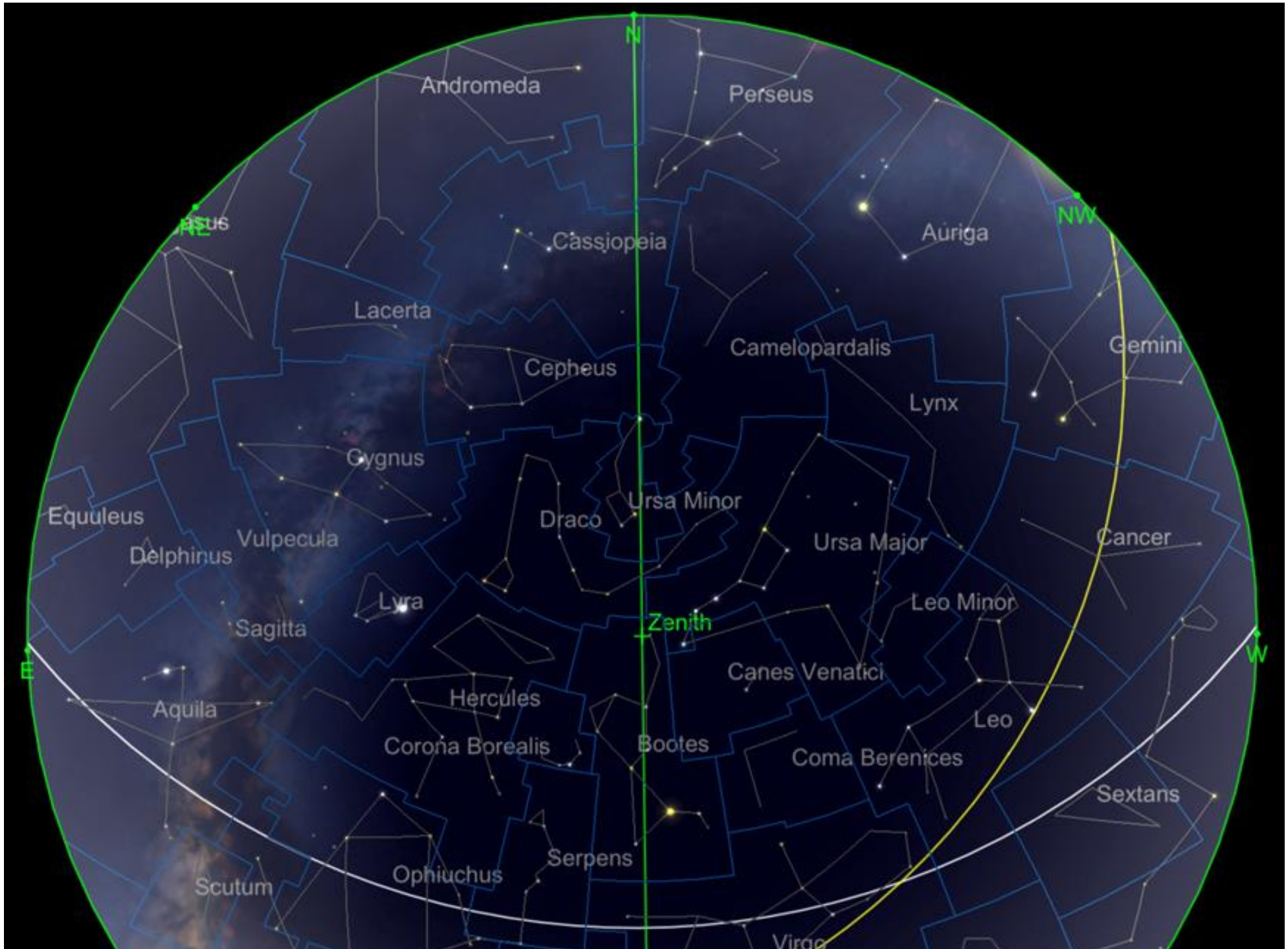
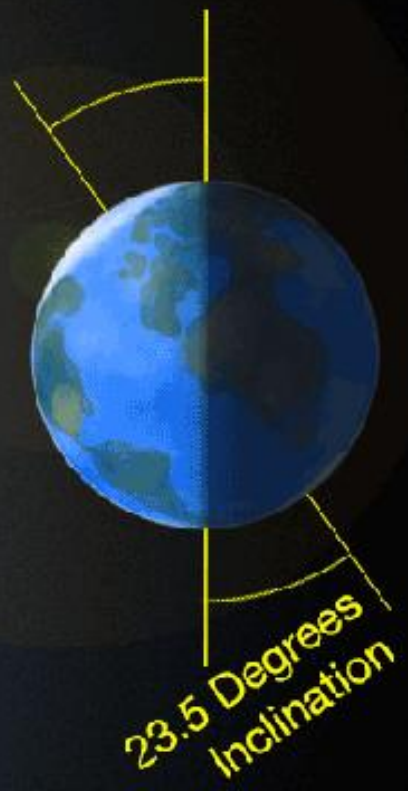

N
Andromeda
Perseus
NE
Cassiopeia
Auriga
NW
Lacerta
Camelopardalis
Gemini
Cepheus
Lynx
Cygnus
Ursa Minor
Equuleus
Draco
Vulpecula
Ursa Major
Cancer
Delphinus
Lyra
Leo Minor
Sagitta
Zenith
E
W
Canes Venatici
Hercules
Aquila
Leo
Corona Borealis
Bootes
Coma Berenices
Sextans
Serpens
Ophiuchus
Scutum
Virgo

June brings with it the Summer Solstice - the longest day and shortest night of the year.  This year the solstice falls on 21st June and this is the point where the Sun reaches its most northerly point in the ecliptic.  With Solar activity beginning to pick up again after quite an extended solar minimum, this time of year also represents the best for making safe observations of our parent star.  White light filters (including Herschel Wedges) or Hydrogen Alpha or Calcium-K line telescopes and blocking filters are to be recommended for this.  White light filters will show the user sunspots and some surface granulation (depending on the instrument used and sky conditions), whereas Hydrogen Alpha systems are able to show the amazing features of the solar atmosphere: prominences, flares and ejection events.

Naturally, for every reaction, there is an equal and opposite one - during June, the Southern Hemisphere experiences its Winter Solstice.  One we have passed the 21st, the nights for those of us in the Northern Hemisphere begin to get longer, as do the days in the Southern Hemisphere.

# Earth's Orbital Inclination During June

Northern Hemisphere of Earth turned further
Towards the Sun in June = longer days



This has noticeable effects on the quality of darkness for those in temperate Northern latitudes, as during this point of the year, the Sun, even at the deepest point of the night is not so far below the horizon. For those in the Northern Europe and the Northern parts of the USA and Canada and Asia, this can mean permanent Astronomical Twilight for a while around the Summer Solstice.

From the 27th of May to 15th July 2021, there is a state of permanent Astronomical Twilight for those in latitudes around 50.5 degrees N, which means that the Sun is less than 18 degrees below the horizon all night long. This means that the skies are never truly dark and that objects around or below the 6th magnitude are unable to be distinguished with the naked eye (technically, +6.5 mag is generally seen as the limit of human eyesight, though this does vary from individual to individual). This obviously has knock-on effects for deep sky observation and astrophotography. The further north one observes from, the longer this period of permanent Astronomical Twilight persists: in Manchester UK (latitude 53.5 degrees N) this extends from mid-May to the end of July; in Edinburgh (just shy of 56 degrees N) the period is yet longer, from early May to the end of the first week of August. Do bear in mind, if you find yourself in latitudes similar to Reykjavik, Iceland (64 degrees N) Astronomical Twilight persists from early April to the beginning of September . North of the Arctic Circle, the Sun will not set at all around the Solstice, whereas south of the Antarctic Circle, the Sun won't rise at all during this period.

No matter where you find yourself, as ever, there's plenty to see in the skies above us this month.

**The Moon**

The Earth's natural satellite finds itself in Gemini at the beginning of June. At a small 4.9% illuminated phase, the Moon will be visible in the evening sky, after sunset, for a brief window, for those with a clear westerly horizon.

