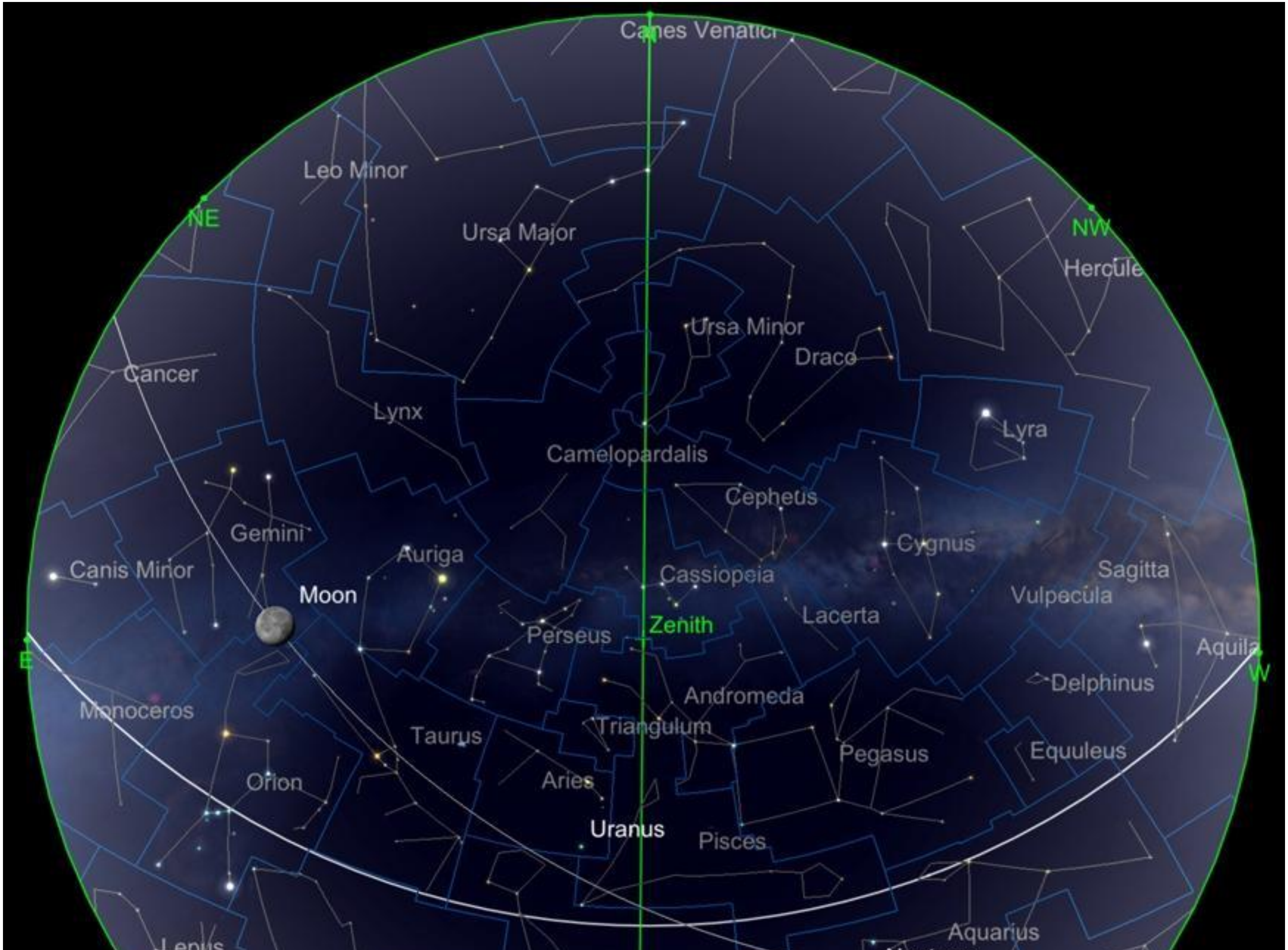

Canes Venatici
Leo Minor
NE
Ursa Major
NW
Hercules
Ursa Minor
Draco
Cancer
Lynx
Lyra
Camelopardalis
Cepheus
Gemini
Cygnus
Auriga
Canis Minor
Cassiopeia
Sagitta
Moon
Vulpecula
Lacerta
Perseus
Zenith
Aquila
E
W
Delphinus
Andromeda
Monoceros
Triangulum
Taurus
Pegasus
Equuleus
Orion
Aries
Uranus
Pisces
Aquarius

Image created with SkySafari 5 for Mac OS X, ©2010-2016 Simulation Curriculum Corp., skysafariastronomy.com.

The Solar System

The Moon

The Moon begins November in Sagittarius as a Waxing Crescent of just 24.5% illumination. At just under five days after New, you'll catch the thin crescent of the Moon low in the evening sky this evening. The Moon will set just over three and a quarter hours after the Sun on the evening of the 1st.

Our natural satellite flanks Saturn in the early evening sky on the 2nd and 3rd, appearing around 8 degrees to the west and just under 5 degrees to the east of the Ringed Planet on respective days.

Pluto
Saturn
M 25
Sagittarius Star Cloud
Moon
Sagittarius
SagDEG
Jupiter
Butterfly Cluster

The Moon, Saturn and Jupiter, an hour after sunset, 2nd January. Image created with SkySafari 5 for Mac OS X, ©2010-2016 Simulation Curriculum Corp., skysafariastronomy.com.

The Moon reaches First Quarter in the 4th while in Capricornus, rising at 2pm GMT and setting a little before 11pm

The Moon continues its climb north through the Ecliptic, reaching Full while straddling the border between the constellations Taurus and Aries on the 12th, rising a little after 4.40pm (GMT) from Western Europe and not setting until around 6.40ak the following morning. As a consequence, this mid-month period is not the best time for observation or imaging of deep sky targets (apart from those utilising narrowband filtration).

