NEWBURY ASTRONOMICAL SOCIETY
MONTHLY MAGAZINE – DECEMBER 2017

THE GEMINID METEOR SHOWER

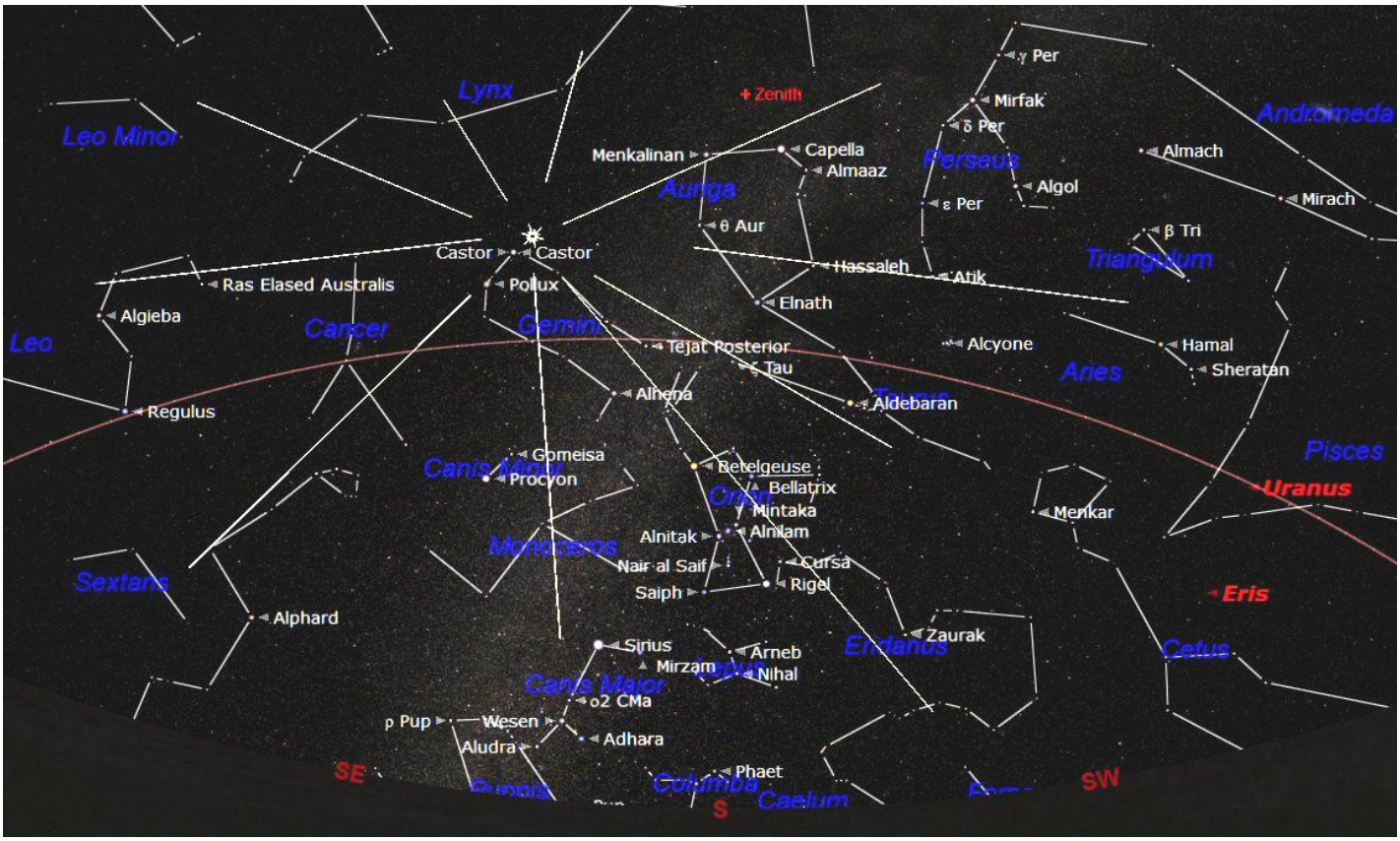


Chart showing the Radiant Point of the Geminid Meteor Shower

In the middle of this month, from 8th to 17th December, there will be a meteor shower known as the Geminid shower. The very best time to watch for the meteors will be during the early morning hours on Thursday 14th.

The Moon does not rise until 03:40 so conditions look very promising and weather permitting, the sky will be dark and moonless for most of the night. The suggested hourly rate is 120 but this would be in a perfect dark clear sky. Even with a perfect sky in the Newbury area we might expect less than that but it could still be well worth waiting for.

The type of meteor that occurs in showers usually originates from a comet and is much more common than the 'Fireballs' that generally originate from asteroids. The Geminid shower, for this reason, is unusual because it is thought to originate from an asteroid known as 3200 Phaethon. This means that some of the meteoroids (the particles moving through space) may be of a rocky nature so they will often be bright and survive for quite a long time. When they enter Earth's atmosphere, about 100km up, they often produce a bright and persistent trail.

The Geminid meteors also enter the atmosphere comparatively slowly at about 35 km/second compared with other showers that enter at over 75 km/second. As a result of this slower entry and some having a more robust rocky make up, the Geminid meteors may appear brighter and their trails across the sky often last longer.

Geminids appear to radiate from constellation of Gemini which is above the horizon from early evening. The meteors can be seen for most of the night and in almost any part of the sky. By midnight the constellation will be almost due south and high in the South Western sky.

If you are intending to have a look remember to wrap up warm before you go out because you will soon feel very cold and that will spoil your enjoyment of the shower. Make yourself comfortable in a garden lounger chair and spend at least an hour looking.

Asteroid 3200 Phaethon is what is known as an Apollo Asteroid. Apollo asteroids are a group of near-Earth asteroids that have orbits around the Sun that extend from the Asteroid Belt (between Mars and Jupiter) into just inside the orbit of Earth. They are generally small but can be up to 8.5 km in diameter with many that cross Earth's orbit. Over 2500 have been identified. See page 2.

