

SKY GUIDE

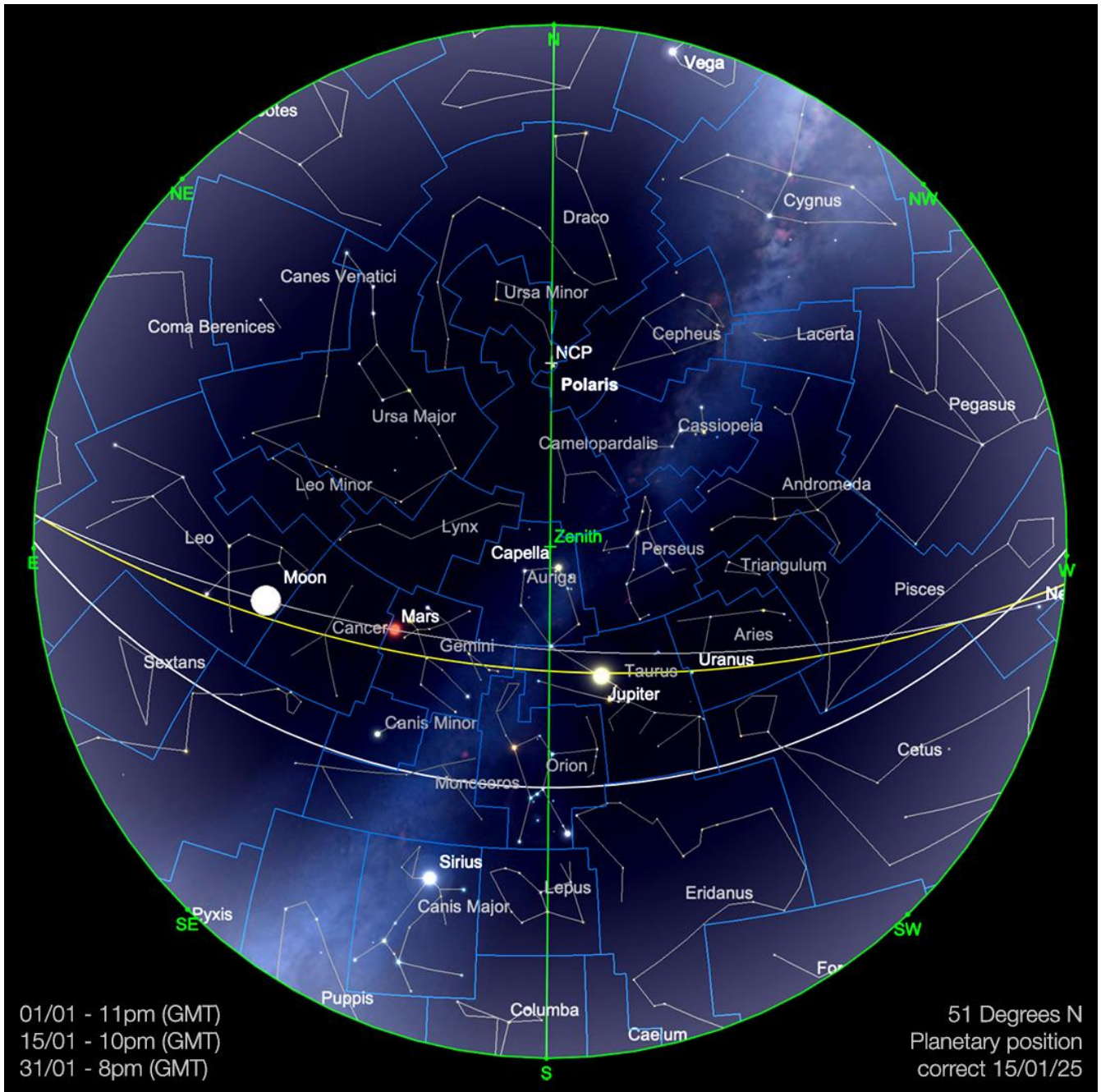
Astronomical guide for
January 2025

The most up-to-date guide to planetary and lunar activity,
comet news and space wonders.

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Gutenbergstr. 2 · 46414 Rhede · Germany
+49 (0) 28 72 – 80 74 – 0
info@bresser.de · www.bresser.de

Original text: Kerin Smith
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Expand your horizon



We wish our readers a warm welcome to 2025. This Sky Guide is now in its 13th year and we hope that our many readers are still finding it a useful source of information and inspiration - or just a decent read when it's cloudy. 2025 promises to be a lively one from an astronomical perspective and we start the year with another potentially bright comet, Mars at opposition and the Quadrantid Meteor Shower. More of this in our regular sections below.

