Telescope House October Sky Guide

Late October is normally the part of the year that finds those of us in the UK and Europe reverting to standard time (CET/GMT). This is normally greeted with groans by those outside the astronomical community, as it leads to it getting darker earlier - those of us of a more astronomcial inclination will feel somewhat different, as it increases the opportunity for observations at a reasonable hour of the evening. In the UK, the clocks go back on Sunday 31st October this year. Those in North America will have to wait until the early part of November for this changeover to take place. Naturally, what happens in the Northern Hemisphere has the opposite effect in the Southern. Those in many territories in Australia and Brazil will begin their Daylight Saving Time (Summer Time) in October (New Zealand and Chile having started their DSTs somewhat earlier).

Wherever you find yourself in the world, there's plenty going on in the skies above us this month...

The Solar System

The Moon

Or natural satellite starts October in the constellation of Cancer. At 23% illuminated phase, the Moon will rise at just before 12:30 in the morning, transiting at 9am (BST, from 51 degrees N). The Moon is in one of its high Autumn Crescent phases at this time of the month. These late lunar month phases occur in the mornings during autumn and all the direct correlations of the high evening Crescent phases of springtime. Those up early in the morning on the 1st of October will be greeted by a Crescent Moon high in the sky, at a brilliant point for observation in both telescopes and binoculars.

During the next few days the Moon will draw closer and closer towards the Sun until it reaches New phase on Wednesday, October 6 when it will join the Sun in the constellation of Virgo. Past this point it will emerge as an evening object low in the western sky for observers in the northern hemisphere. Over the next couple of days the Moon will scoot through the southern reaches of the ecliptic, through the southern part of Virgo and Libra until it meets the planet Venus in western Scorpio on the evening of Saturday, October 9th. The two objects will form a pretty pairing in the evening sky, with the Moon sitting a couple of degrees above the Venus, at about 9 1/2° altitude (from 51 degrees N).

First Quarter phase will occur on Wednesday, October 13th, with the Moon in the constellation of Sagittarius. The Moon rise at just past 4 pm local time, transiting at just a little before 8 pm and will set a little before 11:45 in the evening. Those readers familiar with the sky will be able to tell that the Moon’s evening apparition in October is not a particularly high one, from the northern hemisphere perspective. Conversely, those observers in the southern hemisphere will be experiencing their version of the high spring Crescent phase at this time of year, with a Crescent Moon high above the horizon in the evening sky. On the evening of Friday, October 15th, the 70% illuminated Gibbous Moon can be found in between Jupiter and Saturn in Capricorn, the two planets flanking all natural satellite by an almost equidistant amount during the early evening.

Over the next couple of days the Moon rise higher and higher into the northern part of the ecliptic as seen from a northern hemisphere perspective. Reaching Full on Wednesday, October 20 the Moon will be found in the constellation of Pisces, just on the border with Cetus the Whale and Pisces' fellow zodiacal constellation of the Aries the Ram. Two days later, the Moon will come together with the planet Uranus in Aries. The two targets will be separated from each other by under 2° and while the Moon will provide a useful signpost to the location of the planet, it could be that scattered light from our much brighter natural satellite will interfere with views of the much fainter planet in the background - but local seeing conditions will play a massive part in this.

Climbing over the most northerly point of the ecliptic over the next couple of days the Moon will eventually reach Last Quarter phase on Thursday, October 28 - back in cancer where we first joined it. The Moon will sit just a little to the north of the prominent star cluster M44 in the centre of the constellation, rising at 11:20 pm and transiting as a little before 7 am the following morning.

At the end of October on the 31st the Moon can be found near Regulus in the constellation of Leo. Just under 28% illuminated phase, it will reward the early riser - rising as it does just a little before 2 am. It's worth re-emphasising that this particular part of the year is a great one for observing the Moon at Crescent phase in the morning sky so naturally you have to be up early to do so!

Mercury

The Innermost Planet starts October in a difficult position to observe in the evening sky for those in temperate northern hemisphere locations. The planet and its orbital plane around the Sun are sitting in a very shallow-setting location in the sky for those of us in higher northern latitudes and the planet is on a descending orbital node from this perspective, making it even more difficult. While the planet is separated from the Sun by just under 16°, its visual magnitude of +1.7 magnitude is pretty poor by observational standards and those in the northern hemisphere will be very disappointed if they try and find Mercury at this point in the month. Those in the equatorial regions of the world will fare better at this time, though at 9.7 arc seconds across and 15% illuminated phase, Mercury will still be a bit of a challenge, even in a better observational situation.

This observational situation for Mercury does not improve during the next few days of October. The planet is drawing closer and closer to the Sun and as a result, will continue to be difficult to observe, even from equatorial regions of the Earth. The planet will reach Inferior Conjunction, between the Earth and the Sun, on Saturday, October 9th, after which it will re-emerge in the morning sky.

The morning apparition of Mercury will be considerably superior from a northern hemisphere perspective than its previous evening apparition had been. Though it will be sometime towards the end of the month before Mercury is at a significant height above the horizon before sunrise. The planet will reach maximum western elongation on Monday, October 25, 2021, at which point it will be 18° from the Sun. At this point the planet will be -0.5 magnitude and present a 6.9 arc second diameter disc, showing a phase of just under 56% illumination - making it much easier to find in the sky, even in the glare of the dawn, than it had been in the evening sky at the beginning of the month. On the morning of the 25th, Mercury will stand at an altitude of 15 and three-quarter degrees above the horizon (from 51° north), at sunrise. Mercury’s orbital plane will stand much further towards the vertical, as viewed from a northern hemisphere perspective, at this particular point in its orbital cycle - making it a much easier target from these parts of the world. The peculiarities of where the plane of a planet’s orbit appears in the sky, when viewed from different parts of the world makes a massive difference to our ability to easily observe it, from a given location. The beginning and end of October - as far as Mercury is concerned - aptly demonstrate the extremes of this from a northern hemisphere perspective.

