harp)

The main asterism (shape) of Lyra is composed of a line of three stars with Vega in the centre and a group of four fainter stars that form a rhombus shape that is better known as the 'Lozenge'.

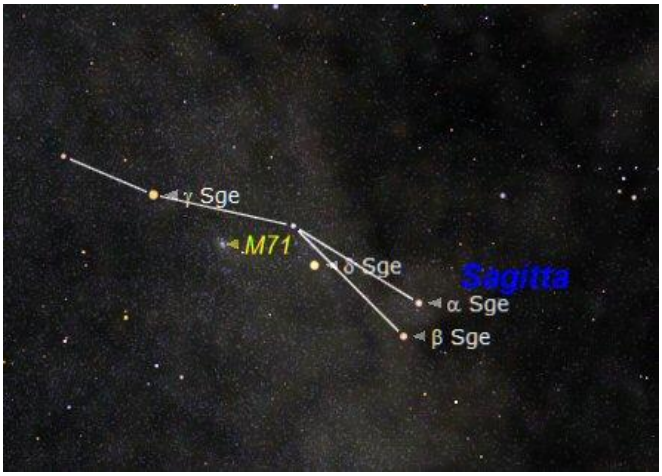
To the south east of the very bright star Vega is the lozenge shaped asterism comprised of four stars. Between the two lower stars: Sulafat and Sheliak is the Messier object M57. This is a 'Planetary Nebula' which has nothing to do with a planet. It is in fact a dying star that was similar to our Sun but older. The star had used most of its Hydrogen fuel and expanded to form into a Red Giant. After passing though that red giant phase it gently collapsed to become a White Dwarf. The very thin outer mantle of the red giant drifted away into space as the star collapsed. The white dwarf is now surrounded by a bubble of gas and dust. It looks like a small 'smoke ring' when seen through a telescope but can't be seen using normal binoculars.

Messier 57 (M57) the Ring Nebula

There are two other constellations that are located within the Summer Triangle. They are both small and comprised of relatively faint stars but are worth seeking out using binoculars.

SAGITTA (the Arrow)

Sagitta is good fun to find using binoculars because it really does look like an 'arrow'. It is composed of three stars that look like the shaft of an arrow and two stars that resemble the flight feathers.



The constellation of Sagitta

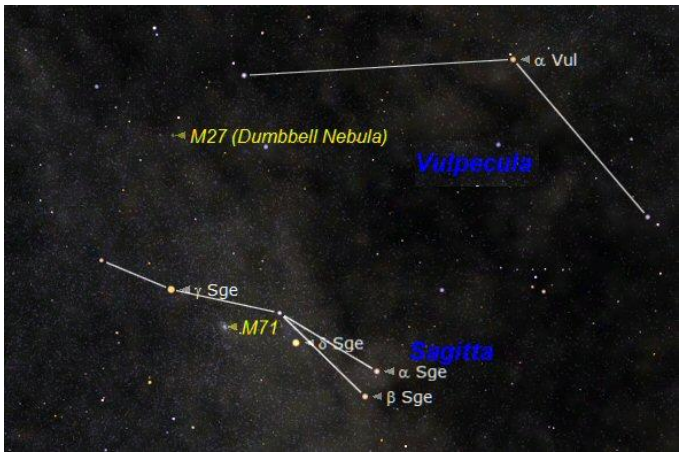
The real beauty of Sagitta is how it looks using binoculars but it does host one messier object, this is M71 also known as NGC 6838. M71 is a rather nice but small and faint globular cluster that does need a medium sized telescope to see well.

A telescope will show Messier 71 (M71) in Sagitta. It is not the most spectacular Globular Cluster but does look nice in a medium sized telescope.

Messier 71 (M71) in Sagitta

A Globular Cluster is thought to be the core of a small galaxy that has ventured too close to our large spiral galaxy (the Milky Way). It had its outer stars stripped away by the powerful gravity of the Milky Way. There about 100 Globular Clusters around our Galaxy.

VULPECULAR (the Fox)



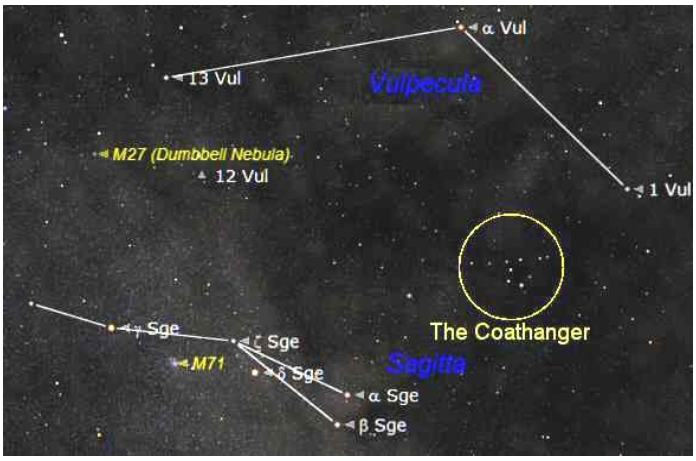
The constellation of Vulpecula

Vulpecular is a quite indistinct constellation located in the Summer Triangle, see the chart above. It has a bright planetary nebula (M27) that can just be seen using a good pair of binoculars. It is also known as the Dumbbell Nebula but looks more like a butterfly. It is a similar object to M57 but has two interesting lobes.

Messier 27 (M27) a planetary Nebula in Vulpecular

THE COATHANGER (asterism)

Between the small constellations of Vulpecula and Sagitta is a rather delightful 'Asterism' (pattern of stars) known as the Coat Hanger. It is best seen using binoculars or a small telescope (using a low power eyepiece). It is located about half way between the 'tail feathers' of Sagitta (the Arrow) and the western (right) star of the three 'brightest' stars in Vulpecular (the Fox).