The Moon comes to Last Quarter on 19th November, while resident in Leo. On the morning of the 24th, the Moon lines up with the diminutive Mars and the brighter Mercury in the east before dawn, the three forming a lose conglomeration, with the tiny 7% illuminated sliver of the Old Crescent Moon acting as a useful signpost for the fainter planets.

The Moon reaches New, a couple of days later on the 26th, when it slides past the Sun in Scorpius. Two days later and there is the possibility to witness a potentially spectacular conjunction when on the evening of the 28th, the tiny sliver of the New Crescent Moon sits almost equidistantly in the middle of the striking pairing of Venus and Jupiter. This will be a potentially tricky spot in the glare of the evening sky, but those with a clear southwesterly horizon should try to catch the tightly spaced trio of the second, third and fourth brightest objects in the sky. The evening after this, the Moon is to be found lying around 3 1/2 degrees to the south of Saturn in Sagittarius.

Our Moon ends the month on the Sagittarius/Capricornus borders, at four days old. It will be around 7% illumination and set at just past 7.30pm GMT on the 30th.

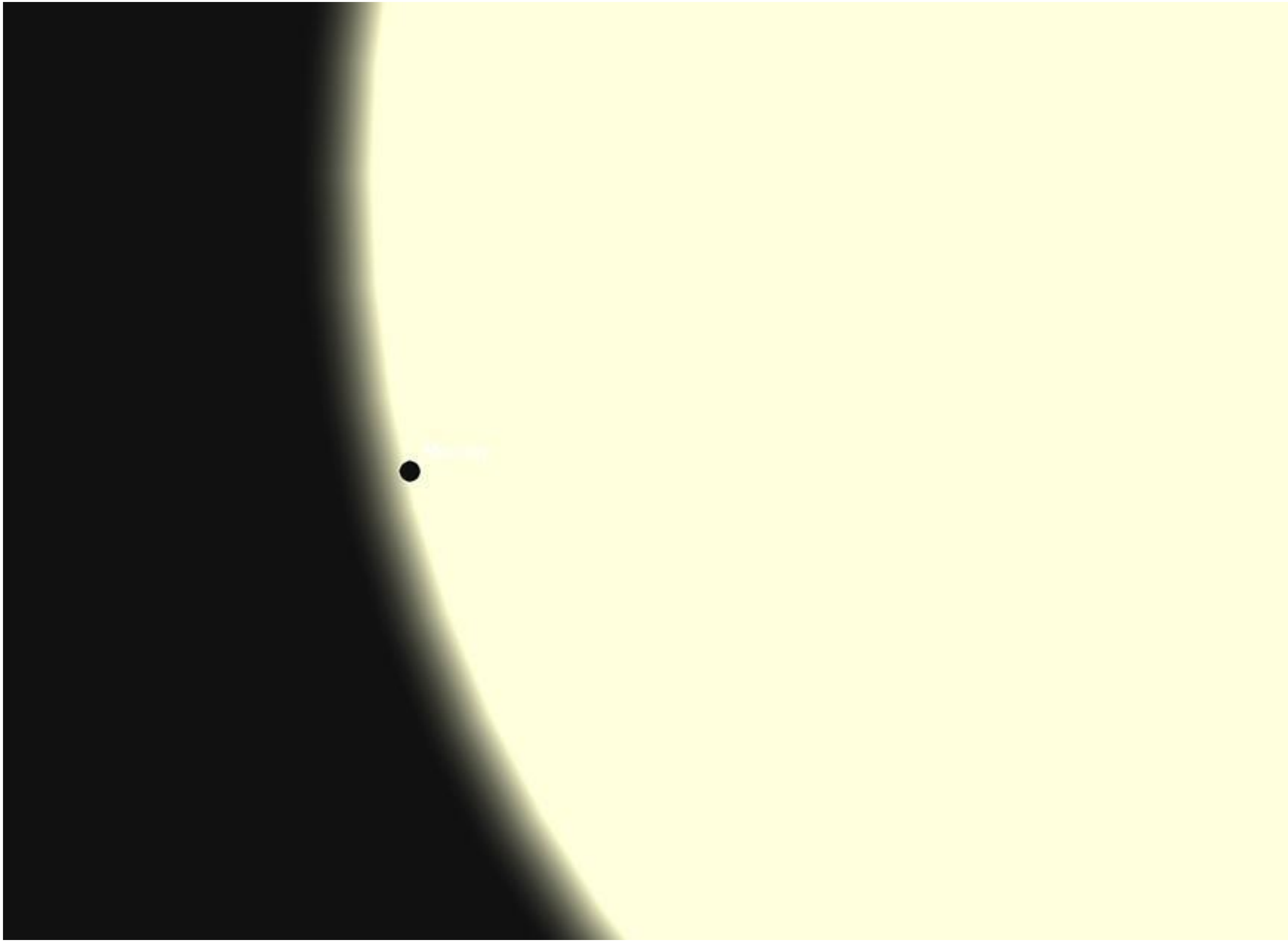
Mercury

Mercury starts a very significant month for the Innermost Planet, as an evening object. A resident of Libra on the 1st, attempted observations from the temperate or higher Northern Hemisphere will be seriously hampered by the shallow angle of the Ecliptic plane as it sets from these parts of the world. While Mercury is just over 18 degrees separation from the Sun on the 1st, it will be just over 2 1/2 degrees high in altitude (from 51 degrees N) as it sets. A challenge which will prove impossible for most of us, though those in the equatorial regions of the Earth will fare much better at this time. Mercury has been in very close conjunction with Venus and although the two are moving apart, the brighter Venus - just over 3 1/2 degrees to the N, will serve as a useful signpost for those in more opportune parts of the world to observe both planets.

Mercury is decreasing its separation from the Sun by around a degree and a half a day, as the month progresses, until it transits the face of the Sun on 11th November.

