NEWBURY ASTRONOMICAL SOCIETY
MONTHLY MAGAZINE – SEPTEMBER 2021

JUPITER IN VIEW THIS MONTH

Jupiter with the shadow of Io 29th August 00:38 BST imaged by Steve Harris

Jupiter and Saturn are well positioned for observing this month as soon as it is dark enough in the evening. Saturn will rise over the eastern horizon about 40 minutes before Jupiter in the early evening. In the middle of September they rise at about 18:00 depending on the view to the eastern horizon. Saturn's official rising time on 15th September is 17:40 and Jupiter is 18:20.

Saturn will have moved to the centre of the southern sky by 22:30 when it will be at its highest point above the horizon (called Culmination). Jupiter will be due south and at its Culmination at about 23:00 around mid month. However both planets will be low with Saturn at just 19º and Jupiter 24º above the horizon.

The low altitude of the planets will mean they will not be at their best for those astronomers who are looking to observe fine detail on the surfaces. When objects are low in the sky they are seen through the densest part of our atmosphere. Also when we look at objects close to the horizon we are looking through about 300km of air. Whereas if we are looking directly overhead we are only looking through about 100km of air of which 50km is rarefied (thin) atmosphere.

Thicker air close to the horizon is also more polluted and is often misty or hazy. Heat from the Sun also warms the ground during the day and causes heat haze that in turn causes turbulence during the night as roads and buildings cool and heat the air that then rises.

So unfortunately the view through a telescope will be affected by the turbulence that causes the image to shimmer and appear unsteady. Sadly there is nothing we can do about the turbulence except wait for the appearance of the planets next year when they will be a little higher in the sky.

Jupiter and Saturn will be moving towards the western horizon in the next few months so we need to take every opportunity to observe them while we can. Even though the 'Gas Giants' are not at their best this year they are always impressive and beautiful to see.

Jupiter can be seen using any telescope but will appear small using a smaller 'beginners' telescope. It will be more impressive when using a larger telescope. We should start with a low power eyepiece (~25mm) to first locate the planets then increase the magnification by using a 10mm eyepiece. Using a 'Barlow' lens will double the size of the planet to show more detail.

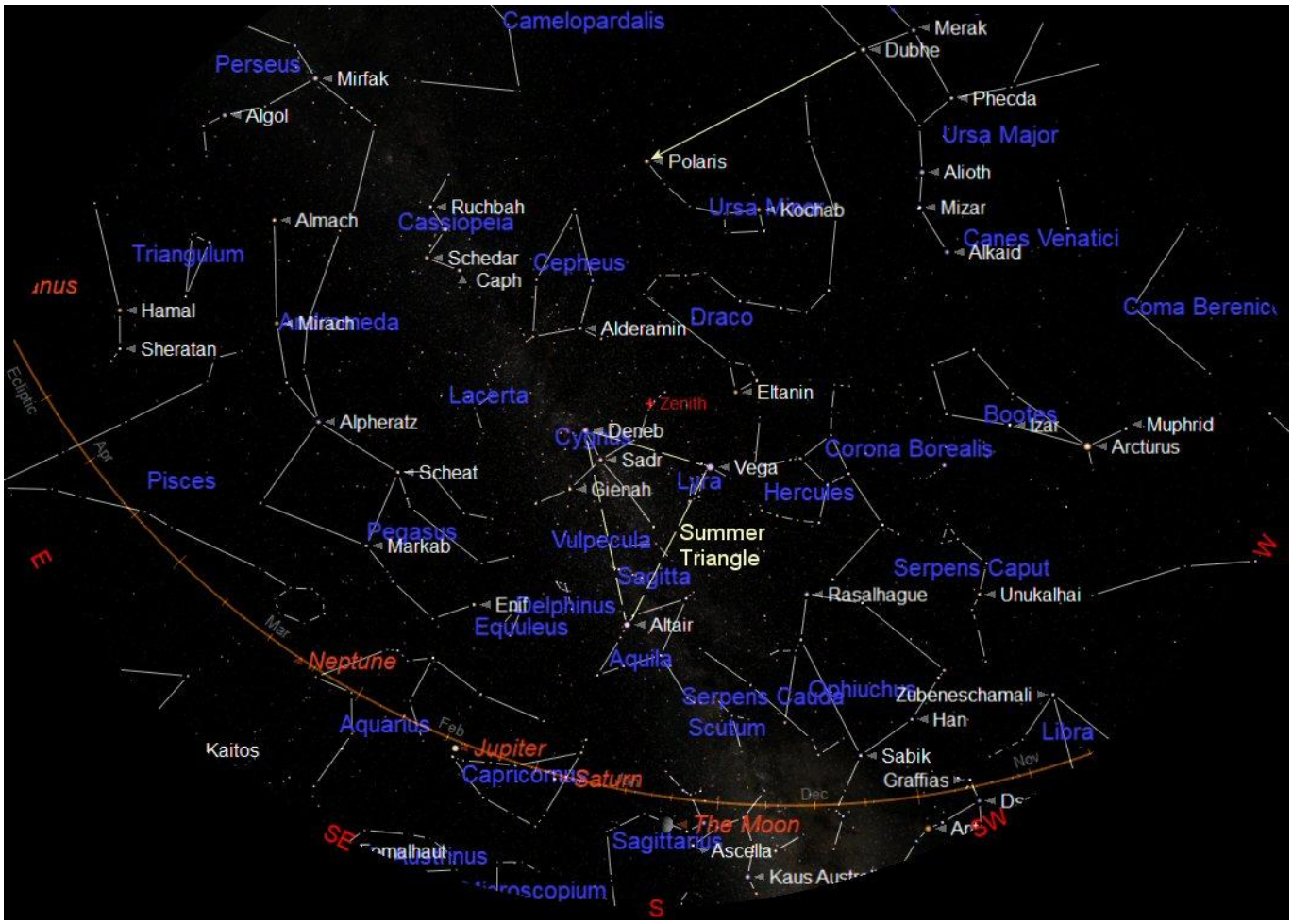
NEWBURY ASTRONOMICAL SOCIETY MEETING

3rd September	Latest news from Zooniverse
Website:	**www.newburyastro.org.uk**

NEXT NEWBURY BEGINNERS MEETING

15th September	Astronomy for beginners
Website:	**www.naasbeginners.co.uk**

AN INTRODUCTION TO ASTRONOMY FOR BEGINNERS



The southern night sky during September

Like most hobbies, Astronomy comes in many levels and branches out into many different fields of interest but the most important thing is, like all other interests, it is there to be enjoyed. In this article we will consider what the beginner to the hobby really needs to learn and what equipment may be required.

The first steps are to find out a little bit of information about the hobby so this article should help there. It does help to have a little knowledge about the night sky that can be gained by actually going outside on a clear night to just have a look around. A simple chart of the night sky is useful to show how to identify some features in the sky. It will show where to look for interesting objects or more obvious features to help find our way around.

The chart above shows the night sky looking south at about 21:00 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 and is shown (in red) at the upper 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'. To standardise how we look at the sky the patterns of the brightest stars are joined (dot to dot) with lines that create a familiar pattern. These patterns are given names and there are 88 internationally recognized constellations.