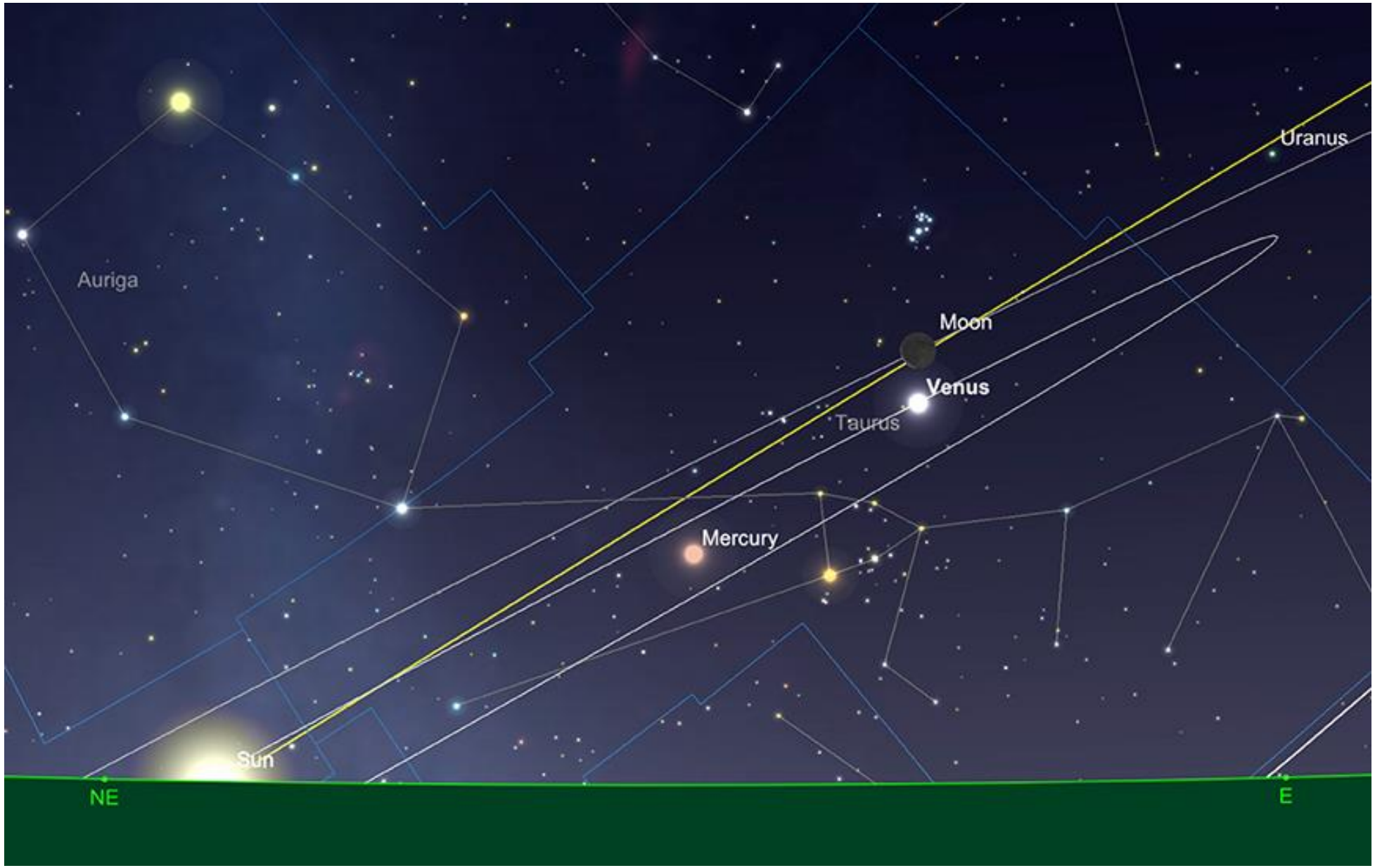
Through the next week the Moon climbs through Gemini, into the neighbouring zodiacal constellations of Cancer and Leo, where reaches First Quarter stage on June 7th. We are now past the region of the year where the Moon appears at its highest in the sky, during its evening crescent phase, for Northern Hemisphere observers - the so-called high Spring Crescent phases – so does not reach quite the extreme heights in the sky, as it has done in preceding months. However, the Moon still reaches a respectable plus 40° plus in altitude (from 51° N) at sunset on the evening of the 7th.

The Moon takes the next three days to cross the large expanse of Virgo and then moves on into Libra and Scorpius and the non-zodiacal Ophiuchus and Sagittarius, where it reaches Full on the 14th. This Full Moon will be one of the so-called 'SuperMoons' (more correctly known as a Perigee-Syzygy event), which occur when the fully-illuminated Moon coincides with its closest approach to Earth, within its slightly less than circular orbit. The Moon does appear to be slightly bigger during an event like this and this will be compounded further by atmospheric lensing, when viewed from the Northern Hemisphere, with it sitting so low in the southern reaches of the ecliptic. While there is no great scientific significance to a 'SuperMoon' event, it has captured public imagination. However, it's worth pointing out that Full Moon is one of the most potential disappointing times to view the lunar surface in a telescope, with very little shadow relief available.

With the Supermoon out of the way, our natural satellite continues its journey through Sagittarius and into neighbouring Capricornus, where it can be found a little to the south of Saturn on the evenings of June 18th.

Last Quarter phase is reached on June 21, when the Moon can be found in the southern part of Pisces, joining the bright Jupiter and the not-quite-so-prominent Mars in the same constellation. The morning of the 23rd finds the Moon and Mars drawing quite close to each other - separated by just over 5 degrees. A couple of days later and the slim 13.5% illuminated waning Crescent Moon will be separated from the faint Uranus by just over 3 degrees - though the glare of the dawn and the ever-present lack of astronomical dawn for those in higher latitudes will make this a very challenging event to observe.

Less challenging will be the Moon and the ever-dazzling Venus' conjunction, which occurs on the morning of the 26th. Though by this time the Moon will be a very slim 7% illuminated phase. The two bodies will be separated by just two degrees and will form a beautiful pairing just below the Pleiades in Taurus. The following morning of the 27th will find the 3% illuminated Moon separated from Mercury by just over three degrees.


Uranus
Auriga
Moon
Venus
Taurus
Mercury
Sun
NE
E

The Moon alongside Venus, sunrise, 26th June.  Image created with SkySafari 5 for Mac OS X, ©2010-2016 Simulation Curriculum Corp., skysafariastronomy.com.

The Moon becomes New again on June 29, when it meets the Sun in Gemini. This neatly “bookends” the month as far as the Moon is concerned and it is to be noted that the beginning and end of the month will best-suit deep sky observers.  Though again, it is worth warning that at this time, the lack of true astronomical darkness in higher northern latitudes will also have a part to play in the quality of deep sky observing possible.

The Waxing Gibbous Moon imaged by Malcolm Porter, using an Explore Scientific David H Levy Comet Hunter 152mm f/4.8 Maksutov-Newtonian and a Canon Ra (ISO 800, 1/2000th second). Image used with kind permission.

**Mercury**

Our Solar System's smallest planet, Mercury, begins June in a less than ideal position for observation, in the morning sky. Emerging from May's Inferior Conjunction, Mercury is drawing away from the Sun, form our perspective here on Earth, but it is still very poorly illuminated at the beginning of the month, making it impossible to observe in the glare of the dawn sky.

By the middle of June, the situation as far as Mercury is concerned has improved significantly. On June 15 at sunrise (from 51° north), we find mercury at +0.7 magnitude, sitting at a little over 7° high in the sky as the Sun rises. Mercury reaches maximum Western elongation on June 16th, but still appears to climb a little higher in the sky and increase its magnitude yet further, over the latter half of the month.

By the end of June, Mercury will be shining at -0.6 magnitude and standing a little above 8° elevation in the east as the Sun rises (from 51° north).


Venus
Taurus
Mercury
Sun

Mercury, sunrise, 16th June - greatest western elongation.  Image created with SkySafari 5 for Mac OS X, ©2010-2016 Simulation Curriculum Corp., skysafariastronomy.com.