Transits are fairly rare events and can only occur when solar system geometry allows. In the case of Mercury, Transits can only happen around either a few days surrounding either May 8th or November 10th. These are the two points in the calendar year where Mercury's orbital plane aligns with the Earth's orbit in relation to the Sun's apparent position in the sky. November transits occur when Mercury's orbit is in ascending node (With Mercury's orbital plane appearing to track northward over the Sun's disk), whereas May's transits occur when Mercury's orbit is in the descending node (with Mercury's orbital plane appearing to track in a southerly direction over the face of the Sun). As the orbit of both Mercury and the Earth are not exactly circular, Mercury's apparent diameter varies somewhat, with Mercury's silhouette appearing slightly smaller during November's Transits, than those of May.

The Transit of the 11th begins with first contact at 12.35pm GMT, when Mercury's disk begins to make contact with the limb of the Sun. A couple of minutes later and the entire Mercurial disk has entered the boundary of the Sun.



Mercury begins its Transit of the Sun, 12.35pm GMT, 11th November. Image created with SkySafari 5 for Mac OS X, ©2010-2016 Simulation Curriculum Corp., skysafariastronomy.com.

The half way point of the Transit occurs at 3.19pm GMT and Mercury ends the event at a 6.03pm GMT. The Sun and Mercury will have set by this point for Europe and much of Africa, though the Americas and parts of Antarctica will witness the event's end. Sadly for those in much of Asia, the Far East and Australasia and the Pacific, it will be nighttime throughout the Transit, so there's no chance of seeing it from these climes.


2019

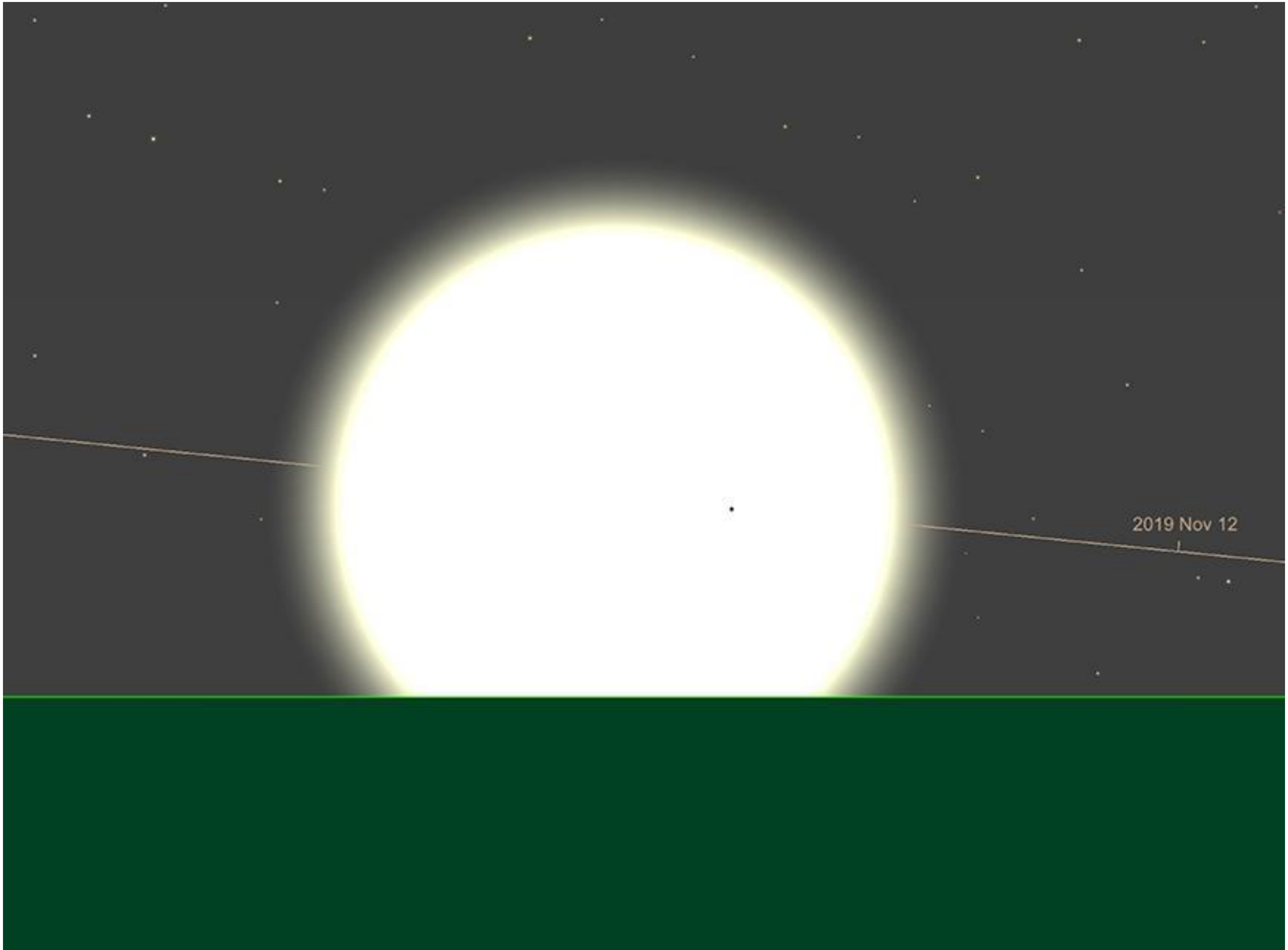
Mercury mid-Transit, 3.19pm GMT, 11th November. Image created with SkySafari 5 for Mac OS X, ©2010-2016 Simulation Curriculum Corp., skysafariastronomy.com.

Transits are well worth planning for: if you have a telescope, or pair of binoculars of reasonable magnification, then all you'll need is proper film/polymer, or glass solar filters for them. These can be bought in sheets in the case of film, but are also available in pre-fitted cells. Those with dedicated Hydrogen Alpha Solar Telescopes, or Calcium-K, or white light Herschel Wedges will already be in possession of all they need to observe and share the view safely.