Venus

Venus occupies much the same area of sky as Mercury dance in the first part of October. Unlike its neighbour, Venus has the advantage of being intrinsically bright at all times, making it much easier to find even if it is in a rather obscure area of the sky. Like Mercury, Venus, from a northern hemisphere perspective, is also in a very shallow-setting part of the sky. However, at -4.2 magnitude and just under 19 seconds diameter, presenting a 62° illuminated phase at the month’s beginning, the planet is blazingly bright in comparison to the much fainter and smaller Mercury. Subsequently, Venus can still be easily found in the temperate northern hemisphere, as long as you have a clear horizon. The planet will be easily seen, even in rather hazy skies, just after the Sun has set. However at just over 8 1/2° elevation above the horizon at sunset (from 51° north), Venus will be difficult to see from built-up areas - even though its separation from the Sun is just under 45° on the first of the month.

For much of the year, Venus has been increasing its separation from the Sun, but towards the end of the month on Friday, October 29 the planet will reach maximum eastern elongation. After this point it will appear to start travelling back towards the Sun from our perspective here on Earth.   This is simply down to a line of sight effect, as Venus continues to draw closer to us on its faster interior orbit. In the coming months the planet will appear to swell in diameter, but decrease in phase (getting brighter as it does), until it reaches Inferior Conjunction, in between the Earth and the Sun, in early January 2022. While we still have a little way to go with Venus still visible as an evening target before then, the position of the planet in the sky as the Sun sets will improve only slightly over the next few months from a northern hemisphere observational perspective, once the planet has passed through the most southerly point in the ecliptic in late October/early November. Naturally, with Venus sitting so close to the horizon it will be negatively effected by atmospheric conditions when attempting to observe it through a telescope. Any observations made of the planet over the next few months from the northern hemisphere must take this into consideration.

However, as with Mercury, Venus's observational position during October, from the equatorial regions of the Earth will be much better than it will be for northern temperate observers, with the planet standing beautifully high in the sky at sunset. As a result, telescopic observations of Venus from the tropics during October will be a very different experience and something to savour.

Mars

The Red Planet is technically an evening object at the beginning of October. However, it is very close to Superior Conjunction which it reaches on Friday, October 8th. This point, it will be behind the Sun and therefore unobservable for much of the month. Once Mars reappears on the morning side of the Sun it will still be very small at just 3.6 arc seconds across, with a visual magnitude of +1.6. It will be sometime before it reemerges from the Sun’s glare to anything like a reasonable observing position. Therefore, during October it is not unkind to recommend other targets for general observing attention instead of Mars - it’s just about as poor as it can get! If we fast forward to December 2020 to Mars will be in a much better position for observation. We must content ourselves with looking forward to the end of next year at the moment, as far as our outer neighbour is concerned.

Jupiter

Where is Mars is disappointing, Jupiter is anything but. At -2.7 magnitude and at just over 46 arc seconds across, Jupiter will dominate the evening sky in the south of the dark. Brighter than any object in its vicinity (bar a brief visit by the moon in mid-October), the King of the Planets cannot be mistaken for a star - it is so much brighter than anything stellar. Jupiter rises at 5.25 pm (BST) and transits at a little before 10.15pm (from 51° north) on the 1st.

Mid-month finds Jupiter having shrunk just fractionally to under 45 arc seconds diameter and is now shining at -2.6 magnitude. At this time it rises at just before 4:30 pm and transits at 9:15 pm (again BST). After October 18th Jupiter returns to a prograde direction in the sky. This is a sure sign that we are leaving summer’s opposition behind. Beyond this point, Jupiter will start to steadily track northwards in the ecliptic, gaining altitude for observers in the northern hemisphere as it does. We have still a little while to go before Jupiter breaks through the magic 30° elevation barrier for observers in middle northern latitudes, however it won’t be too long to wait before this happens. Once it does, Jupiter will be in an area of sky with more clement prevalent seeing conditions and as such will be a more rewarding target to observe and image with telescopes.

The end of October finds Jupiter having shrunk a little further to 42.30 seconds diameter, now shining at -2.5 magnitude. Still a brilliant target and well worth anybody’s time when it comes to observing, Jupiter will rise at 3:30 pm (GMT) transiting at a little after 8:15 pm and setting at a little after one the following morning. Make the most of this fascinating world whilst we have it in the evening sky and so easy to observe.

There are a few interesting transit events to observe this month: first of all, a mutual Europa and Great Red Spot transit occurs at a little after 9 pm (BST) on Thursday, October 7th. Another mutual Great Red Spot and Europa transit occurs on the 14th of October and can be observed just after 11 pm. There is a nice mutual transit of the Great Red Spot, Io and its shadow occurring at a little after 8 pm (BST) on Friday, October 22. This event occurs again at a little after 8:15 pm on Friday, October 29th.