For those of us at mid-northern hemisphere latitudes, the fact we are now past late December's Winter solstice will gradually become noticeable. While early January will still be dark and hours of night will definitely outnumber those that are daylit, it is normally towards the end of the month that those of us who observe the sky on a regular basis will start to notice a slight shift in the evenings and mornings. By the time we get to the end of the month, we will be less than seven weeks from the Vernal Equinox, when the Sun crosses over the celestial meridian and moves into the northern part of the sky, heralding Spring for the northern hemisphere. Of course, exactly is opposite for our readers in the southern hemisphere who will be basking in the heat of the latter part of the Summer.

No matter where you are in the world, as ever, there's plenty to see in the skies above us...

The Solar System

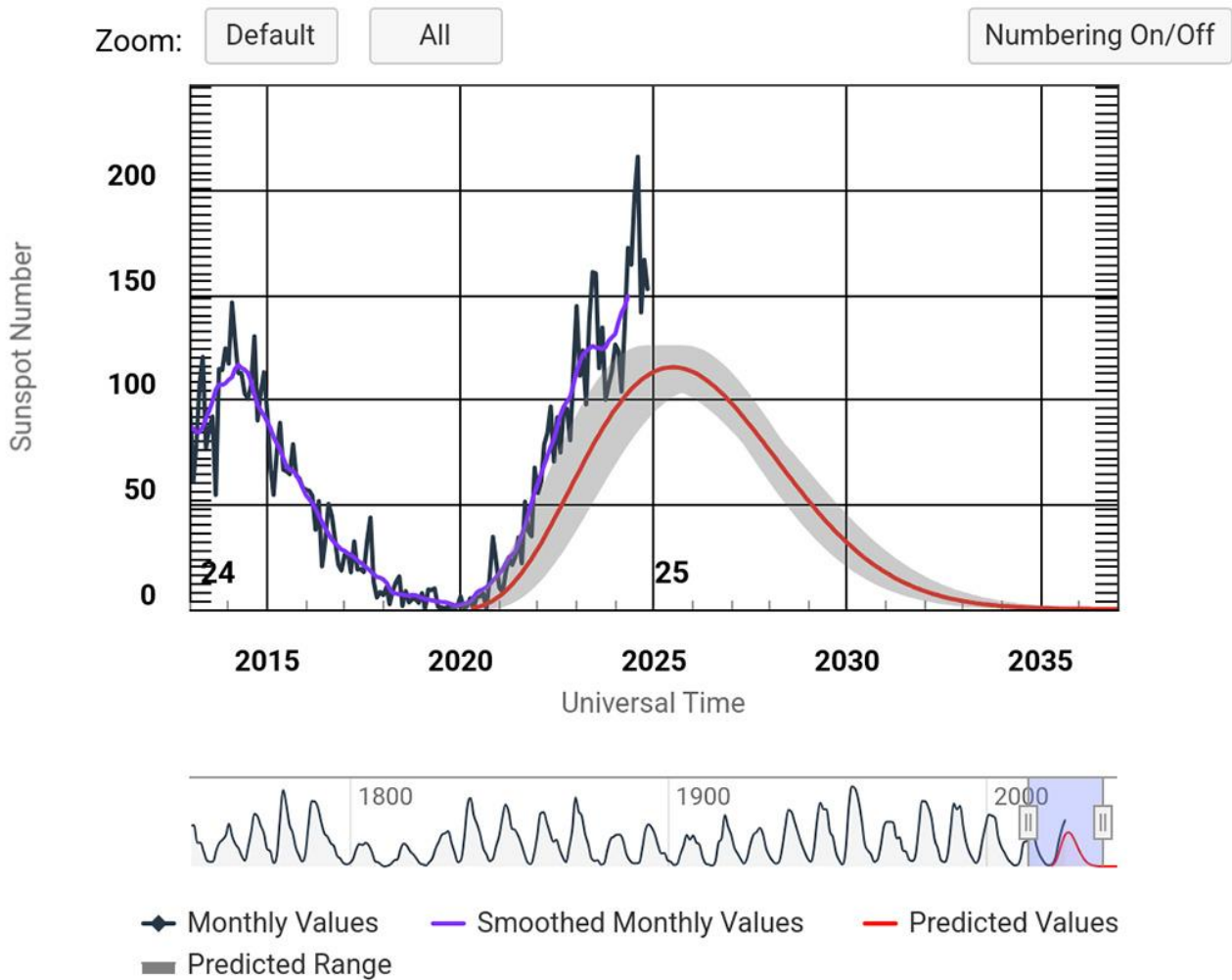
The Sun

Our parent star continues its very active streak and shows little sign of settling down from its peak of activity. This current peak of recorded activity has already significantly outperformed the last one of 2014/15, which in truth was fairly weak. Sunspot activity has peaked at over 225 in recent months. This still has some way to go to match the monster record of cycle 19, which peaked around 1958, which recorded over 350 sunspots pcm at its height. There is little chance of the current cycle 25 reaching these dizzying heights, but it is way above those rates predicted.

At the of writing there has been no significant recent repeats of lower latitude auroral displays, that we experienced in May, August, September and October of 2024. Though with sunspot levels still significantly high, this could change at very short notice.