Those with binoculars are reminded that it's a good rule that observers generally need a minimum of 7x magnification and decent seeing conditions to make out Mercury's crossing of the Sun. Once double figures are reached in terms of magnification, finding and tracking Mercury tends to be much easier.

It goes without saying that any type of solar observations must be approached with caution. If you are converting conventional optics by using solar filters, only use approved filters and make sure these are snug and securely in place before pointing binoculars or a telescope anywhere near the Sun. Make sure those you are sharing the view with are suitably informed about solar safety and watch that your finderscopes are capped during the event if you don't have a filter for them.

While the weather in November for those in the northern hemisphere can be best described as variable, Transits are quite lengthy as events and as such, allow for longer periods of observing potential. Here's going wherever you are, you get the chance to witness at least part of it, as the next one isn't until November 13th, 2032.


2019 Nov 12

Mercury at Transit as the Sun sets from Greenwich, London, 4.29pm GMT, 11th November. Image created with SkySafari 5 for Mac OS X, ©2010-2016 Simulation Curriculum Corp., skysafariastronomy.com.

Venus

Venus is an evening object, starting the month just under 21 degrees from the Sun. As we have covered with Mercury, with which it shares the same part of the sky, Venus is very low for meaningful observations from the Northern parts of our planet. At -3.9 magnitude on the 1st, it is bright enough, but very low at sunset - just under 5 1/2 degrees in altitude (from 51 degrees N).

By the middle of November, matters have improved by a fractional amount: Venus is no brighter and has gained just over a degree in altitude at sunset (again, from 51 degrees N), but has increased its separation from the Sun to just over 24 degrees, which will mean those in further south will reap the benefits of greater angular height in the evenings.

On the 23rd and 24th, Venus will come into close conjunction with Jupiter - with the two brightest planets separated by around 1 1/2 degrees. This should be a pretty sight if you have a clear enough westerly horizon to witness it.

Ophiuchus
Scutum
Nov 29
Venus

Venus and Jupiter in conjunction, sunset, 23rd November. Image created with SkySafari 5 for Mac OS X, ©2010-2016 Simulation Curriculum Corp., skysafariastronomy.com.

While Venus' position in the sky currently disappoints us somewhat in the temperate northern hemisphere, the planet is headed for a pretty spectacular evening cycle in the latter part of the year, but especially in the first half of 2020. By the end of March 2020, when Venus is again at greatest eastern (evening) elongation, the planet will be over 40 degrees high in the West at sunset (from 51 degrees N) - a much better prospect than the present.

Mars

The Red Planet reached Superior Conjunction on 2nd September, after which, it has emerged as a morning object. At the beginning of November, Mars presents a 3.7 arc second, +1.8 magnitude disk, which has a separation from the Sun of just over 20 degrees. Mars will be a little difficult for many to locate at this time and very disappointing if you happened to do so.


Celestial Equator
Serpens
Mars
Mercury
Libra

Mars at sunrose, 30th November. Image created with SkySafari 5 for Mac OS X, ©2010-2016 Simulation Curriculum Corp., skysafariastronomy.com.

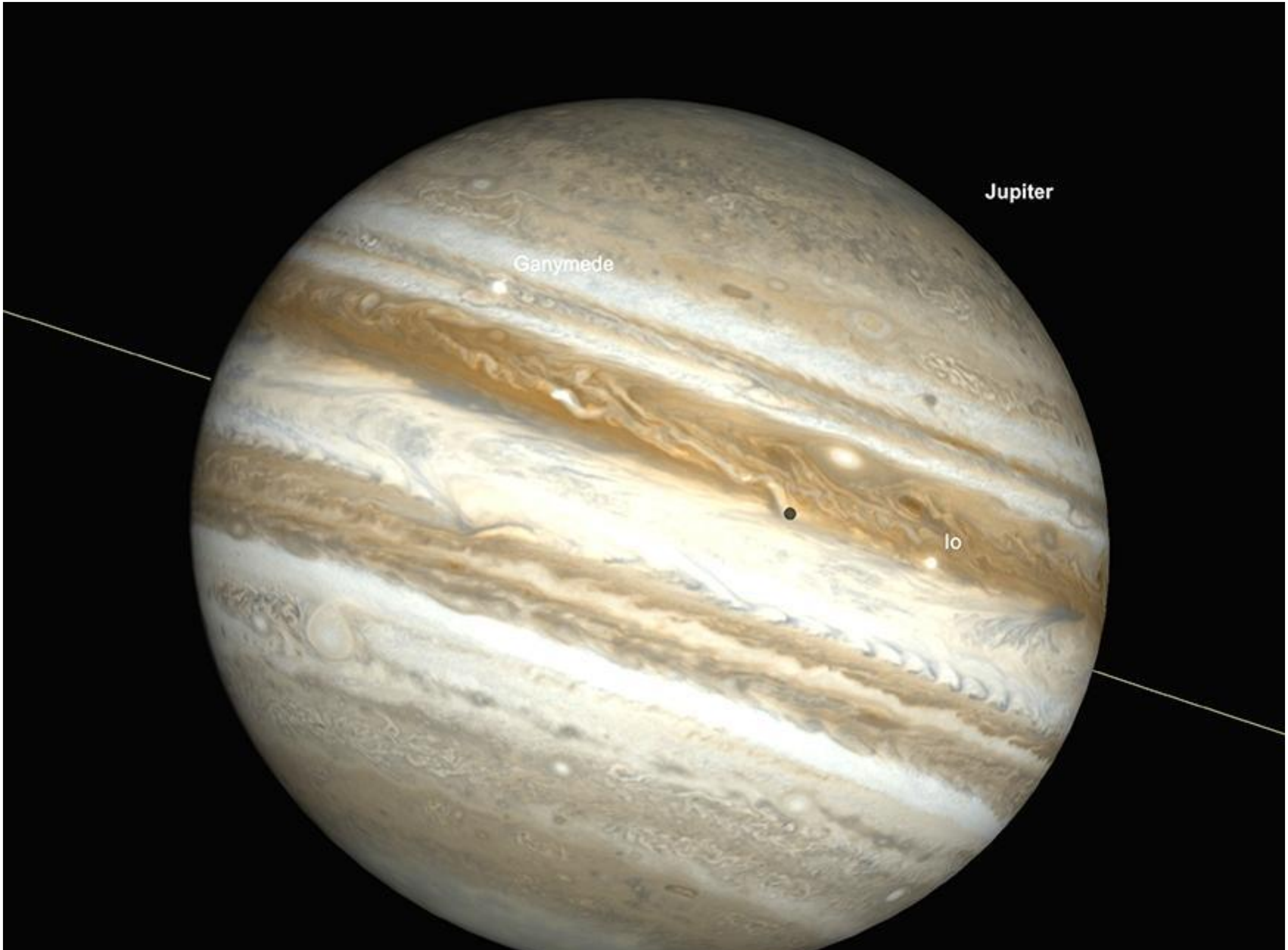
By the end of the month, Mars will have increased its separation from the Sun to 30 degrees, rising a little over an hour before sunrise. However it will still be very underwhelming - its angular size is just 3.9 arc seconds across and it will be fractionally brighter at +1.7 mag. For the time being, as far as Mars in concerned, there are more interesting and inspiring targets to observe.