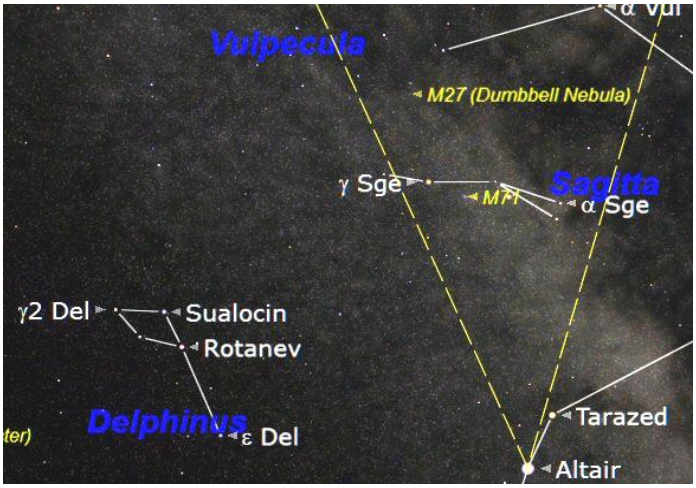
The Coathanger star cluster in Vulpecular

The Coat Hanger (also known as C399) is sparse Open Cluster of ten 5th to 7th magnitude stars in a pattern that does resemble an up-side-down Coat Hanger. It is easily seen using a pair of 8x50 binoculars and looks very pleasing to the eye. There are other smaller stars in the cluster but the main interest is the Coat Hanger shape.

To find the Coathanger, first locate the two tail feather stars of the Arrow then slowly sweep the binoculars up and to the west (right) and the Coat Hanger should come into view. The asterism is too large to fit into the field of view of most telescopes but looks good in the finderscope.

DELPHINUS (the Dolphin)

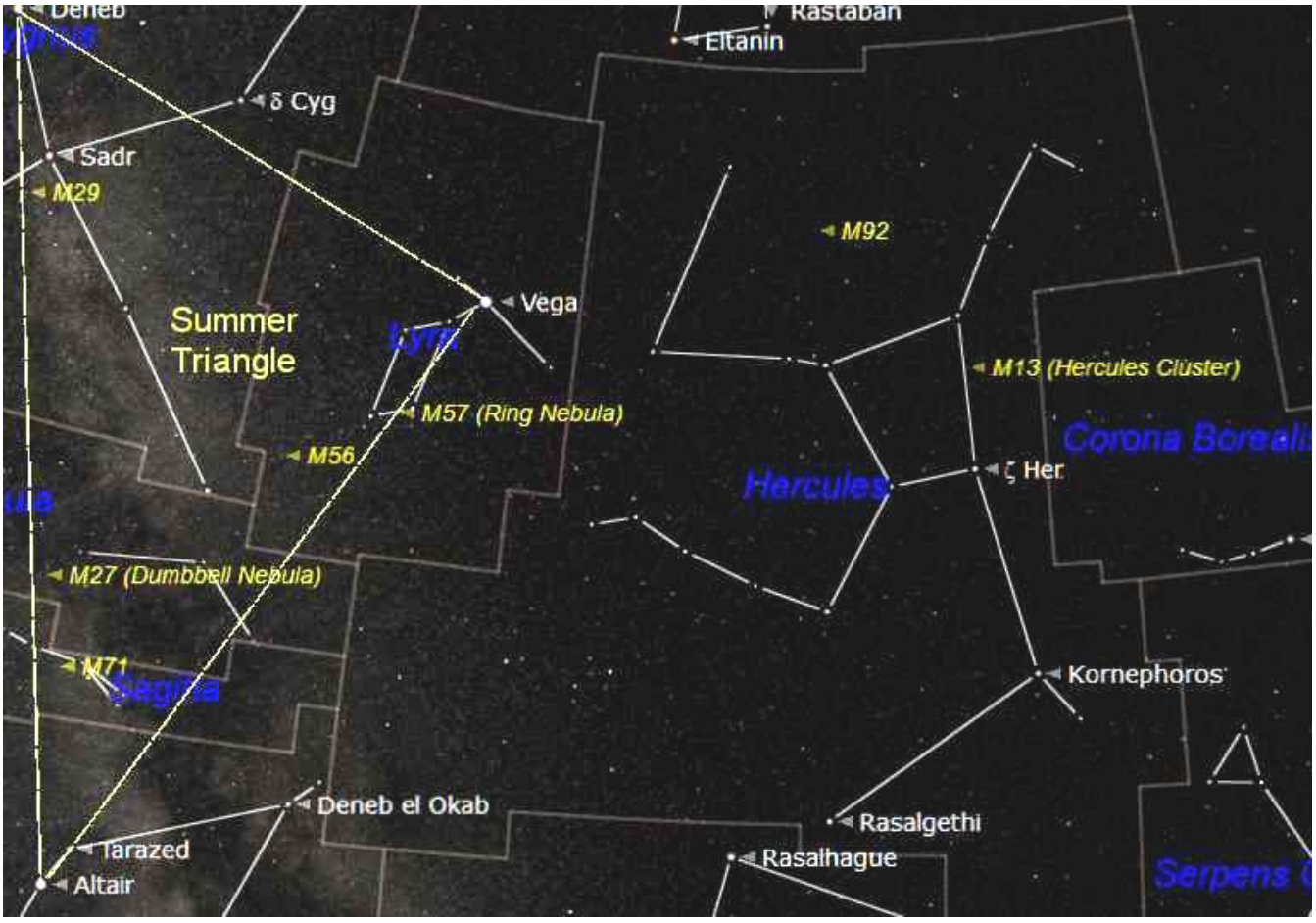
Just to the east (left) of the lower part of the Summer Triangle is the lovely little constellation of Delphinus (the Dolphin). It is small but can be seen easily with the unaided eye from a dark area when there is a clear sky.