Constellations through which the ecliptic passes this month are: Libra (the Scales), Scorpio (the Scorpion), Sagittarius (the Archer), Capricornus (the Goat), Aquarius (the Water Carrier) and Pisces (the Fishes) rising in the east. On this evening the Planets Saturn, Jupiter and Neptune can be seen on the Ecliptic at the bottom of the chart. The Moon is also shown a little below the ecliptic. This is because the orbital plane of the Moon is tilted compared to the orbits of the planets around the Sun.

Some constellations are easier to identify than others. This is because a constellation may have brighter stars to make the constellation easier to see. Other constellations may have fainter stars and the pattern formed may be smaller and more difficult to identify. We can accommodate this problem by identifying the more prominent constellations then looking for the fainter ones adjacent to them.

If a constellation has a particularly bright star then we can use that star to find its constellation. For instance, in the centre of the chart is the constellation of Cygnus (the Swan) with its bright star called Deneb. Another is the bright star Arctaurus in the constellation of Boötes (the Herdsman) to the west (right) of the chart.

There are three bright stars in the summer sky that mark out the corners of the Summer Triangle. These are Deneb in Cygnus, Vega in Lyra and Altair in Aquila. These stars are quite noticeable and can be used as a starting point for finding our way around the sky.

STARS ARE NOT ALL THE SAME

When we look up into the night sky and see the stars. They look much the same although some are obviously brighter than others. Their brightness depends on two obvious factors. Some stars are actually brighter than others but in many cases their different distances from us just makes some look brighter than others. Stars that are closer to us will obviously look brighter than stars that are much further away. So we can then say a star's apparent brightness is dependent on the intrinsic brightness of that star and its distance from us.

If some stars are intrinsically brighter than others then something must be making them brighter so stars must be different in some way. It turns out that the brightness is mainly determined by the size of the star. We must however be careful about what we mean by size.

There are two measures of size attributed to stars one is its mass the other is its diameter. To explain this we can compare the sizes of a cricket ball and a balloon. The balloon is obviously larger in diameter but the cricket ball is heavier. We can say the cricket ball is heavier because it has more stuff in it so we say it has more mass or is more massive. The balloon is full of light air which has less weight or mass. So if we say one star is more massive than another star this means it has more stuff in it and is heavier.

Some stars are very massive but not necessarily large in diameter. Other stars may be very large in diameter but are less massive.

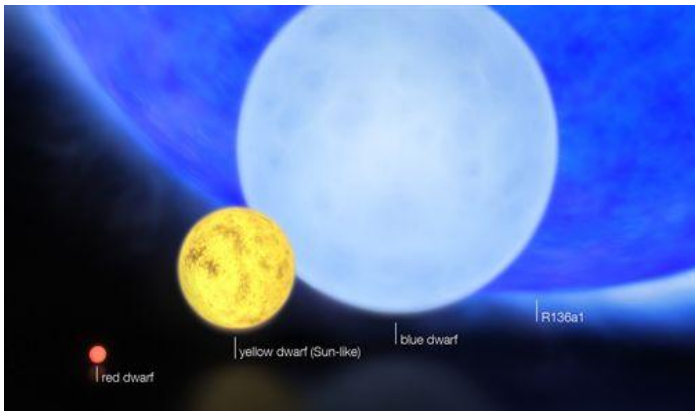
Our Sun is a fairly typical star in many ways. It is known as a Yellow Dwarf. This does not mean it is particularly small it is just that there are some types of star that are much bigger. Our Sun appears slightly yellow because the hot gas on the visible surface emits this wave length of light. The temperature of the gas in the photosphere of our Sun is at about 5500ºK. Gas heated to this temperature will shine white hot with a slight yellow tinge. Hotter gas will appear pure white and even hotter will appear blue and even hotter still may even appear slightly green. Stars that are cooler than our Sun will look more yellow through to orange and if much cooler can appear distinctly red.

Class	Surface temperature[8] (kelvin)	Conventional color	Apparent color[9][10][11]
O	≥ 33,000 K	blue	blue
B	10,000–33,000 K	white to blue white	blue white
A	7,500–10,000 K	white	white to blue white
F	6,000–7,500 K	yellowish white	white
G	5,200–6,000 K	yellow	yellowish white
K	3,700–5,200 K	orange	yellow orange
M	2,000–3,700 K	red	orange red
L	1,300–2,000 K	purple-red[citation needed]	red[citation needed]
T	700–1,300 K	brown[citation needed]	purple-red[citation needed]
Y	≤ 700 K	dark brown[citation needed]	brown[citation needed]

Chart showing the classification of stars

So the colour of a star is due to the temperature at the surface but what makes a star hotter or cooler? There is a general rule: the more massive a star is, the hotter it will be but like most rules there are some exceptions.

Classifying stars is mainly based on the mass of the star but not exclusively. The smallest of all 'NORMAL' stars are called Brown Dwarfs and are very cool with surface temperatures as low as 700ºK. These stars may live (figuratively speaking) for many trillions of years. They start with a mass of a few tens of Jupiter masses.



The range of sizes of stars

Red Dwarfs have surface temperatures of 1300ºK to 3700ºK and may also 'live' for trillions of years. One of our closest neighbours Alpha Proxima is a red dwarf but is not observable from the UK or northern latitudes. These stars have a mass of around 0.1 to 0.5 compared to the mass of our Sun and are very faint.

Yellow Dwarfs include our Sun and have a mass of slightly less than the Sun to about twice the mass. The actual dividing line is not clear as star types can overlap within certain limits of mass. There is not a White Dwarf class as this name is given to completely different class of star that we will discuss in a later issue.

Sub-giants are the group having a mass slightly more than our Sun and up to about three solar masses.

White Giants are massive stars from three and up to about ten solar masses and can be many thousands of times brighter than our Sun.

Super Giants are rare stars that are between ten to a hundred times the mass of our Sun. They consume their Hydrogen fuel at a frantic rate and will explode as a Supernova in just a few million years. This is why they are so rare (because they are not around for very long).

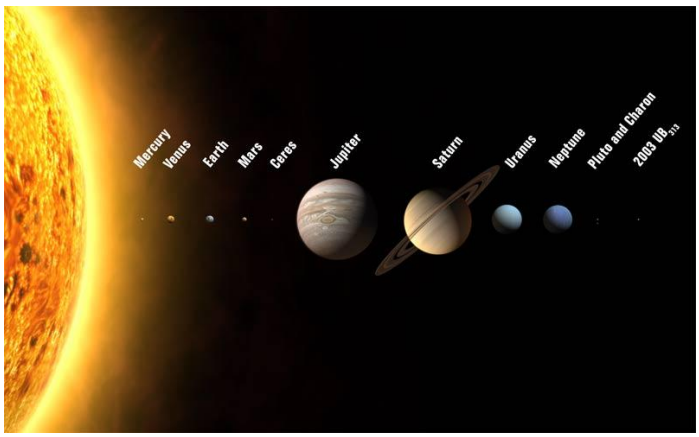
Some stars appear brighter to us but most look white to us as we look up into the night sky but a few stars do appear a little more orange. The stars are mainly too faint for eyes to discern any colour but using binoculars or a telescope may reveal some colour.