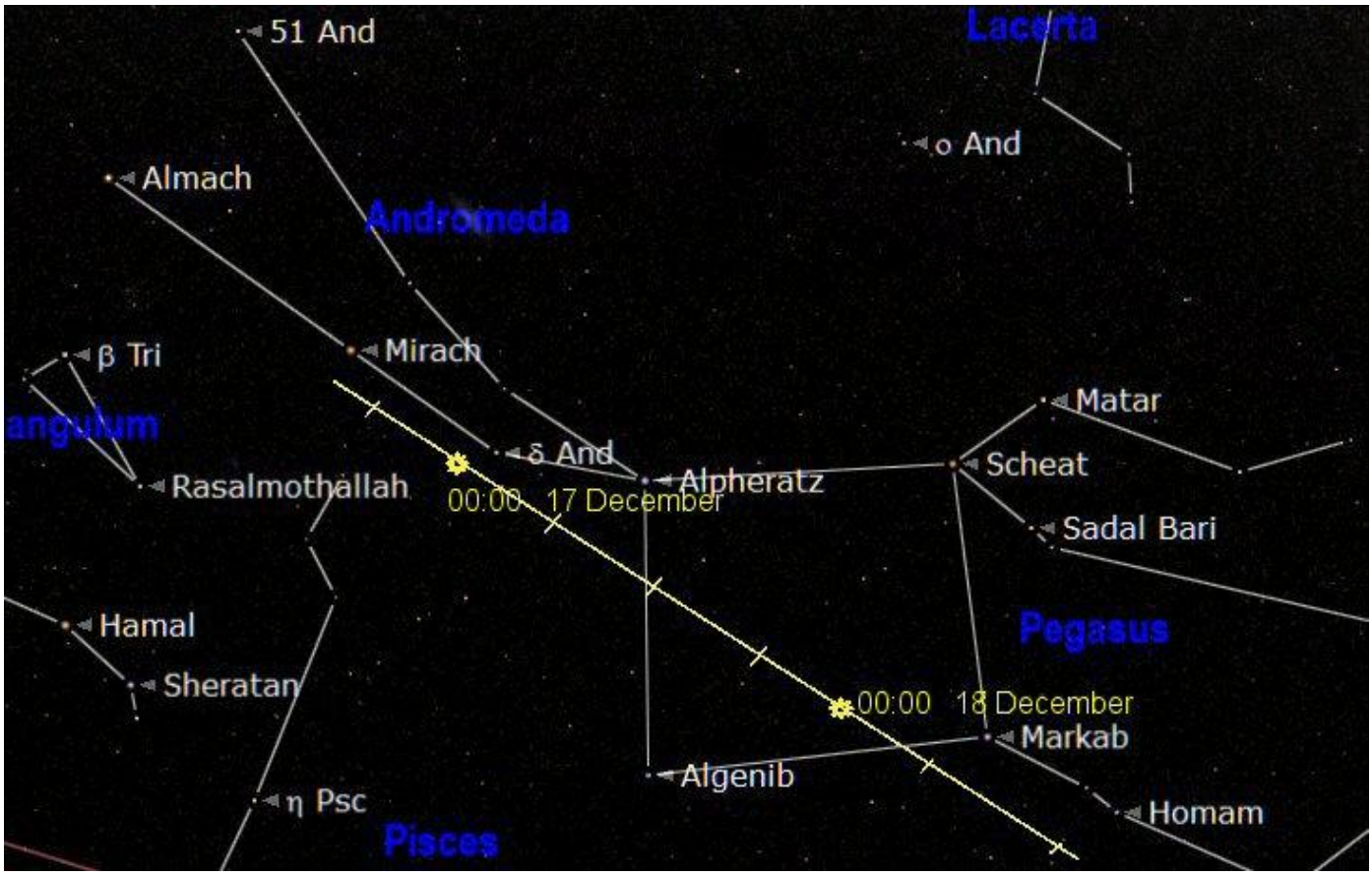
NEWBURY ASTRONOMICAL SOCIETY MEETINGS

5th January 13 Journeys through space & time
Website: www.newburyastro.org.uk

NEXT NEWBURY BEGINNERS MEETING

17th January Cassini's final bow
Website: www.naasbeginners.co.uk

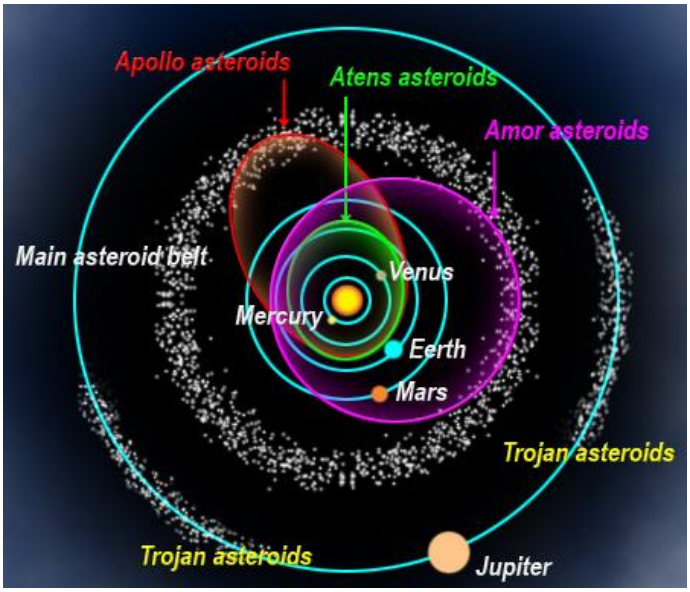
MINOR PLANET 3200 PHAETHON



The path 3200 Phaethon will take through Pegasus

During the Geminid Meteor Shower this year, those who have access to a telescope may be able to see the progenitor of the meteors in the shower. The specks of dust (meteoroids) that produce the meteors (streaks of light in the sky) originate from an Asteroid called 3200 Phaethon. This asteroid is different to those we find in the Asteroid Belt located between the orbits of Mars and Jupiter. They are called Apollo Asteroids.

Apollo Asteroids have orbits around the Sun that extend from just inside the orbit of Earth out to the Asteroid Belt. Many of these objects can cross Earth's orbit and are referred to as 'Near Earth Objects'.



The orbital path of the Apollo Asteroids (shown in red)

3200 Phaethon orbits the Sun every 523.5 days and on every pass deposits tiny grains of rock along its path. The particles continue along the approximate path of 3200 Phaethon as Meteoroids. Once a year (in December) Earth will plough into this trail of particles and they will burn up in the upper atmosphere in the streak of light we call a Meteor.

3200 Phaethon will be passing close to Earth on the evenings 15th to 18th December and will be at its closest at 23:00 on 16th December. The asteroid will follow the path shown on the chart above and will be at the points marked with a '☼'at midnight on 16/17 and 17/18 December. There are also marks on the line at 6 hour intervals.

At its closest approach the 5 kilometre diameter asteroid will be only 10.4 million kilometres from Earth. This is about 26 times the distance from Earth to the Moon. It will only be magnitude +11 which is very faint and will require a fairly large telescope to see. When located it will move quickly through the field of view at a speed of 38 arc-seconds per minute. This is fast enough for it to be noticeable when using a large telescope at a high magnification.

On 15th February 2013 a large meteor (called a Bolide) exploded over the city of Chelyabinsk in the southern Urals region of Russia. It was estimated that 1000 people were injured by flying glass from broken windows caused by the explosion. **It was an Apollo class asteroid!**

Before it exploded it was approximately 20 metres across and weighed about 12,000 tonnes. It was travelling at an estimated 65,000 km per hr (18 km/s) when it hit our atmosphere. It exploded with an estimated yield equivalent to 450,000 tonnes of TNT (about 30 times the yield of the atomic bomb detonated over Hiroshima).

THE ANATOMY OF A BEGINNER'S TELESCOPE

Skywatcher Evostar 90 EQ2 Refracting Telescope

Skywatcher Explorer 130 EQ2 Reflecting Telescope

Last month we looked at the sorts of telescopes that are available for the beginner to the hobby of astronomy. This month we will consider some of the components that make up the telescope assembly. The main sub assemblies that make up the overall telescope assembly are:

TUBE ASSEMBLY – The optical tube assembly

MOUNTING ASSEMBLY – Used to support the Tube Assy

STAND ASSEMBLY – Usually an adjustable height tripod

The two example telescopes shown above have been selected from the same manufacturer and both retail at a price around £150. They are representative of similar products in the same price range that will also be available from other manufacturers. Both the example Telescope Tube Assemblies are shown mounted on the same type of mounting and tripod.

The Skywatcher Evostar 90 EQ2 is a 'Refracting' telescope that has a lens as its main optic. The job of the lens is to gather light from a distant object and focus that light into an image that can be studied with our eye. Most telescope lenses are comprised of two or sometimes three lens elements. This is to correct colour distortion in the image produced.

The Lens and Dew Shield on a SW Evostar 90

Most beginners' telescopes have a solid tube to support the lens and the other components needed. The lens is secured to the top of the tube and protected by a removable tube extension called a 'Dew Shield'. This is fitted to protect the lens, reduce stray light entering the tube and to help to reduce dew forming on the surface of the lens. A 'Dust Cover' is normally fitted into the Dew Shield to protect the lens when the telescope in not in use. Some Dust Covers have a hole in the centre with a cap that can be removed and the Dust Cover fitted to the telescope to reduce the light and glare when observing the Moon.

At the lower end of the Tube a Focuser Unit will be fitted. This is used to locate an Eyepiece and to adjust the focus to suit each individual observer's eye.

The Focuser and Finder on a SW Evostar 90

The Skywatcher Evostar 90 EQ2 Refracting Telescope is supplied with a 6x30 Telescope Finder (shown above). It is also supplied with a 90° Diagonal, shown above. This is a small mirror that directs the image through 90° to provide a more comfortable observing position.

The Skywatcher Explorer 130 EQ2 Reflecting Telescope, shown on the previous page, has a mirror to gather light from a distant object and focus that light into an image that can be studied with our eye. Mirrors used in telescopes are made of low expansion glass and have an Aluminium reflective coating on the front concave surface.