Delphinus (the Dolphin)

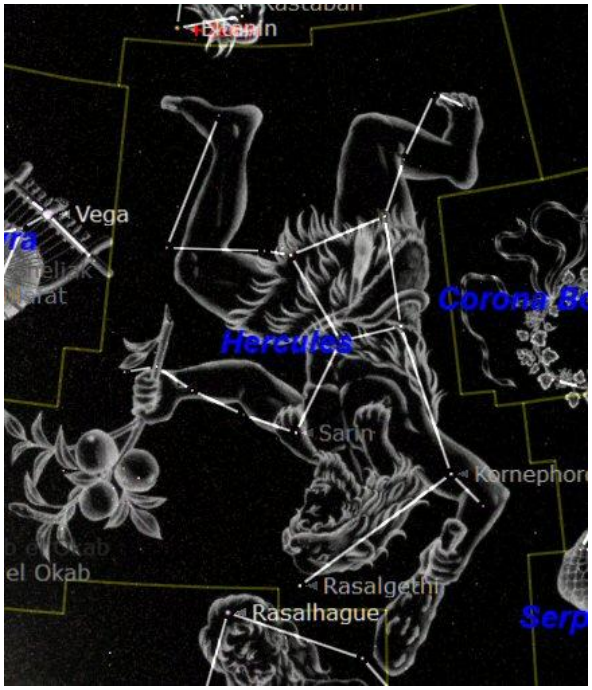
The asterism (shape) of Delphinus is comprised of a four stars that form a neat diamond shape and a fifth star a short distance from the diamond shape that completes the dolphin's body and tail. With a little imagination it does look remarkably like a dolphin leaping out of the water. It looks even more striking when seen using binoculars.

CONSTELLATION OF THE MONTH - HERCULES



The constellation of Hercules

The chart above shows the constellation of Hercules and its location to the west (right) of the Summer Triangle. Hercules is the great strongman from Greek mythology. He is illustrated in the picture below (up-side-down), as he appears in the sky, with a club held above his head. The 'Keystone' asterism (shape) can be a little difficult to identify in a light polluted sky but easy to find again.



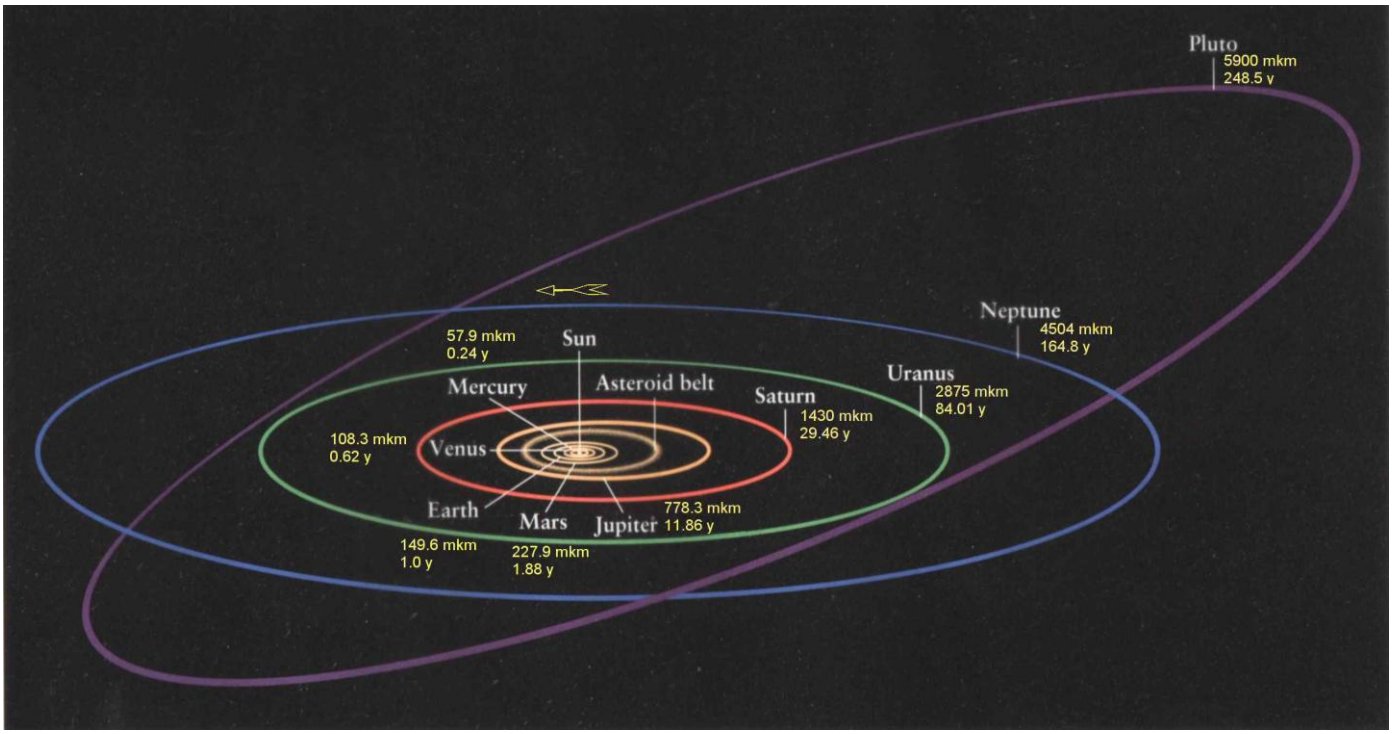
An illustration of the constellation of Hercules

The jewel of Hercules is without doubt is the Great Globular Cluster, Messier 13 (M13). M13 can be found in the western (right) vertical imaginary line of the 'Keystone'. It is just visible using a good pair of 9 x 50 binoculars. The cluster, of about a million stars, can be seen using a 90mm *f*10 telescope but will look even more impressive when using a larger telescope.

