Telescope House September Sky Guide

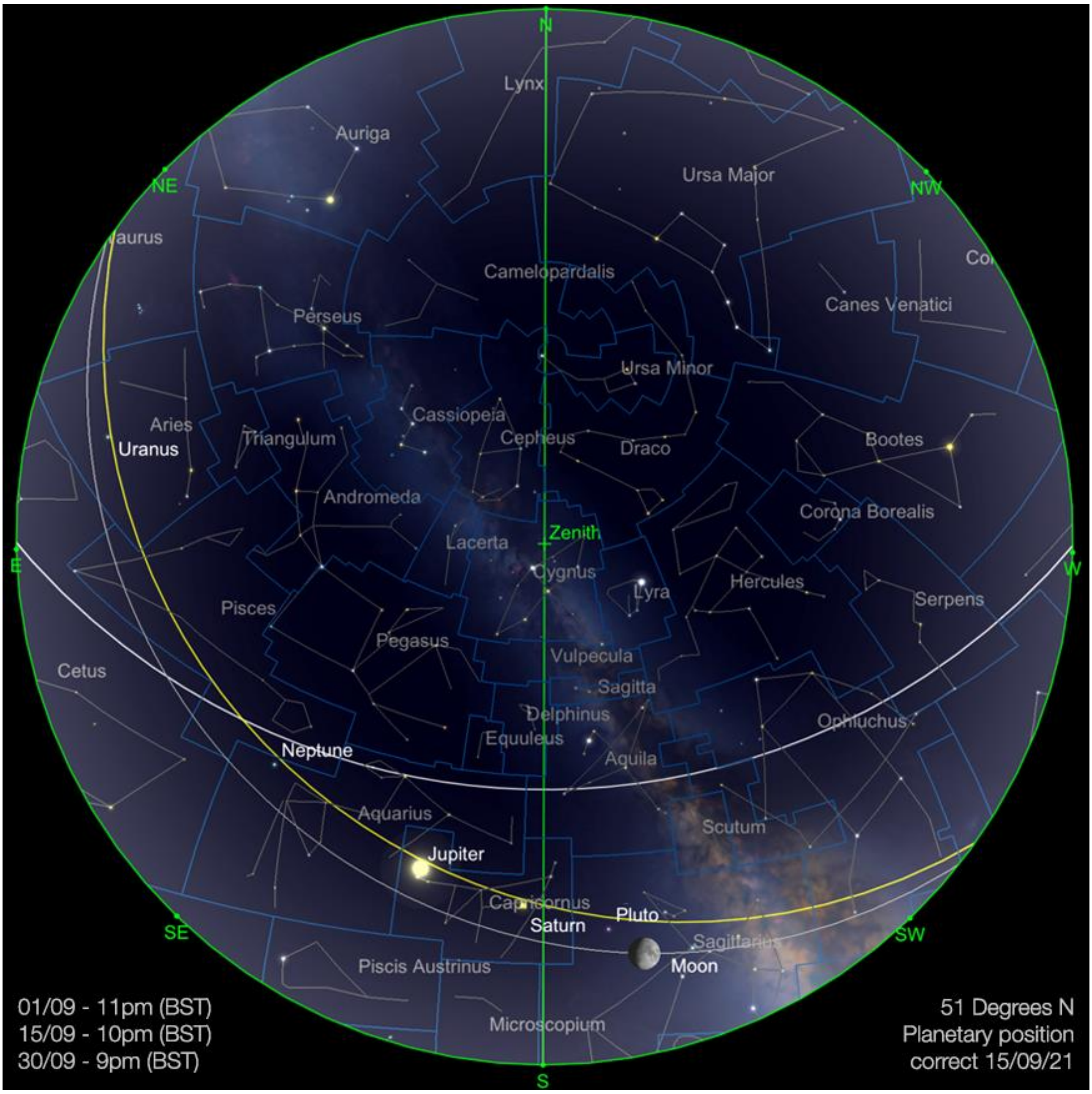


Image created with SkySafari 5 for Mac OS X, ©2010-2016 Simulation Curriculum Corp., skysafariastronomy.com.

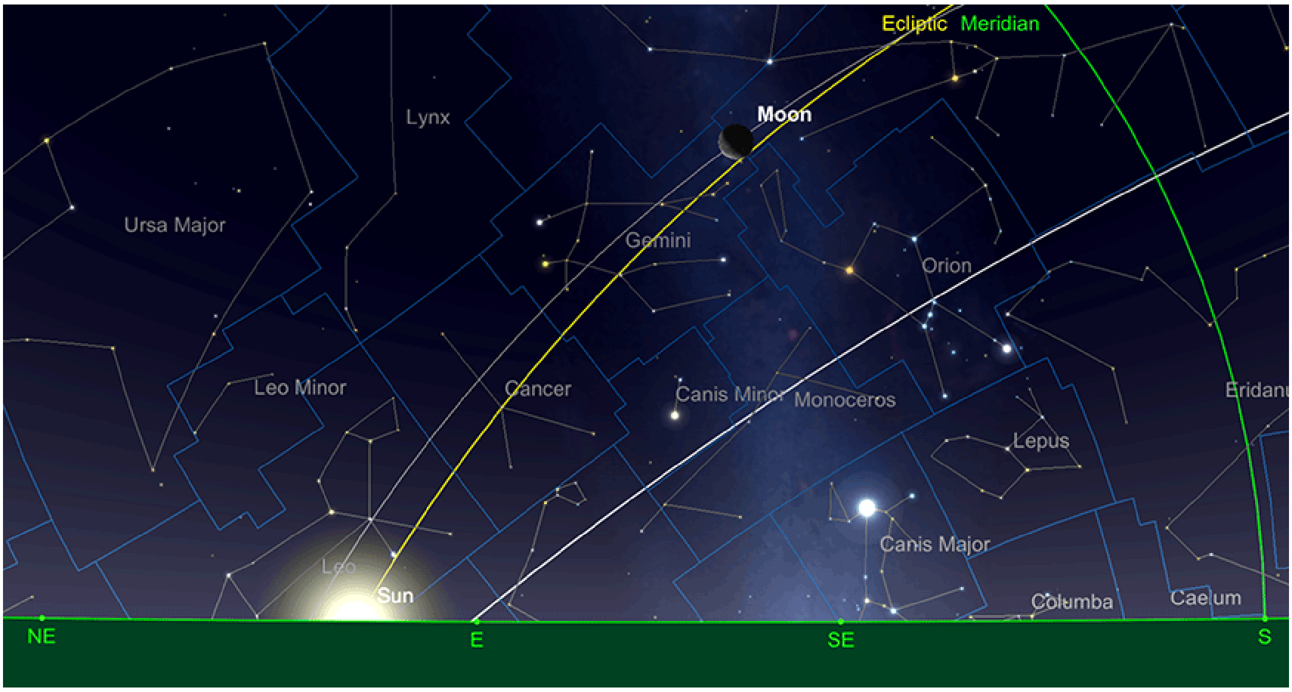
September brings the Autumnal Equinox for the Northern Hemisphere and the Vernal, or Spring Equinox for this in the Southern Hemisphere. This year these events occur on 20th of September, where for a brief period for day and night are of nearly equal length. This equality of dark and light really depends on where you find yourself, as there are few places on Earth on the 23rd September where day and night are *truly* equal. However, crucially, the 20th marks the point where the Sun crosses into the southern celestial hemisphere - which results in increasingly greater hours of darkness than light for those of us in the Northern Hemisphere; and of course increasingly less darkness for those in the Southern reaches of our planet, who concurrently experience their Vernal (Spring) Equinox. Many people for whom astronomy is of no more than at most a casual interest will bemoan the lack of daylight in the Northern Hemisphere - the same cannot (in all probability) be said of the many readers of this Sky Guide. For us astronomers, the dive towards Winter does have its perks.

As ever, there's a lot to see in skies above us this month...

The Solar System

The Moon

The Moon begins September on the Taurus/Gemini borders as a Waning Crescent of just over 32% illumination. At this time of year the Moon displays the opposite to the High Spring Evening Crescent phases at the beginning of the year. This is the season of the High Autumnal Morning Crescents and September’s is a pretty good example. This time of year rewards the early riser, as far as lunar observation is concerned, with the Moon at great separation from the horizon and dramatically lit. While observers in the equatorial regions of our planet frequently experience High Crescent Moons (as from these parts, the Ecliptic passes overhead), those of us in the temperate parts of the Earth never experience the elevation of our solar system’s orbital plane to anything like this extent. This is why the Spring and Autumn are so significant for lunar observation in the more extreme Northern and Southern Hemispheres.