Websites such as www.spaceweather.com and Michel Deconinck's monthly newsletter: <https://astro.aquarellia.com/doc/Aquarellia-Observatory-forecasts.pdf> cover numerous facets of solar observations and are also sources of a great deal of useful overviews of the current situation with our parent star. Signing up to the AuroraWatch app, produced by Lancaster University in the UK, is also highly recommended for those looking for advanced warnings of impending auroral events.

ISES Solar Cycle Sunspot Number Progression



Space Weather Prediction Center

Image created by National Oceanic and Atmospheric Administration's Solar Cycle Progression Tool, showing this cycle's much higher activity peak, as compared to the last. Public Domain.

The Moon

The Moon begins January at a little after new phase. It is a waxing crescent of just over one day old on the evening of the 1st. A resident of Sagittarius, the Moon is very low in the sky and will start climb up out of the very deep south of the eclectic plane during the first week of the New Year. The evening of the third sees the moon and Venus come together in close conjunction in Aquarius. The two objects being separated from one another by around 2°.

The following evening the Moon will occult Saturn (also in Aquarius) - more of this a little later in the sky guide. The Moon will also occult Neptune on the evening of the 5th, though this encounter will occur at around sunset in Europe, making the very faint planet impossible to observe, until it has re-emerged from behind the Moon.

The Moon reaches First Quarter phase in Pisces on the evening of the 6th January. Beyond this, the Moon will occult the Pleiades Taurus in the small hours of January 10th and then create over the "top" of the ecliptic, reaching Full on the evening of the 13th. Naturally, around

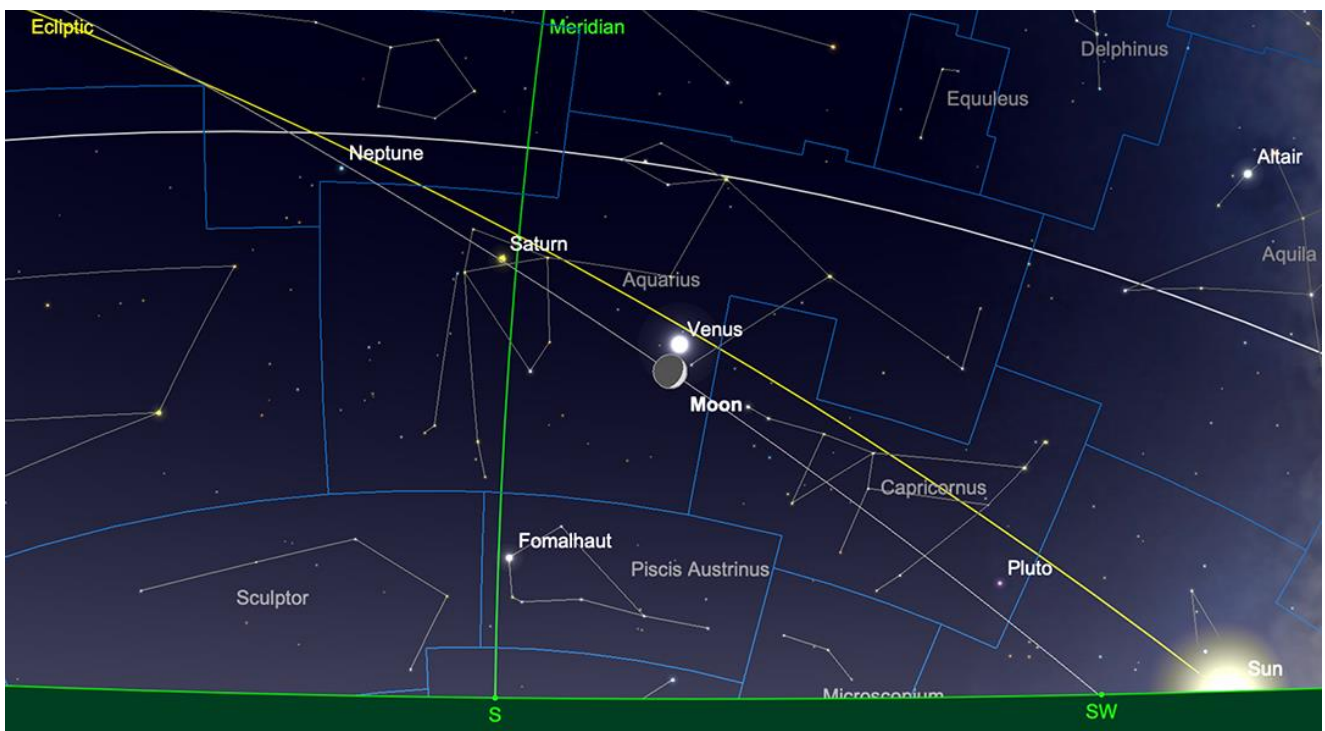
the middle of the month is the worst time for observing fainter targets in the night time sky, as the Moon will be up all night and at maximum illumination.