The Great Globular Cluster in Hercules

Globular clusters are thought to be the cores of small galaxies that have ventured too close to Giant Spiral Galaxies like our Milky Way. The outer stars of these smaller galaxies have been stripped away, by the gravity of the giant spiral, leaving the dense core clusters of between 100,000 and a million stars. There are about 100 Globular Clusters in a halo around the Milky Way.

EXPLAINING ASTRONOMY – THE ORBITS OF THE PLANETS (Part 1)



The orbital paths of the main planets and Pluto

There a two ways of thinking about how the planets orbit the Sun. The first way is to think about how we might look at the planets from outside the Solar System, with the orbits as shown in the diagram above. Another way is to think about them how we perceive them from our vantage point on Earth. We need to do this bearing in mind that our planet is tilted over at an angle of 23.4° to the plane of the orbits of the planets. This, as you may expect, gives us a tilted view of the sky.

First we must consider how the Solar System as whole works then we will be more able to understand how we see the planets moving in the sky. First, the basic facts about the Planets. The diagram above shows the orbits of the main planets and Pluto (more about Pluto later).

Here are the main orbital statistics:

Planet name	Dist. from Sun (Millions of km.)	Period of orbit (Earth years)
Mercury	57.9	0.24
Venus	108.2	0.62
Earth	149.6	1.00
Mars	227.9	1.88
Jupiter	778.3	11.86
Saturn	1429.4	29.46
Uranus	2875.0	84.01
Neptune	4504.3	164.79
Pluto	5900.0	248.5

It can be seen from the table above that each planet is approximately twice as far from the Sun progressively outwards. However there is a noticeable discrepancy between Mars and Jupiter. This is where the Asteroid Belt is located between these two planets.

There is a rather tenuous correlation of the orbital periods in that there is an increase on the inner orbital time of 2 to 3 times with every orbit outwards. This is with the exception of Mars to Jupiter where there is a 6 fold increase in the orbital time. However the obvious and inevitable conclusion is: 'the further out from the Sun a planet orbits the longer it takes to complete its orbit'.

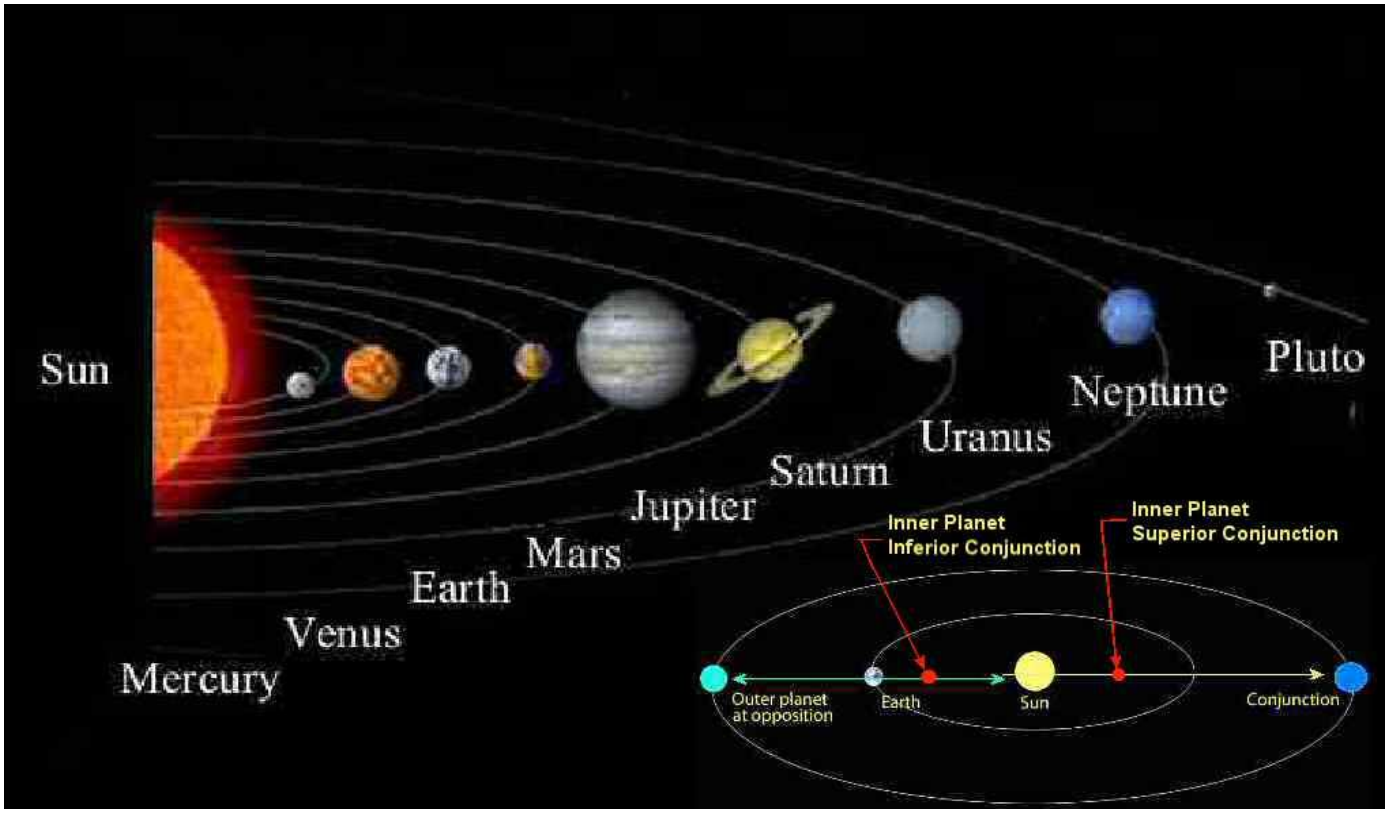
All the planets orbit anti-clockwise when viewed from above the north pole of the Sun as indicated by the arrow on the diagram above. The main eight planets all orbit in almost the same plane of the Solar System. This means that the planets appear to behind the Sun on every orbit. In the case of Mercury and Venus they appear to pass behind the Sun but also pass in front of the Sun. The planets cannot be seen easily as they approach the Sun and not at all when they pass behind the Sun. We call this a 'Conjunction'. If Mercury or Venus passes directly in front of the Sun we call this a 'Transit'. When any planet appears to disappear directly behind the Sun this is called an 'Occultation'.