The Mirror at the bottom of the Tube Assembly

Smaller reflecting telescopes have the mirror mounted at the bottom of a solid walled tube but some may be fitted to and open frame assembly known as a 'Truss Tube'. To allow for alignment, the mirror mounting is fitted with adjusting screws.

There is a problem with this type of telescope where the image is formed at the top of the tube so if we try to study the image our head will stop light entering the tube. Sir Isaac Newton solved this problem by fitting a small Secondary mirror at the top of the tube, set at 45°, to direct the image out through a hole in the tube. The Secondary Mirror is mounted on a four veined assembly called a 'Spider' see the image above. This type of Reflecting Telescope is called a Newtonian Telescope.

On a Newtonian Tube the Focuser Unit will be fitted over the hole at the top of the tube. This is used to locate an Eyepiece and to adjust the focus to suit each individual observer's eye.

The Focuser and a Red Dot Finder on the Explorer 130

A 'Dust Cover' is normally fitted to the top of the tube to protect the mirrors when the telescope in not in use. Some Dust Covers have a 'off centre' hole with a cap that can be removed. The Dust Cover can be refitted to the telescope to reduce the light and glare when observing the Moon.

All good telescopes are fitted with a 'Finder' to help locate the object to be observed. The main telescope will have a small field of view in the sky that makes it difficult to locate the object to be observed. To make this task easier, a finder is fitted. There are two types of finder that can be in the form of a small telescope or a 'Red Dot' Finder.

A small telescope finder will be similar to the one shown on the Skywatcher Evostar 90 EQ2 Refracting Telescope, shown in the previous images. The model shown is a 6x30 telescope fitted in an adjustable mounting with a standard 'Dove Tail' shoe used to mount it to the main telescope tube. This small telescope has a 30mm lens and has a 6 times magnification. It also has internal 'Cross Hairs' to help centralise the object to be found.

A 'Red Dot' Finder is shown fitted to the Skywatcher Explorer 130 EQ2 Reflecting Telescope in the previous column. It has a small LED light that shines a red dot of light on to a small glass screen located in the housing at the front of the finder. The observer moves the main telescope until the red dot is aligned on the object to be found. It is very easy to use but has a disadvantage in it can only be used to locate objects that can be seen with the naked eye.

On both the example telescopes the Tube Assembly is secured to the Equatorial Mount using 'Tube Rings'. These are split rings that are clamped around the tube then bolted to a metal 'shoe' on the Mount.

An EQ2 Equatorial Mounting

The telescope shown above is fitted to an EQ2 Equatorial Mounting and has manual adjustment in both (Altitude) known as Declination (Dec) on an EQ Mount and (Azimuth) known as Right Ascension (RA) on an EQ Mount. The nomenclature 'EQ2' defines the robustness and quality of the EQ mount. The mounts are generally classed from EQ1 (cheapest) to EQ6 (most expensive).

The Equatorial Mounting has been developed to solve the problem of Earth's axis of spin being tilted 23.4°. The Azimuth axis has the ability to be tilted to compensate for the tilt of Earth's axis. This means only the Azimuth needs to be adjusted to track objects as they appear to move across the sky in an arc. See the October 2017 magazine.

Equatorial Mounts can be fitted to most standard astronomical tripod stands. These stands have adjustable legs to alter the height of the telescope assembly and to compensate for uneven ground.

To keep costs down cheaper telescopes, like those shown on the previous pages, are supplied with fairly basic accessories. This includes the eyepieces and the finder. This is not a great problem because the beginner to astronomy will generally not be experienced enough to notice the difference. These can however be upgraded as the owner gains experience.

Eyepieces supplied with the example telescopes are not bad and give a pretty good view. Most beginners' type telescopes are supplied with a 25mm and 10mm eyepieces and a Barlow lens that effectively doubles the magnification of the supplied eyepieces.

The eyepieces, Barlow lens and diagonal supplied

The 90° Diagonal, shown at the bottom of the image above, is a small mirror, supplied with a refracting telescope, to direct the image through 90° to provide a more comfortable observing position. On the left is a 25mm eyepiece, a 10mm eyepiece in the centre and a 2x Barlow on the right. These used on the Refracting Telescope with a focal length of 900mm will produce a magnification of 900 ÷ 25 = 36 times magnification and 900 ÷ 10 = 90x. Used in conjunction with the Barlow they will double the magnifications to 72x and 180x.

Finders can be upgraded and the upgrade can make finding fainter objects a lot easier. A Red Dot finder can be replaced with a telescope finder. The replacement can be by a 6x30 for about £30 or a full upgrade 9x50 for £43. Most Finders are supplied with a dovetail adjustable mounting. The Red dot can still be quickly and easily refitted if required.

Skywatcher 50mm and 30mm Finders

Most telescopes have a standard 'Dove Tail' mounting shoe that will accept other types and makes of finder. The two examples shown above have white mountings but are also available with black mountings.

When the beginner has become familiar with the first telescope and the night sky it will be time to consider the next major upgrade. This would be to fit a RA Drive Motor. The two example telescopes shown on page three are mounted on Skywatcher EQ2 equatorial Mounts. This mount does have the facility to fit a RA Drive built in as bought. See the image below.

The RA Drive Gear, Mounting Spindle and Lever

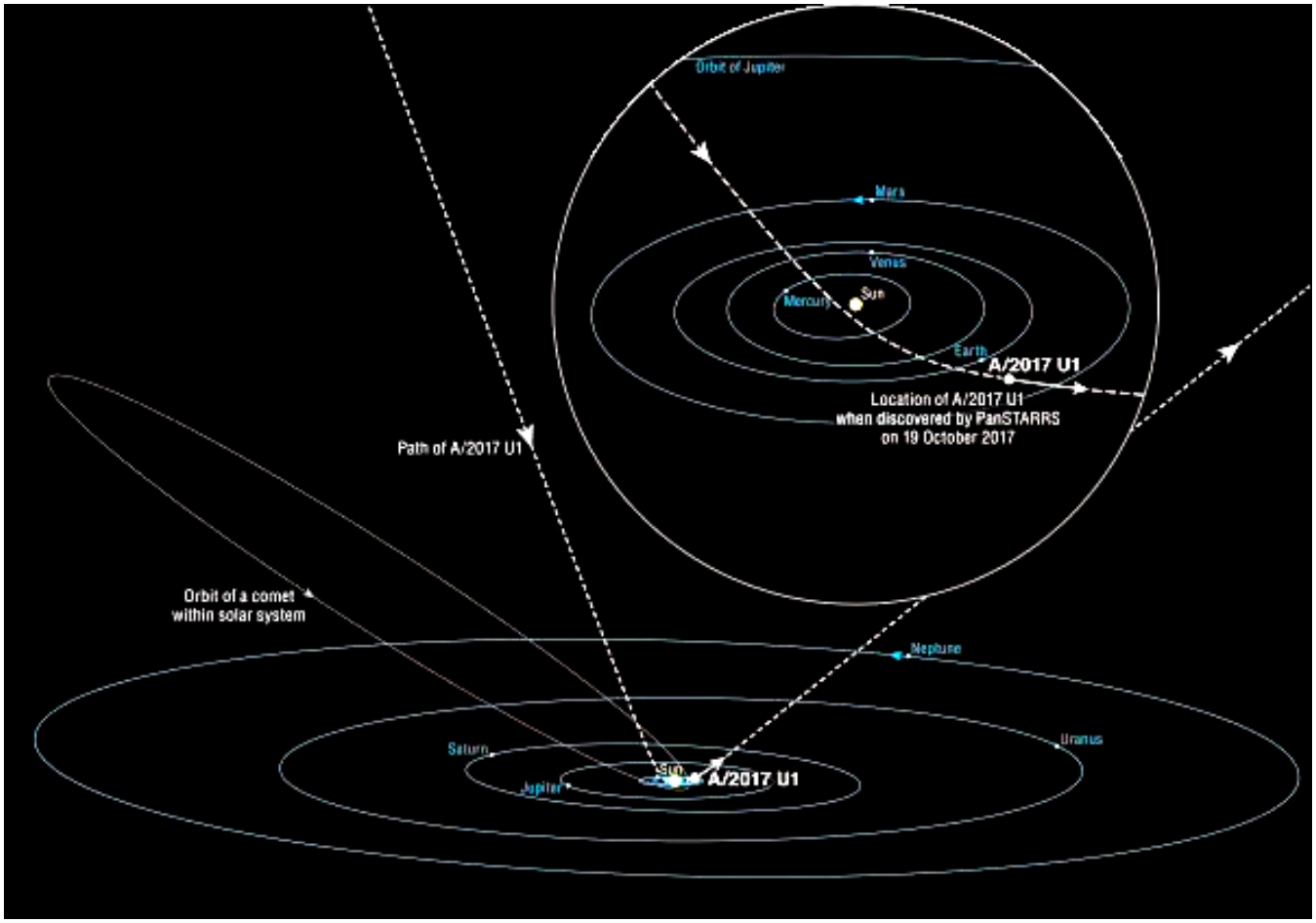
The photo above shows the Mounting spindle on to which the RA Drive Motor is mounted. A small gearwheel on the RA Drive Motor engages with the gearwheel on the EQ Mount. A lever on the EQ Mount enables the RA Motor to be engaged and disengaged with the drive gear. So the RA can be manually adjusted or driven by the motor.