Most stars appear to us as a single point of light but a few can be seen to be double stars. In fact up to 60% of stars are actually double or multiple star systems. The middle star 'Mizar' of the 'saucepan' shape handle of the constellation of Ursa Major is one of the very few 'naked eye double stars. Its fainter companion called Alcor can be seen fairly easily with our unaided (naked) eyes.

Stars can also be seen in groups or clusters. Most clusters need binoculars or a telescope to see. A few clusters can be seen with our naked eyes. The most famous is the Pleiades 'Seven Sisters' which is the brightest and most famous.

OUR PLANETS

Our Sun has eight main planets named (on order out from the Sun): Mercury, Venus, Earth, Mars, Jupiter, Saturn, Uranus and Neptune.



Our Solar System with planets shown at relative size

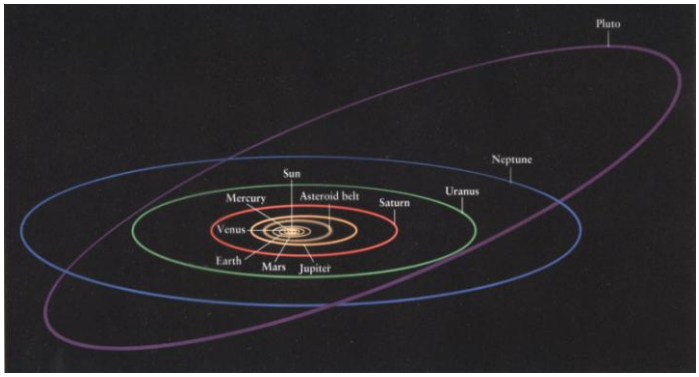
We divide the planets of our Solar System into three groups of different types of planets. The inner four planets Mercury, Venus, Earth and Mars are called the Terrestrial (rocky) planets. Jupiter and Saturn are called Gas Giants (because they a large and made of gas) the outer planets Uranus and Neptune are called Ice Giants because their gases are mainly frozen.

Here are the main orbital statistics of the planets:

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

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.

To help us observe the planets it is useful to know how the planets move around our sky and how they appear when viewed from Earth. The diagram below shows how the planets orbit the Sun on the same plane (in a sort of flat disc). Except Pluto that has an odd inclined orbit.



The orbits of the planets

The two inner planets, Mercury and Venus, orbit closer to the Sun than Earth and are called the Inferior Planets. This means we can sometimes see these planets pass in front of the Sun in what is called a Transit. The outer planets are called the 'Superior Planets' and they cannot pass in front of the Sun. All the planets can appear to pass behind the Sun that is called a 'Conjunction'.

The inferior planets have shorter orbital times than Earth and the Superior Planets have longer orbits. So Mercury and Venus overtake Earth (on the inside) and the other planets are overtaken by Earth on the inside of them.

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 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 Earth longer to catch up. There are two terms that are used to describe the orbital periods of the planets.

Sidereal Period – The true orbital period of a planet, the time it takes the planet to complete one full orbit of the Sun. See the table in the previous column.

Synodic Period – This is the time elapsed between two successive identical oppositions of a planet (The time taken for Earth to catch up with another planet).

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 (Earth 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

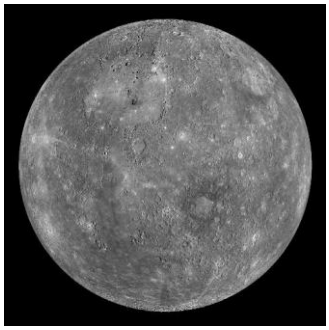
The Inferior Planets (Mercury and Venus) orbit inside Earth's orbit so they pass in front and behind the Sun as seen from Earth. These two conjunctions are called Inferior Conjunction (when the planet passes in front of the Sun) and Superior Conjunction (when the planet passes behind the Sun). Unlike the Superior Planets (those with orbits outside Earth's orbit) Mercury and Venus cannot have an opposition. This is because they are always in the same direction as the Sun therefore it cannot be directly behind Earth when looking at them.

The Superior planets appear to move across our sky from year to year. They therefore appear in different constellations each year (called their annual apparition). The Inferior Planets move faster so they will appear to move across the sky faster. With the Superior planets, the further out they are from the Sun the longer their orbits will be. Therefore they appear to have moved less across the sky from year to year.

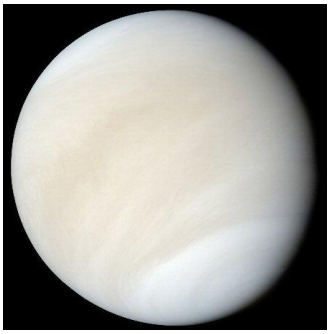
THE MOONS OF OUR PLANETS

We have looked at our Solar System with our star, the Sun, being the dominating central object of the system with the Planets, Dwarf Planets, Asteroids and Comets having primary orbits around the Sun. Now we can consider those objects that have secondary orbits within the Solar System. We call these Moons as they orbit around planets that in turn orbit the Sun.

There are two planets that do not have moons these are MERCURY and VENUS, the two innermost planets of the Solar System.



Mercury



Venus

EARTH's single natural moon is the largest moon compared the size of its parent planet of all the planets and is sometimes said to be almost a double planet.

Earth and its Moon comparison of size

MARS has two moons but they are very small and are thought to be asteroids that have been captured by the gravity of Mars and are now in orbit around the planet. Phobos is 22.2 km wide and Deimos is 12.6 km wide.

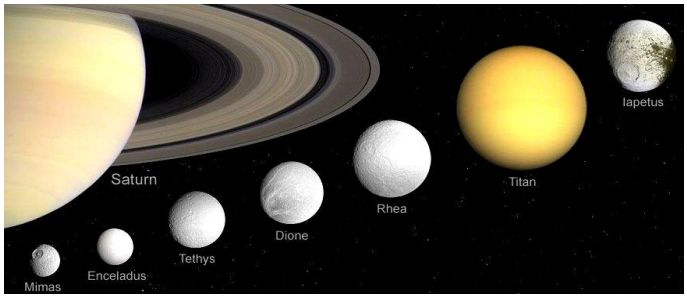
The moons of Mars Phobos and Deimos

JUPITER is the largest planet and classified as is a Gas Giant Planet. It has about 80 moons but only four are large and about the same size as our Moon. They are called Io, Europa, Ganymede and Callisto. These four largest moons are known as the Galilean moons as they were discovered by Galileo Galilei in 1610. Ganymede is the largest moon in the Solar System at 5262km in diameter. The Galilean moons can be seen in any telescope and even using binoculars.

Jupiter's Galilean moons are very different to each other in size and appearance. Io is the inner moon and is covered in active volcanoes. Europa is the smallest and is mainly water ice. Ganymede is the largest moon and Callisto has the oldest surface in the Solar System.