The Moon at sunrise, September 1st. Image created with SkySafari 5 for Mac OS X, ©2010-2016 Simulation Curriculum Corp., skysafariastronomy.com.

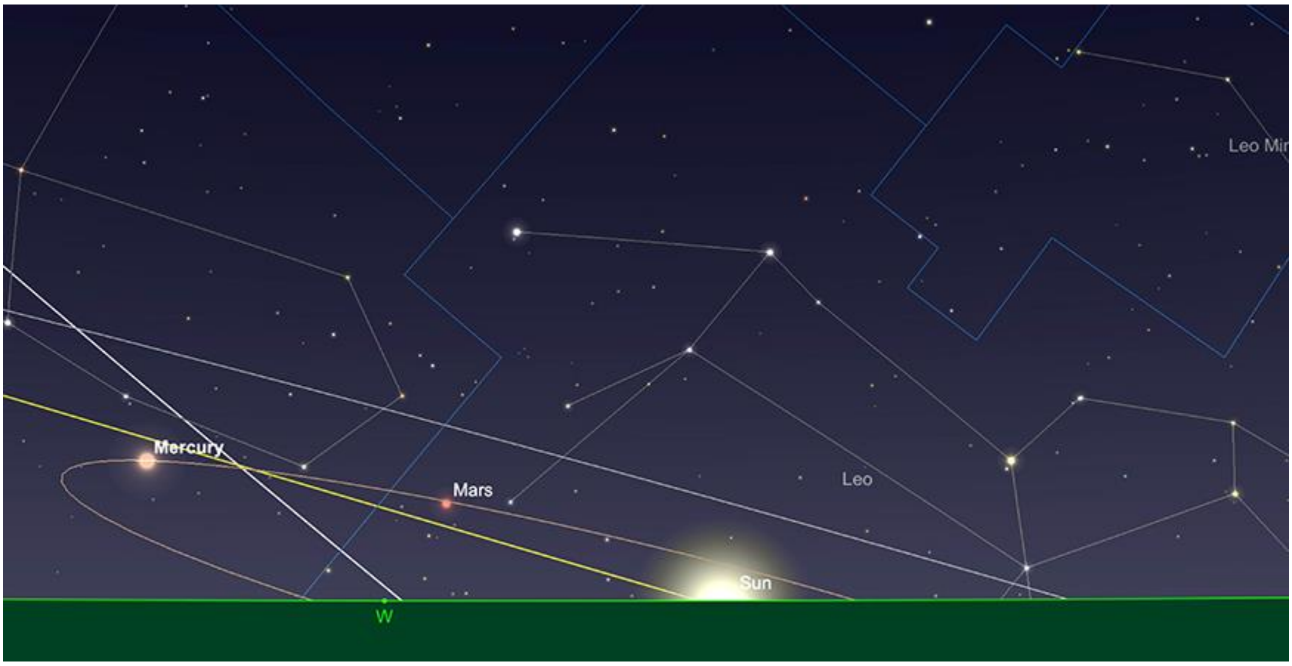
The Moon spends the next week descending through the Ecliptic (from a northern hemisphere perspective), until it reaches New, meeting the Sun in Leo of the 7th. From which point it becomes an evening target, joining Mercury and Venus as the Sun sets. As the Ecliptic "sets" in a very shallow manner from a Northern Hemisphere perspective, none of these objects will appear very high in the sky at this point in time.

The Moon then slides through the rather low-sitting part of the Ecliptic from a Northern Hemisphere point of view (though at this time of year the higher latitudes of the Southern Hemisphere will be experiencing their own "High Spring Evening Crescent Phase"), reaching Half Phase in Ophiuchus on the 13th. Beyond this, the Moon starts climbing towards Full, which it reaches on the Pisces/AquariusCetus border region on the 21st. As usual, we point out the obvious: this part of the month won't be the best for deep sky observation or imaging, without recourse to fairly extreme filtration.

Our natural satellite reaches last Quarter in Gemini on the 29th and then ends the month the following day, while still in Gemini, at 40% illumination.

Mercury

Mercury begins September as an evening target, shining at a steady +0.0 magnitude, displaying a disk of 5.9 arc seconds across. At just over 5 degrees high in altitude (from 51 degrees N) as the Sun sets, it’s hardly in a conspicuous - nor easily observed - part of the sky from higher northern latitudes. Those further south in the equatorial regions of the Earth will witness Mercury stand up to 24 degrees high at sunset - quite a difference!



Mercury, sunset, 1st September.   Image created with SkySafari 5 for Mac OS X, ©2010-2016 Simulation Curriculum Corp., skysafariastronomy.com.

Mercury reaches maximum eastern elongation on the 14th, by which time it will be +0.1 mag and has increased diameter to 6.7 arc seconds, displaying a 60% phase. Sadly, by this point in the month, the planet sits just under 4 degrees high (from 51 degrees N) at sunset, making it even more of a challenge to observe at September’s beginning.

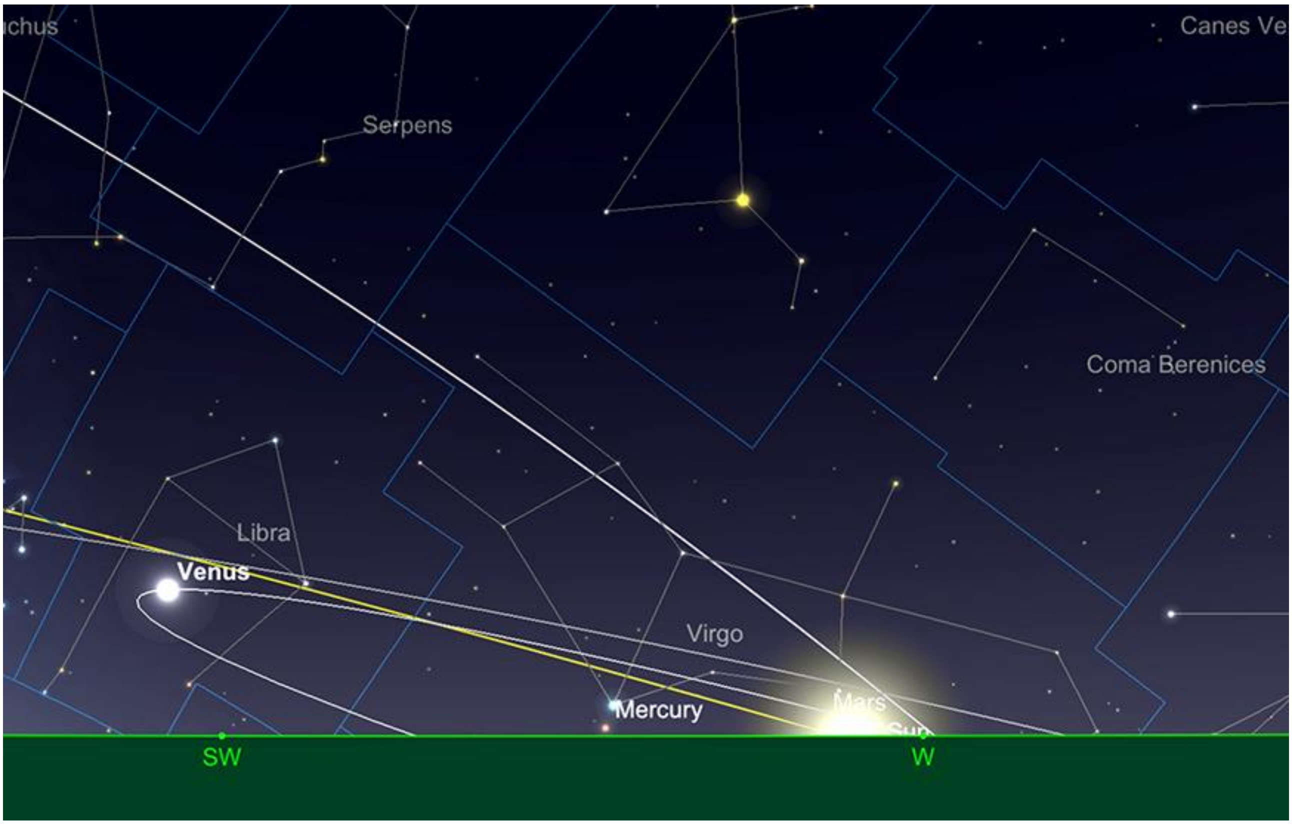
The Innermost Planet then starts its journey back towards the Sun, losing altitude (from a Northern Hemisphere perspective) as it does so and making it extremely challenging to observe beyond the middle of September. The foreshortening of phase as Mercury heads sunwards causes the planet to fade considerably, even though it swells in size, as it draws towards us in its orbit. Mercury ends the month at +1.5 mag and 9.5 arc seconds across, displaying an 18% phase.