As Earth passes the other planets on their orbits and the planet is directly in line with Earth and the Sun, this is the moment when an inner planet overtakes an outer planet. As the outer planets take longer than the inner planets to complete their orbit there is an added effect on the period it takes to overtake the other planet each time. The outer planet will have moved along its own orbit so it will take the overtaking planet longer to catch up.

There are two terms that are used to describe the orbital periods of the planets.

Sidereal Period – True orbital period of a planet, the time it takes the planet to complete one full orbit of the Sun.

Synodic Period – The time that will elapse between two successive identical oppositions of a planet (when it is overtaken by Earth and seen from Earth).



The Planets aligned at Opposition and Conjunction

The table below shows the Synodic Period of the planets (the time between successive oppositions seen from Earth) and the Sidereal Period (time taken for the planet to complete one orbit of the Sun).

Planet	Synodic Period (days)	Sidereal Period Earth times
Mercury	116	88 days
Venus	584	225 days
Earth	-	1.0 year
Mars	780	1.9 years
Jupiter	399	11.9 years
Saturn	378	29.5 years
Uranus	370	84.0 years
Neptune	368	164.8 years
Pluto	367	248.5 years

The Inferior Planets (Mercury and Venus) orbit inside Earth's orbit so they pass in front and behind the Sun as seen from Earth. These conjunctions are called Inferior Conjunction (when the planet passes in front of the Sun) and Superior Conjunction (when the planet passes behind the Sun). Unlike the Superior Planets (those with orbits outside Earth's orbit) Mercury and Venus cannot have an opposition. This is because they cannot align with the planet and the Sun directly 180° on either side of Earth. As shown on the inset diagram above.

The Synodic Period is the time taken for a Planet to return to the same position in the sky. From the chart above we can see that although Mercury orbits the Sun in 88 days it takes 116 days to return to the same point in the sky as seen from Earth due to relative movements of the two planets. This means although Mercury completes four orbits for every orbit of Earth (365 ÷ 88 = 4.15) we only see (365 ÷ 116 = 3.15) Inferior and Superior conjunctions each year. So the inner planets do not have Oppositions but have two Conjunctions.

The best time to observe the Superior (outer) planets is when they are at or near opposition. This is because the planet will be at its closest to Earth (appearing largest) and at its highest point in the sky at midnight.

Opposition is especially interesting when observing Saturn. For a few hours around the exact moment of opposition, it may be possible to discern a noticeable brightening of Saturn's rings. The Ring system appears to brighten compared to the planet's disk, this is known as the Seeliger Effect.

The Seeliger Effect occurs because Saturn's rings are made of various sized ice particles. Each particle is normally illuminated by the Sun at a slightly different angle from our viewing angle so that we see some illuminated particles and some which are in the shadow of others. At around the time of opposition, however, the ice particles are illuminated from almost exactly the same direction from which we view them, meaning that we see very few that are in shadow. This means more sunlight is reflected directly back in the same direction. As Earth is in the same direction as the Sun, we see the ring brighten.

The dates of the oppositions of the Superior (outer) planets this year and the next opposition are shown in the table below.

Planet	2018 opposition	Next opposition
Mars	27th July 2018	13th October 2020
Jupiter	9th May 2018	10th June 2019
Saturn	27th June 2018	9th July 2019
Uranus	23rd October 2018	28th October 2019
Neptune	7th September 2018	10th September 2019

Next month we will consider how we perceive the planets from our vantage point on Earth.

OBSERVING THE PLANETS THIS MONTH

Mars, Saturn and Jupiter at 21:00 on 1st September

Jupiter imaged on 6th July 2018 by Steve Harris

Jupiter will be bright and unmistakable in the south west as soon as the sky is dark enough to see it. It is actually past its best for this year but good pair of binoculars will just about be able to reveal Jupiter's four brightest moons, Io, Europa, Ganymede and Callisto. The moons can be observed to move noticeably from night to night.

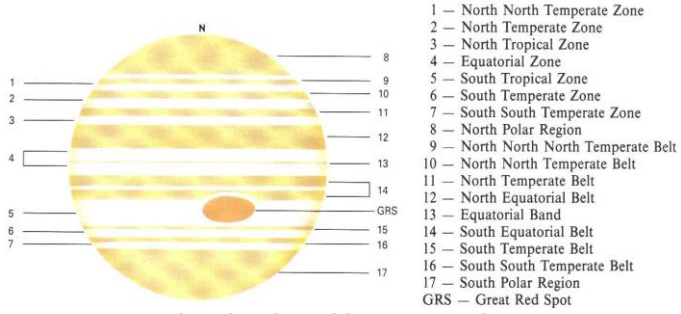
A small telescope will enable the two most obvious cloud belts to be seen on the surface of Jupiter. These are the brown equatorial belts located above and below Jupiter's Equatorial Zone which is much lighter in colour. It will also be possible to see the four brightest moons approach and move away from the planet and even disappear as they pass in front or behind and even pass through Jupiter's shadow.