Saturn

Sitting a little to the west of Jupiter, also in Capricornus, Saturn is by no means as bright, but just as interesting and worthwhile seeking out in a telescope. The 1st October finds Saturn sitting at +0.5 magnitude with an apparent disc diameter of 17.6 arc seconds. It will rise at a little before 4:45 pm in the evening transiting a little after 9 pm and setting as just after 1:30 am the following morning on the 1st. The evening of the first finds Saturn's disk transited by the inner moon Mimas. At somewhat less than 123 miles in mean diameter, Mimas is the trickiest of all Saturn's seven "easily" observed moons to find. At a mean magnitude of around +12.9, the moon requires extremely good seeing conditions and a suitably large telescope to observe it. Observations of any Saturnian moon transits are difficult and often require a larger telescopes to achieve successfully. Saturn being that much further away from us than Jupiter and the majority of its satellites being much smaller than the Galileans combine to make Saturnian transit events a challenge to observe. However, if sky conditions are kind and you have a reasonably large telescope (minimum 200-250mm aperture) at your disposal, why not give it a go? Those using high-speed imaging and deconvolution stand a much better chance of being able to record transit events on Saturn. As Saturn's ring plane and therefore orbital plane of major satellites is closing up from our perspective here on Earth, transit events on Saturn will steadily become more common, up to and beyond the point of ring plane crossing in the late 2025.. Both Mimas and Enceladus are the two moons whose orbit intersects Saturn's disc at present, but easier to observe moons Tethys, Dione, Rhea and especially Titan, will become more regularly transiting satellites the closer we come to ring plane crossing in 2025.

Mid-month find Saturn at +0.5 magnitude still, having shrunk just fractionally to 17.2 arc seconds diameter. At this point in time the planet right rises at just before 4 pm, transits at a little before 8:15 pm and sets just before 12.40 am the following morning (all BST).

By the time we come to the end of October, Saturn has faded just a little to +0.6 magnitude and now shows an apparent size of 16.8 arc seconds diameter. Rising a little after 1:45 pm the planet will transit at a little after 6 pm and set at just past 10:30 pm in the evening (all times GMT). The steadily encroaching hours of darkness the northern hemisphere observers at this time of year, mean that Saturn can be observed earlier and earlier, at a more clement time of the evening. Although a little further south in the ecliptic than Jupiter, Saturn will still attain a reasonable height above the horizon at transit point and those with telescopes are therefore encouraged to seek it out while it is easy to observe in the evening sky. Time spent at the eyepiece, observing Saturn is rarely wasted.

Uranus and Neptune

The outer gas giants are both well-placed for observation in the evenings. Neptune being further west in the ecliptic in the constellation of Aquarius is always the more challenging of the two to observe, but at +7.8 magnitude and 2.3 arc seconds diameter has just passed opposition and therefore still close to its best for this year (though it is worth noting that neither outer gas giant changes dramatically in brightness or diameter, even when fairly far from a opposition). Requiring a telescope to see any sign of a disc, Neptune can never be seen with the naked eye. However, those with larger binoculars can easily make it out amongst the background stars of Aquarius and even a relatively small telescope will show its rather vibrant blue colour. In the middle of the month, Neptune transits at around 11 pm, At which point the planet stand just under 35° above the horizon (from 51° north).

Further east in the ecliptic in the constellation of Aries, Uranus at +5.7 magnitude and 3.7 arc seconds diameter, is a much easier target. Technically, a naked eye object for those with good eyesight and exceptional sky conditions, Uranus can be found readily with binoculars and a small telescope will easily show its tiny green-grey disc. Around mid month Uranus rises at a little before 7 pm and transits at a little after 2:20 am. At transit point, the planet will stand just under 55° in the altitude (from 51° north).