Venus

In a similar part of the evening sky to Mercury, Venus is significantly brighter and subsequently much easier to fine. At -4.0 magnitude and just over 15 arc seconds across on the evening of the 1st, Venus currently displays a 72.6% illuminated disk and sits just over 9 1/2 degrees high in the west (from 51 degrees N) at sunset. While brighter and higher than Mercury, you'll still need a fairly clear westerly horizon to find Venus.

By mid-month, Venus has brightened fractionally to -4.1 mag and increased its separation from the Sun to 42 1/2 degrees. As the planet is drawing around towards its maximum eastern elongation, it is approaching us on its path and increasing its angular size as a result. On the 15th this sits at 16.7 arc seconds, though Venus' phase has shrunk to 67.9%. As the Sun is heading south in the Ecliptic, Venus' height at Sunset is decreasing slowly, despite its increasing separation from our parent star. At mid-month, Venus sits 9 degrees high at sunset.

By September's end, Venus has increased brightness to -4.2 mag, while its phase has diminished to 62%. The reason for this increase in brightness is the planet's steady encroachment towards Earth, increasing angular size to 18.8 arc seconds - while Venus' phase is shrinking, the illuminated surface area of the planet is increasing, an thus its brightness. Standing 8 degrees high in the west as the Sun goes down, it will still be prominent enough to find from temperate northern parts, despite the planet's steady march south.



Venus, sunset, 30th September. Image created with SkySafari 5 for Mac OS X, ©2010-2016 Simulation Curriculum Corp., skysafariastronomy.com.

Mars

The Red Planet is approaching Superior Conjunction in early October and as such extremely poorly placed and about as dim as Mars gets at +1.8 magnitude. Found just 12 degrees to the east of the Sun in the evening sky, with a tiny 3.6 arc second diameter disk on the 1st, Mars will be extremely difficult (if not impossible) to find and very disappointing if you do. By the end of the month, separation from the Sun has decreased to just 2 1/2 degrees, by which time observing Mars will definitely be an impossibility. This precedes Superior Conjunction on October the 8th.

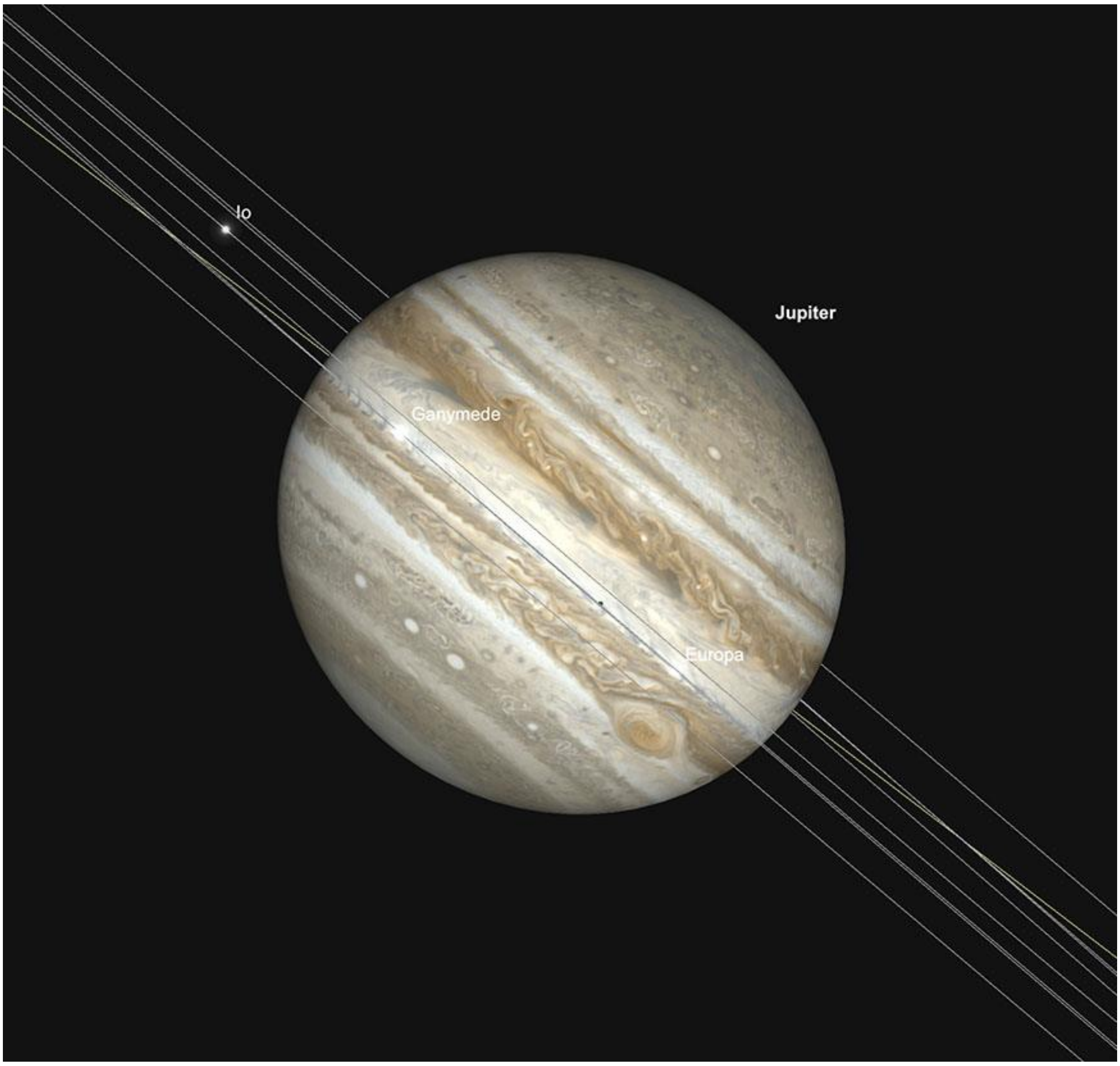
Jupiter

From the disappointment of Mars, to a very different planetary observing experience: Jupiter at just past Opposition. Post-Opposition means that an outer planet rises earlier and earlier and is subsequently prominent and well-placed in the sky during a more clement hour of the night. Rising at just before 7.30pm BST, at -2.9 magnitude and 48.9 arc seconds across, Jupiter is brilliant and well-situated for observing, coming to transit point in the sky at a 12.25am BST on the 1st.

By the 25th Jupiter will have faded imperceptibly to -2.8 and shrunk slightly by 0.9 of an arc second from the month’s beginning. It now rises at 6.30pm BST and reaches transit at 11.19pm.

By the end of the month, Jupiter will have faded a tiny amount more to -2.7 mag and now displays a 46.4 arc second disk. Rising at just before 5.30pm BST, the planet will now transit at 10.16pm.

There are some interesting transit events during the month: the 1st sees a mutual Great Red Spot and Callisto transit and shadow transit, starting at just after 1am BST. From around 1am BST on the 6th, there’s a GRS, Europa, Europa shadow and Ganymede transit. On the 13th there’s a GRS and Europa transit starting a little before 1am and a similar event on the 20th, starting just before 3am and again on the 23rd in the early evening as Jupiter is rising. There’s a GRS and Io transit and shadow transit which begins at a little before midnight on the 27th. Another mutual GRS and Europa transit begins at a little before 7pm on the evening of the 30th.