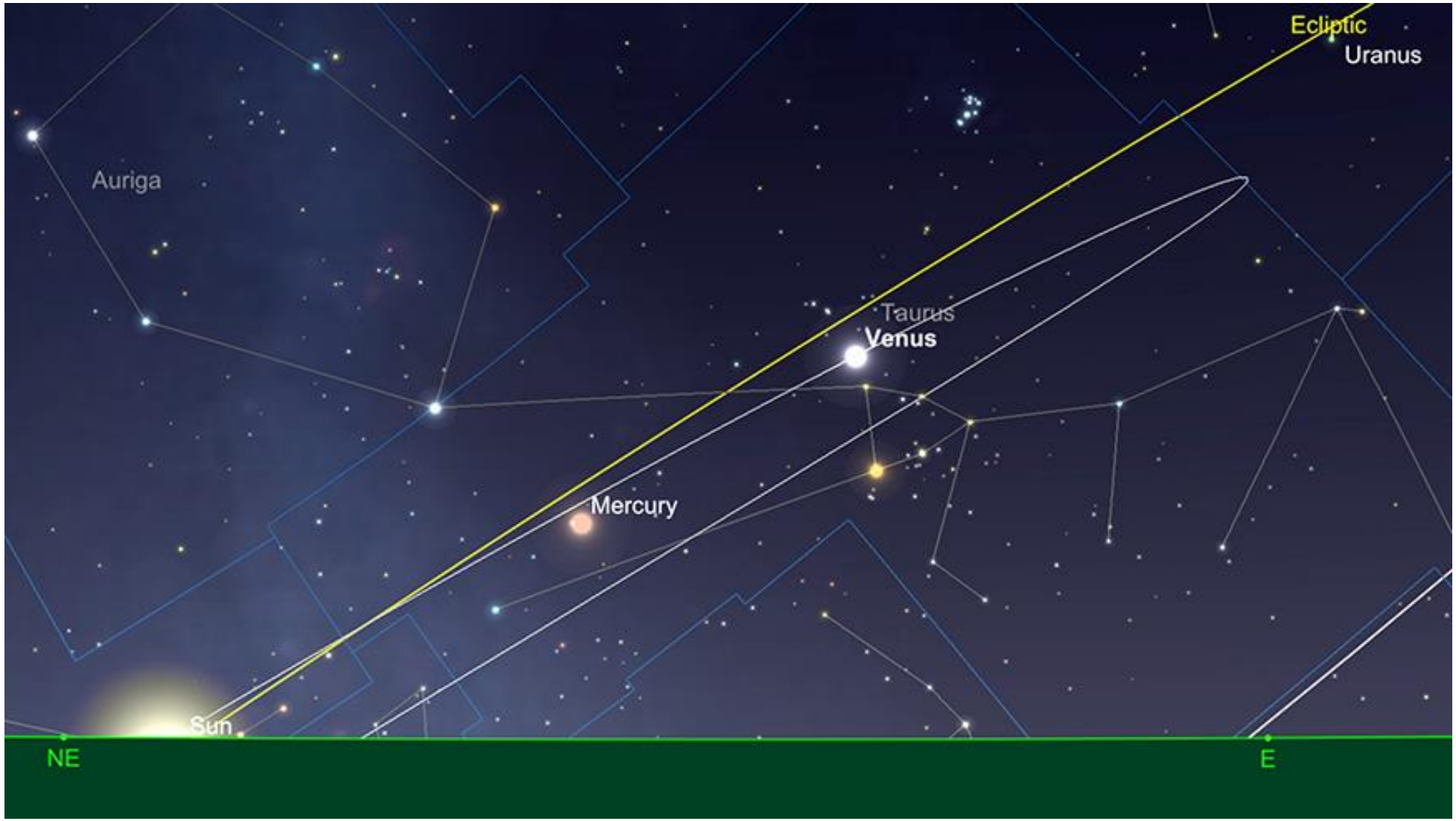
**Venus**

Sitting in roughly the same area of sky (in the constellation of Aries) as Mercury, the much brighter Venus, shining at -4.0 magnitude on June 1 is very much easier to find. Standing at just over 11° high above the horizon (from 51° north), Venus is to be found almost due east at this time of year.

Venus is heading back sunwards in direction, after completing its furthest Western elongation in March. The planet is now moving away from us as time moves on, shrinking very slightly day-by-day, as it does. At the beginning of the month, Venus shows a 13.7 arc second diameter disc, illuminated by just under 78%.  By the middle of June, Venus will display a 12.7 arc second diameter disk and while it will have increased its illuminated phase a little to just under 82%, this isn't enough to prevent it dropping in brightness fractionally to -3.9 mag. In practical terms, this difference in brightness could only really be recorded astrometrically. To the visual observer, Venus would appear just as bright, though naturally enough, it's apparent shrinkage would be more than evident in a telescope's eyepiece.

As previously mentioned, Venus and the Moon come together in close conjunction on the morning of the 26th, which should make a pretty event to observe for the early riser.

The end of the month find Venus having shrunk a little further to 11.9 arc seconds diameter and is now a resident of Taurus, sitting just above the Hyades as the Sun rises on the morning of the 30th, at an altitude of around 14.5° (from 51° north).  Now showing an 85.8% illuminated phase, the planet will remain steady in brightness at -3.9 magnitude.




Venus above the Hyades, sunrise, 30th June. Image created with SkySafari 5 for Mac OS X, ©2010-2016 Simulation Curriculum Corp., skysafariastronomy.com.

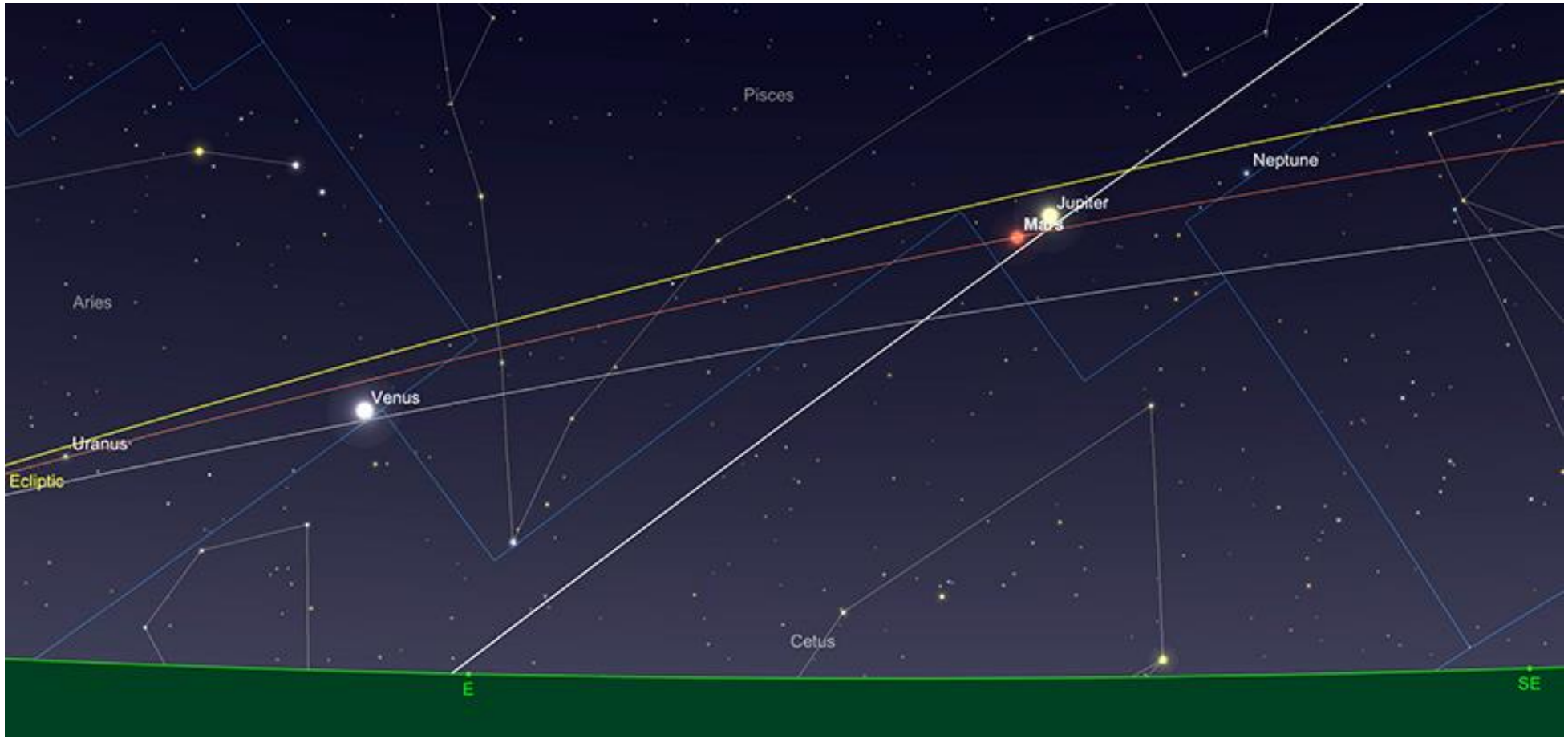
**Mars**

The Red Planet continues to improve, slowly, but it’s still far from at its best.

On the 1st of June, Mars will be found right next to Jupiter, in southern Pisces, shining at +0.7 magnitude and showing a 6.4 arc second diameter disc. The two worlds are now separating after coming together for a very close conjunction in late May. The contrast between Mars and Jupiter could not be more apparent: while Jupiter is large, bright and prominent, Mars is more more modestly-seen - be this observed with the naked eye, or in the eyepiece.

By mid-month, Mars has brightened fractionally to +0.6 magnitude and is now displaying 6.8 arc second diameter disc.

Fast forwarding to the end of June, we find Mars still in Pisces, but now +0.5 mag and 7.2 arc seconds in diameter. We have still got some way to go until Martian Opposition later in the year, but as we can see, Mars is steadily improving - although it has a long way to go yet, in terms of improvement.




Mars and Jupiter, sunrise, 1st June. Image created with SkySafari 5 for Mac OS X, ©2010-2016 Simulation Curriculum Corp., skysafariastronomy.com.