Comets

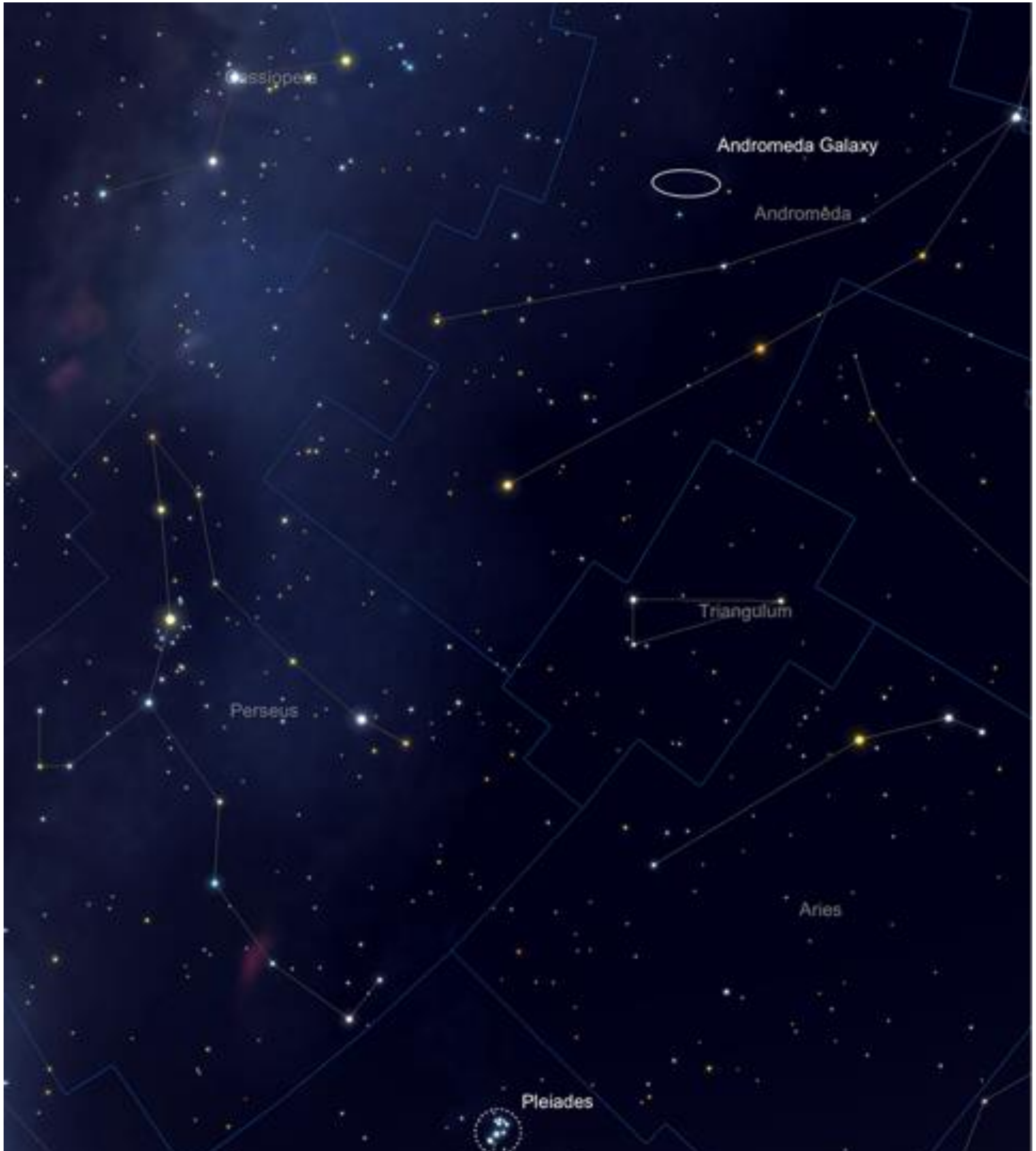
Comet C/2021 A1 (Leonard) may begin to be worthwhile seeking out in a telescope or large binoculars during October. This comet is creeping south through Ursa Major during October and may become a faint naked eye object later on in the year. As ever, as far as comments are concerned, caution must be applied. Comets have a habit (more often than not) of being something of a disappointment. This comet will be best observed in the early morning before sunrise, though at time of writing is low 12th magnitude, but is expected to brighten rapidly. December will find the comet reasonably close to earth at 0.2 AU.

There have been some reports of a “monster” comet which has been found in archival images from the Dark Energy Survey. C/2014 UN271 (Bernardinelli-Bernstein), as the object is known, was found when it was 29AU or 2.8-3.1 Billion km from the Sun (nearly as far as Neptune’s mean distance). This makes it possibly the furthest out of any cometary discovery ever made. Although it is unsure quite how large an object this is, current estimates put it around 100 km in diameter - besting both Comet C/1995 O1 Hale Bopp and the Centaur Chiron for size. Although originally given a minor planet designation, it is now believed that cometary activity has been detected and therefore the object has been given cometary status. Unfortunately, it seems that perihelion will be achieved in January 2031 at a distance of just under 11 AU, which puts it just outside of the orbit of Saturn at closest approach to the Sun. If this object were to make it into the inner solar system it would likely have been one of the brightest comet ever recorded. Sadly, due to the great distance of perihelion it is unexpected unlikely to get any brighter than 13th mag. Still, this visitor from the inner Oort cloud of comets will hopefully add to our further knowledge of the outer solar system, even if it will appear singularly unspectacular at its closest approach to us.

Meteors

The Orionid meteor shower occurs between October 2nd to early November. This shower is fed by the most famous comet of all: P/1 Halley (also responsible for the Eta Aquariids of Springtime). Peaking on the night of the 21st of October this year, sadly this particular shower will be negatively influenced by the eternal nemesis of meteor showers, the Moon, which will be at very close to Full on this night. However, as the shower is a particularly drawn out affair, it will be possible to see an Orionid or two during the early or later part of October. We must content ourselves in the knowledge that next years Orionids will peak under much more favourable circumstances.

Deep Sky Delights in Perseus, Andromeda & Triangulum


Cassiopeia
Andromeda Galaxy
Andromeda
Triangulum
Perseus
Aries
Pleiades

Perseus, Andromeda and Triangulum. *Image created with SkySafari for Mac OS X, ©2010-2012 by Southern Stars, www.southernstars.com.*

We start this month in the southerly part of Perseus, where the open cluster M34 is located. M34 is an original part of Messier's List and was first identifed by Giovanni Battisa Hodierna in the mid-1600s. Hordierna was born in what is now Dubrovnik in Croatia, though did most of his observing from the court of the Duke of Montechiaro in Sicily. Hodierna was a leading telescopic observer of his day and complied a pre-Messier catalogue of Deep Sky objects. M34 was part of this original list, though Messier discovered it independently in 1764. The cluster is easily spotted in smaller binoculars and occupies an area of sky roughly equivalent to the diameter of the Full Moon. At +5.19, M34 is reasonably bright and contains around 80-100 observable stars in medium-sized telescopes (the actual number stands at around 400, but many these are beyond the range of amateur instruments). Precise professional observations of M34's movement have concluded that there is a distinct possibility that M34, the neighbouring Pleiades and a number of other nearby clusters are exhibiting a common angular motion, suggesting a common origin. M34 lies 1400-1500 light years away.