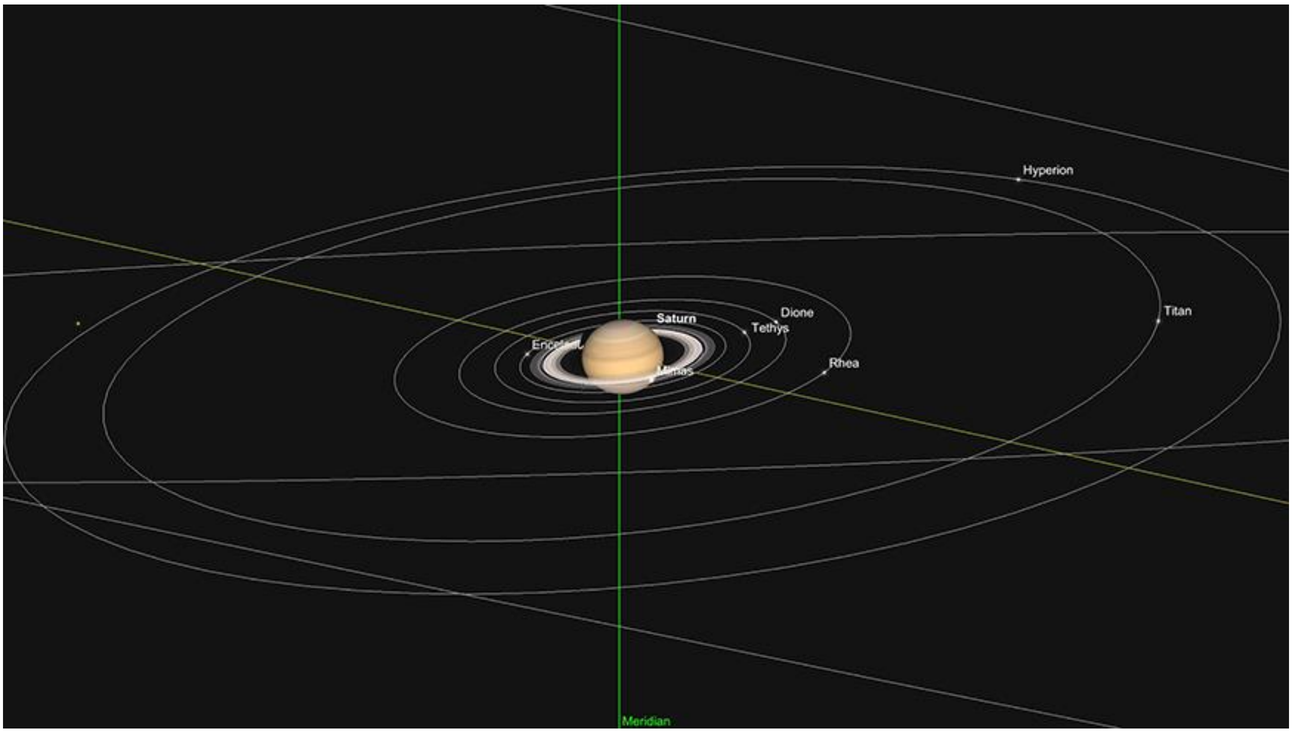


Jupiter, Great Read Spot and Ganymede and Europa transits, 6th January 2am (BST). Image created with SkySafari 5 for Mac OS X, ©2010-2016 Simulation Curriculum Corp., skysafariastronomy.com.

Saturn

Just like Jupiter, Saturn is very well-placed for evening observation. Being further to the west in the Ecliptic than its neighbour, Saturn rises and transits earlier in the evening. At +0.3 mag and 18.3 arc seconds across on the 1st, the Ringed Planet will rise at a little before 7pm and transit at a little past 11pm. Once Jupiter has risen, Saturn's position will be easy to find in relation to its brighter neighbour - if you stretch out your fingers and thumb of one hand to their widest point and hold it at arm's length, this is the separation between the two planets in the sky. Saturn will be the next brightest "star" found to the right of Jupiter using this "full hand span" measurement.

By mid-month, Saturn will have faded very slightly to +0.4 mag and now displays an 18 arc second disk. The planet will now rise at just before 6pm BST and transit at a little after 10pm.

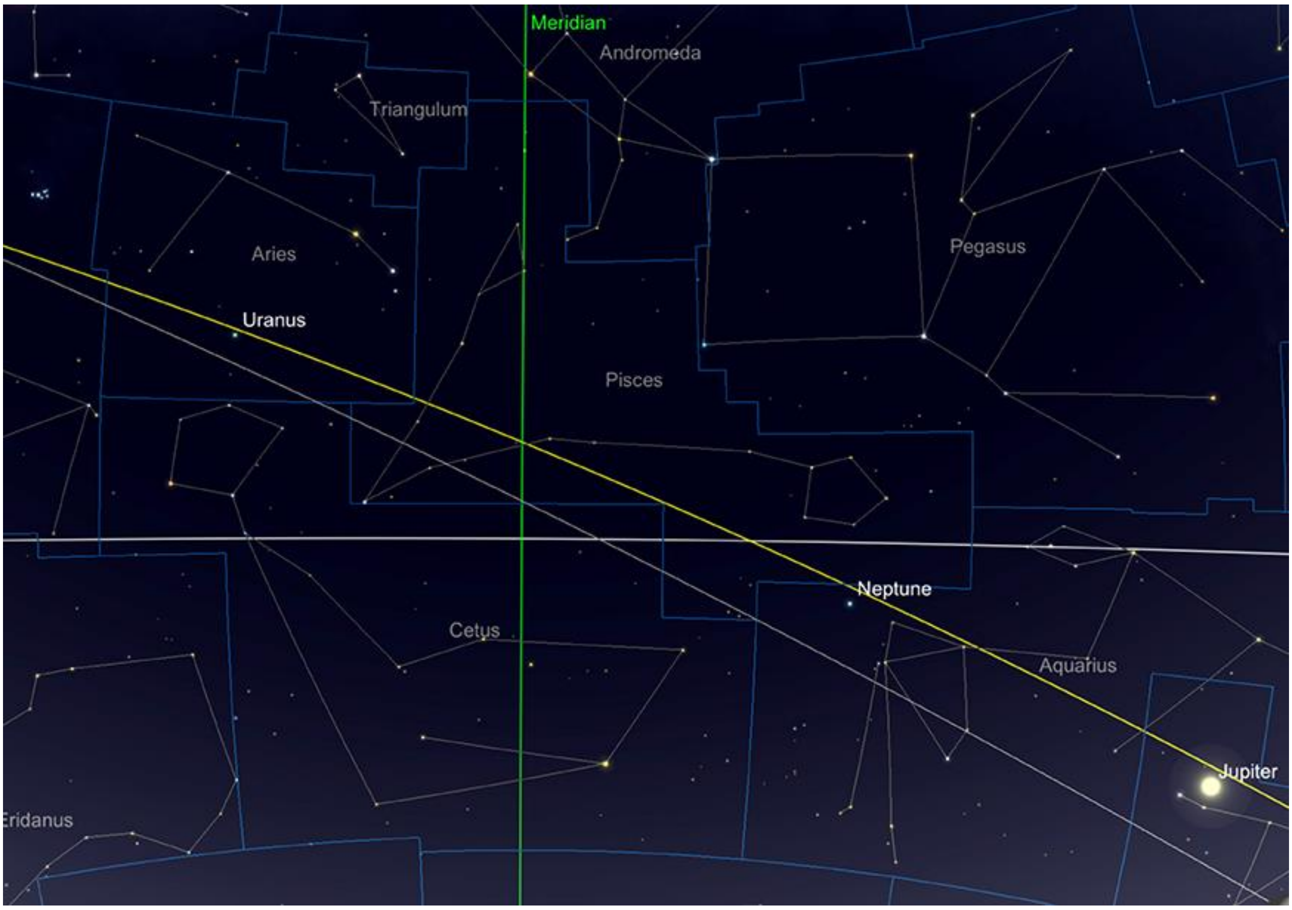


Saturn and inner moons, transit point, 15th September.   Image created with SkySafari 5 for Mac OS X, ©2010-2016 Simulation Curriculum Corp., skysafariastronomy.com.

By the end of September, Saturn will have faded yet further to +0.5 mag. The planet's diameter now measuring 17.7 arc seconds. As previously mentioned in preceding Sky Guides, Saturn isn't exceptionally well-placed for observing and imaging from the temperate Northern Hemisphere. Reaching around 20 degrees elevation (from 51 degrees N) at transit point, Saturn is still in quite a murky part of the sky so will need a night of clement and transparent seeing to make out much detail. However, even if the sky isn't playing ball, using a sensible upper limit of magnification, if you have a telescope, it will still reveal much of this planet's remarkable beauty.