The RA Drive Motor, Control Box and Battery Pack fitted

Just a word of advice is required here. When the author fitted a RA Drive to his Skywatcher Evostar 90 EQ2 Refracting Telescope the Telescope Tube hit against the Drive Motor when the tube was mounted in the designed orientation. That is on the right of the EQ Mount with the telescope pointed to the south. It was necessary to rotate the RA axis 180°, rotate the Dec and refit the Telescope Tube in the Mounting Rings so it pointed south on the left side of the EQ Mount. This made the RA and Dec Clutch Clamps a little more difficult to tighten and loosen but the Telescope Tube was not obstructed by the new RA Motor.

If the owner of a telescope has any problems with this procedure they should contact their local Astronomical Society for help. Most Astronomers will be very pleased to help set the telescope up.

A VISITOR FROM ANOTHER SOLAR SYSTEM



The path Asteroid A/2017 U1 took through our Solar System

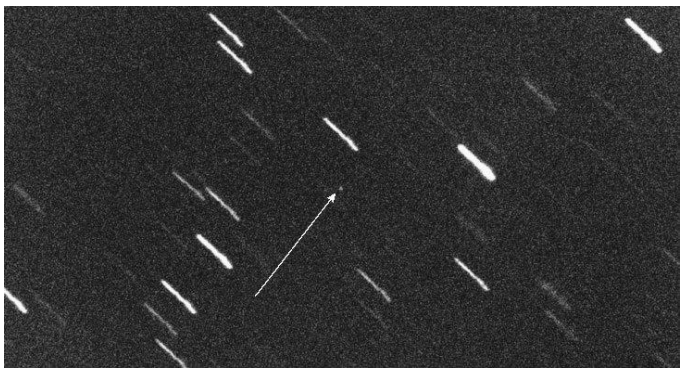
The first interstellar object visiting our Solar System has been observed as it was caught then speeding back into deep space. Scientists rushed to study it as it passed. It is incredibly rare that we get any visitors from outside our solar system. In fact, astronomers believe they spotted their first one in October 2017. The asteroid was estimated to be 400 metres across. It zoomed into the Solar System at a speed of 25.5 kilometers per second and after receiving a sling-shot boost from our Sun is now heading out at an incredible 44 km/s.

The previously unknown space rock, initially dubbed A/2017 U1 was later named 'Oumuamua'. It entered our solar system from above the ecliptic plane where most planets, asteroids and comets native to our system orbit around the Sun. It then looped around our Sun and headed back out into deep space but not before scientists had a better look at this fleeting visitor.

By looking at the asteroid's trajectory, scientists have determined that A/2017 U1 had most likely come from the direction of the star Vega in the constellation of Lyra. It was first noticed is it began its close approach to the Sun in September then swung around our star and passed within 30 million km of Earth on 14th October. The problem was it was not spotted until 18th October when it was already heading away from us.

The alien asteroid is interesting not just because of its potentially interstellar origin but also because of its speed; it was seen dashing past us at 44 km per second. It also turns out to be a little more colourful than the drab gray of the rocks we tend to imagine when we think of asteroids.

In fact, NASA astronomers have suggested A/2017 U1 may actually be red.