**Jupiter**

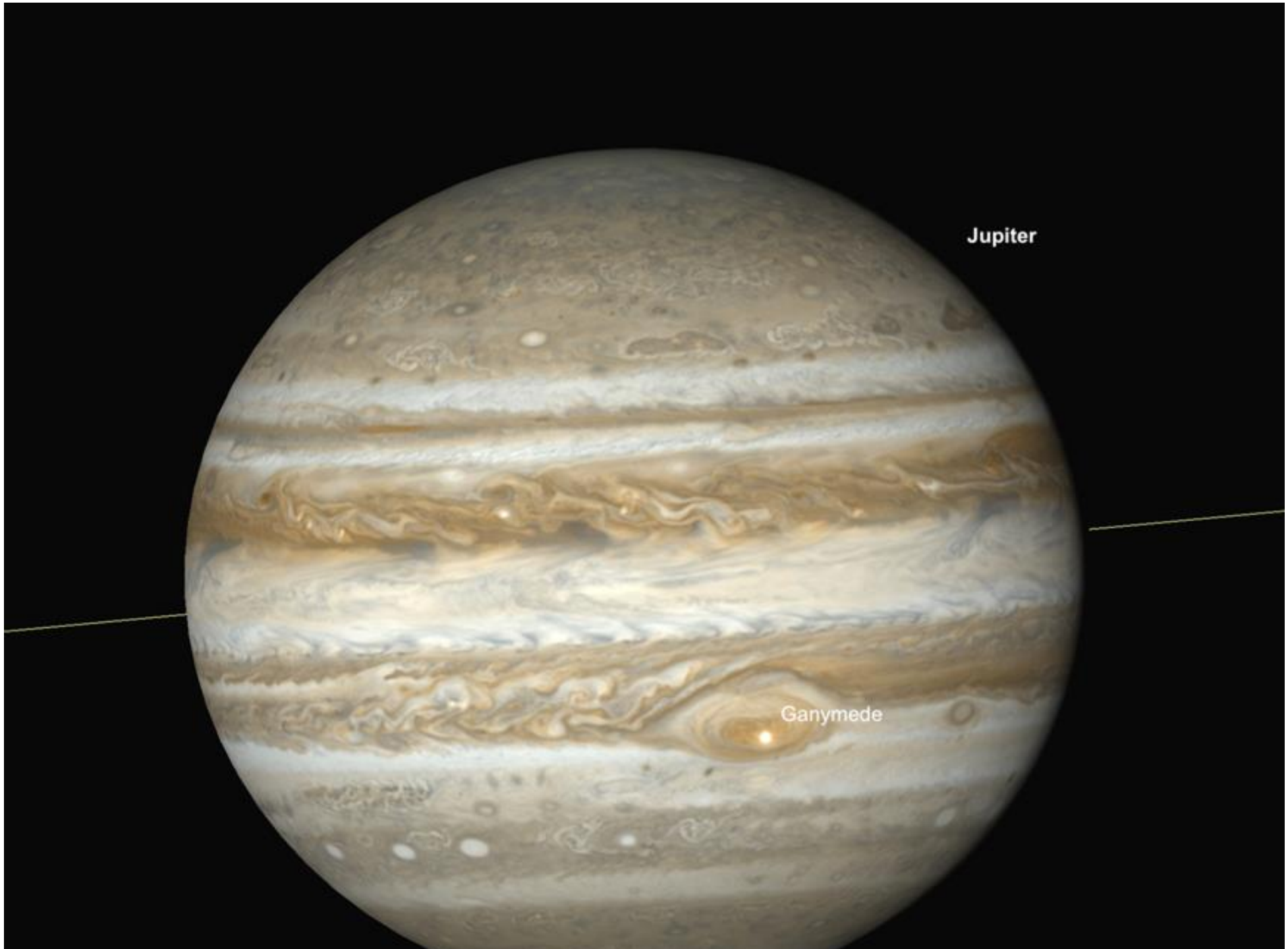
As previously reported, Jupiter and Mars are emerging from late May's very close conjunction, so are to be found together in the southern reaches of Pisces, as the month begins.

On the first of the month, Jupiter displays an official magnitude of -2.3 and an apparent size of 37.4 arc seconds diameter.  Although we are still some way off September's Jovian Opposition, the trend is definitely upwards as far as Jupiter is concerned.

By mid-month, the planet has increased its diameter to just under 40 arc seconds. However, it remains steady in brightness at -2.3 mag. The planet will stand around 26° high in the south-east at dawn (from 51° north).

At the end of the month, Jupiter can be found as a brief resident of the non-zodiacal constellation of Cetus. At this time, the planet will be displaying a visual magnitude of -2.4 and an apparent size of just under 41 arc seconds.

There are a few interesting Jovian events to observe from Europe in June. Starting with a nice mutual Great Red Spot and Io/Io Shadow Transit on June 1st. This is followed by a GRS and Europa shadow transit, at just before dawn on the morning of the 3rd. There is another GRS and Io/Io shadow transit event on the morning of the 8th. Just before dawn on 18th June, there is an rare and interesting event, where Ganymede appears to transit the Great Red Spot itself - this will be well worth catching in a telescope, if you're up early enough.


Jupiter
Ganymede

Jupiter with Ganymede transiting the Great Red Spot, dawn, 18th June.  Image created with SkySafari 5 for Mac OS X, ©2010-2016 Simulation Curriculum Corp., skysafariastronomy.com.

**Saturn**

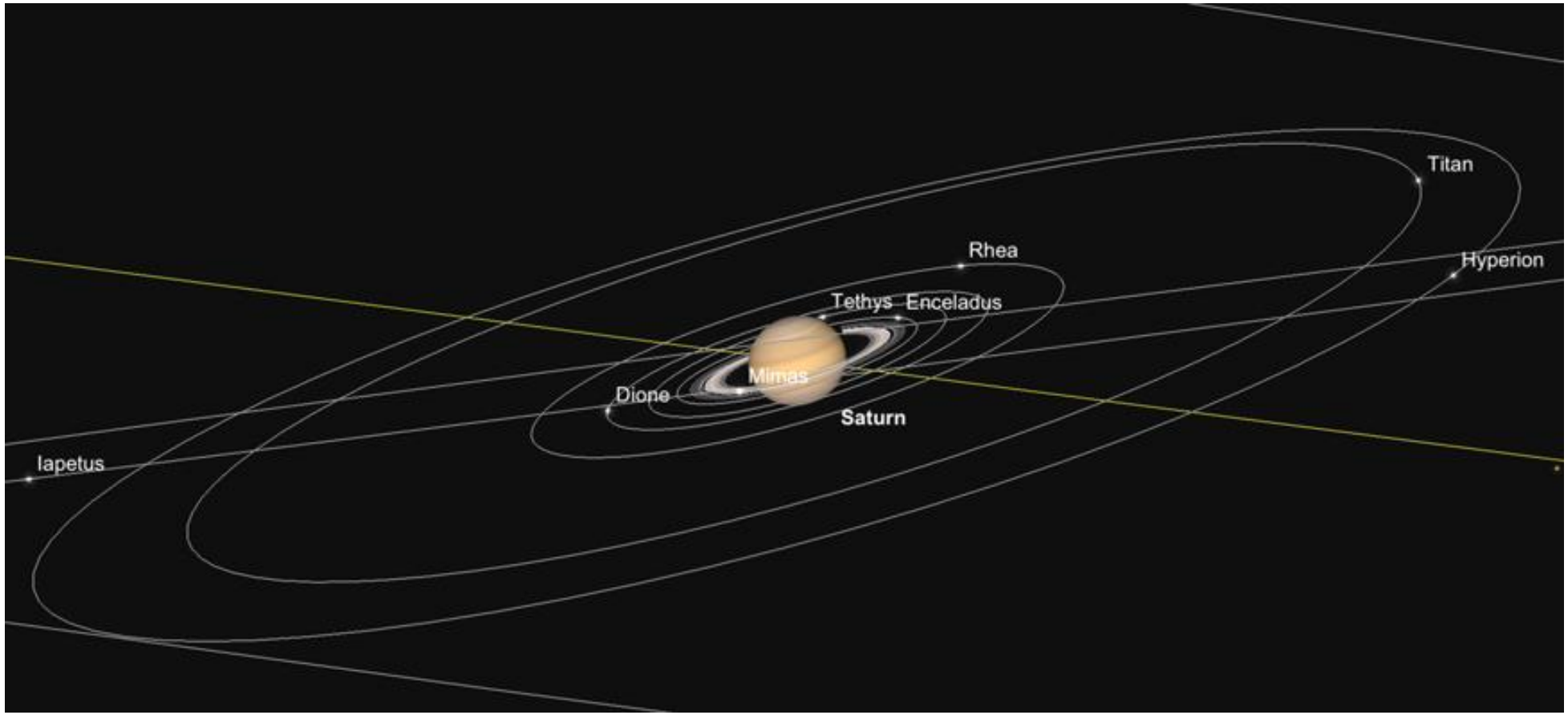
Saturn starts June a resident of Capricornus, at +0.8 magnitude displaying a 17.4 arc second diameter disk.  Rising at a little before 2.30am (BST), Saturn is the furthest west in the ecliptic of all the major planets, so rises earliest. By the time the sun rises, it has attained a height of just under 22° (from 51° north).