Uranus and Neptune

Uranus and Neptune can both be observed as evening objects during September. Neptune, at +7.8 magnitude, being much further from the Sun in the Ecliptic in Aquarius, will rise earlier and attain a reasonable height at transit point - 35 degrees (from 51 degrees N). The Outermost "true" planet reaches Opposition on the 14th September, when it will reach a maximum angular diameter of 2.4 seconds of arc. Naturally, despite being at its best and brightest for the year, Neptune, being much fainter than the naked eye can resolve, will still require binoculars or a telescope, plus patience and good reference guides to find. Though it's worth pointing out that the Outer Gas Giants never vary greatly in brightness, or angular size, due to their consistently extreme distance from us here in the inner solar system.



Uranus and Neptune relative positions, September 2021. Image created with SkySafari 5 for Mac OS X, ©2010-2016 Simulation Curriculum Corp., skysafariastronomy.com.

Uranus, while much brighter at +5.7 mag, is much further sunward, so will rise later, but is much further north within the Ecliptic in Aries than its neighbouring world - so attains just over 55 degrees height at sunrise on the 30th (from 51 degrees N). Both worlds are worth seeking out in a telescope or binoculars. While they never show the type of atmospheric detail you can make out in Jupiter and Saturn, they do have their own charms. Many people never get to see these distant worlds, but this time of year is a great one to make your own personal discovery of Uranus and Neptune, if you haven't already.

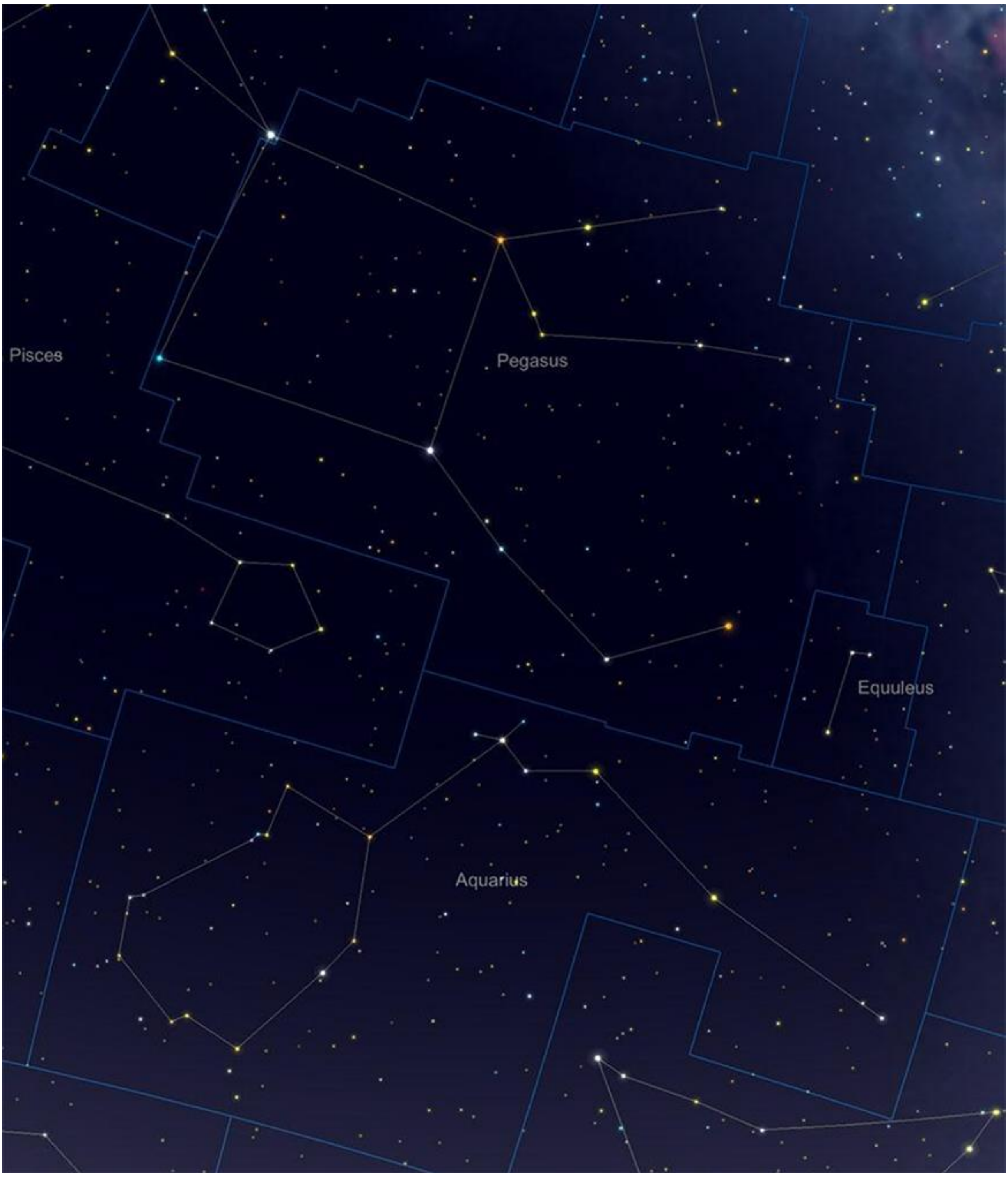
Comets

There are no bright comets around at present. We must be patient and see how comets 2021 A1 (Leonard) and the very recently discovered 2021 O3 (PanSTARRS) develop. The former may reach around 4th magnitude towards the end of 2021 and the latter may reach 6th mag in May 2022. However, as we always remind readers, comets are rather fickle and while promising much, may not develop. C/2021 O3 seems to be particularly small and faint as an object at present, so there's a distinct chance it won't survive Perihelion in April of next year.

Meteors

There are no major showers in September - though the Southern Taurids are active in the latter period of the month, from the 10th onwards. These produce no more than 5 meteors an hour, but can result in notable fireballs. The shower, along with its northern contemporaries, which peak in November, are thought to emanate from Encke's Comet, the regular short period body. If you do see a bright meteor during September, trace the trail and if it appears to come from the Taurus areas, there's a good chance that you've witnessed a Taurid. However, it should be pointed out that you're almost as likely to see a sporadic meteor during this period, if you're in a reasonably dark location. This "shower" stretches the often disappointing term practically to breaking point!