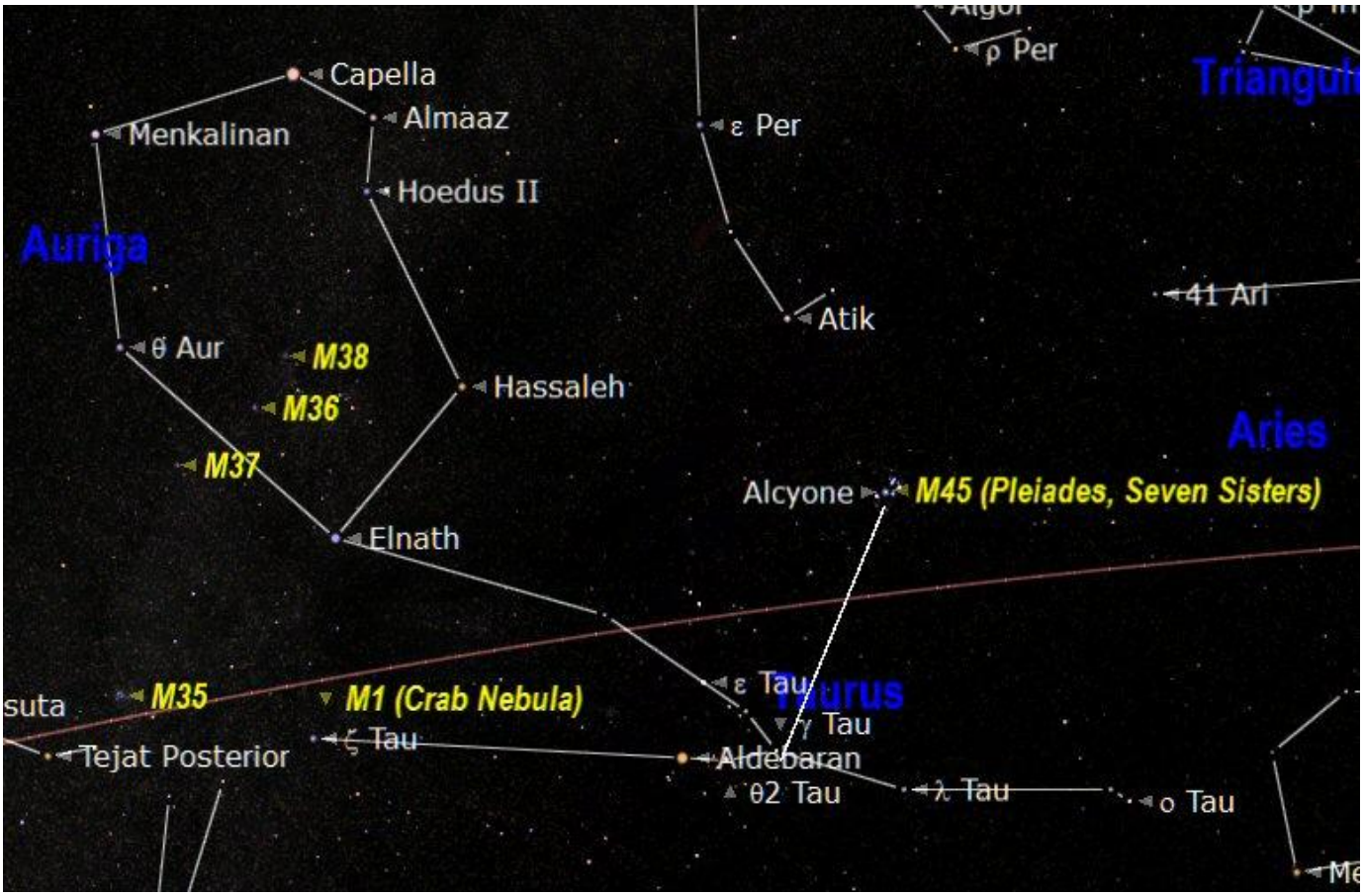


An image taken as Asteroid A/2017 U1 sped past

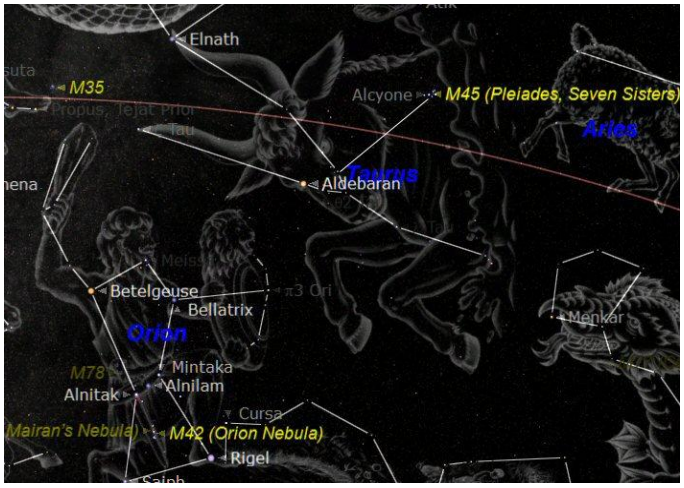
It has been theorized for some time that such objects as A/2017 U1 do exist. These are thought to be asteroids or comets moving between the stars and occasionally passing through our solar system. However this is the first such detection. So far everything indicates this is likely to be an interstellar object but more data would help to confirm it.

It has been calculated that other stars might pass close to our Sun a number of times every million years. If a star passes within about five light years icy objects like those in our Oort Cloud may be disturbed and pushed out of their fragile orbits. It is thought likely that other stars will have their own Oort clouds so passing stars may even exchange members. Rocky objects can also be accelerated and thrown out from the influence of their parent star by close encounters with large planets.

CONSTELLATIONS OF THE MONTH – TAURUS AND AURIGA



The chart above shows the constellation of Taurus the Bull. There are many different representations of Taurus but he is generally shown with his horns tipped by the stars at the end of the obvious '>' shape. The bright red star Aldebaran is normally used to show the bull's eye.



An illustration of the constellation of Taurus

With a little imagination Taurus appears to be charging Orion in the illustration above. Taurus sits on the Ecliptic and is one of the star signs of the Zodiac. The asterism (shape) used to identify Taurus resembles a stretched 'X'.

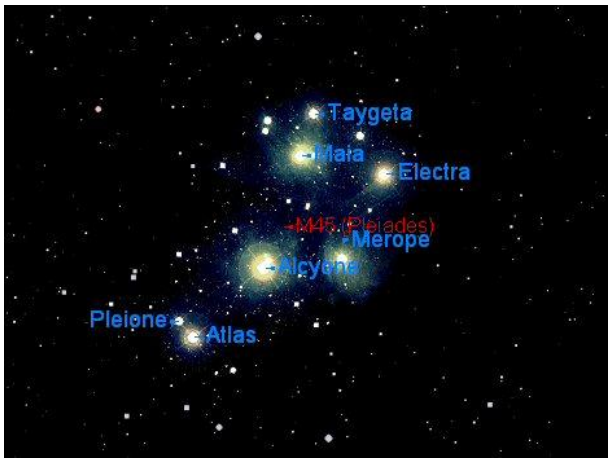
Surrounding the bright red star Aldebaran is a cluster of stars called the Hyades. In a dark Moonless sky the cluster can be seen with the naked eye but is seen best using binoculars. The cluster is large, at 3.5° in diameter (about 7 Moon diameters) and well dispersed. This cluster is at the centre of a larger and even more dispersed cluster that covers a sky area 50° in diameter.

The real jewel of Taurus is without doubt is the beautiful Open Cluster, Messier 45 (M45) also called the Pleiades or the Seven Sisters. It is visible to the naked eye initially looking like a patch of light. Closer observation will reveal a cluster of up to seven stars. Using a good pair of binoculars many more stars will be seen. There are in fact about 300 young stars in the cluster that is estimated to be about 100 million years old. M45 is one of the closest open clusters to us at 400 light years.

Messier 45 (M45) the Pleiades (Seven Sisters)

The Pleiades look brighter than the stars of the Hyades because they are very bright large young stars. The largest is Alcyone which is 10 times the mass of our Sun and 1000 times brighter. The larger and brighter stars of the Pleiades are also rotating very fast. The fastest is Pleione which is rotating 100 times faster than our Sun.

The stars of the Pleiades cluster would have formed from the gas and dust of a Nebula. Gravity draws the atoms of the Nebula together to form denser clumps of gas that become ever denser. Eventually the gas is squeezed into dense spheres where the pressure and high temperature at the core causes atoms to combine through Nuclear Fusion. As Hydrogen atoms are fused into Helium. Heat is produced and the sphere becomes a shining star. Any left-over gas and dust is blown away by intense radiation from the young stars and a cluster of new stars is revealed. This type of star cluster is called an 'Open Cluster'.



The names of the Seven Sisters

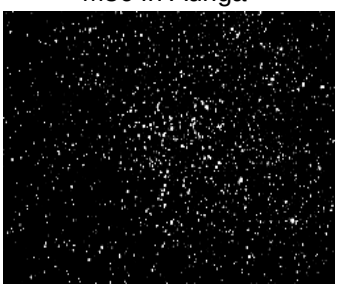
Impressive as they are, the Seven Sisters are just the brightest (naked eye) stars in a cluster of around 250 young stars estimated to be only about 100 million years old. At around 380 light years from us it is one of the closest clusters to us. Being so close to us the cluster has a relatively high apparent movement across the sky although it is still too slow for us to perceive. It will take 30,000 years to move a distance equal to the diameter of our Moon.

Although the cluster is moving through space the individual stars all have slightly different trajectories and relative speeds. Gradually over millions of years the stars will move further apart and the cluster will disperse. Binoculars will reveal around 30 to 50 stars in the cluster and a telescope will reveal many more. However the cluster is too large to fit into the field of view of most telescopes so the outline of the cluster will be lost.

M35 in Gemini

M36 in Auriga

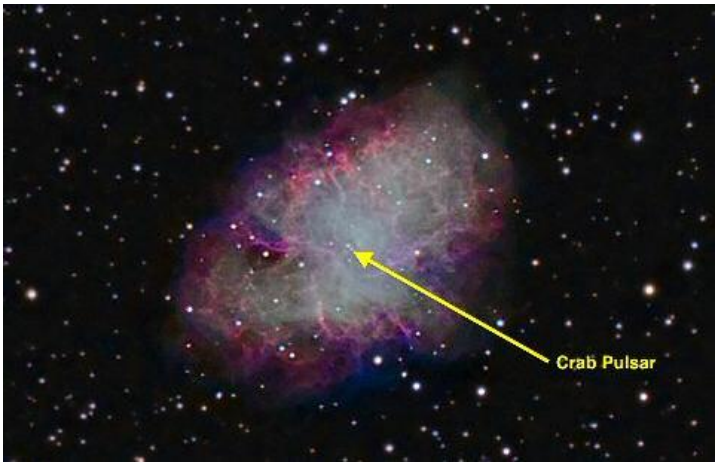
M37 in Auriga



M38 in Auriga

In the neighbouring constellation of Auriga there are some other Open Clusters to search out. Auriga is joined to Taurus at the star Elnath located at the end of the upper left arm of the 'X' shape of Taurus. There is a line of three Open Clusters; M36, M37 and M38 in Auriga with another; M35 over the border in the constellation of Gemini. See the pictures at the bottom of the previous column. These are farther away and appear smaller and fainter than M45.

There is another very interesting object in Taurus. At the end of the lower left (east) arm of Taurus is Messier 1 (M1) the Crab Nebula. It can be seen using binoculars in a dark clear sky but really needs a telescope. From Aldebaran look east to the star ξ (Ksi) Tauri. Just above ξ Tauri is a small smudge of light, this is M1.