Jupiter's largest 'Galilean Moons'

SATURN has about 82 moons but most are quite small. One moon Titan is 5150 km in diameter. It is the second-largest moon in the Solar System after Jupiter's moon Ganymede. The other moons are smaller but Titan and three or four of the other moons can be seen using a medium sized (150 – 200mm) telescope.



The largest of Saturn's ~82 moons

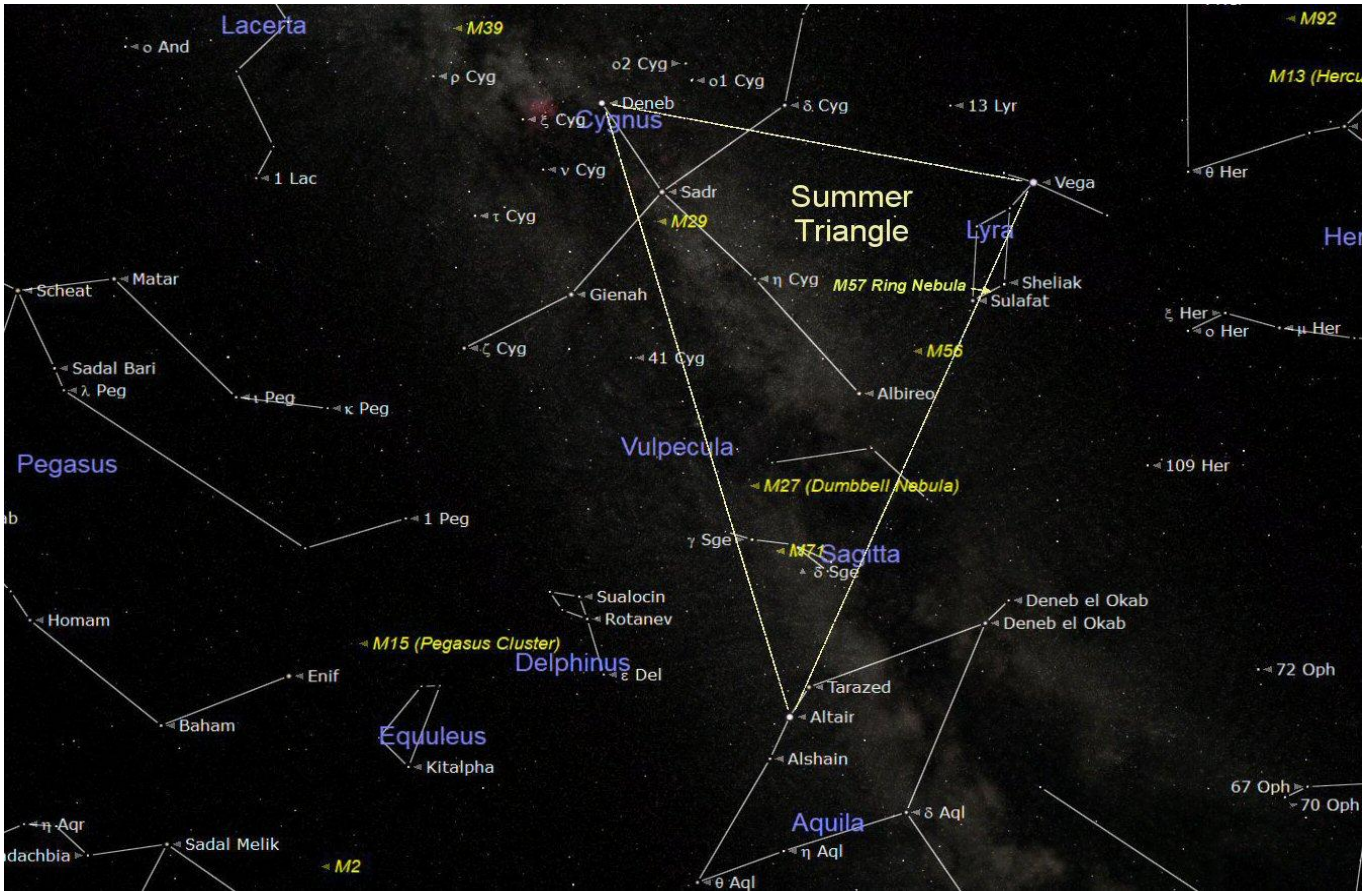
URANUS has 27 known moons with four over 1000km in diameter. The largest is Titania which is 1580km with Oberon almost as large at 1524km in diameter. All of the moons of Uranus are too small and faint to be seen using a telescope but can be imaged using a large telescope.

The moons of Ice Giant Planet Uranus

NEPTUNE has 13 known moons including one large moon called Triton. Triton was a surprise to scientists when the first close up images were returned to Earth. It was shown have a geologically active surface. Geysers were seen erupting with dark plumes and leaving trails across the surface. This indicated that there was a heat source below the surface and winds in the thin atmosphere. None of the moons can be seen using a typical amateur astronomer's telescope.

The moons of Neptune

EXPLORING THE SKY AROUND THE SUMMER TRIANGLE



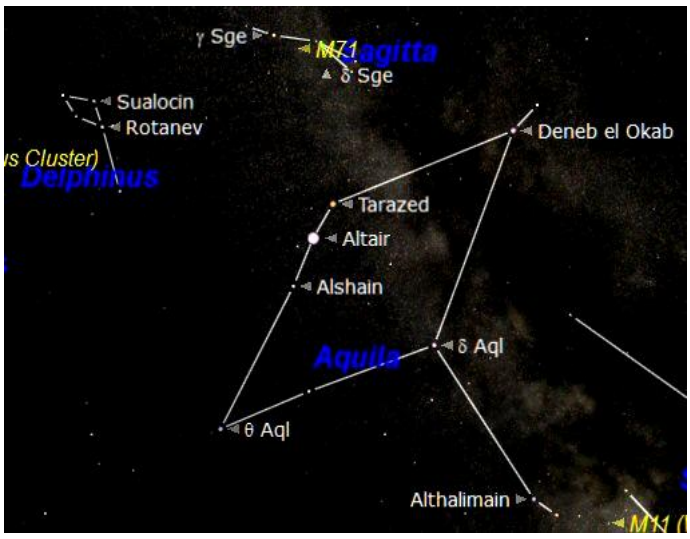
The chart above shows the sky around the Summer Triangle. The term 'Summer Triangle' was suggested by Sir Patrick Moore and has now become the best known feature of the summer night sky. The corners of the imaginary triangle are positioned on the three obvious bright stars: Deneb in the constellation 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.