Deep Sky Delights in Pegasus and Aquarius



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

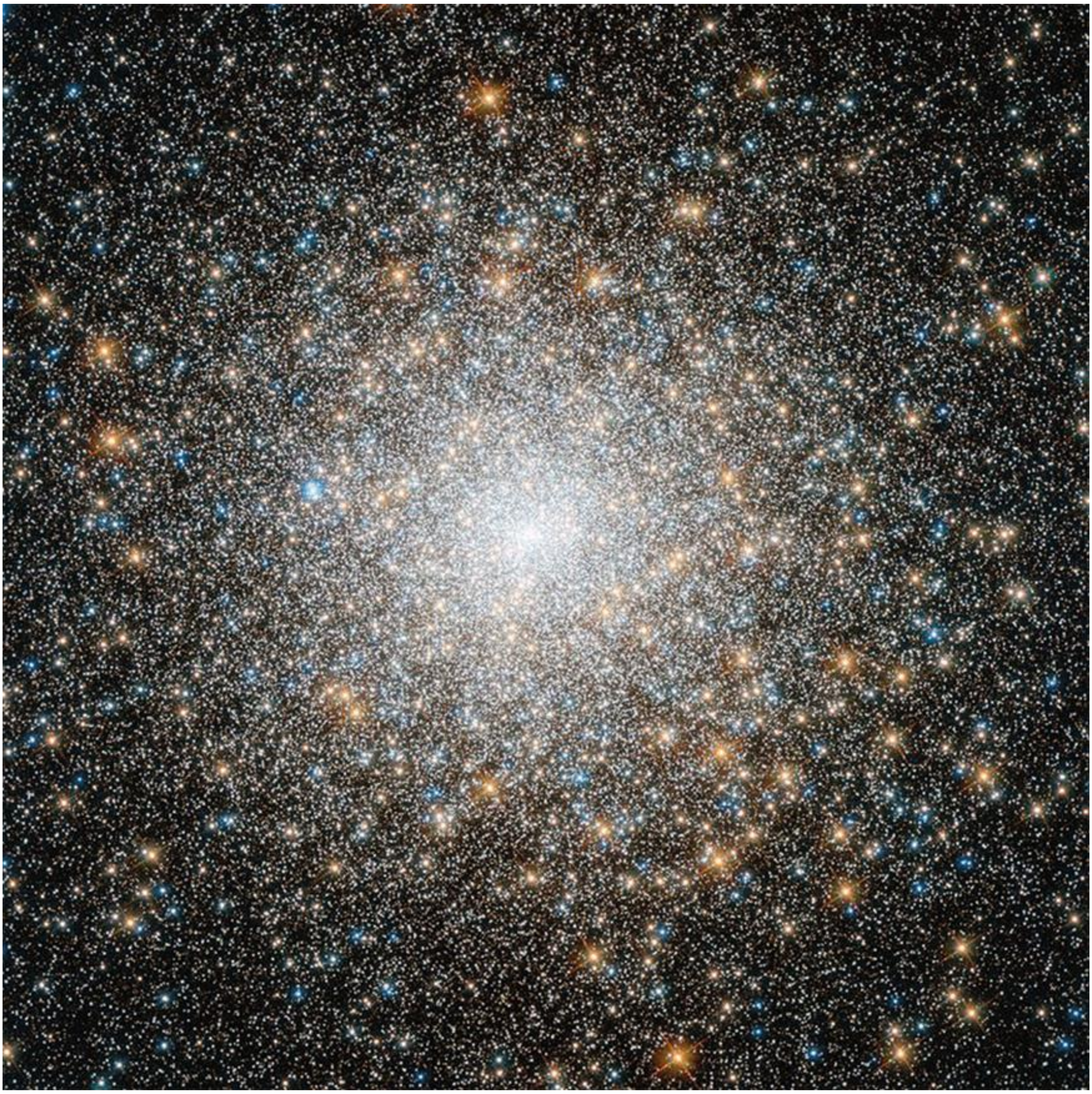
Moving in a southerly direction from last month's Deep Sky highlights in Cepheus and Cassiopeia, we come to the constellations of Pegasus and Aquarius, which share a border and are home to some easy and not-so-easy to observe objects.

Though lacking in major nebulae, Pegasus is a haven for galaxies - maybe not quite to the extent of the Virgo and Leo regions - but has many extra-galactic targets worth attention.

The most famous feature of Pegasus is readily observable without a telescope - this is, of course, the famous Square of Pegasus. Consisting of the stars Alpheratz (Arabic for “the navel”), Scheat (”the leg”), Algenib (”the flank”), Markab (”the saddle”), the Square of Pegasus dominates this area of sky and can be used as a useful “jumping off” guide for starhopping. However, the Square of Pegasus is not solely “of Pegasus”, as Alpheratz is actually now officially a part of neighbouring Andromeda. This is a similar situation to Elnath (Beta Tauri) which is officially now part of Taurus, but has been shared as Gamma Aurigae with neighbouring Auriga. These constellations are rare as they are still shown on modern star charts as connected via their “shared” star.

A third of the way along the line between the lower stars of the Square, Markab and Algenib, lies an object not visible to the naked eye at all. This is the notable (if unspectacular) Pegasus Dwarf Galaxy, This is an associated galaxy with the nearby M31, the Andromeda Spiral and as such a neighbour of our own Milky Way. It’s a rather faint object at +13.2 mag and spread out over a reasonable area of sky, so is only really detectable in long duration photos. Dwarf galaxies are often (though not always) older, more primitive than galaxies such as our own. However, whilst they are not brilliant in the conventional visual sense, dwarf galaxies such as the Pegasus Dwarf are havens for Dark Matter. The Pegasus Dwarf lies 3 million light years away from the Milky Way and is tidally interactive with M31.

Much more easily-observed and better-known is an object on the other side of Pegasus: the great globular cluster, M15. Found 4 degrees north-east of the star Enif (Arabic for “nose”), or Epsilon Pegasi, M15 is a glorious object in any telescope or binoculars and at +6.2 mag can be seen as a naked eye object from a reasonable site. This globular was discovered by Maraldi in September 1746 and catalogued 18 years later by Messier in 1764. Located about 33600 light years away, M15 contains around 100,000 stars. As a well-known object, it has been studied exhaustively and found to contain the first extra-galactic planetary nebula discovered: Pease 1, first identified in 1928. In addition to Pease 1, M15 has a pair of co-orbiting neutron stars, 8 pulsars and two strong X-ray sources. It has been postulated that one of these sources is in fact a Black Hole, to which has been attributed M15’s relatively recent core collapse. Globular clusters are both beautiful and intriguing objects and M15 is almost certain to contain more as-yet-undiscovered features.

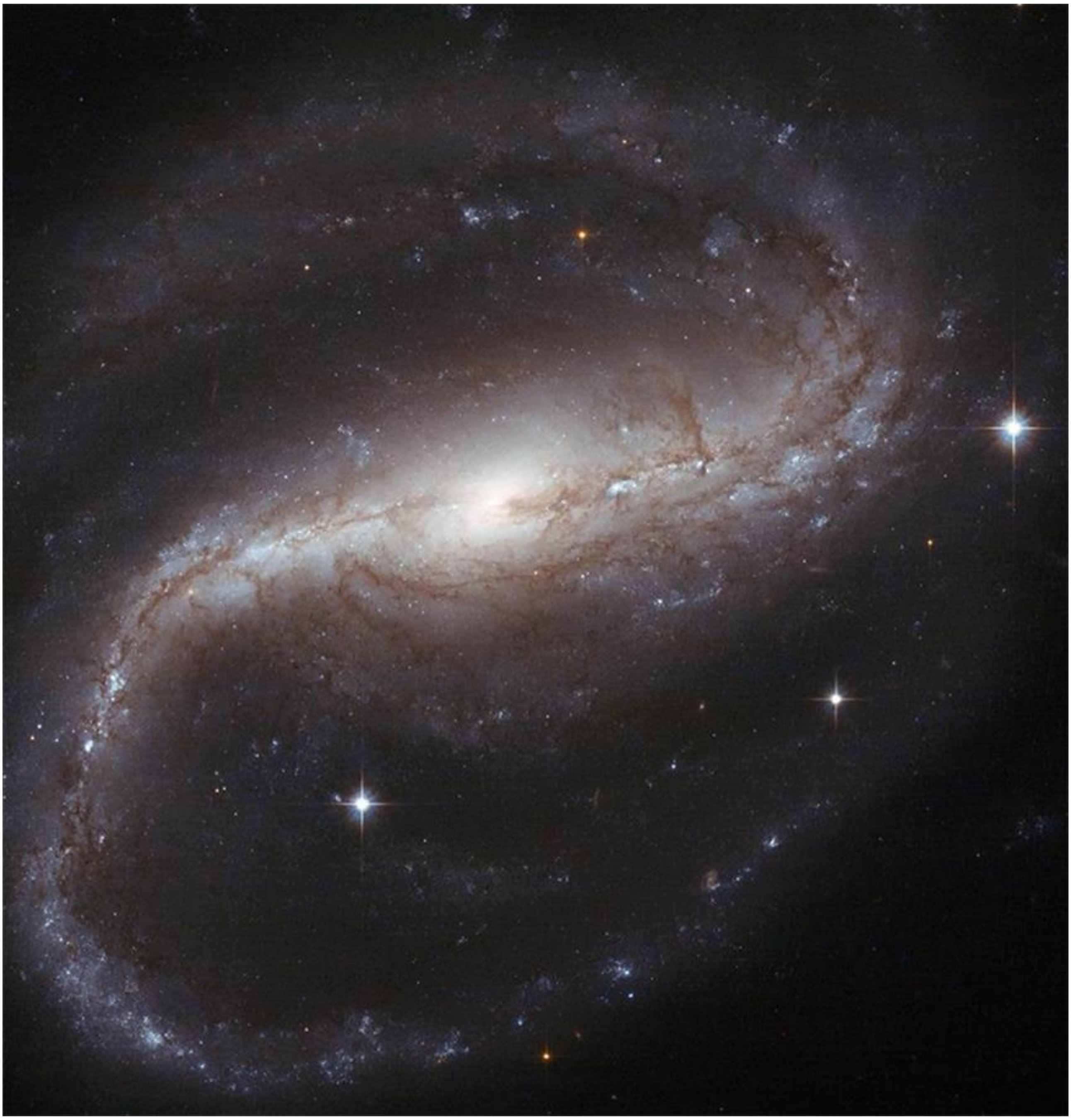


M15, pictured by the Hubble Space Telescope (showing Pease 1, upper left centre). Image Credit: NASA/ESA, Public Domain.