A medium sized telescope 150mm will allow other belts to be seen and more detail in the cloud markings. The Great Red Spot will also be visible.

A good pair of 9 x 50 binoculars will just about show the four bright moons known as the Galilean Moons. These four bright moons are called the 'Galilean Moons' after Galileo Galilei who first recorded seeing them.

Jupiter and the Galilean Moons imaged by Steve Harris

The image above shows the sort of view seen using a small to medium sized telescope. The North and South Equatorial Belts are located, as the names suggest, above and below the white Equatorial Zone.



The cloud markings on Jupiter

These belts are mainly different shades of browns with variations from yellow, through orange to chocolate brown. There are even reds especially 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 using primitive telescopes nearly 350 years ago.

Saturn imaged on 16th August 2018 by Steve Harris

Saturn is the second largest planet in our Solar System and is a Gas Giant like Jupiter. The rings are 275,000 km (170,000 miles) across but are mostly less than 30 metres thick. To put this in perspective, the ring diameter is about ¾ of the distance from Earth to the Moon. The rings are made up of millions of small pieces of mainly water ice and varying in size from a few millimetres to a few metres across.

Saturn has a 27.6° tilt but is always tilted in the same direction as it orbits the Sun. Therefore as we look out from our position, close to the Sun, Saturn's ring appears to tilt up and down as Saturn orbits the Sun every 30 years. In 2003 the rings were tilted with its south pole towards us. (Shown at the extreme left position in the diagram below). We were therefore able to see the ring system tilted away from us so we could see the underside of the rings that appeared wide open.

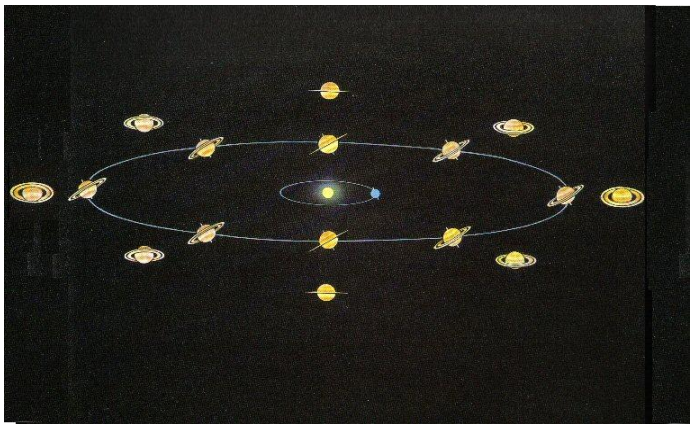


Diagram showing how we observe the ring system.

After 7½ years Saturn completed a quarter of its approximately 30 year long orbit around the Sun and appeared as at the lower position shown in the diagram above. Therefore in 2009 we were looking at Saturn side on. As the rings are very thin they almost completely disappeared for a few months. Over the next 7½ years the rings gradually appeared to open out again. Last year (2017) we saw the north pole and the top surface of the rings tilted towards us, as show in the position at the right of the diagram.

The closing sequence then will continue until 2025 when we will again view the rings side on as shown at the top position in the diagram. Eventually in 2032 Saturn will return the same position that it we saw it in 2003 when the rings will be tilted away from Earth and wide open again. This year the ring system appears almost fully open. See the upper image above.

Mars imaged in 2010 by Steve Harris

Mars is the fourth planet from the Sun and the second smallest planet in the Solar System, after Mercury. It is about half of Earth's diameter at 6,794 kilometres and has an orbital period (year) of 686.7 Earth days. A day on Mars is equivalent to 23.9 hours. Mars is called the 'Red Planet' because of the reddish iron oxide prevalent on its surface. This gives it a reddish appearance that is distinctive among the astronomical bodies visible to the naked eye. Mars is a terrestrial (rocky) planet with a thin atmosphere. It has surface features reminiscent both of the impact craters of the Moon and the valleys, deserts and polar ice caps of Earth.

Mars is one of the most interesting planets to observe with a telescope although it does require a moderate sized telescope (>125mm) and good 'seeing' conditions. Mars has a significantly elliptical orbit that brings it closer to Earth on occasions. The last and closest encounter was in 2003 when Mars was at its closest point to the Sun and Earth was at its point furthest from the Sun. That time also coincided with Earth overtaking Mars on their orbits. This overtaking occurs approximately every 23 months. As Earth is moving around its orbit it will catch up with Mars. However Mars is moving further along its own larger orbit so it takes longer to catch up.

Observing Mars this year was best in July because Mars was at Opposition on 27th July (see page 8). This meant it was at the position where Earth was overtaking Mars on their orbits around the Sun. On 27th July Mars was at its best observing position and was due south at midnight 24:00 GMT (1 o'clock BST). However it is still good for observing and is now appearing earlier in the evening.

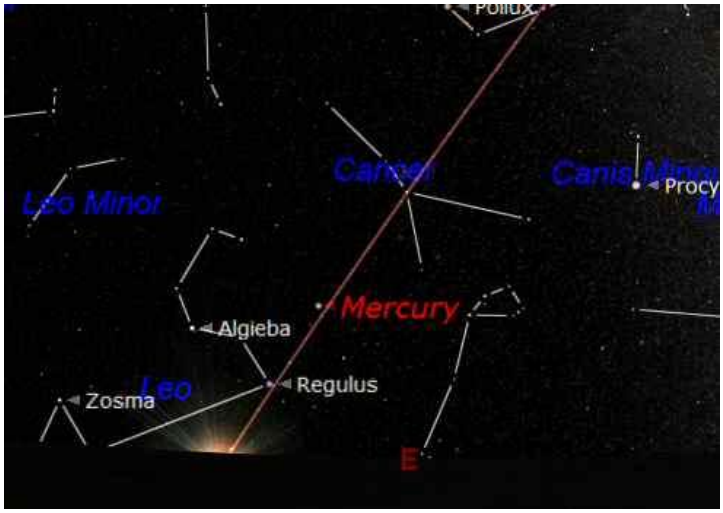
Unfortunately the view of Mars will not be good this year despite the two planets being relatively close together. The Red Planet will be positioned very low in the sky and just above the southern horizon. This means we will be looking through the Maximum amount of our own atmosphere. This is also where there is the most turbulence due to heat rising from the ground and where the mist and smog is at its worst. See page 11.