THE CONSTELLATION OF AQUILA (the Eagle)

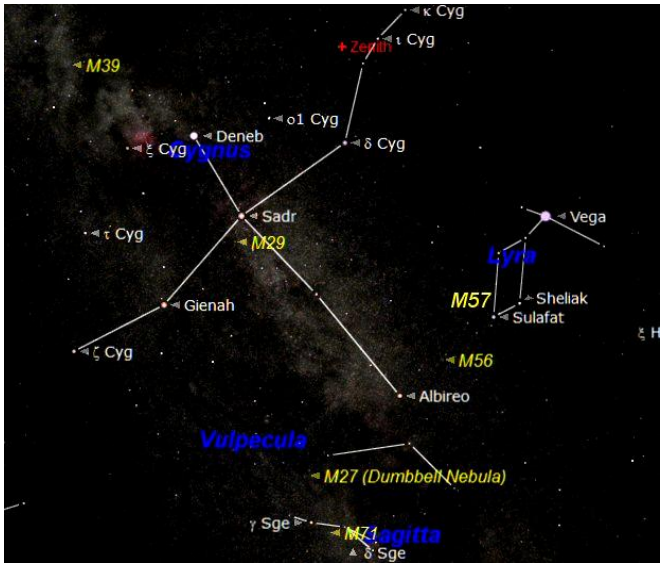
The constellation of Aquila (the Eagle) is found at the bottom corner of the Summer Triangle. There are no interesting objects in Aquila but the one bright star, Altair, has a fainter star above and below it that makes it quite easy to find.

THE CONSTELLATION OF 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 constellation of Aquila



The constellations of Cygnus and Lyra

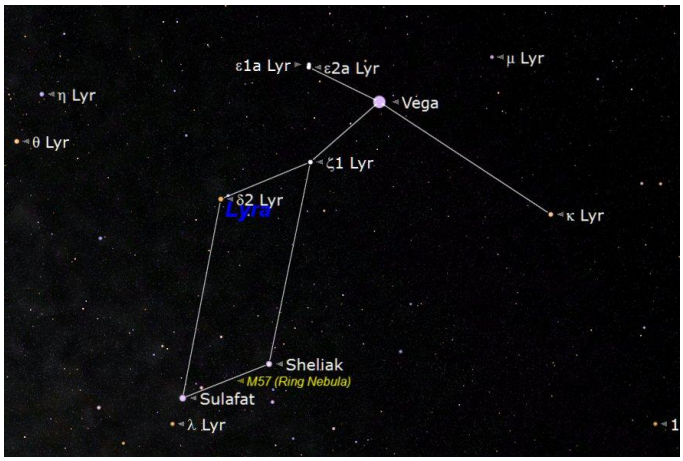
Cygnus (the Swan) does actually resemble the swan it is supposed to represent. We start at the bright star Deneb which marks the tail of the swan. From the fairly bright star Sadr the wings are spread out to each side and the long neck of the swan stretches on to Albireo.

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 fainter and distinctly blue. This is not 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 coloured 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 and 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 parallelogram shape that is better known as the 'Lozenge'.

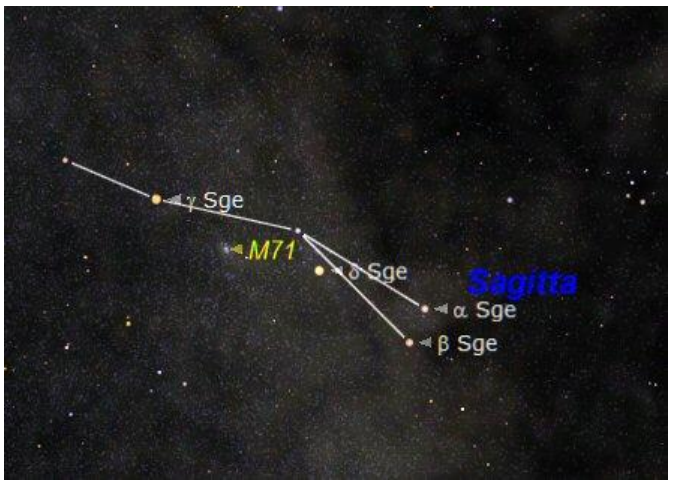
To the south east of the very bright star Vega is the lozenge shaped asterism comprised of four stars. Between the two lower stars: Sulafat and Sheliak is the Messier object M57. This is a 'Planetary Nebula' which has nothing to do with a planet. It is in fact a dying star that was similar to our Sun 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)

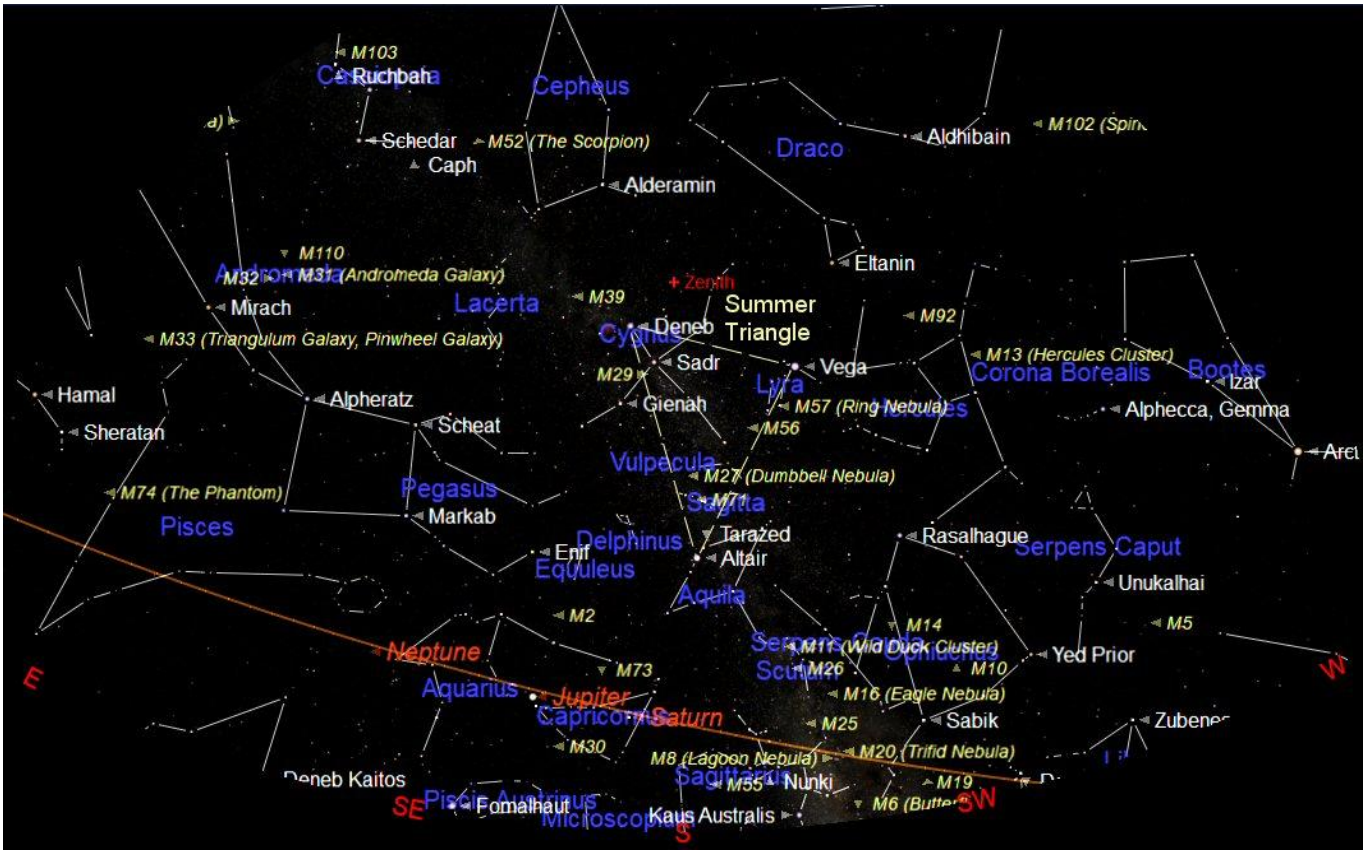
Sagitta is good fun to find using small binoculars because it really does look like an 'arrow'. It is composed of three stars that look like the shaft of the arrow and two stars that resemble the flight feathers.