During the first week of June, Saturn begins to go retrograde - changing position in relation to background stars not from west to east, but from east to west. This is a sure sign that the planet is gearing up for opposition. Retrograde motion is emphatically *not* the planet itself changing direction, but is caused by the foreshortening of sightlines by the  Earth catching Saturn up on its faster interior orbit.  Saturn will remain retrograde until late October.

By mid-month, Saturn will have brightened very slightly to +0.7 magnitude and now displays a 17.8 arc second diameter disk. It will rise at a little before 1.30am (BST) and transits in the south a little after dawn.

By the end of June, Saturn will have brightened up fractionally again to +0.6 mag and now displays an 18.2 orc second diameter disk. It will rise at a little before 12:30 am (BST) and transit as a little after 5 pm on the 30th.

While we still have some way to go before August’s Saturnian Opposition, Saturn, rising earliest of all the major planets is arguably our best proposition for planetary observation during June.




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

**Uranus and Neptune**

Neither of the outer gas giants are particularly well-placed for observation this month.

Uranus, recently emerged from Superior Conjunction is poorly positioned in Aries for observation during June. Technically, it may be observable in a limited window, but lies a little too close to the Sun at present and doesn't rise particularly highly before sunrise and will be very, very difficult to make out in the dawn sky.  At + 5.8 mag, the glare of the approaching Sun will make contrast with the background sky an almost insurmountable problem.

Neptune, lying much for the west in the ecliptic in the constellation of Pisces, will rise earlier and will have attained a greater height above the horizon by sunrise. Nearby Jupiter will act as an indication of the area of sky in which Neptune can be found, but being fainter than Uranus, at +7.9 mag, will be a challenge to find and will definitely require powerful binoculars, or a telescope to do so.

It will really be a little later in the year before these two worlds be in a better position in the sky for more reliable regular observations.


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

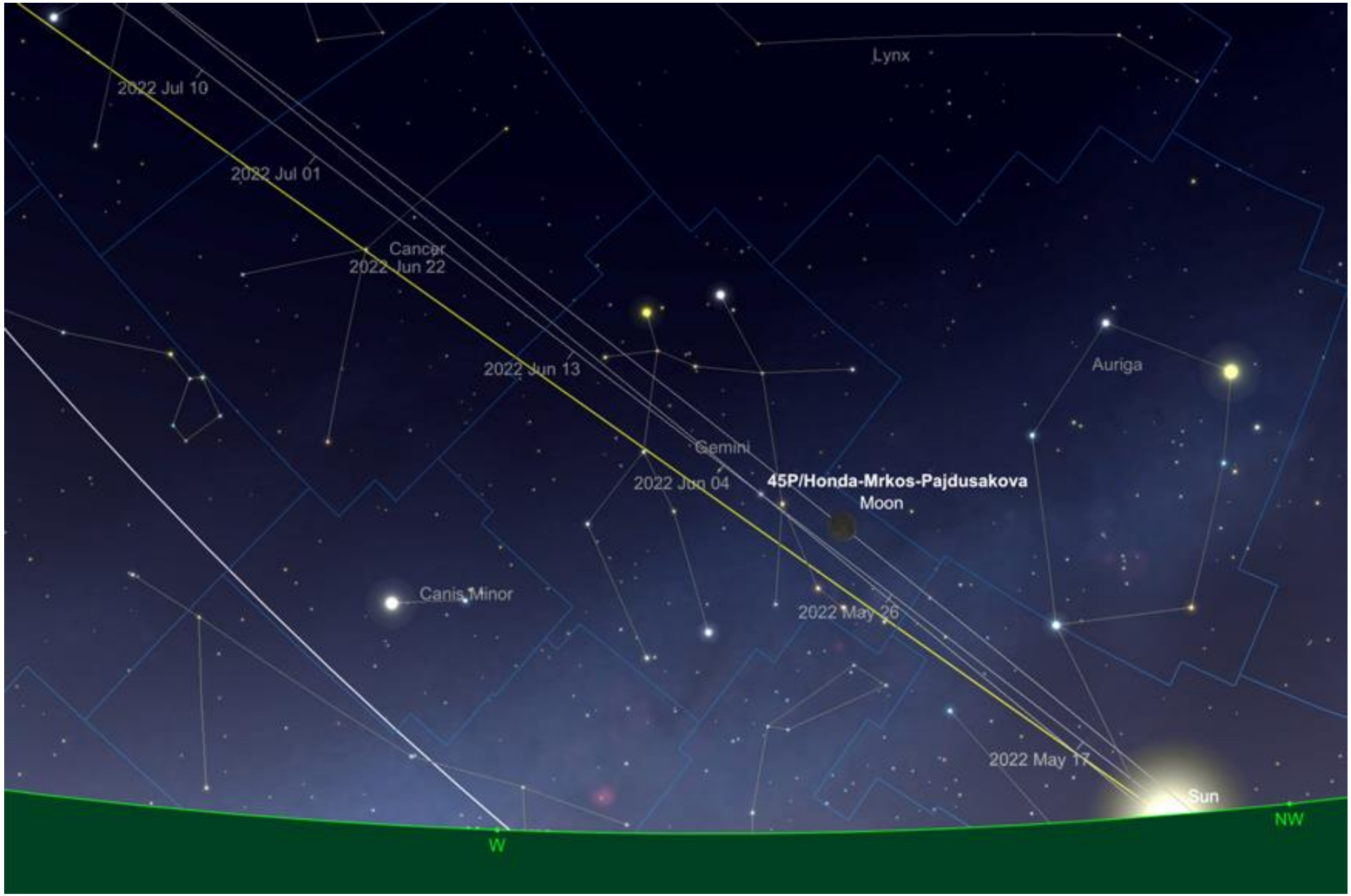
**Comets**

Observations of Comet 2017/K2 (PanSTARRS) suggest it is still brightening, but this has slowed somewhat. Most recent observations put it around the 11th magnitude presently. The comet may however become brighter from August of this year, but is unlikely to get any better than 7th or 8th magnitude, making it very much one for telescopic or large binocular observations.  The comet will track through the generous expanses of Ophiuchus during June, making it pretty well-placed for observing throughout the month.


Meridian
2021 Oct 31
Serpens
2021 Nov 14
2021 Nov 28
2021 Dec 12
2021 Dec 26
2022 Jan 09
2022 Jan 23
2022 May 16
2022 May 30
2022 Feb 06
2022 Jun 13
2022 Feb 20
2022 Mar 06
C/2017 K2 (PANSTARRS)
2022 Jun 27
Ophiuchus
2022 Jul 11
2022 Jul 25
2022 Aug 08
Aquila
2022 Aug 22
Sagittarius
2022 Sep 05

Comet 2017/K2 (PanSTARRS) path through June (comet position shown 1st June). Image created with SkySafari 5 for Mac OS X, ©2010-2016 Simulation Curriculum Corp., skysafariastronomy.com.

The periodic comet 45P/Honda-Mrkos-Pajdusakova is currently reported to be two magnitudes higher than expected at +7 mag. However, this comet is poorly placed for visual observations and while this will improve, the further into June we travel, the more the comet is likely to have faded by then. Still, it will be interesting to see if this is a brief outburst, or something longer lasting, as the comet tracks through Gemini and into Cancer.


Lynx
2022 Jul 10
2022 Jul 01
Cancer
2022 Jun 22
2022 Jun 13
Auriga
Gemini
2022 Jun 04
45P/Honda-Mrkos-Pajdusakova
Moon
Canis Minor
2022 May 26
2022 May 17
Sun
NW
W

Comet 45P/Honda-Mrkos-Pajdusakova, through June (comet position shown 1st June). Image created with SkySafari 5 for Mac OS X, ©2010-2016 Simulation Curriculum Corp., skysafariastronomy.com.

**Meteors**

There are no major meteor events in June, though being out under clear skies, there is always the chance of observing a sporadic meteor or two, during any clear night. The next shower to be on looking out for are the Southern Delta Aquariids in late July/early August.