A small telescope will show the planet as a bright orange disc with the white ice cap just visible. A larger telescope will show the ice cap in more detail and some surface features may be visible. These are in the form of darker regions that used to be thought (even up to the 1960's) to possibly be vegetation on the surface. Picking out detail may be difficult this year due to the position of Mars being so low in the sky.

Mars has two very small moons but these will not be visible in amateur's telescopes.

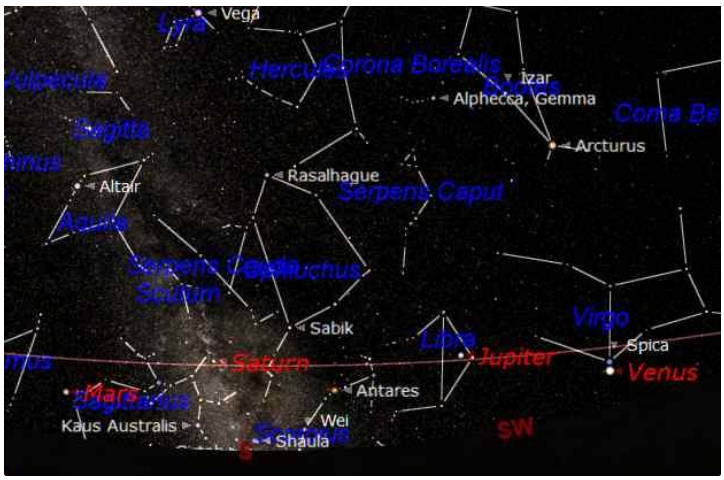
THE SOLAR SYSTEM THIS MONTH

MERCURY is an early morning object rising in the east at 04:00 at the beginning of the month. It will be very difficult to see as it is low in the east as the sky begins to brighten. Mercury will move back towards the Sun during the month and will be in Superior conjunction (passing behind the Sun) on 21st September. See the chart below.



Mercury in the east at sunrise 06:00

VENUS is moving back towards the Sun and will just be visible above the western horizon soon after the Sun sets. It sets at about 19:30 so will need a clear view towards the western horizon after the Sun has set at about 18:40. See the chart below. Venus is moving into Inferior conjunction (passing in front of the Sun) on 26th October.



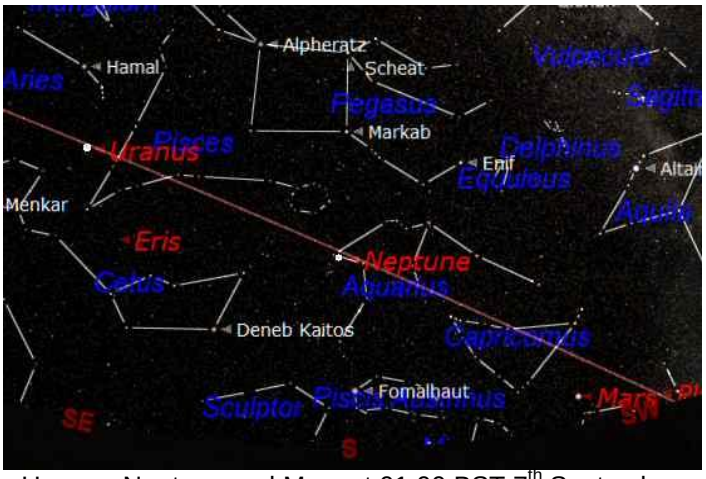
Mars, Saturn , Jupiter and Venus on 1st September

MARS will be well placed this month for observing but is very low over the southern horizon in turbulent and smoggy air. .The Red Planet passed through 'Opposition' on 27th July so is still close to Earth. It appears fairly large at 20.0 arc-seconds in diameter and is still very bright at magnitude -2.0. See page 10. More about Mars next month.

JUPITER is moving into conjunction with the Sun on 26th November so it is beginning to be difficult to observe low in the west. See the chart above and page 9. It is still easy to see but detail is starting to be difficult to make out.

SATURN is well positioned in the south but low in the sky and in turbulent, smoggy air close to the horizon. A small telescope will show the ring system but a larger telescope will be required to show it well. However the view is likely to be rather poor as shown in the image on page 10.

URANUS will be in a good observable position this month. It is moving towards its opposition on 23rd October when it will be due south at midnight (01:00 BST). Uranus will be quite high in the south east as soon as the sky is dark. A good pair of 9x50 binoculars will reveal a slightly fuzzy blue, star like, object. A telescope at a magnification of 100x will show it as a small blue/green disc.