The constellation of Sagitta

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

A TOUR OF THE NIGHT SKY - SEPTEMBER 2021



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 and is shown (in red) at the upper 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: Libra (the Scales), Scorpio (the Scorpion) Sagittarius (the Archer), Aquarius (the Water Carrier), Capricornus (the Goat) and Pisces (the Fishes).

Prominent in the southern sky is the Summer Triangle that dominates the Summer Sky and was described in detail previous pages. The triangle is defined by 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. The Summer Triangle is bigger than may be expected but once it has been found it is very easy to find again.

As the Summer Triangle is so easy to find it is very useful to use as a starting place for finding our way around the night sky. See Pages 6 and 7.

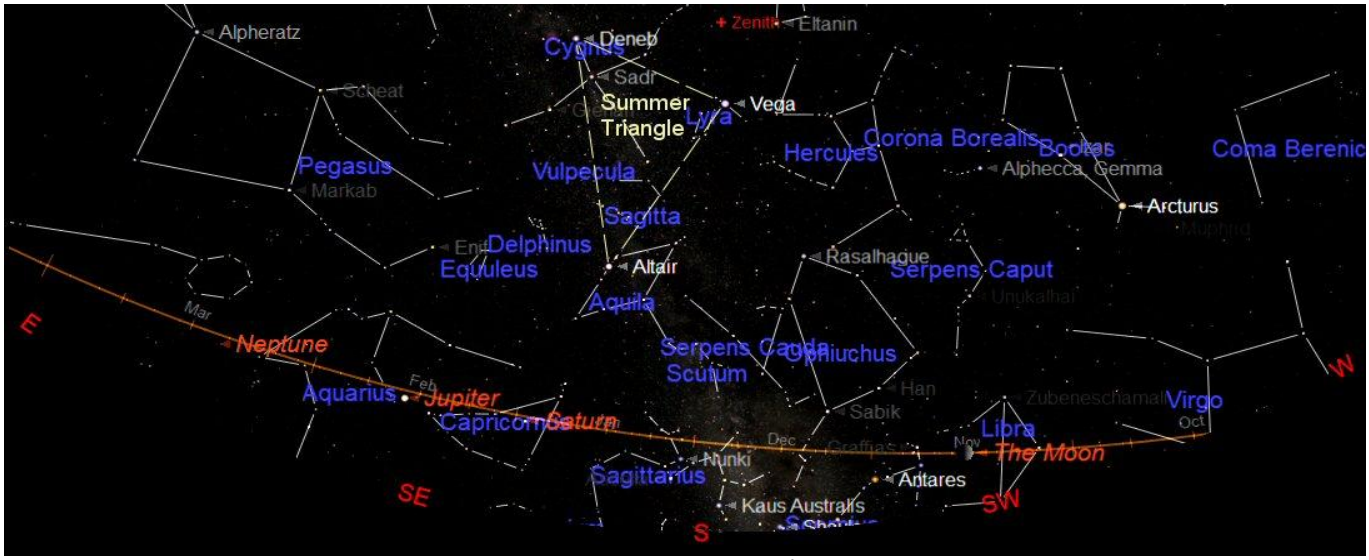
To the west (right) of the Summer Triangle and almost overhead is the constellation of Hercules (the Strong Man). Hercules has a distinctive distorted square shape, at its centre, called the 'Keystone'. This is due to its resemblance to the centre stone of an arch or bridge. The jewel of Hercules is without doubt the Great Globular Cluster, Messier 13 (M13) that can be found in the western vertical imaginary line forming the 'Keystone'. It is just visible using a good pair of 9 x 50 binoculars. The spherical 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.

To the west of Hercules and moving towards the western horizon is the bright orange coloured star called Arcturus in the constellation of Boötes. Arctaurus is a star similar to our Sun but more advanced and is developing into a Red Giant star that is nearing the end of its 'life' as a normal star. It has used almost all of its Hydrogen fuel and has expanded to become a Red Giant, 25 times the diameter of our Sun. At the moment it shines 115 times brighter than our Sun but it is destined to collapse and become a White Dwarf and Planetary Nebula.

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. The square can be used to judge the seeing condition of the night sky. Under perfect conditions about ten stars can be seen inside the square this would indicate a very good night for observing. If three to five stars can be seen then conditions will still be good. If fewer or none can be seen then stick to looking at the Moon or planets. There is a very nice Globular cluster in Pegasus it is known as Messier 15 (M15). It is a lovely sight to see in a medium to large telescope.

The Ecliptic is low in the sky during the summer months so the Moon and planets appear close to the southern horizon. Saturn and Jupiter are well placed but due to their low altitude will not be at their best for observation this year. The thick, murky and turbulent air will cause the planets to appear quite unsteady.

THE SOLAR SYSTEM - SEPTEMBER 2021

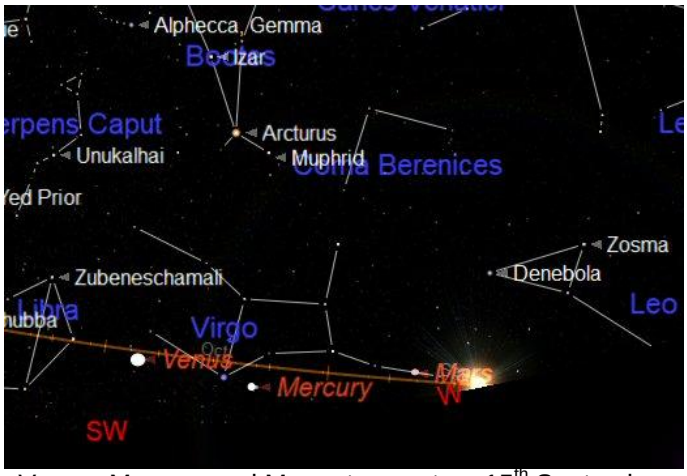


The planets at 22:00 on 15th September

The chart above shows the location of the planets along the Ecliptic. The sky has been darkened to make the planets visible. The planets to the west of the Sun (right) will be visible late evening and early morning sky before sunrise. The planets to the east of the Sun (left) will be visible in the early evening sky after sunset.

MERCURY will be very close the Sun after sunset. Experts may be able to find it in the bright evening sky but it will require a clear view to the western horizon.