**Noctilucent Clouds**

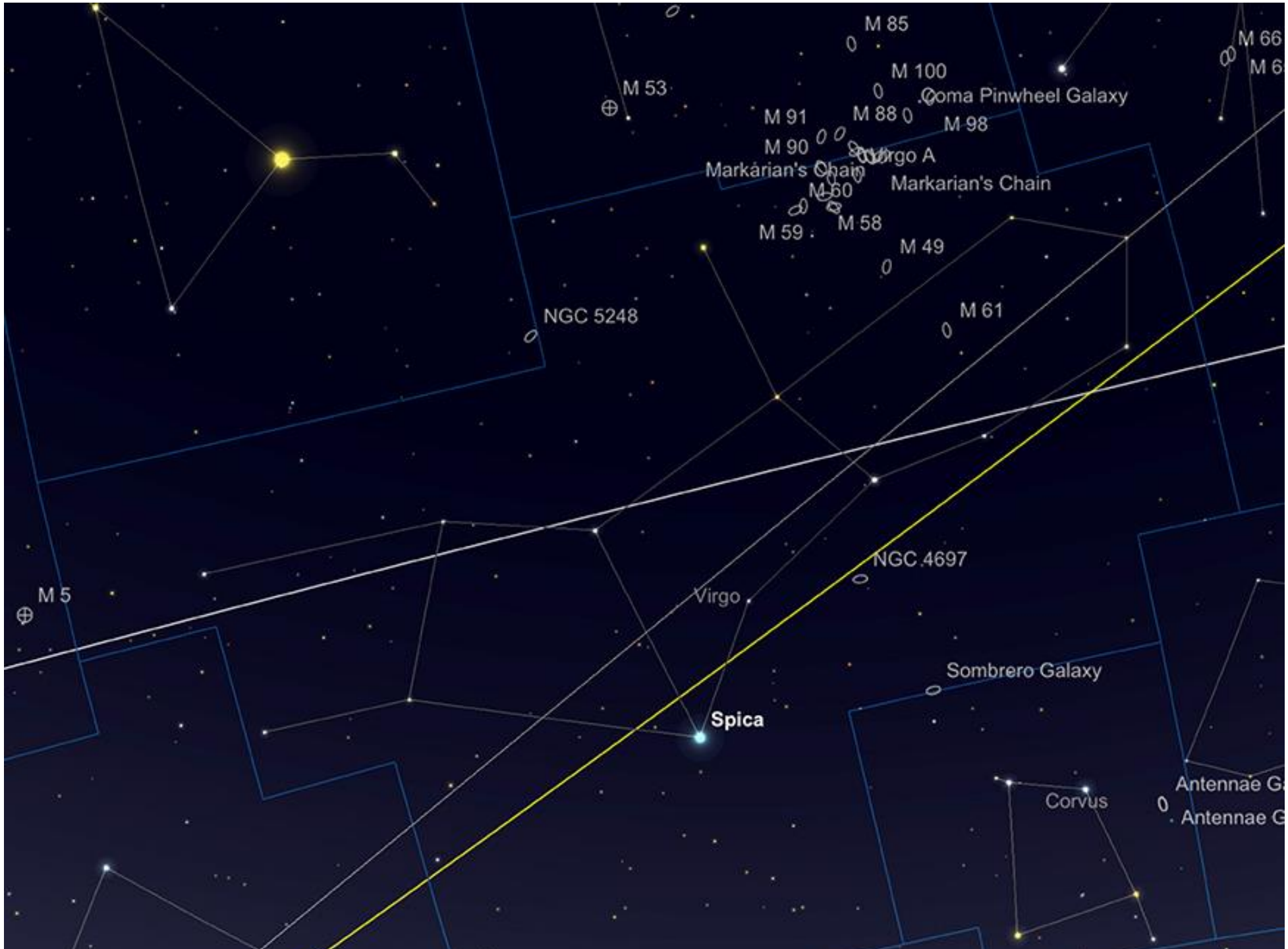
Noctilucent Clouds are often seen in June - their bright gossamer/web-like structures can normally be seen low on the northerly horizon, between latitudes of 50-65 degrees, when the Sun is between 6 and 16 degrees below the horizon. These clouds are mysterious - there were no recorded sightings of them before 1885. Some researchers believe they are formed as a result of volcanism, human-induced atmospheric pollution, or even the condensation of water vapour along the trails of meteors. Interestingly, a significant link between the power of the Northern Polar Stratospheric Vortex and the production of NLCs in the Southern Polar Mesosphere (the atmospheric layer above the Stratosphere) has been found by analysis of ground based data and that gleaned form NASA climate satellites. It would appear that when the Northern Polar Vortex is particularly strong, this negatively affects the production of NLCs over the Southern pole over 12,000 miles away. These interconnections are a sure sign of how little we truly understand the mechanics of the atmosphere of our home planet and how much is still potentially to be uncovered.

Whatever their origins, now is the best time to see NLCs from Northern latitudes.  Interestingly, whilst Noctilucent Clouds have been observed in the Southern Hemisphere, their incidence appears much fewer than their Northern Hemispherical counterparts.

A spectacular NLC display captured by Bresser's Anke Morbitzer.  Check out Anke's other pictures of the sky and atmospherics at http://astroyuki.com.  Image used with kind permission.

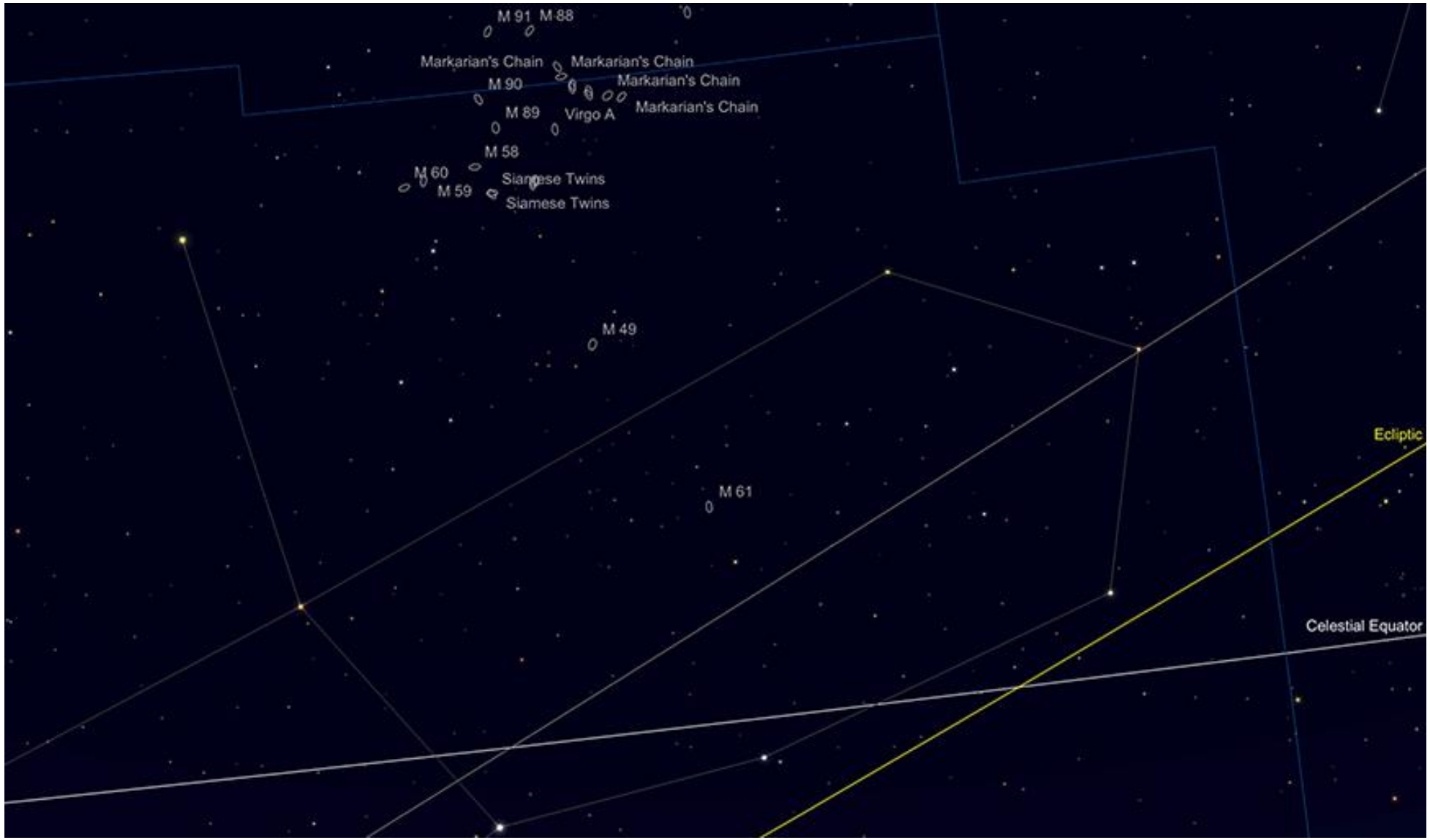
# Deep Sky Delights: Galaxy Season part 3, Virgo

Picking up from where we left off Leo last month, we move south and east, over the border into the large and extremely galaxy-rich constellation of Virgo.


M 85
M 100
Coma Pinwheel Galaxy
M 53
M 91
M 88
M 98
M 90
Virgo A
Markarian's Chain
Markarian's Chain
M 60
M 58
M 59
M 49
M 61
NGC 5248
NGC 4697
M 5
Virgo
Sombrero Galaxy
Spica
Corvus
Antennae G
Antennae G
M 66
M 6

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

The so-called "Bowl of Virgo", which comprises of the most northerly section of the constellation is where the majority of the objects discussed below lie.  So crammed in are these galaxies that it is difficult to see in the larger scale map above exactly where these mass of objects lie in relation to one another.  The image below is a more detailed depiction of the "Bowl' area, which really gives an indication how crowded this area is.