The Moon will also occult Mars for observers in Western Africa, North America and parts of Mexico on the evening of the 14th. Sadly this event will not be visible from Europe - though the Moon and Mars will be separated from each other by just half a degree during the very early hours, as seen from Europe.

The Moon will then slip through the constellations of Cancer, Leo and on into the largest constellation of all, Virgo. It is in Virgo that the Moon will reach Last Quarter phase on the 21st January.

The last week of January will see the moon sink lower into the southerly part of the ecliptic again, passing through Libra, Scorpius, Ophiuchus and Sagittarius. Thereafter, our natural satellite climbs up from the deep south of the ecliptic into Capricornus, where it will meet the Sun on the 29th and become New again.

The last couple of days of January sees the Moon climbing up through Aquarius, as a very thin waxing crescent.



The Crescent Moon and Venus, Jan 3rd, 2025. Image created with SkySafari 6 for Mac OS X, ©2010-2016 Simulation Curriculum Corp., skysafariastromy.com.

Mercury

We find Mercury a resident of Ophiuchus at the beginning of 2025. Shining at a steady -0.5 magnitude, it will be seen in the SE just before daybreak, standing a little over 10° degrees

high (as seen from 51° N). At a phase of around 78%, the planet will be the brightest object in its area of sky, though will still be challenging in the glare of the dawn sky.

Mercury is in a descending node, heading south of the ecliptic plane in the sky and into the most southerly part of the ecliptic in Sagittarius. As January continues, this will make observations from the northern hemisphere increasingly challenging. By mid-month, Mercury will stand just under 5° above the horizon at dawn (as seen from 51° N). It will be -0.4 mag at this point, having moved further away from us on its orbit, but increasing its phase as it does - the upshot of this is that it remains fairly static in terms of brightness.

Mercury reaches superior conjunction in early February, so the last half of the month - particularly the very end - the planet will effectively be too close to the Sun for meaningful visual observations.