Back inside the Square of Pegasus lies the lovely NGC7814 - the “Little Sombrero” (so called because it resembles the Sombrero Galaxy, M104, in Virgo). NGC7814 is a Spiral, presented edge-on to our line of sight. This reveals a dark dust lane bisecting a bright core. At +10.6 mag this galaxy isn’t overly bright, but due to its compact nature, is still well-seen in small telescopes. NGC7814 is easily found due to its proximity to Algenib.

NGC7814. Image Credit: Hunter Wilson, Creative Commons.

Another galaxy near to a member of The Square is NGC7479, which lies just under 3 degrees south of Markab. This is one of the most photogenic Barred Spirals in the sky, lying almost face on to us. It was discovered in 1784 by William Herschel and is just slightly fainter than 7814 at +10.9 mag. NGC7479 is a very active galaxy - a so-called Seifert Type, in which enormous amounts of star formation are taking place. The serpentine structure of NGC7479 is beautifully depicted in long-duration photos - it almost seems to be slithering like a Sidewinder through space!



NGC7479, pictured by the Hubble Space Telescope. Image Credit: NASA/ESA, Public Domain.

Further north are a fascinating collection of galaxies: the NGC7331 group and Stephan’s Quintet. These two groups of galaxies are separated by just half a degree of sky and can be found north of Matar (Eta Pegasi). Of the two groups, the NGC7331 group are the more conspicuous and their principle member was discovered first - by William Herschel - in 1784. This principle galaxy, NGC7331, was thought to be a very similar size, mass and taxonomy to our own Milky Way: a tightly-barred spiral. However, most up-to-date surveys of the Milky Way suggest that it may only have two massive spiral arms, whereas NGC7331 has more (NGC6744 in Pavo is now seen to be the nearest Milky Way analogue). Behind NGC7331 lie NGCs 7340, 7336, 7335, 7327 and 7338 - some of which can be seen with averted vision in reasonable-size telescopes. NGC7331 at +9.5 mag is by far and away the most prominent of the group and can be seen in smaller scopes. The whole group is a great target for astrophotography as regular contributor Mark Blundell’s picture below clearly shows.

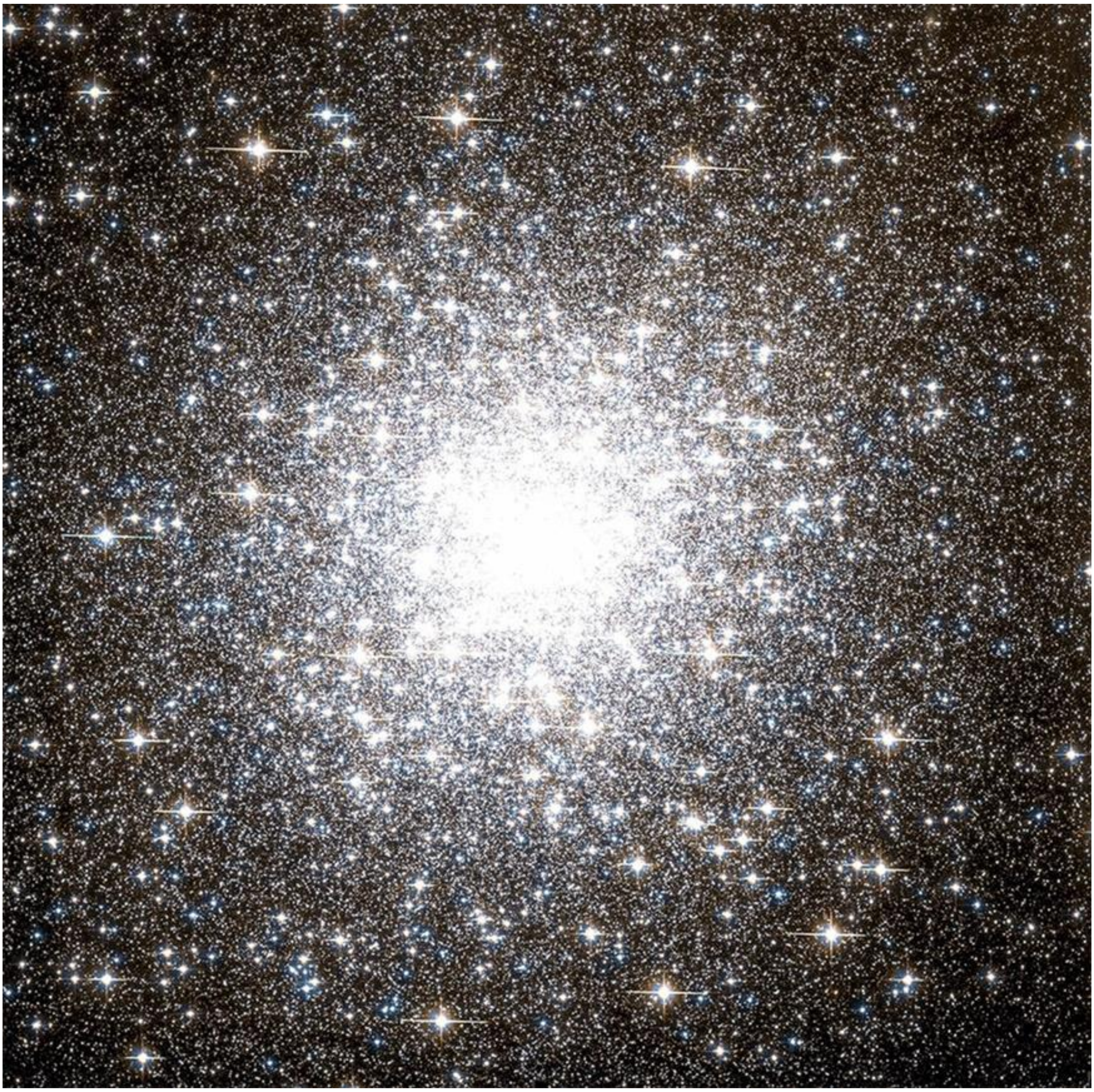
NGC7331 and Stephan's Quintet. Image Credit: Mark Blundell.

The second of these two galaxy groups is the famous Stephan’s Quintet. Discovered in 1877 at Marseilles Observatory by Eduoard Stephan, the Quintet consists of NGCs 7317, 7318, 7318A, 7318B, 7319 and 7320 (this is technically a Sextet as 7318A and B are separate galaxial cores). Stephan’s Quintet occupies a tiny area of 3.5‘ x 3.5’ of sky and is an area of both enormous destruction, as the component galaxies literally rip each other apart and massive areas of creation where the resulting gas-rich loops of material released by these dynamics leads to starbirth.

The interior of Stephan's Quintet, pictured by the Hubble Space Telescope. Image Credit: NASA/ESA, Public Domain.