Messier 1 (M1) the Crab Nebula imaged by Hubble

This is the remnant of a giant star that exploded as a Supernova about 7000 years ago. Its light took 6000 years to reach Earth and was observed by Chinese astronomers in the year 1054 AD. It can still be seen in a dark clear sky as a 'fuzzy' patch of light using a medium sized telescope.

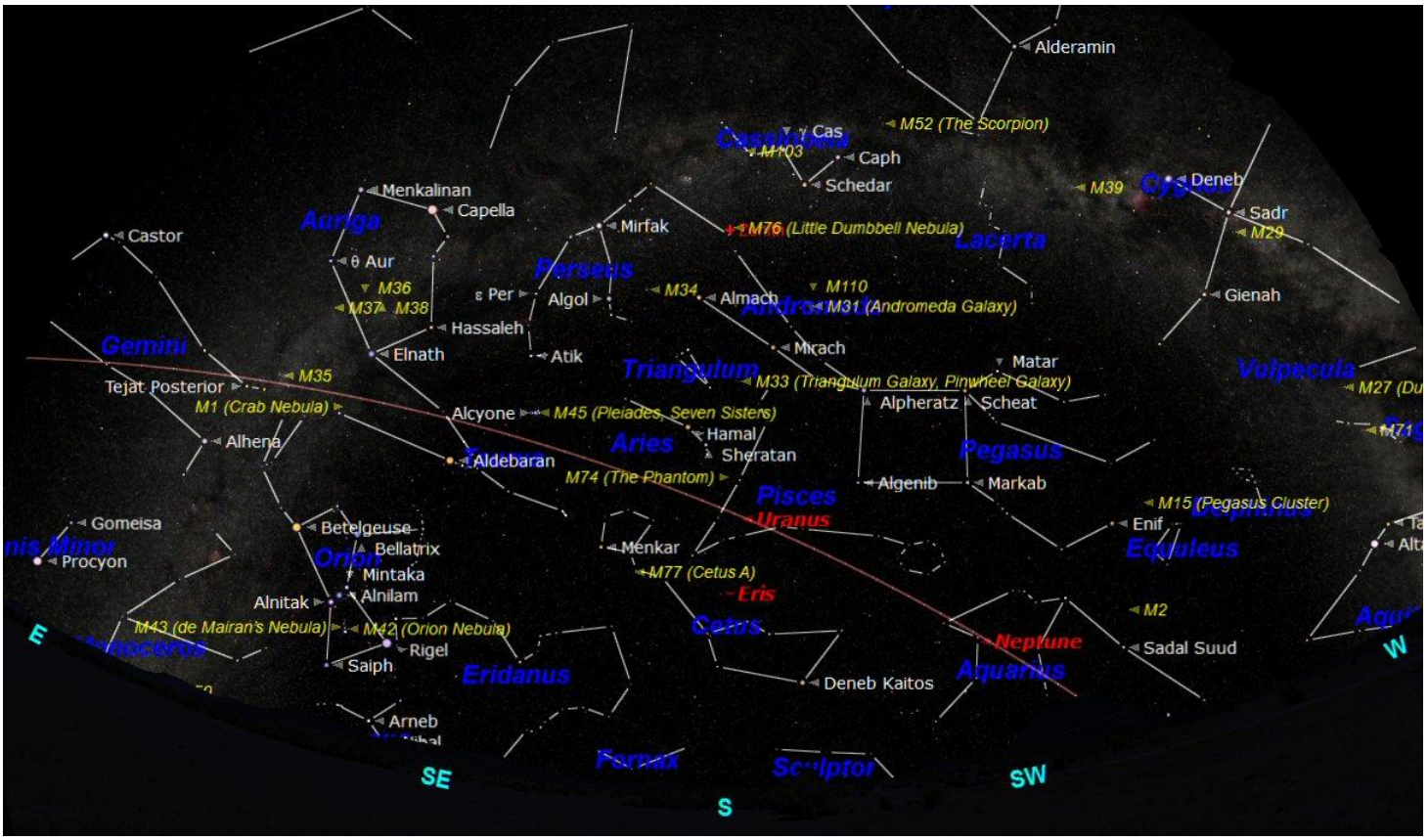
A Supernova is the 'death' of a star more than three times the mass of our Sun. Giant stars consume their Hydrogen fuel at an expediential faster rate than smaller stars. Consequently bigger stars do not 'live' as long as smaller stars. As stars begin to exhaust their supply of Hydrogen they develop into a Red Giant (similar to Aldebaran). More massive stars develop into larger Red Giants.

A star like our Sun and those up to about twice the mass of our Sun eventually slowly collapse as their fuel eventually runs out. The outer layers of the Red Giant drift away to form a gas bubble and the core 'gently' collapses to form a White Dwarf Star.

Stars two to three times the mass of our Sun come to a more dramatic end. As the fuel of a larger Red Giant Star finally runs out the star suddenly collapses and all the mass of the star falls inwards under the massive force of its own gravity. The collapse reaches a point where the pressure and heat causes a massive thermonuclear explosion and the outer regions are blown into space to create a Supernova Remnant like M1. During the explosion the core collapses inwards to create a super dense Neutron Star about 12,000km in diameter.

The Neutron Star will have a mass up to 1.4 times the mass of our Sun and may be spinning up to more than 1000 times per second. Beams are radiated from its poles causing it to flash so it is often called a 'Pulsar'.

THE NIGHT SKY - DECEMBER 2017



The night Sky December 2017 at 21:00 (09:00 pm)

The chart above shows the night sky looking south at about 21:00 GMT on 15th December. 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 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 constellations through which the ecliptic passes are known as the constellations of the 'Zodiac'.

Constellations through which the ecliptic passes this month are: Aquarius (the Water Carrier), Pisces (the Fishes), Aries (the Ram), Taurus (the Bull), Gemini (the Twins), Cancer (the Crab) and just off the chart to the east and soon to rise is Leo (the Lion).

The Milky Way (our Galaxy) appears to rise up from the western horizon through the Summer Triangle and Cygnus. It continues up through Cassiopeia then down towards the East through Perseus and Auriga. Then the constellations of Gemini, Orion and Monoceros at the bottom of the chart.

The outermost planet Neptune is in the constellation of Aquarius but looks small and faint and will need a telescope to see. A *beginner's* telescope will show Neptune as a rather fuzzy looking star with a blue tinge but a larger telescope will show it as a small blue disc. Uranus is located in the constellation of Pisces and is slightly easier to see than Neptune as it is only half as far away as Neptune. It appears twice the diameter of Neptune and four times as bright so it can be seen as a small disc using a *beginner's* telescope with a magnification of 100x or more.

The planets Venus, Mars and Jupiter rise just before the Sun in the early morning in the east with Mercury and Saturn setting just after the Sun in the west in the evening. None of these planets are well positioned for observing.

Sitting astride the ecliptic in the south east is the constellation of Taurus (the Bull). The Taurus asterism (shape) looks like a squashed cross 'X'. At the centre of the cross is a large, faint Open Cluster called the Hyades. It has the bright Red Giant star Aldebaran at its centre. The real beauty of Taurus is the naked eye Open Cluster M45 the Pleiades (Seven Sisters). See pages 7 and 8.

To the north of M45 (the Pleiades cluster in Taurus) is a line of stars defining the constellation of Perseus. The whole asterism (shape) of Perseus looks like a horse rider's stirrup. At the top of the line of stars is the beautiful object 'the Double Cluster' best seen using binoculars.