Jupiter

The giant planet Jupiter is still fairly-placed for evening observing during the first part of the month. However, the window of opportunity for Jovian observations continues to shut (though this is offset a little by the increasing hours of darkness in the northern hemisphere at this time of year. On the 1st, Jupiter transits at just past 3pm (GMT) and sets at around four hours later (from 51 degrees N). At this point in time it is -1.9 magnitude and presents a 33.4 arc second diameter disk. At this point, Jupiter is separated from the Sun by just under 45 degrees.

The King of the Planets is never poor in a telescope, but caution must be advised for those of us in the observing it from the temperate parts of the northern hemisphere, as the planet is dipping lower and lower in the south of the ecliptic and as such is subject to much more in the way of potential atmospheric disturbance. Keeping magnification sensible will help combat poor seeing conditions to a certain extent, as it’s pointless making any planetary target bigger and consequently appear lower in brightness and contrast detail. The Wratten 80A Filter is a light blue and is regularly recommended for Jovian observations. While it can’t help with atmospheric seeing, it can help isolate cloud belt detail and is useful in observing and isolate transits and shadow transits.

In terms of Jovian events, visible from Europe, we have a nice dual Europa and Io transit in the early evening of the 7th November followed by an early evening GRS transit on the 8th and a Ganymede transit that will be visible in part on the 9th. GRS Transits again in the early evening of the 10th and 15th and a simultaneous Ganymede and Io Transit viewable on the early evening of the 16th. The GRS transits again in the early evening of the 17th, 20th and the 22nd. A day later on the 23rd, Jupiter will be transited by Io in the early evening. The GRS transits in the early evening of the 27th.



Jupiter
Ganymede
Io

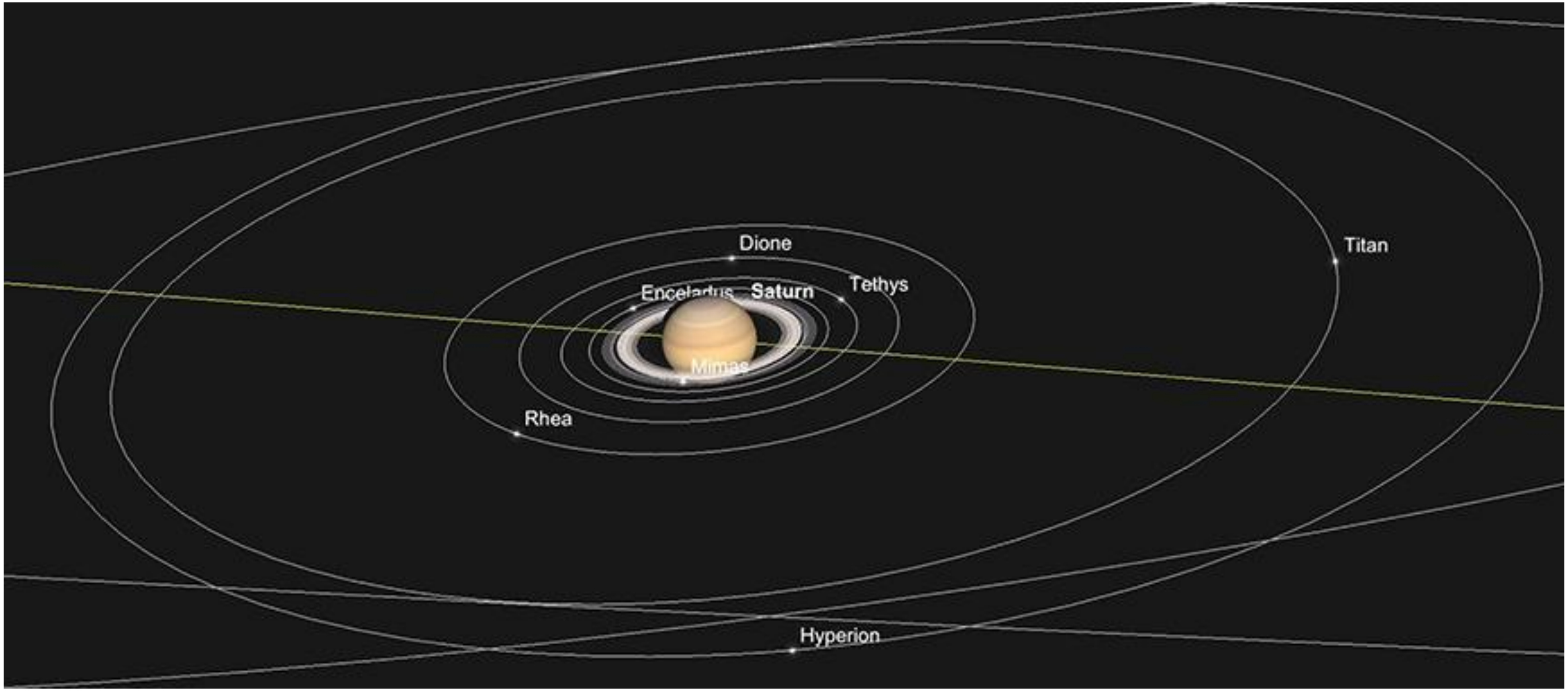
Jupiter with dual Io and Ganymede Transits, 16th November around sunset. Image created with SkySafari 5 for Mac OS X, ©2010-2016 Simulation Curriculum Corp., skysafariastronomy.com.