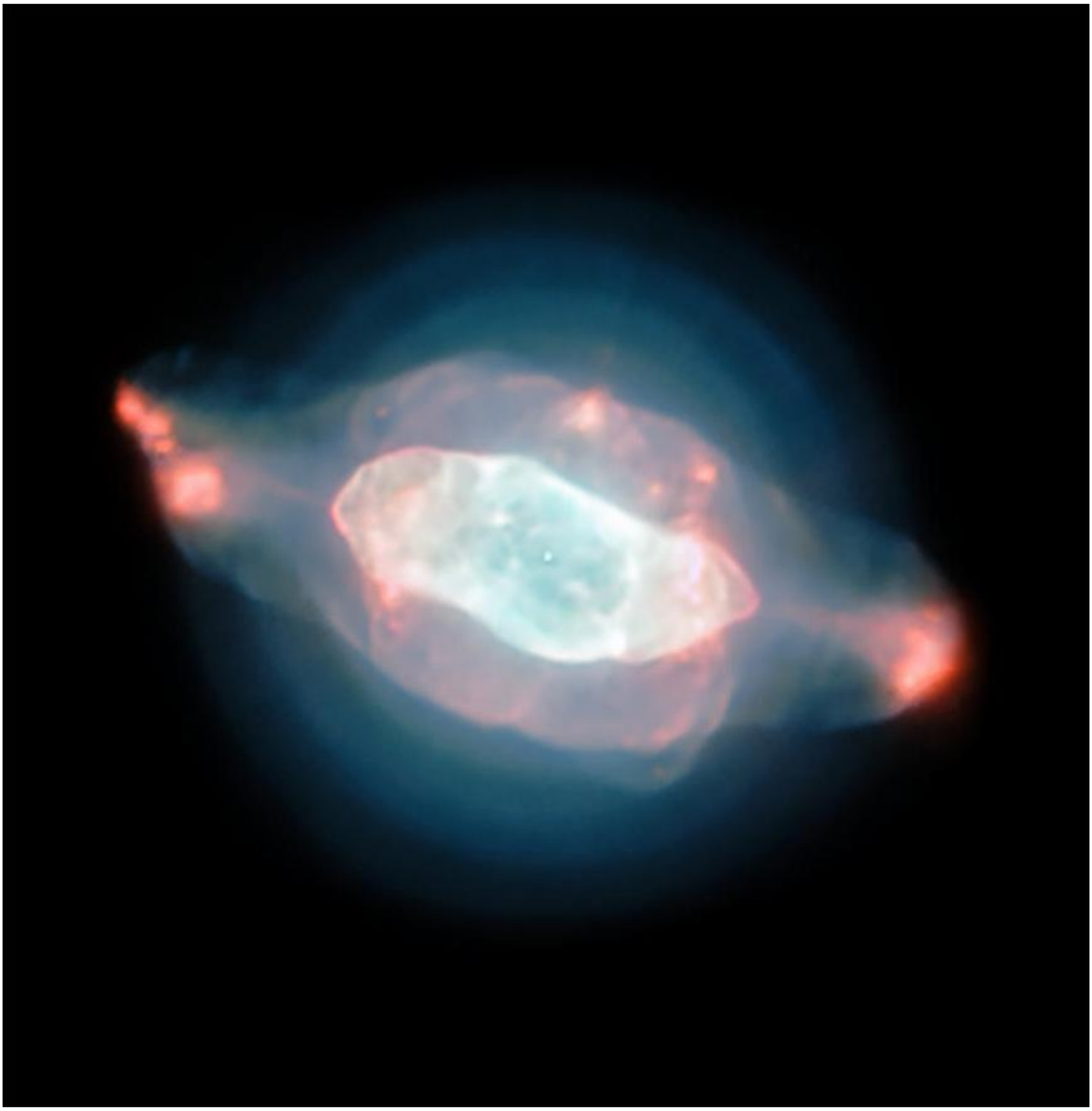
Of the components of the Quintet, NGC7320 appears to be an unrelated foreground object - much closer to us at 39 million light years distance as opposed to the 210-350 million light years of the other members.

Moving south into the Zodiacal constellation of Aquarius, the Water Carrier, we are presented with a large, but quite a barren area of sky. Although Aquarius is rather muted in terms of brighter stars, it is a haven for deep sky objects. The most northerly of these is the very fine globular cluster M2. At +6.46 mag, it is amongst the brighter of these interesting objects, lying 37,500 light years away from us and about 175 light years in diameter. From Earth, it appears 2.1 arc minutes in diameter, M2 is about the same relative size and brightness of the neighbouring M15 and the second of Hercules' well-known globulars, M92. Discovered by Comet Hunter Jean-Dominique Maraldi in 1746, it languished in relative obscurity until Messier added it to his list in 1760, describing it as a "Nebula without stars". Modern instruments show it as most definitely "with stars", indeed there are several beautiful star chains visible through telescopes, as well as some deep, dark lanes and patches, adding to the "three-dimensionality" of the object, particularly in larger telescopes. There are quite a mix of older orange and newer blue stars within M2, making it a particularly pretty telescopic sight.



M2, pictured by the Hubble Space Telescope. Image Credit: NASA/ESA, Public Domain.

Moving SW from M2, we arrive at three objects in quick succession: NGC 7009, The Saturn Nebula, the asterism M73 and another globular, M72. The Saturn Nebula is a fascination Planetary Nebula, well worth seeking out in any telescope, as it is reasonably bright, at +7.8 mag, yet compact at 0.5 arc minutes across. Telescopes of 6-8-inch aperture will be needed in order to see the two extended lobes that give the object its popular name. Lord Rosse, observing NGC 7009 in 1850, described two lobes or projections sitting either side of the nebula, making it appear very similar to Saturn, when its rings are edge on to us. Although the object has a distinctly un-Saturn-like green-blue hue, which is most easily seen in long duration photographs. The Saturn Nebula, in common with some other Planetaries - including the Blinking Planetary - can appear to blink on and o when looking at it for prolonged periods. This is of course a trick of the eye, caused by NGC 7009's reasonably bright central star overwhelming a dark-adapted observers eye. When the observer averts their vision slightly, the Saturn Nebula returns to view. Although the Blinking Planetary is the most well-known object that exhibits this phenomenon, to the writer's mind, the Saturn Nebula is actually the best example of a "Blinking" Planetary Nebula. As ever, aperture helps in resolving the finer details of NGC 7009 (especially the projections), but the Saturn Nebula should be sought out by all those with telescopes - it's certainly bright enough to be seen in even the smallest scopes.



Saturn Nebula, pictured by the Hubble Space Telescope. Image Credit: NASA/ESA, Public Domain.

The next object is an interesting one. When is a star cluster not a star cluster? Answer: when it's an Asterism like M73. Lying less than 2 degrees SW of the Saturn Nebula, M73 has been the subject of some controversy over the years since its discovery. Charles Messier first noted it in 1780 as a "cluster of four stars with nebulosity", although this nebulosity has never been picked up by any other observers. John Herschel, whilst including it in his General Catalogue, was suspicious of its definition as a true cluster. Debate raged on throughout the 20th century as to the true nature of the Y-shaped M73, with evidence of a relationship between the members of the group being published for and against. The matter was finally and conclusively put to bed in 2002, when spectral signatures of each of the constituent members, gathered in high resolution, concluded that they were all moving in different directions and the cluster was not, it fact, a cluster. M73 is not unique amongst the Messier list for controversial description, but remains interesting for the fact that it took so long to finally work out its true nature.

1.5 degrees to the west of M73 is the slightly less controversial Globular Cluster M72. At +9.27 mag, it is considerably fainter than M2, despite being not much smaller. M72 is considerably further away from us than M2 - it lies 55,000 light years distance from Earth. As it is fainter and further away, M72 requires a larger telescope to resolve individual stars. It is a pleasing sight in a 10-inch reflector and above, though William Herschel in his observing notes of 1783, noted that a power of 150x was needed to resolve the individual stars “fairly”.

M72, pictured by the Hubble Space Telescope. Image Credit: NASA/ESA, Public Domain.

Lastly, we journey 23 degrees east of NGC 7252, to rendezvous with the closest Planetary Nebula to Earth, NGC 7293 - The Helix Nebula. Overlooked by experienced observers, such as Messier and William Herschel, it is not difficult to understand why. Though intrinsically quite bright at +7.59 mag, the Helix is half the diameter of the Full Moon, which spreads its surface brightness out considerably. The Helix was eventually discovered around 1824 by German Astronomer Karl Ludwig Harding. Observation or the Helix requires either large binoculars and a very dark site, or a wide eld low power eyepiece and as much telescopic aperture as you can throw at it! Large Dobs are the ideal instrument for observing the Helix, particularly when coupled with an OIII filter. From our perspective on Earth, we see the Helix like looking down a tube. Its prolate spheroid shape is almost aligned on axis with us, at a distance of 650 light years. 2.5 Light years across, the Helix appears 14.7 arc minutes across at its widest point. A magnificent object, it will take the right conditions to see it well - if the Moon’s up, you’ll have to wait until it has set before attempting to locate the Helix. It will be well worth the wait though.

The Helix Nebula, pictured by the Hubble Space Telescope. Image Credit: NASA/ESA, Public Domain.

Text: Kerin Smith