M34. Image Credit: Ole Nielsen - Creative Commons.

East of M34 is a more challenging object, the Perseus A Galaxy, or NGC1275. At +11.89 mag, this is not an intrinsically bright galaxy, though it is quite a compact target and can be seen in medium to larger telescopes. This object is actually a pair of galaxies that have undergone a collision and have formed a larger galaxy strewn with laments of stars and dark material, most likely blasted outwards by the supermassive Black Hole at the heart of the system. Perseus A is a Seyfert Galaxy - strongly emitting on Radio frequencies, suggesting a large amount of star formation. NGC1275, at 235 million light years distance, is one of the most prominent members of the Perseus cluster of galaxies, which occupies this region and is amongst the largest structures in the known Universe.

5 degrees to the west of M34 lies the most famous eclipsing binary star in the sky, Algol, or Beta Persei. Algol represents the eye of the head of the Gorgon Medusa, whose gaze would turn to stone all those unfortunate enough to look at it. According tho the legend, Perseus held Medusa's severed head up to the sea monster Cetus in the successful rescue of Andromeda. Cetus was turned to stone and Perseus unchained Andromeda from the rock to which she was attached. Algol's name derives from the Arabic "ra's al-ghul", translated as "head of the ghoul" - though it has been know by several equally unfortunate titles. In Hebrew, Algol was known as "Rosh ha Satan" or "Satan's Head". A 16th century text labels Algol as "Caput Larvae" or "Spectre's Head". But the prize used to go to the now sadly disproved ancient Chinese description, "Tseih She" or "Jishi", meaning "Piled Up Corpses" - though this is now thought to refer to Pi Persei instead. Regardless, Algol was part of the Anciet Chinese constellation of the Tomb or Mausoleum. No matterwhich culture attempts to define Algol, it always seems to have a sinister undercurrent - quite unfair really, as it is a fascinating object.

Algol's eclipsing binaries occupy a startlingly small amount of space - just 0.062 Astronomical units, or around 5.76 million miles, separates the two stars. These two stars are Beta Persei A and Beta Persei B (there is a third member of this system, Beta Persei C which plays no part in the eclipse). Beta Persei A is the brightest of these stars and is eclipsed by the dimmer Beta Persei B every 2 days, 20 hours and 49 minutes, for around 10 hours at a time. This eclipse has the effect of dimming the +2.1 mag star to +3.4 mag for the period of the eclipse. There is also a much shallower dimming when A eclipses B, though this is very difficult to detect visually. The main eclipse can easily be detected with the naked eye and is possibly the reason that this star was held in such suspicion by ancient astronomers. Regardless, it is a very clear example of stellar orbital dynamics and Algol, suspicious or not, continues to be of interest as a result. It's always worth comparing the brightness of Algol with Almach - as they're normally roughly similar brightness. If this isn't the case, you can be sure the Algol's in eclipse.

Nine and a half degrees east of Algol sits the 2.91 mag star Adid Australis, Epsilon Persei, which is a useful is a pointer to those attempting to locate NGC1499 - the California Nebula - which lies along the line between this star and the neighbouring +4.40 mag star Xi Persei, or Menkib. a prime candidate for Supernova (though lying at a distinctly safe distance of 1200 light years). The California Nebula can be found just under a degree to the North of Menkib.

The California Nebula by Mark Blundell. Image used with kind permission.

Discovered in 1884 by Barnard (he of Barnard Star’s fame), the California is a confusing object Technically it is a bright +5 mag object of very large proportions - 145 x 40 arc minutes (just slightly smaller than M31, the Andromeda Galaxy), but due to its size, it has low surface brightness. The California is very easily picked up by cameras with relatively modest exposures, but to see it visually requires two things: a decent sky and a Hydrogen Beta Filter. Many observers consider aperture to be of importance when picking out low surface brightness objects from the background sky, and while this is normally very sound advice, with large objects such as the California, this must be tempered by the amount of sky a telescope can adequately display at low power. It has been suggested than NGC1499 can be seen in some cases better with smaller telescopes, of shorter focal lengths at low power with a Hydrogen Beta Filter. Larger instruments will show the curtain of light of the edge of the nebula well under filtration and can pick out more lament detail within its inner structure, but a smaller wide eld telescope can potentially t the entire nebula into a single eld of view - a potentially superior view from an aesthetic standpoint. Others have observed the nebula with the naked eye from a dark site, simply by holding an H Beta Filter up to its area of sky. The H-Beta filter, unlike the more popular UHC and OIII options is only of great use for this nebula, and the adjacent nebulas the Horsehead in Orion and the North American in Cygnus and a few lesser objects. For those attempting to see these famous objects, it really is a must. It is thought that the radiation from nearby Xi Persei is responsible for exciting the gas of the California and causing it to glow. The rich gas and material deposits in this area of the Milky Way have given birth to many massive stars, of which the previously mentioned Menkib and Adid Australis are probably prime examples. The California Nebula is thought to lie some 1000 light years from our position in the galaxy and is about 100 light years across at its widest point.