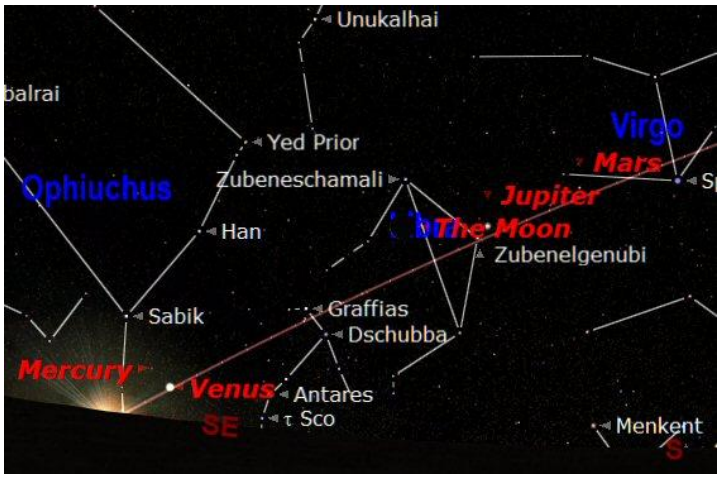
Above and linked to the constellation of Taurus by the star Elnath is the constellation of Auriga (the Charioteer). The shape of the 'stick figure' of Auriga is like a misshapen pentagon. The brightest star in Auriga is the beautiful bright white star Capella. It is the sixth brightest star in the night sky. Cappella has a magnitude of approximately 0 (actually +0.06) so can be used as the base star when working out the brightness of other stars. Auriga has three Messier Open Clusters: M36, M37 and M38. They appear to form a straight line through Auriga which also appears to continue on in line to M35 in Gemini. See pages 7 & 8.

Following Taurus along the ecliptic is Gemini (the Twins). The twin stars Pollux and Castor are easy to find. There is a lovely Messier Open Cluster M35 in Gemini just off the end of the line of stars emanating from the bright star Castor. Castor is a double star when seen in a telescope.

Following behind Gemini is the faint and elusive stars of Cancer (the Crab). Although Cancer itself is quite difficult to identify it is worth seeking out because at its centre is the lovely open cluster Messier 44 (M44) also known as Praesepe. It is faint but lovely to see using binoculars.

THE SOLAR SYSTEM DECEMBER 2017

MERCURY passes through inferior conjunction with the Sun mid month. It will be between us and the Sun and just above Sun on 15th December. The smallest planet will be too close to the Sun and not observable this month.

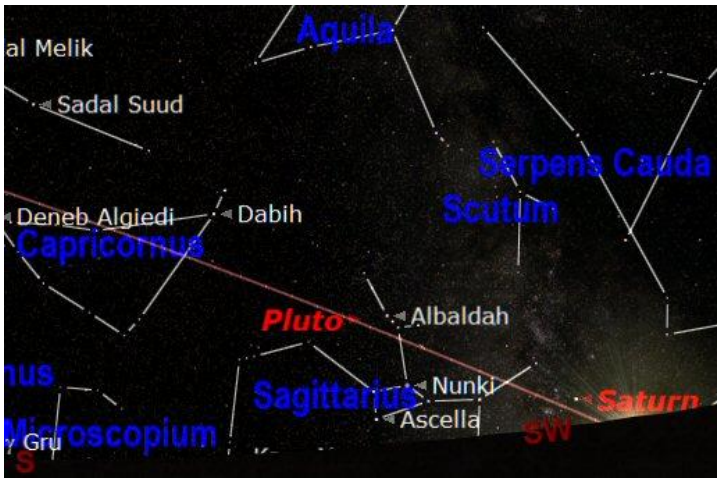


Mercury, Venus, Jupiter and Mars at sunrise

VENUS is rapidly moving towards the Sun and will be in conjunction (pass behind) the Sun in January. It will not be visible this month. See the chart above

MARS rises at around 03:30 and will be in the south east before the Sun rises and the sky begins to brighten. The Red Planet appears small at just 4.4 arc-seconds in diameter and is starting to slowly brighten to magnitude +1.5. Earth is just starting to catch up with Mars so it will slowly appear larger and brighter. See the chart above.

JUPITER is just moving out far enough from the Sun that it is becoming visible in the early morning before the Sun begins to rise. It rises over the South Eastern horizon at 05:00 at the beginning of the month and 03:50 by the end of the month. It will be quite low in the South East as the sky is brightening before the Sun rises at about 08:00. It will be observable for the early riser at about 06:00 at the end of December. See the chart above.



Saturn moving towards the Sun through December

SATURN is moving closer to the Sun and will pass through conjunction over Christmas so will not be visible. The ringed planet rises at about 07:30 at the end of this month just before the Sun rises at 08:00. This means Saturn will be moving into an observable position later in the new year. It will rise progressively earlier before the Sun in the South East and will begin to appear in the early morning sky.

URANUS is in a very good observable position this month. It will be visible in the south mid-evening (21:00 GMT). Uranus may just be visible using a good pair of binoculars but a telescope at a magnification of 100x or higher will be needed to see it as a small blue/green disc.

NEPTUNE will be visible in the south as soon as the sky is dark. It is past best position for observation this year and is moving towards the western horizon and setting by about 22:30. A larger telescope will be needed to show Neptune as a small blue/green disc using a magnification over 150x.

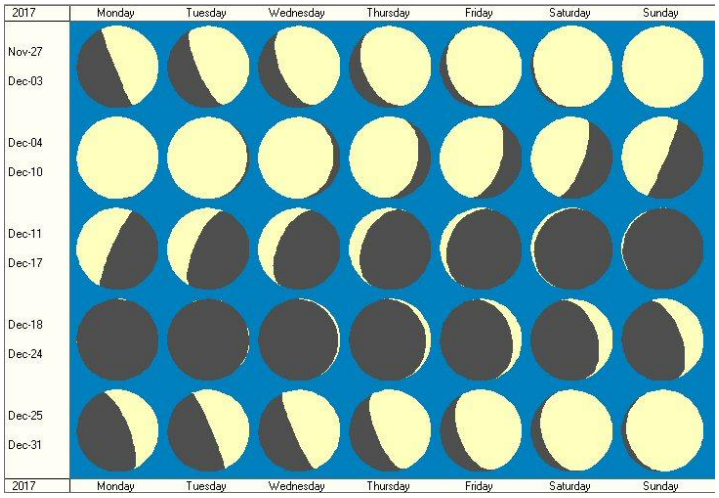
BRIGHT METEOR LAST MONTH

The images above were taken by Newbury Astronomical Society member Richard Fleet at 23:59:58 on 24th November from his house in Wilcot near Pewsey, Wiltshire. The Meteor was caught on camera by Richards automated (all night) meteor monitoring observatory.

THE SUN

The Sun rises at 07:45 at the beginning of the month and at 08:00 by the end of the month. It will be setting at 15:55 at the beginning and 15:55 by the end of the month.