Uranus, Neptune and Mars at 01:00 BST 7th September

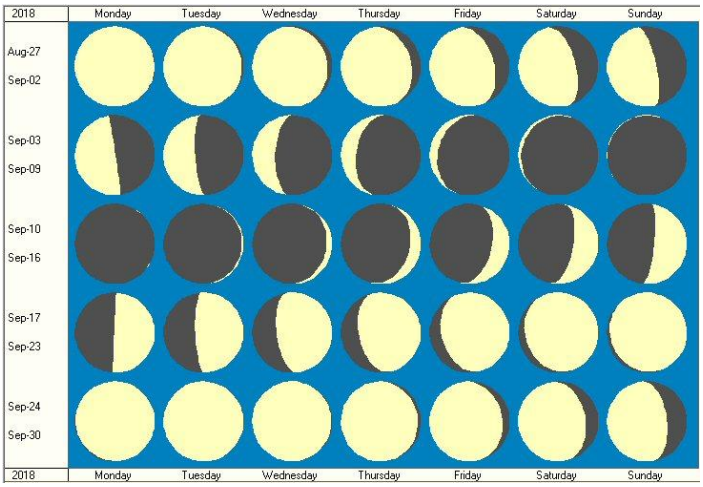
NEPTUNE will be at opposition (due south at midnight – 01:00 BST) on 7th September so at its best position for observation this year. See the chart above. A telescope will be needed to show Neptune as a small blue/green disc using a magnification of 100x but it is small and difficult to find. The chart above shows Neptune at its Opposition.

THE SUN

There may still be the odd small sunspots even though the active phase of the Solar Cycle is now over.

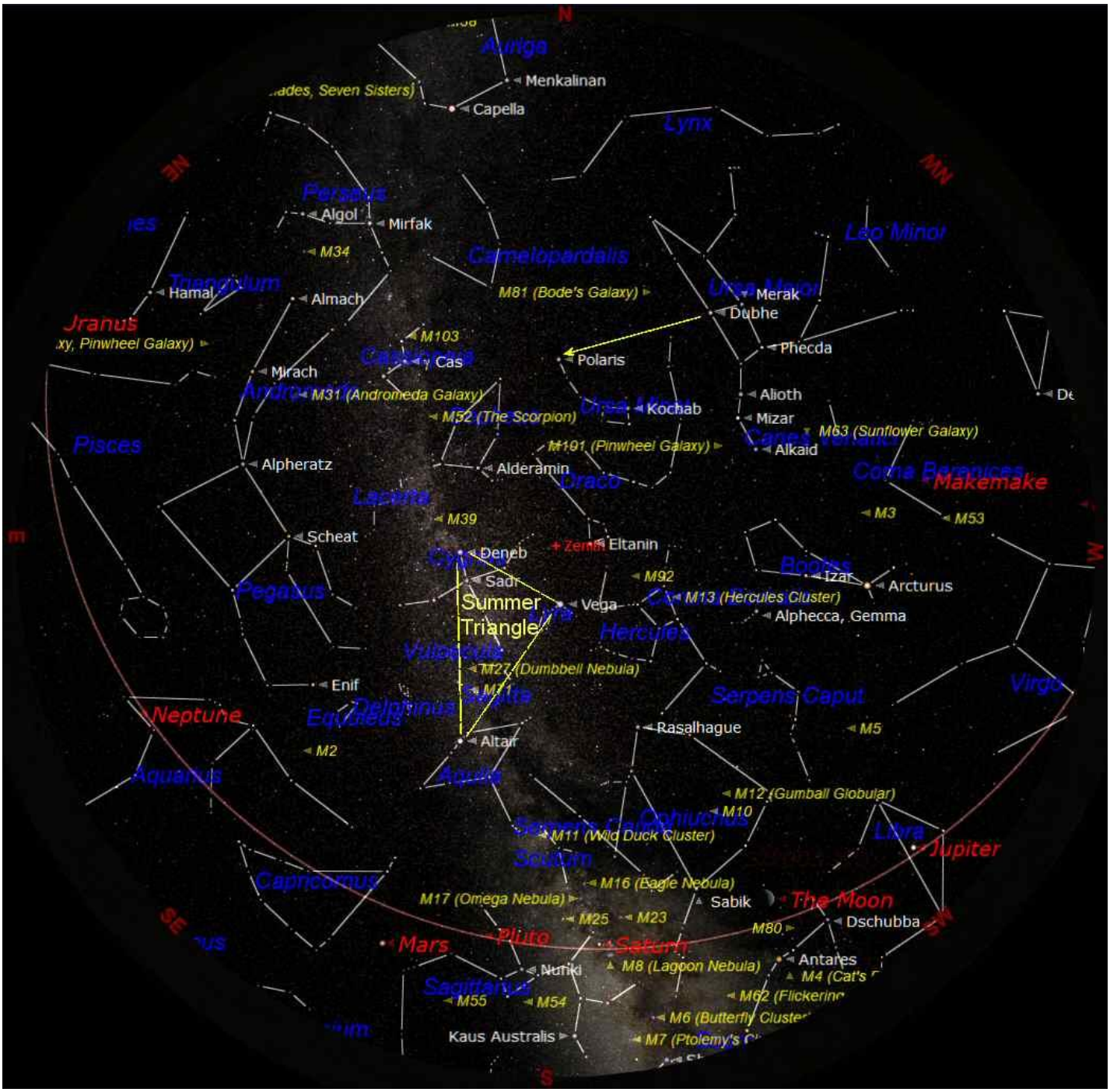
The Sun rises at 05:10 at the beginning of the month and at 06:00 by the end of the month. It will be setting at 18:45 at the beginning and 17:40 by the end of the month. Sunspots and other activity on the Sun can be followed live and day to day by visiting the SOHO website at: http://sohowww.nascom.nasa.gov/ .

THE MOON PHASES IN SEPTEMBER



Last Quarter will be on 3rd September
New Moon will be on the 9th September
First Quarter will be on 16th September
Full Moon will be on 25th September

THE NIGHT SKY THIS MONTH



The chart above shows the night sky as it appears on 15th September at 21:00 (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 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 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 observable this month: Jupiter (early evening) Saturn, Mars, Uranus and Neptune.