As previously mentioned, jupiter and Venus come into very close conjunction on the eveings of the 23rd and 24th November, when the two worlds will be separated by 1 1/2 degrees - this will be a pretty special event to witness and won't require any optical assistance to view it - just a clear westerly horizon and reasonable sky conditions.
By the end of the month, Jupiter sets at around just a little past 5.30pm (GMT) from the UK. This is just over an hour and a quarter after the Sun. At the end of the month, Jupiter will have faded almost imperceptibly to -1.8 mag and will now be separated from the sun by just under 21 1/2 degrees. Jupiter's Superior Conjunction with the Sun will not occur until late December, but after the end of the month, the planet will become much more difficult to catch in the sky during the evenings. This year's evening encounter with Jupiter is nearly over from a practical perspective.

Saturn

Saturn is still observable in the evening. But again, like Jupiter, it is low for observers in the temperate northern hemisphere. At the beginning of the month, now some four months past this year's Opposition, Saturn has dropped from its peak angular size, to a slightly smaller 16.0 arc seconds diameter and its brightness at +0.6 mag has faded somewhat from July's peak. Saturn of course will present a wonderful view in any telescope, with its glorious rings, while past their point of maximum opening, very well presented for observation. Saturn is decreasing its angular distance from the Sun and this foreshortening of angle is causing the planet's shadow to fall more noticeably on its beautiful ring system. However, we are now past the point of maximum Saturnian shadow and this effect appears to be decreasing as the planet appears to head towards the Sun from our perspective here on Earth.

Saturn reaches transit point on the 1st at a little after 4.30pm (GMT) from Europe. This is just a little over 19 minutes before sunset (from 51 degrees N). This means it is at its peak height in the sky and offers the best potential for viewing at its furthest point from the horizon at around this time. Although Saturn tends to appear slightly less affected by atmospherics that Jupiter is, this is more of a perceptual difference. Jupiter being so much brighter, disturbances are easier to perceive when you look at it telescopically.



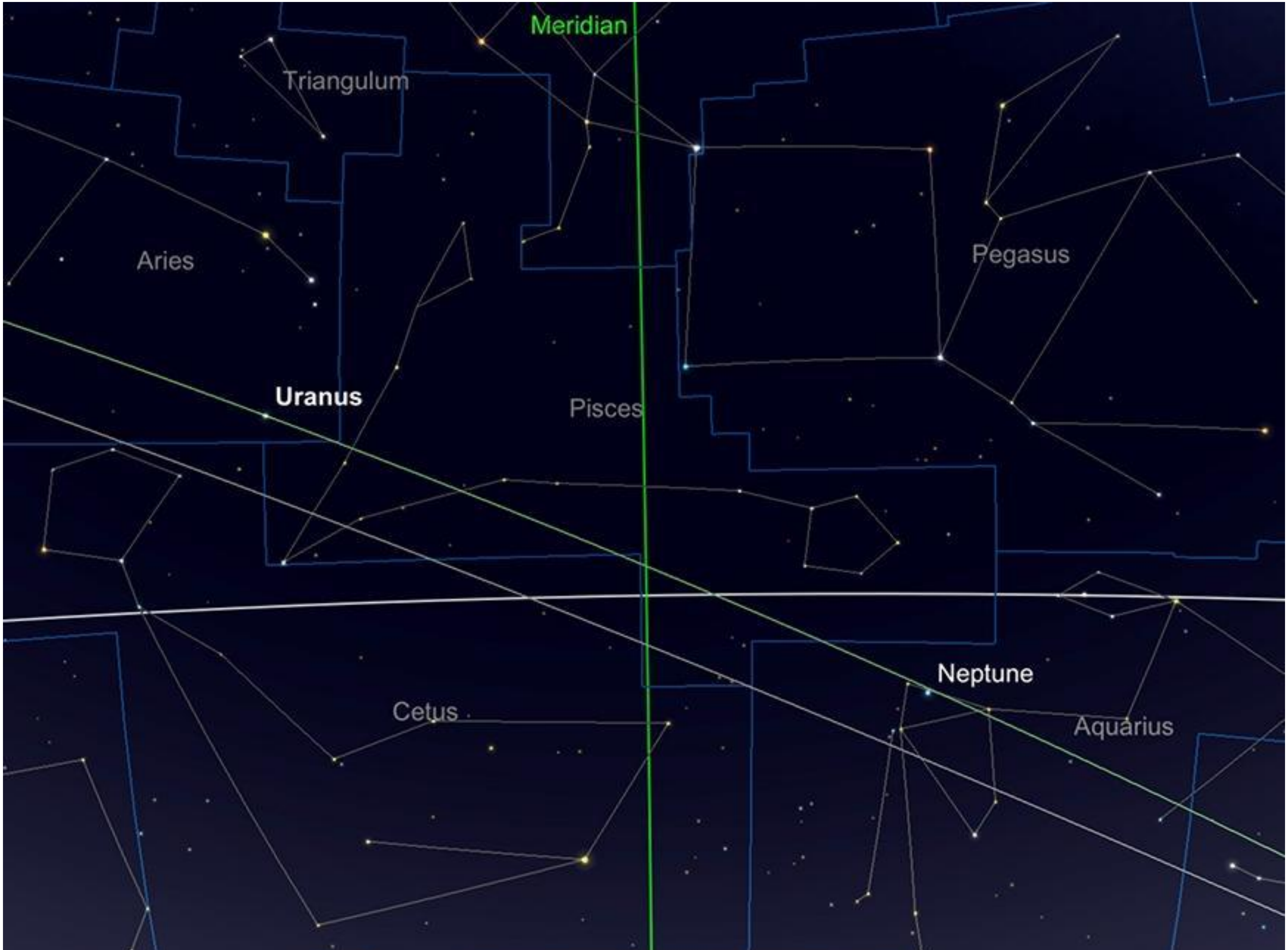
Saturn and Inner Moons, 15th November. Image created with SkySafari 5 for Mac OS X, ©2010-2016 Simulation Curriculum Corp., skysafariastronomy.com.