THE MOON PHASES IN DECEMBER



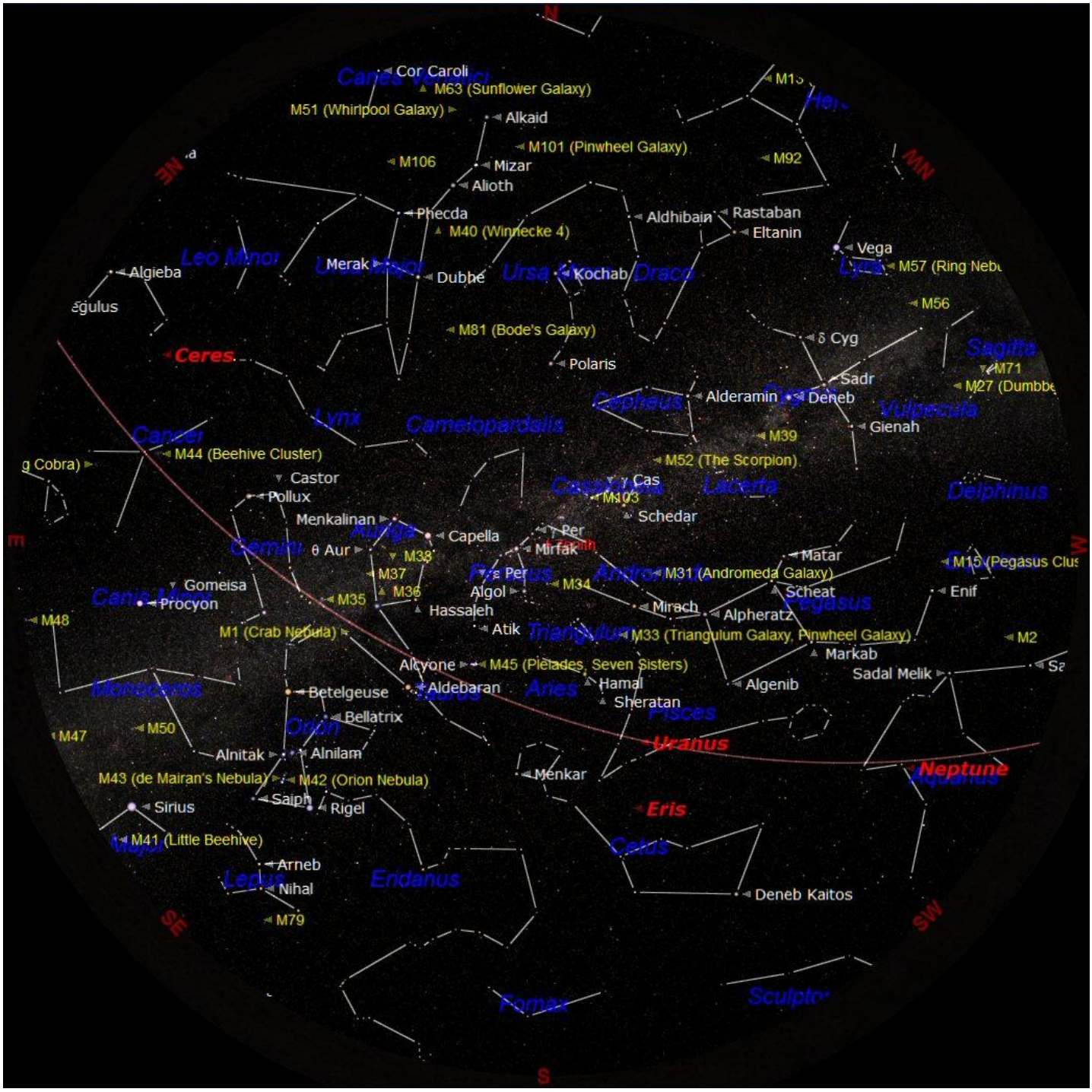
Full Moon will be on 3rd December

Last Quarter will be on 10th December

New Moon will be on 18th December

First Quarter will be on 26th December

THE NIGHT SKY THIS MONTH



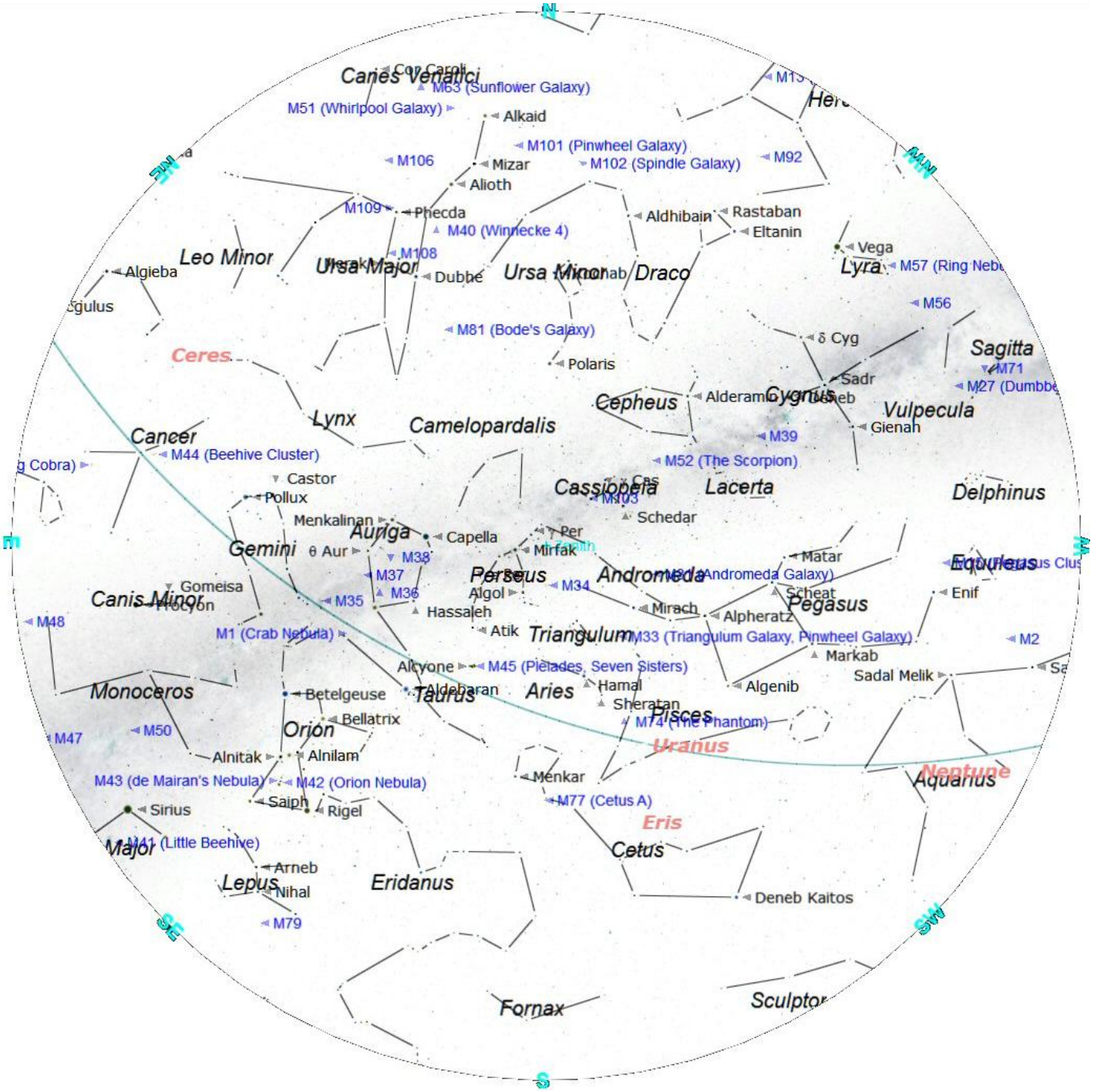
The chart above shows the whole night sky as it appears on 15th December at 21:00 (9 o'clock) in the evening Greenwich Mean Time (GMT). As the Earth orbits the Sun and we look out into space each night the stars will appear to have moved across the sky by a small amount. Every month Earth moves one twelfth of its circuit around the Sun, this amounts to 30 degrees each month. There are about 30 days in each month so each night the stars appear to move about 1 degree. The sky will therefore appear the same as shown on the chart above at 10 o'clock GMT at the beginning of the month and at 8 o'clock GMT at the end of the month. The stars also appear to move 15º (360º divided by 24) each hour from east to west, due to the Earth rotating once every 24 hours.

The centre of the chart will be the position in the sky directly overhead, called the Zenith. First we need to find some familiar objects so we can get our bearings. The Pole Star **Polaris** can be easily found by first finding the familiar shape of the Great Bear 'Ursa Major' that is also sometimes called the Plough or even the Big Dipper by the Americans. Ursa Major is visible throughout the year from Britain and is always quite easy to find. This month it is in the North East. Look for the distinctive saucepan shape, four stars forming the bowl and three stars forming the handle. Follow an imaginary line, up from the two stars in the bowl furthest from the handle. These will point the way to Polaris which will be to the north of overhead at about 50º above the northern horizon. Polaris is the only moderately bright star in a fairly empty patch of sky. When you have found Polaris turn completely around and you will be facing south. To use this chart, position yourself looking south and hold the chart above your eyes.

Planets observable this month: Uranus and Neptune. Jupiter is visible in the east before sunrise.

THE NIGHT SKY THIS MONTH

This chart below is included for printing off and use outdoors



Position yourself looking south and hold the chart above your eyes with south at the bottom.

The chart shows the sky at 21:00 on 15th December 2017