Moving to the opposite end of Perseus from the California Nebula, we come to the spectacular Double Cluster, or Sword Handle - NGCs 869 and 884. It is perhaps testament to the easy nature of their observation that they were never given Messier number classification. These twin clusters - and there can be little doubt about their mutual origin - are of +5.9 visual magnitude and are excellently seen through binoculars of all sizes, but really come alive in wide field telescopes. Of the two, NGC 869 is the slightly more populous being of 3700 solar masses to NGC 884’s 2800 and are thought to between 3.2 and 12.8 million years old (sources, again differ on this figure) - considerably younger even than the Pleiades’ 75 million years. Both clusters have in excess of 150 hot blue stars visible to amateur telescopes and are also a fabulous target for astrophotography. Both elements of the Double Cluster lie between 7500-9600 light years distance from us and are approaching us at around 39 km per second.


The Double Cluster. Image Credit: ESO, S Bruner - Creative Commons

The last target we shall examine in Perseus is M76, otherwise known as the “Little Dumbell”, due to its physical similarity to M27 the Dumbell Nebula in Vulpecula. Found 3 degrees North of 51 Andromedae, the other of Andromeda’s feet (alongside Almach), M76 is a very compact object and one of the dimmest of the Messier list at +10.10 mag. Still, as with many planetary nebulae, it is an attractive object. Unlike the Ring Nebula, M57, M76 is presented side on, so we can clearly see the two lobes of bass that were ejected from the central star. Were this object presented to us end on, much like the Ring Nebula, we would see the distinctive disk or ring-like pattern, rather than a sort of hourglass shape that M76 resembles. As with most planetaries, M76 responds well to OIII filters.

M76 by Mark Blundell. Image used with kind permission.

M76's distance is widely disputed, some sources give it as 1500 light years distances, others in excess of 15,000 light years away. Spectroscopy has shown it is certainly approaching the Solar System, at a rate of 19 km per second.

Moving away from M76, we cross the border into Andromeda and turn our attention to the less well-known, but prominent and easily-found galaxy in the constellation: the wonderful NGC891. 11 1/2 degrees to the SE of M76 and discovered by Sir William Herschel in 1784, NGC891 is a spiral galaxy, potentially much like our own, presented absolutely edge-on to our perspective. At +9.89 mag, it is not especially bright, but it is well-condensed. Its axis is bisected by a dark dust lane, splitting the object in two. In telescopes of moderate aperture, NGC891 appears like a shard - or rather two parallel shards of light, with a very small bulge of the galaxy's core in the centre. It is a lovely object - maybe not having the glamour of its neighbour M31 (NGC891 is 30 million light years away from us), but a very rewarding galaxy to observe or photograph.

NGC891 by Mark Blundell. Image used with kind permission.

3-degrees to the west of NGC891 can be found Gamma Andromedae, or Almach - an easy pointer to the galaxy, but an equally interesting object in its own right. Almach is one of the sky's best double stars: a pair of orange-yellow and striking greeny-blue stars of +2.17 and +4.75 mag respectively. The principle element of the system is a K3 giant star, nearing the end of its life. However, the fainter secondary green-blue star is itself a double - albeit a very difficult one. It will take telescopes in the 30-inch + class to split this second double. However, in coming years, this secondary element will become steadily easier to split with smaller instruments as the elements drift apart around their mutual gravitational centre - although it will be the mid-2020s before they are resolvable with 8-inch class telescopes.

The main elements of Gamma Andromedae are gloriously split in most small telescopes. Even for those with the smallest of telescopes should have a go at splitting this star.

Andromeda is, of course, home to the most prominent galaxy in the sky - M31 and its attendant satellite galaxies M32 and M110. As a major member of our Local Group of Galaxies, the M31 system is the largest gravitational influence on our own Milky Way and in under 4 Billion years it is likely the two Spirals will collide and eventually form a large Spheroid elliptical Galaxy. Approaching the Milky Way at around 300km per second, M31 is already a huge angular size - the boundaries of which stretch over 6 times the width of the Full Moon in the sky. At +3.4 mag, M31 was probably one of the rst Deep Sky objects - certainly the rst galaxy - to be noticed by humanity. First recorded by the great Persian Astronomer Abdul al-Rahman al-Su in his 962CE text “Book of Fixed Stars”, al-Rahman described M31 as the “Little Cloud” - and while his is the rst record of the object, it was doubtlessly noticed sooner, being the most prominent deep sky object alongside the Pleiades and Hyades in Taurus and M42 in Orion.

Simon Marius first turned a telescope to M31 in 1612, though made no claim to its discovery - he may have been aware of it from earlier star charts - a Dutch example dating from 1500 shows the object. Throughout the 17th and 18th Centuries, the Galaxy was “re-discovered” independently by astronomers. While there was clearly communication between astronomers of the era regarding M31, many, including Edmund Halley, erroneously credited the discovery of the object to different people. Charles Messier credited its discovery to Marius, when forming his famous Messier list in 1764. Theories abounded as to the true nature of M31: a nascent Solar System forming, a cloud of glowing gas forming stars, a dying, decomposing star. Spectroscopy hinted at the true nature of M31. William Huggins , the early adopter of telescopic spectroscopy found that unlike many other nebulae, M31 exhibits a broad, continuous spectral response, rather than the definitive lined spectra of a gaseous nebula. Something that clearly set M31 apart from the likes of M42. In 1887, the first of many, many photographs of the galaxy was taken by Isaac Roberts from Crowborough in Sussex (just a short journey from the location of Telescope House in Edenbridge). Robert’s beautiful picture clearly shows dust lanes in the outer spiral arms and the satellite galaxies of M32 and M110, much as Mark Blundell’s more modern portrait does below.

M31 by Mark Blundell. Image used with kind permission.