The planet will set at a little before 8.40pm (GMT) at the beginning of November, when it can be found 66 1/2 degrees to the east of the Sun in the ecliptic. By mid-month, transit point occurs 40 minutes earlier than it did on the 1st, with roughly the same being the case for setting times. By the end of the month, Saturn will transit at a little before 3pm (GMT), when it sits around 14 degrees high in the south (from 51 degrees N) and sets around four hours later. Just as with Jupiter, the window for evening observations of Saturn is closing, so get out and enjoy it in the early evening while you can. The end of the month finds Saturn having decreased its angular distance from the Sun to just under 40 degrees.

Uranus and Neptune

The outer planets are now firmly evening objects, with Uranus rising around sunset on the 1st and Neptune about an hour and a half earlier. Uranus rises in Aries and Neptune is found further west in the ecliptic in Aquarius.

Both planets are now past Opposition, but are as such, well-placed for observation during the month. By mid-month Neptune will transit at around 7.45pm (GMT) and Uranus will do so a little under three hours later.


Meridian
Triangulum
Aries
Pegasus
Uranus
Pisces
Neptune
Cetus
Aquarius

Uranus and Neptune relative positions, 15th November. Image created with SkySafari 5 for Mac OS X, ©2010-2016 Simulation Curriculum Corp., skysafariastronomy.com.

Uranus is always the easier of the two outer planets to find and at +5.7 mag is technically a naked eye object (though exceptional conditions and eyesight will be needed to find it without any sort of optical assistance). Uranus is much easier to find in binoculars or a small telescope. The planet's 3.7 arc second diameter disk looks very akin to a planetary nebula in a small telescope - though larger instruments and high magnification will be needed to see if you can glimpse the brighter of Uranus' family of Moons.

Neptune, by contrast, will be significantly fainter than Uranus, at +7.9 magnitude and 2.3 arc seconds across at the end of October. Sitting lower in the sky in Aquarius, Neptune needs binoculars or telescopes to reveal its tiny blue disk, if you're patient enough to find it. Those with larger telescopes can attempt to see if it's possible to observe the largest of Neptune's Moons, Triton, which at +13.8 mag is a challenge at best. Triton is thought to be a captured Kuiper belt object and shares more then a superficial resemblance to Pluto and other outer dwarf planets.

Comets

As reported in previous sky guides, we have the prospect of C/2017 T2 PanSTARRS to look forward to. This comet was discovered back in 2017, by the PanSTARRS automated survey. It emerged from conjunction with the Sun at the end of July/early August was observable in the constellation of Taurus during October. It crossed over into neighbouring Auriga in late October is to be found in Auriga for the entirety of November.

C/2017 T2 passes by the prominent star clusters M36 and M38 at the beginning of the month, making for a good potential widefield photo opportunity, as long as the Moon is out of the way.