M 91
M 88
Markarian's Chain
Markarian's Chain
M 90
Markarian's Chain
M 89
Virgo A
Markarian's Chain
M 58
M 60
Siamese Twins
M 59
Siamese Twins
M 49
M 61
Ecliptic
Celestial Equator

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

The galaxies shown in the map above are just the brightest and easiest to observe in this area of sky.  There are many more fainter galaxies lurking in the background, making up the Virgo cluster of galaxies.  Indeed, it is thought that the interlinked Virgo Supercluster, which comprises of galaxies in neighbouring Leo, right the way through Ursa Major and our own local group of galaxies, is one of the largest structures in the known Universe.

Just under a degree SSW of M88, where we left off last month, lies the small +10.19 mag spiral galaxy of NGC 4477, which in turn marks the beginning of a glorious 1.5 degree long arc of galaxies known as Markarian's Chain.  This gently curving line of galaxies is one of the finest sights in the sky and an almost peerless photographic subject from a galaxial point of view.

Markarian's Chain comprises of the aforementioned NGC 4477 at the Northerly end and the major galaxies M84 (elliptical, +9.10 mag), M86 (lentinicular, +8.89 mag), at its Southerly tip.  Galaxies NGC 4473 (elliptical +10.19 mag), NGC 4461 (spiral +11.19 mag), NGC 4458 (elliptical +12.10 mag), NGC 4438 and NGC 4435 (both spiral, +10.80 mag, together known as "The Eyes").  The Chain spills over the Coma Berenices border into Virgo, where the largest part of it resides.

Markarian's Chain is named after the Armenian Astrophysicist Beniamin Markarian, who in the early 1960s first suggested a common motion for all these galaxies. Observations have proved than all the above galaxies are in fact gravitationally interacting with each other, though there are outlying and closer objects  - most noticeably the spiral NGC 4388 which may, or may not, be a part of the system - which also populate the area.

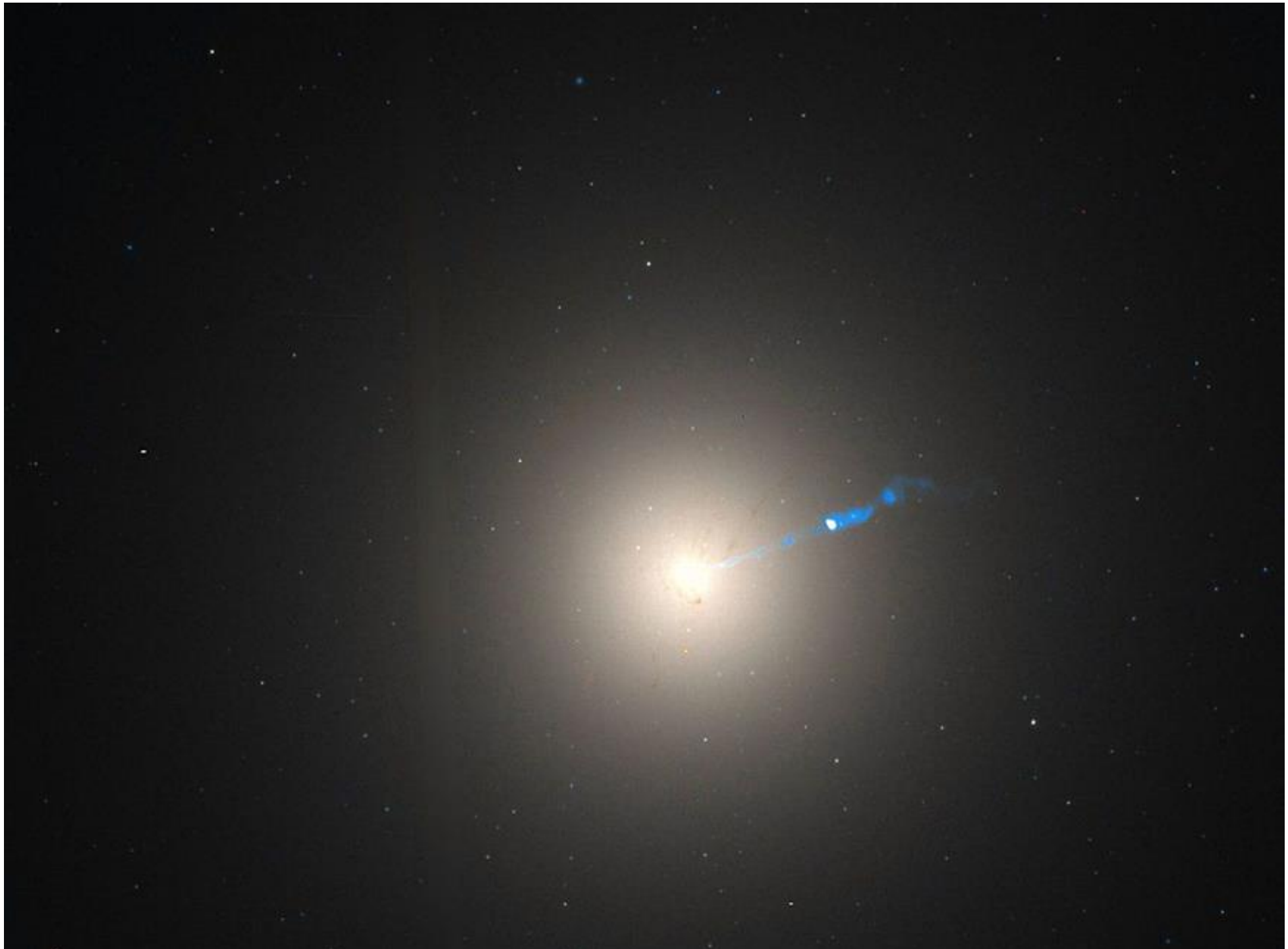

Markarian's Chain (Virgo Cluster)
M82, M84
NGC 4435, 4438 (Eye Galaxies)
By Mark Blundell
8th March 2016

Markarian's Chain by Mark Blundell.  Image used with kind permission.

Frankly, it's difficult to pick out clear highlights in Markarian's Chain, but special mention must go to the eerily-named "The Eyes" galaxy pairing of NGC 4438 and NGC 4435.  This pairing do appear like a pair of eyes peering back at an observer through the gloom and were first nicknamed this by late-19th and 20th century astronomer L.S. Copeland.  Looking at these two objects in even a relatively small telescope will confirm this nickname's accuracy - the similar galaxial core brightness and angular orientation of both objects help to complete the illusion.  Both galaxies it is clear have gone through some sort of interaction in the recent past as astrophotography reveals a large amount of stellar and dark material spilling from NGC 4438's disk.

A degree to the SE of the eyes lies the vast elliptical galaxy M87, otherwise known simply as Virgo A.  This enormous object is easily picked up in amateur instruments from even fairly light polluted environments, shining as it does at +8.60 mag.  M87 was discovered and catalogued by Messier in 1781.

To call M87 vast is to somewhat understate the case: it is estimated to be anything up to 200 times the mass of our own Milky Way galaxy and has over 12,000 globular clusters in orbit around it, compared to our galaxy's rather paltry estimated 150-200.  M87 also appears to be close to the gravitational centre of the Virgo-Coma Supercluster and may be the key gravitational driver of the whole system.  Astrophotography reveals a large jet emanating from M87's centre.  This was first recorded by Lick Observatory Astronomer H.D. Curtis in 1918 and a corresponding much fainter opposite jet was discovered in 1966.  These jets mark at their epicentre one of the most massive black holes so far postulated - a 2-3 billion solar mass object, condensed to about the volumetric size of our solar system.  It is thought to be this object that makes Virgo A one of the most energetic sources of X-Rays, Radio Waves and Gamma Rays in the sky.



Virgo A, Hubble Space Telescope image, ESA/NASA.  Public Domain.

This remarkable monster galaxy can be easily spotted in decent sized binoculars from a reasonable location and is one of the most straightforward galaxies to observe in the sky.  To give a sense of scale, M87 lies 55 million light years away and its outer extents observable from here on Earth cover an area of sky larger than the full Moon.  If put in place of M31, the Andromeda Spiral, in our skies, M87 would probably fit into an area the size of the Square of Pegasus - it's that big!  However, even the mighty M87 pales in comparison to the galaxy IC1011 (also in Virgo) which takes the prize of the largest galaxy currently known at a staggering 6 million light years across - 60 times the size of our Milky Way's 100,000 light year span.

Just over a degree E of M87 lies another elliptical galaxy: M89.  This Messier-discovered object is fairly bright and compact at +9.80 mag and 3.5 x 3.5 arc minutes in size.  M89 is a remarkably spherical object, or at least appears to be from our perspective.  This is unusual, as most elliptical galaxies do appear slightly elongated.  M89 is rather special in terms of its conformity.  This makes for an easily observed object in most telescopes, but unfortunately, a rather bland experience.

M89, Hubble Space Telescope image, Hubble/ESA.  Creative Commons.