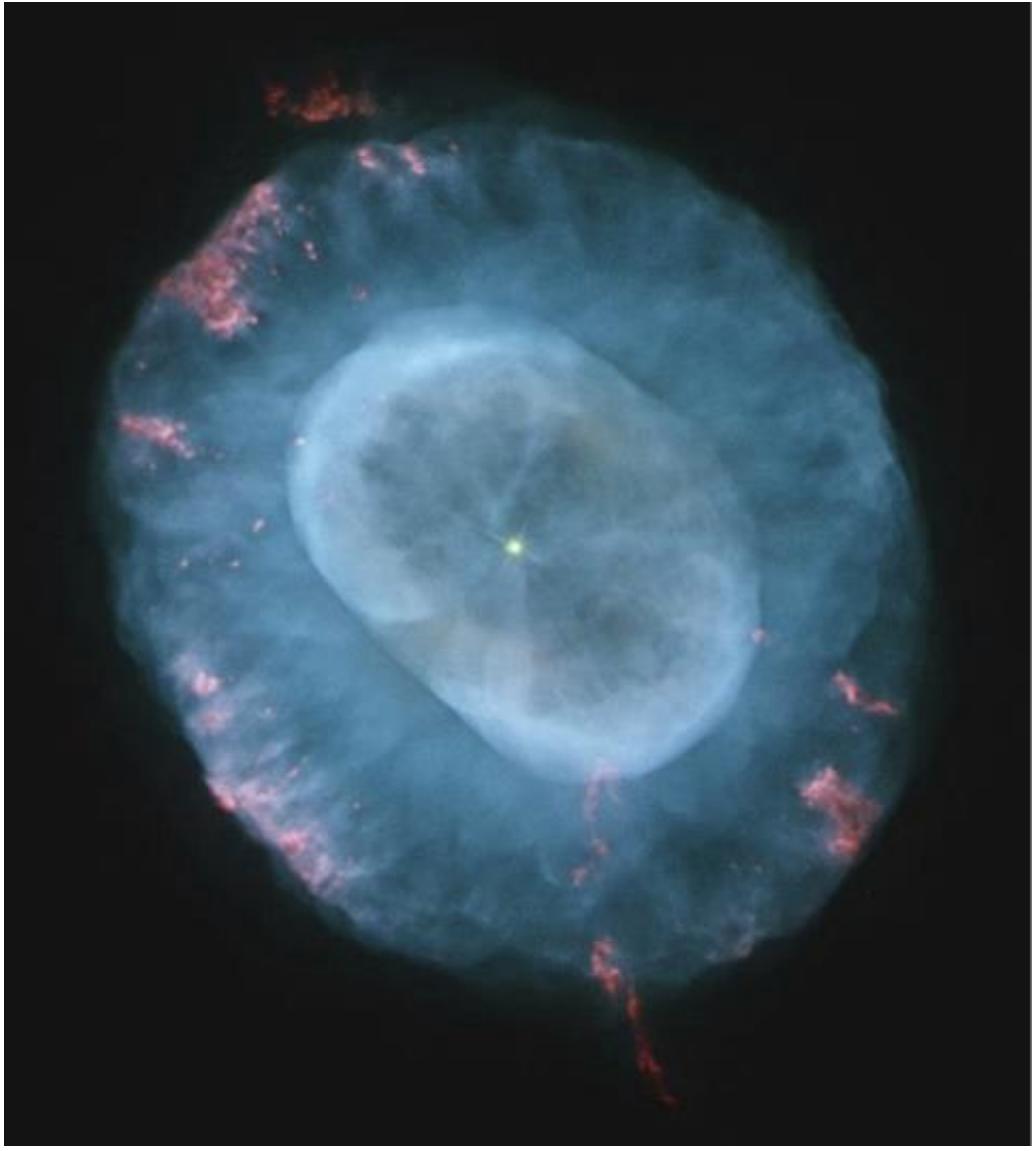
Roberts subscribed to the theory that M31 was a Solar System in the early stages of formation. However, this theory was put to bed by mounting evidence of Novae observed and photographed within the reaches of M31. Heber Curtis discovered his first Nova in M31 in 1917 and went on to find a further 11. These were observed to be a mean of 10 magnitudes fainter than those observed within our own galaxy, leading to Curtis to suspect that M31 was considerably further away than first thought. Curtis was amongst those Astronomers that put forward the theory that objects of this type were “Island Universes”. This was famously debated in a meeting between Curtis and Harlow Shapely in 1920 - Curtis was for, Shapely against.

The matter was settled in 1925 by Edwin Hubble, who discovered the first Cepheid Variable in M31. Comparisons with these variables and the Cepheids in our Galaxy proved that M31 was a separate conglomeration of stars, distinct from the Milky Way. Although underestimating the distance of M31 by a factor of two, Hubble proved that the Universe was a much larger and more mysterious place.
Walter Baade, using the 200-inch Palomar Reflector discovered two separate types of Cepheids Variables in the population of M31, which had the effect of doubling Hubble's pervious distance estimate in 1943. Current distance estimates are around the 2.5 million light years mark. M31 was also discovered to be heavily blueshifted in its spectral lines, proving via the Doppler effect that unlike the vast majority of galaxies in the sky, it is actually advancing towards us (or more accurately, both galaxies are attracting one another).