VENUS will be visible in the early evening sky as soon as possible after sunset. It will be easy to find but will it require a clear view to the western horizon. Venus is emerging from its excursion behind the Sun when it was in 'Conjunction' with the Sun. It will appear at its smallest diameter and will be fully illuminated because it is still beyond the Sun from our point of view.



Venus, Mercury and Mars at sunset on 15th September

MARS has now moved out of view and will not appear in the evening sky again until September 2022. It can be seen very close to the Sun in the chart above but it will be too close to the Sun and too small in diameter to be observable.

JUPITER will be rising in the east at about 18:30 and will be visible in the south east by 19:30. Jupiter was at opposition and its best on 20th August. See pages 1 and 10 for more advice on observing Jupiter.

SATURN will be rising in the east at about 18:00 but will be more difficult to observe than Jupiter in the turbulent air close to the horizon. Saturn rises before Jupiter in the east and was at its best for this year on 2nd August when it was at opposition.

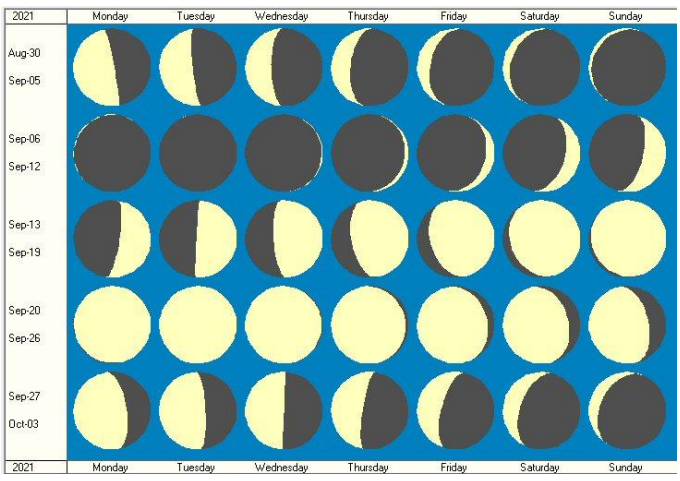
URANUS will be observable this month and will be best at 04:00 when it will be due south and at its highest point above the horizon but is small and faint at +5.7.

NEPTUNE will be just visible this month to the east of Jupiter (see the chart). It is small a difficult to see at only 2.4 arc-seconds in diameter and magnitude +7.7.

THE SUN

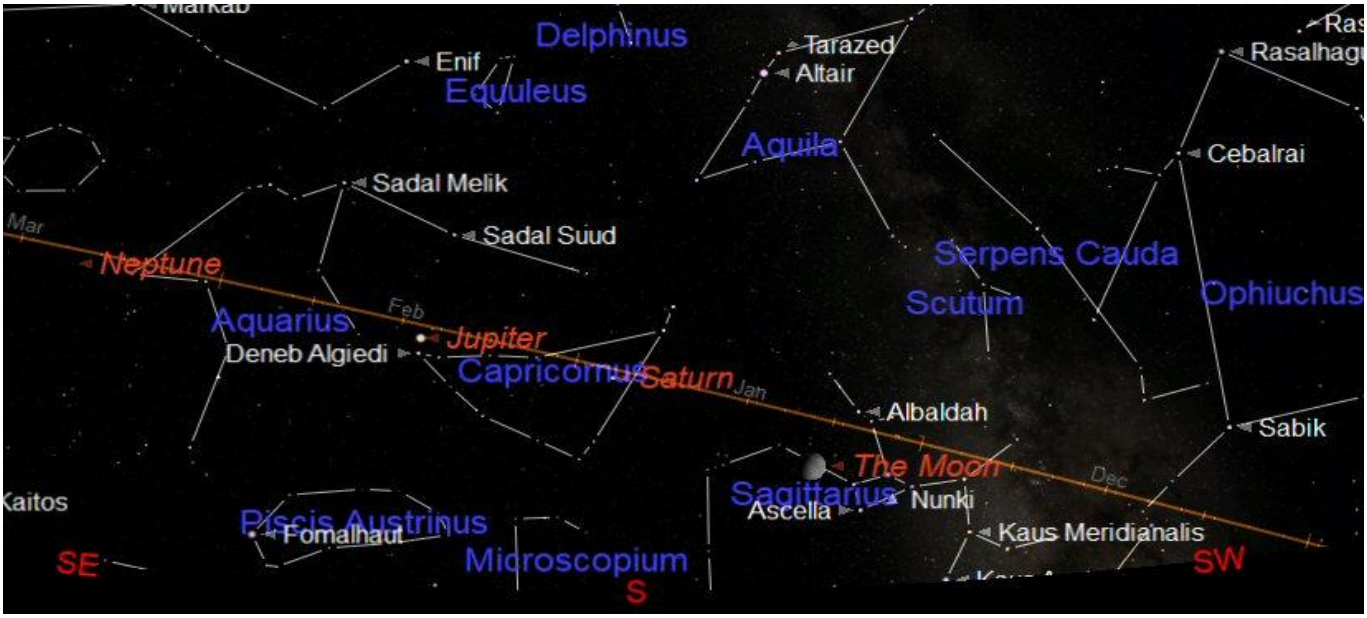
The Sun rises at about 06:20 at the beginning of the month and 06:52 by the end. It sets at 19:35 at the beginning of the month and 18:50 at the end of the month. It reached its highest point in the sky on 21st June which was the Summer Solstice and will be at the Autumn Equinox on the 22nd September. There have been a few small Sunspots during July and August.

THE MOON PHASES DURING SEPTEMBER



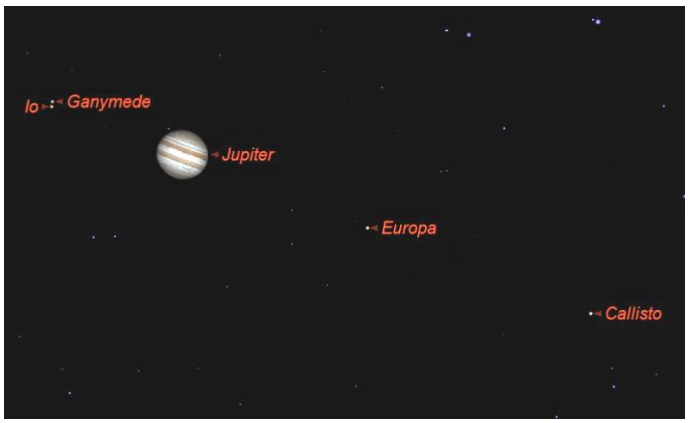
New Moon will be on 7th September
First Quarter will be on 13th September
Full Moon will be on 21st September
Last Quarter will be on 29th September