Whereas the unfortunate M89 is fairly bland, its neighbour, M90, to be found 3/4 of a  degree to the N is anything but.  At +9.50 mag and an angular size of 9.5 x 4.4 arc minutes, it is a touch difficult in binoculars in comparison with its two elliptical neighbour, but is well-seen as a elongated spiral in larger telescopes.  M90 is fairly unique amongst Messier galaxies, as its spectral shift is very pronounced towards the blue side of the spectrum, suggesting it is rapidly approaching us in relation to the rest of the cluster.  This may be due to it having broken free of the gravitational bounds of the cluster, or indeed it may be considerably closer than the 50-or-so million light years distance it is thought to lie.  Another interesting feature of M90 is that star formation appears to have ceased almost entirely within the system.  As such it is referred to as a "Fossil Galaxy".  M90's swift flight through the interstellar medium is thought to have stripped it of much of its star forming material via the process known as "Ram Pressure Stripping".  This appears to also have been compounded by several supernovae in its central arm regions, which would naturally be richer in this material.  The combined stellar winds from these events have blown much of the material out of the galactic disk and out of the gravitational influence of the galaxy.

M90. Image credit: Sloan Digital Sky Survey [www.ssds.org] Creative Commons.

One and 1/3 degrees S of M90 lies another spiral galaxy, M58. Although M58 is a little fainter than M90, at +9.69 mag, it appears, due to its compact size - 6.0 x 4.8 arc minutes - a little brighter overall. M90 is a barred spiral, though due to the relative brightness of its spiral arms, the bar appears a little obscure, particularly in smaller telescopes - though these will show its disk shape well. Larger instruments will start to resolve the mottled internal structure and arms better, with the central bar becoming more obvious in instruments of the 8-10-inch class. M58, alongside M90 is a relatively poor galaxy for star formation and seems to be a victim of the dreaded Ram Pressure Stripping as well. Lying some 62-68 million light years away (sources differ) it is suggested that at the time of its discovery by Messier in 1779, it was the furthest observed object in the Universe.

M58 taken with the 0.8m Shulman Telescope.  Image credit: Adam Block/Mount Lemmon SkyCenter/University of Arizona - http://www.caelumobservatory.com/gallery/m58.shtml. Creative Commons.

Just over a degree to the E of M58 lie the first of two elliptical galaxies, M59 and M60 (a little under half a degree further E).  These two galaxies were first discovered by Johann Gottfried Koehler in April 1779, Messier listing them shortly after.  Both men were principally concerned with comet watching rather than any notion of "Deep Sky" objects - ironically their discoveries of these pesky objects getting in the way of "true" comets would ultimately be of much greater cosmic significance.

Of the two galaxies, M60 is dominant, being +8.8 mag to M59's +9.6 and slightly larger at 7.6 x 6.2 to M59's 5.4 x 3.7 arc minute size.  Still, M59 in a large telescope is a fine object, displaying a bright outer halo, though M60 trumps it in imaging terms, which reveal a closely packed spiral companion galaxy, NGC 4647, at +11.30 mag, to its NW, overlapping the larger elliptical's outer regions.  It is possible to see this attendant galaxy with large telescopes (12-inch+) from a dark site, but it will be difficult with anything smaller.  It is debated whether or not NGC 4647 is truly interacting with M60, as evidence, bar the obvious visual closeness has been scant.  However, latest observation by the Hubble Space Telescope suggest that interaction is possibly at the beginning stages and the two objects are not simply line of sight co-incidental.


M60, NGC4647 Galaxy's
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M59 (top) and M60 (middle) by Mark Blundell.  Image used with kind permission.

Both M59 and M60 are thought to contain supermassive black holes in the order of mass equal or larger than the mass of M87's - with M60's thought to be a huge 4.5 billion solar masses.

If we trace a line back West from M60, to M 59, then back to M58, we have a starting point for the identification of the next target for this month, the Siamese Twins Galaxy or Butterfly Galaxy.  This is in fact two objects, NGCs 4567 and 4568, which can be found just over half a degree to the SSW of M58.  These objects are +11.30 and +10.80 mag respectively and can be resolved as a V-shaped patch of light in smaller telescopes.  Larger (8-10-inch class) instruments will clearly resolve the objects as a much more rounded "V" - very reminiscent of a butterfly in flight, in fact.  Larger instruments under good conditions will start to resolve some variance of brightness within the disks, but it is in astrophotography that this target really begins to show its true awesome beauty.  Images reveal the early onset of a collision between these two spiral galaxies, which has been confirmed by professional infrared observations.

NGC4567 and NGC4568.  Image credit: Goran Nilsson & The Liverpool Telescope.  Creative Commons.

Following a line from M58, through the Siamese Twins, extending SSW by just over 3 and 1/2 degrees, we come to the penultimate object for discussion this month, the bright elliptical galaxy M49.  M49 was discovered by Messier on 19th February 1771 and was the first of the Virgo group to be added to his list of objects.  At +8.39 mag and 10.2 x 8.3 arc minutes dimensions, this galaxy is large, but still pretty bright - certainly conspicuous enough in binoculars under average conditions.  Indeed, M49 is the brightest of all the Virgo cluster, though M87 does give it a run for its money.  It was thought that both objects were of similar size and mass, but observations have now proved than M87 is by far the larger and heavier of the two galaxies.  By comparison, M49 has "only" 6000+ globular clusters to M87's 12000+.

4 degrees to the SSW of M49, extending the imaginary line we stared from M58, we come to the final objects in this month's epic tour of just some of Virgo's Deep Sky delights.  This object is one of the most beautiful and the most active, M61.

M61 was discovered by Barnabus Oriani on 5th May 1779 and was also noted on the same night by Messier, who classed it as a possible comet.  Less than a week later, Messier had realised that M61 was a static object, so then added it to his list.

At +9.69 mag and 6.5 x 5.9 arc minutes, M61 is a fairly compact galaxy, having a bright star-like core, surrounded by evidence a its face on spiral nature, which is visible in smaller telescopes as a tenuous halo, but is resolved much more readily and successfully by the 12-inch+ class of telescope into a definitive spiral.  In fact, M61 is another barred spiral, but this bar is very compact in comparison to virtually every other barred spiral galaxy previously mentioned here.  Again, M61 is a worthy target for astrophotographers, who will pick up this compact spiral's structure well in long duration photographs.

M61 is unusual in being one of the most active star-forming galaxies in the Virgo cluster.Likewise it holds the joint record with M83 as being the most active Messier object for Supernovae, with six being observed in the the past century.

M61.  Image credit: ESO/VLT.  Creative Commons.

From M61, we can trace a curving arc to the SE in the direction of Spica, Virgo's principle star, which takes in a few of Virgo's lesser galaxies, the elliptical +9.50 NGC4636 is exactly 5.5 degrees SE of M61, followed by the +10 mag spiral NGC4753, then reaching NGC4697, which is a brighter elliptical galaxy, discovered by William Herschel in 1784.  This galaxy is fairly easy in small telescopes, as is its neighbour NGC4699, an attractive but compact spiral, which lies just under 3 degrees due South.

At the bottom of this arc, 3 and 3/4 degrees to the SW of NGC4699, lies one of the jewels of the night time sky, M104, the Sombrero Galaxy.  The Sombrero was discovered in 1767 by Pierre Machain and though noted by Messier in an addendum to his original list, had to wait until Camille Flammarion rediscovered it in Messier's original notes in the early 1920s for it to be officially added as a Messier object.  William Herschel made an independent discovery of it in 1784 and remarked upon the appearance of a "dark stratum" in the object.  We now know this to be a prominent dust lane which rings the outer spiral structure of the Sombrero and gives it its distinctive - and apt - nickname.

The Sombrero is bright for a galaxy at + 8 mag and a decent size, (though hardly over-large) at 8.6 x 4.2 arc minutes in dimensions.  It can be found in telescopes and binoculars of all sizes, though contrary to what is stated in many publications (which tend to overstate the size of telescope required), a good quality 4-inch refractor and a dark observing site and decent dark adaption will be needed to see its dust lane.  Admittedly, the lane is much easier with a reflector of 8-10 inches in aperture, which will also resolve the true shape of the Sombrero better, but this should not put off observer with smaller instruments from attempting to spot it. Once found, M104 will not be forgotten in a hurry, it is a lovely object.  M104 is even more spectacular when imaged, though from UK locations astrophotography of this target has to be timed carefully, as it is only at a reasonable height from the horizon for a limited period.

M104, The Sombrero Galaxy, by Gary Palmer.  Image used with kind permission.  https://www.astrocourses.co.uk/

M104 is thought to lie around 30 million light years away and calculations show that although it is around half the diameter (50,000 light years) of our own Milky Way Galaxy, it is considerably more luminous and has many more than our own galaxies' number of attendant Globular Clusters - 1200 to 2000 compared to the Milky Way's estimated 160 - more in line with a much larger spherical galaxy like the nearby Virgo A.  M104 is also thought to be home to a supermassive black hole and the first object to have its redshift measured, which proved that it was clearly not a part of the Milky Way galaxy in 1912.