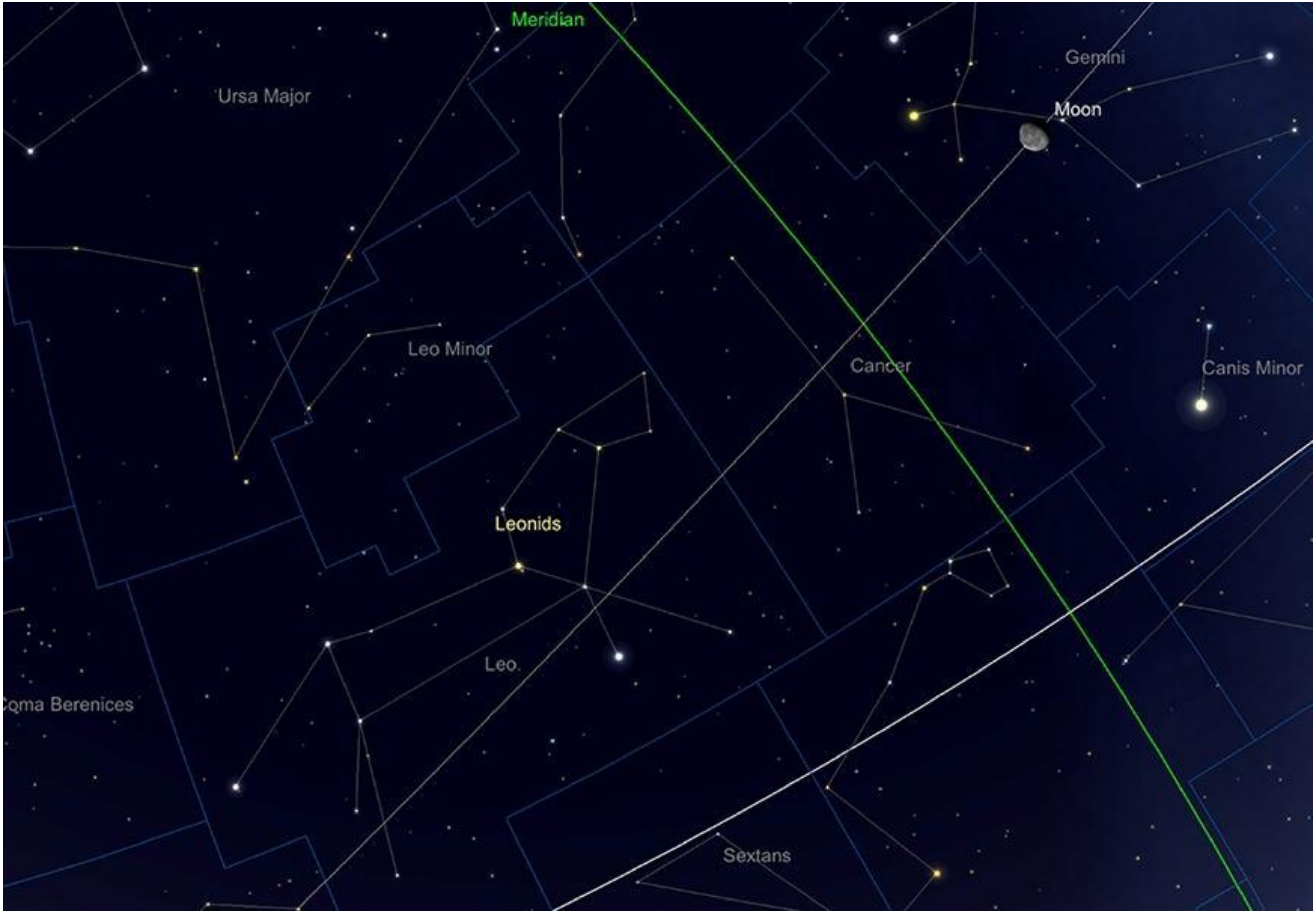
2019 Dec 01
2019 Nov 25
Auriga
2019 Nov 19
2019 Nov 13
2019 Nov 07
2019 Nov 01
C/2017 T2 (PANSTARRS)
2019 Oct 26
M 37
2019 Oct 20

C/2017 T2 PanSTARRS path through Auriga, November 2019. Image created with SkySafari 5 for Mac OS X, ©2010-2016 Simulation Curriculum Corp., skysafariastronomy.com.

Initial observations of this comet were variable - visual predictions of magnitude remained on the higher side of the average predicted light curve of brightness, whereas electronic astrometric measurements tended towards the lower than average. The comet's brightness was rising slightly faster than predicted and looked as if it continued on this course, it should be technically a naked eye object . However, C/2017 T2 PanSTARRS predicted brightness now put it around +5-6 at best, will still make for a good show - just a binocular or telescopic one, rather than a full-blown visual extravaganza. The comet is predicted to reach peak brightness in March to May of 2020, so there is still some way to go before then and the situation may still change. The good news for Northern Hemisphere observation is that the comet will be circumpolar for most of its peak in 2020 - passing through the likes of Perseus, Cassiopeia, Camelopardalis and Ursa Major during maximum brightness. However, this will obviously disadvantage those in the Southern Hemisphere somewhat.

Meteors

November brings us one of the most mercurial of meteor showers: the Leonids. This shower is ordinarily quite low in number - peaking at around 10-15 meteors an hour maximum from any given location. However, once its parent comet, 55P/Tempel-Tuttle returns to the inner solar system (which it does every 33 years), the chances of a really active shower - sometimes a storm level of thousands of metoers per hour - becomes much more likely. We now know a little more about modelling the positioning and density of debris left over from Tempel-Tuttle, so can predict these peaks a little more accurately. Suffice to say, this year's Leonids won't be anything near storm levels and with the Gibbous Moon parked in the adjacent constellation of Gemini for the peak evening - that of the 17th November - this will not be a vintage year for the shower. The next potential outburst peak of the Leonids won't occur until around 2033, though it is suggested that the Earth may encounter debris laid down by Tempel-Tuttle by its passage through the inner solar system in 1733, again in 2022, causing a peak of hundreds of meteors an hour again, as occurred in 1999 and the early years of the 21st century.



Meridian
Ursa Major
Gemini
Moon
Leo Minor
Cancer
Canis Minor
Leonids
Leo
Coma Berenices
Sextans

Leonids radiant point, 17th November. Image created with SkySafari 5 for Mac OS X, ©2010-2016 Simulation Curriculum Corp., skysafariastronomy.com.

Deep Sky Delights in Andromeda, Perseus & Triangulum

Andromeda, Perseus and Triangulum. Image created with SkySafari 5 for Mac OS X, ©2010-2016 Simulation Curriculum Corp., skysafariastronomy.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

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.


NGC 869/884 Double Cluster - Perseus
© 2017 Mark L Blundell
20th October 2017

The Double Cluster by Mark Blundell. Image used with kind permission.

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 Little Dumbbell
By Mark Blundell
19th Augest 2014

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.


NGC 891 Galaxy
Const: Andromeda
By Mark Blundell
2nd October 2016

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 Andromeda Galaxy
By Mark Blundell
19th December 2014 (PM)

M31 by Telescope House's Mark Blundell

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, we come to 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 Triangulum Galaxy
By Mark Blundell
24th Augest 2014 (AM)

M33 by Mark Blundell. Image used with kind permission.

At +5.69 magnitude, 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 Hodierna and then independently re-discovered and catalogued by Charles Messier in 1764, large binoculars will show M33 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.

Triangulum contains no further objects of interest to deep sky observers - its principle stars, Alpha, Beta and Gamma Tranguli are all doubles, but none are brighter than 3rd magnitude, meaning the constellation is a tricky spot from light polluted environments.

Text: Kerin Smith