OBSERVING JUPITER AND SATURN - SEPTEMBER 2021



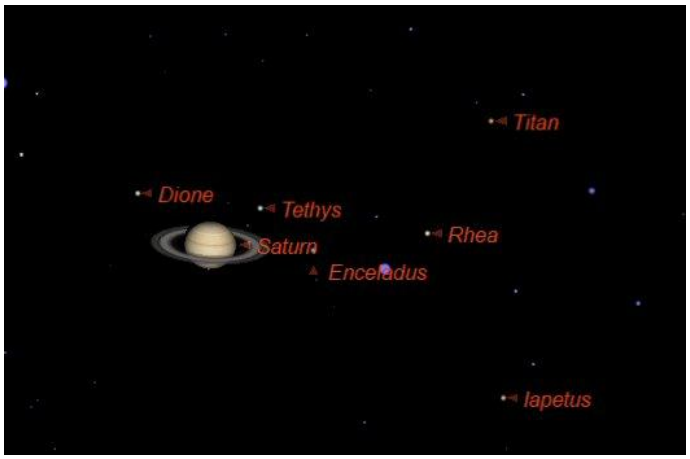
Jupiter and Saturn at 22:00 on 15th September

Jupiter will look brilliant and interesting on any clear night but some nights there may be something special to see. The computer generated chart below shows the moons spread out to both sides of Jupiter at midnight on the 2nd September. This spread is always lovely to see but at this time Io will appear to be passing close to Ganymede.



Moons Io and Ganymede close at midnight 2nd Sept

Jupiter and Saturn can be seen in a smaller telescope of the sort that a beginner to astronomy might have been advised to buy as a first telescope by experienced astronomers.



Saturn and its brightest moons

A high magnification must be used and on a good clear and still night when the view will be very rewarding. The previous charts show the sort of things that can be expected in one of these first telescopes along with an example of the view through a larger aperture telescope and with a longer effective focal length.

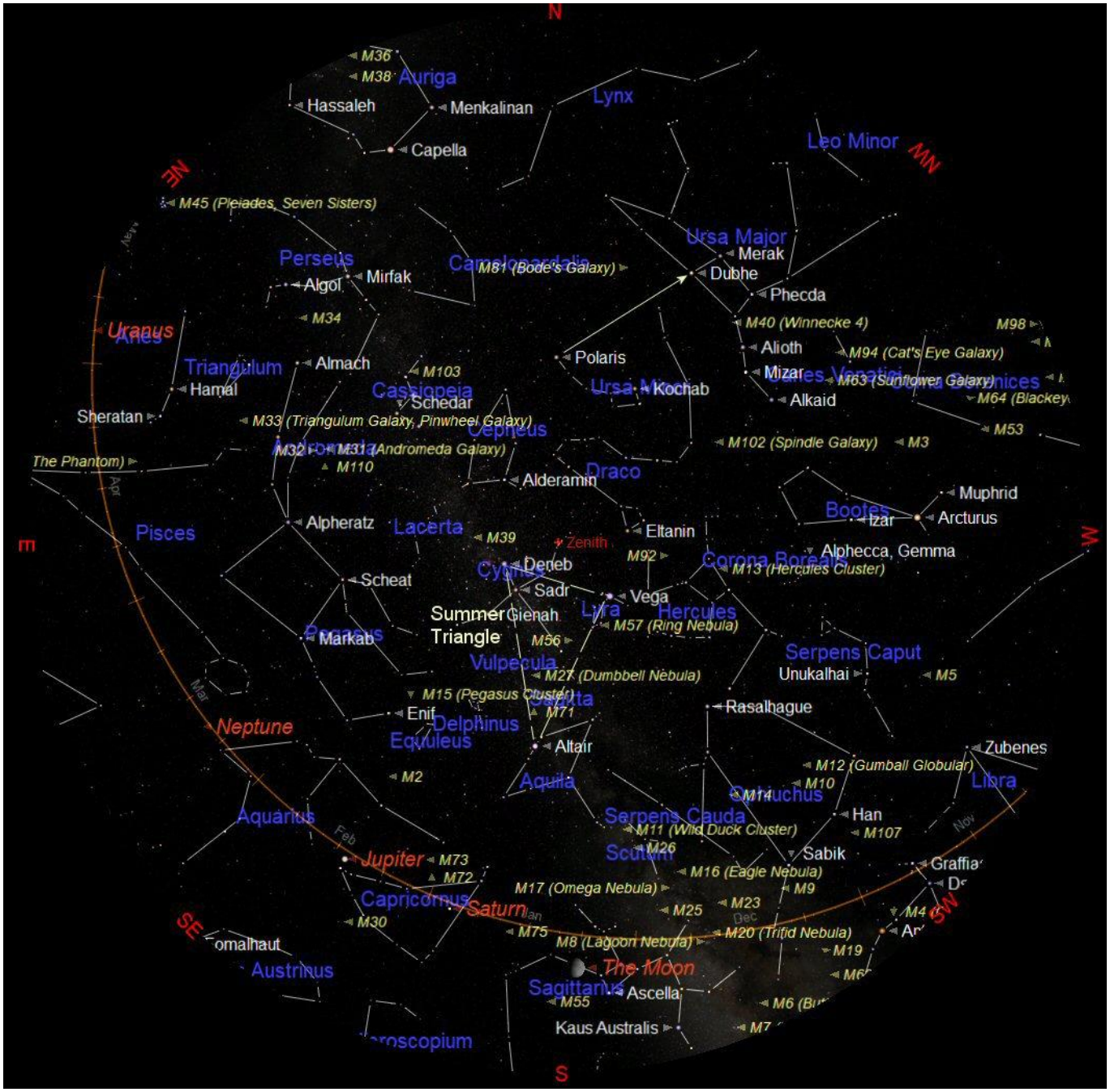
As Saturn is twice as far away as Jupiter it looks smaller and fainter. At twice the distance of Jupiter the amount of sunlight (per unit of area) reaching Saturn is a quarter of what Jupiter receives. Also the amount of light that we see reflected back from Saturn is also four times less that reflected by Jupiter. In total this means that Saturn not only appears much smaller but is also more than 16 times fainter (4 x 4) than Jupiter.

So that is the bad news but this is compensated for by the magnificent ring system of Saturn. The ring does add a little to the brightness and can be seen even using a smaller telescope.

The movement of Jupiter's moons can be predicted by using a Planetarium Application on a computer. The free to download application called Stellarium is very good for doing this. We are able to predict when a moon will pass in front (transit) or behind the planet (occultation). There will always be something interesting going on.

The Moon Io casting its shadow on to Jupiter

THE NIGHT SKY – SEPTEMBER 2021



The chart above shows the whole night sky as it appears on 15th September at 22:00 (10 o'clock) 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 9 o'clock BST at the beginning of the month and at 11 o'clock BST at the end of the month. The stars also appear to move 15º (360º divided by 24) each hour from east to west, due to the Earth rotating once every 24 hours.

The centre of the chart will be the position in the sky directly overhead, called the Zenith. First we need to find some familiar objects so we can get our bearings. The Pole Star **Polaris** can be easily found by first finding the familiar shape of the Great Bear 'Ursa Major' that is also sometimes called the Plough or even the Big Dipper by the Americans. Ursa Major is visible throughout the year from Britain and is always quite easy to find. This month it is high 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 in the evening sky: Venus early evening with Saturn, Jupiter, Neptune and Uranus later.