M31 can be observed with (or without) all manner of optical equipment. It is probably best seen in large Binoculars (70mm objective size +) from a reasonably dark location. Rich field, short focal ratio telescopes like Dobsonians, and shorter Refractors show it well too, but due to its large angular size, powers must be kept low to see the Andromeda Galaxy in all its glory. Both satellite galaxies, M32 and M110 are easy to spot too (M32 the easier of the two). In larger instruments, with suitable filtration, it is possible to observe nebulous regions in M31 - similar features to the Orion Nebula in the Milky Way. This is a challenge, but a rewarding one! We'll never see the true beauty of our own galaxy from the outside, so must content ourselves with the marvellous vista that M31 offers us. Some of M31's globular clusters, including the remarkably large G1 are also visible though instruments of 10-inch aperture and above.

However, it is in long duration photography that M31 really reveals its true extent and size. A 30 second unguided exposure with a wide field lens will easily show M31, though a small, high-quality refractor on an equatorial mount will be ideal in terms of framing the whole object on a standard DSLR chip. Multiple exposures, when stacked in a free program such as Deep Sky Stacker, will reveal the huge dust lanes and knotted, hydrogen rich areas of nebulosity. M31 is a prime beginner's Deep Sky photographic target, but it is such a rewarding photographic object that Astrophotographers feel compelled to return to it time and time again. That it is well-placed for those of us in the northern hemisphere during the winter months is indeed fortuitous. All though observable through much of the year, now is the time to take full advantage of this fabulous Deep Sky wonder.

To the western side of Andromeda, 2.5-degrees to the W of Iota Andromedae is the lovely NGC7662 - otherwise known as the Blue Snowball Nebula. This Planetary Nebula is a great object - albeit compact, at 0.5 minutes of arc - and is well seen in telescopes of most apertures. A 6-8-inch class telescope will show it clearly as a blue-green ball of light. However in larger telescopes, the subtleties of NGC7662 really become noticeable - it's internal rings and slight elongated internal lobes can be distinct. The Blue Snowball can exhibit “blinking” just like the famous Blinking Planetary and Saturn Nebula. The Blue Snowball's central white dwarf star shows distinct variability - peaking at +12 mag, but sometimes dimming down to below +16 mag. Current distance estimates put it at 5,600 light years distance from us and 0.8 light years in diameter.



The Blue Snowball Nebula. Image Credit: HST/NASA/ESA. Public Domain.

Drifting back east, beyond M31 and its companions, we come to two unusual objects. Mirach and Mirach's Ghost are formed by Beta Andromedae and a condensed elliptical galaxy, NGC404. Line of sight from our perspective on Earth place these two completely unrelated objects in a very close pairing - they are separated by just under 7 arc minutes, making this galaxy easy to locate, but not necessarily so easy to see! Mirach has a tendency to overpower its neighbour, due the their differences in brightness. In clear, calm conditions NGC404 can be spotted in large binoculars, though telescopic observation can be a little trickier. Higher magnification can help under some conditions, though aperture will help as well. Photography of NGC404 is a challenge as well, but a worthwhile one. Mirach and Mirach's Ghost are one of those interesting "Odd Couples" of the night sky, that perspective and chance throws our way. It would be a pity to let the perceived dificulty of observation stand in the way of taking a look.
Another of Andromeda's obscurer residents is the open cluster NGC752. Consisting of over 70 stars of around the 9th magnitude, NGC752's cumulative magnitude stands at +5.7. Best seen in giant binoculars, this cluster has some particularly elderly residents for a star cluster: its A2-class stars indicate an age of over a billion years. The cluster is full of star chains and occupies an area of over 75 minutes of arc in the sky. It lies over 1500 light years from Earth.

Just under 9 degrees to the SW of NGC752, just over the border in neighbouring Triangulum, forming an almost right-angled triangle in the sky with the cluster and the previously-mentioned Mirach and Mirach's Ghost is the third largest member of our local group: M33, otherwise known as the Pinwheel (a description it unhelpfully shares with M101 in Ursa Major) or simply, the Triangulum Galaxy. Whereas M31 is inclined to our perspective, M33 is presented to us in a much more "face on" aspect. It is a smaller, less massive object than its neighbour, and occupies less area in the sky - M33's major dimension is about as wide as M31's narrowest. However, at it is still a major object, though its lower surface brightness make it more difficult to spot.

M33 by Mark Blundell. Image used with kind permission.

At +5.69 mag M33 is technically visible to the naked eye, but one would have to be in a particularly dark location and very well dark-adapted in order to see it unaided Discovered in 1654 by Giovanni Batista Hodeierna and then independently re-discovered and catalogued by Charles Messier in 1764, large binoculars will show M33 very well from a good locale and larger aperture observations can reveal some of the brighter nebulous regions. The largest and most prominent of these was first recorded by William Herschel in 1784 and now known as NGC604. As previously mentioned with M31, these two galaxies (setting aside the satellite Magellanic Clouds of our own Milky Way) are the only two external systems in which it is possible to view nebulous regions visually through a reasonably-sized telescope. H-Alpha and H-Beta Filters will help considerably with this endeavour - though inevitably, aperture and a good sky is key. Those with access to instruments in the 16-inch or above class would be able to spot some of M33's globular clusters, arranged in a halo around the galaxy, much as they are in our own Milky Way.

Current measurements put M33 at a distance of around 3 million light years away from us - 500,000 light years further from us than M31. M33 contains around 30-40 billion stars, less than our galaxy’s 200-400 billion and much less than M31’s trillion stars. M33 has supposedly interacted with M31 in the distant past, and as it is moving towards us and M31, will probably do so again. Whether this results in a collision such as that predicted for the Milky Way and M31 is, as yet, unknown.