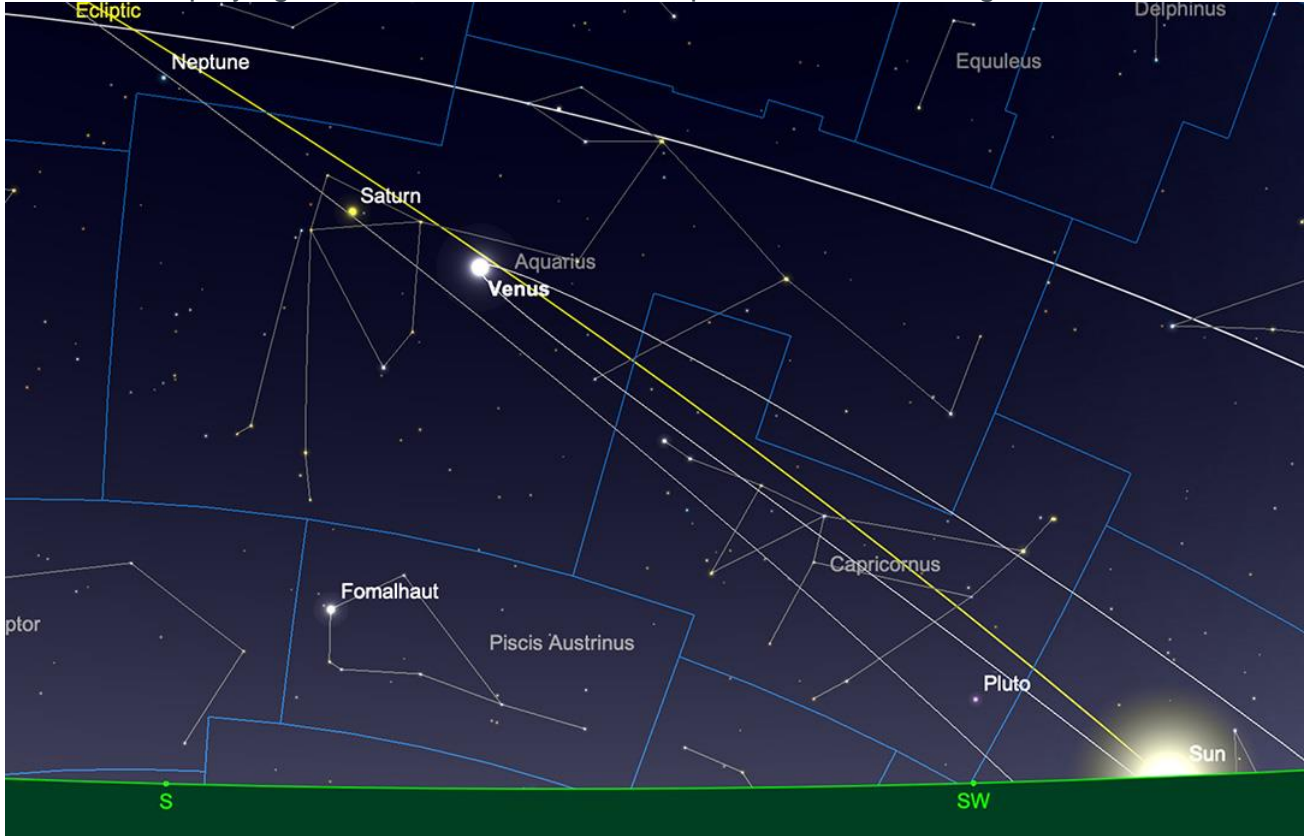
Mercury at sunrise, 1st January. Image created with SkySafari 6 for Mac OS X, ©2010-2016 Simulation Curriculum Corp., skysafariastronomy.com.

Venus

Venus is an evening object during January. It reaches maximum eastern elongation on the 10th, taking it to its furthest point from the Sun. At a dazzling -4.4 mag at the beginning of the month, it will be unmistakable in the SSW after sunset. At just over 22 arc seconds diameter and standing a little over 25 degrees high (as seen from 51° N) at sunset, it will be in nearly prime position for telescopic observations. Showing a just over half phase 55% illumination on the 1st, the phase will be visible to keen eyed observers even in binoculars.

Even though Venus starts to head towards the Sun after maximum elongation, as the Sun is now climbing up from the deep south of the ecliptic (as observed from the northern hemisphere), rather than decreasing Venus' separation from the horizon, this has the effect of boosting apparent height in the sky. By the time we get to mid-month, Venus will stand just over 30 degrees high (as seen from 51° N) at sunset. The planet is drawing closer to us on its orbit and this has the bonus of increasing its angular size, to 26 arc seconds diameter and boosting its brightness to -4.5 magnitude - even while its phase decreases to around 48% illuminated.

By the time we get to the end of the month, things have improved further. Venus now stands just under 35 degrees high at sunset - putting it into an area of sky statistically likely to be calmer and less negatively influenced by atmospheric extinction than those under 30 degrees. This makes Venus a prime target for early evening observing and imaging. The planet will have reached a near maximum brightness of -4.6 magnitude and 31.8 arc seconds diameter, displaying a 38% illuminated crescent phase on the evening of the 31st.

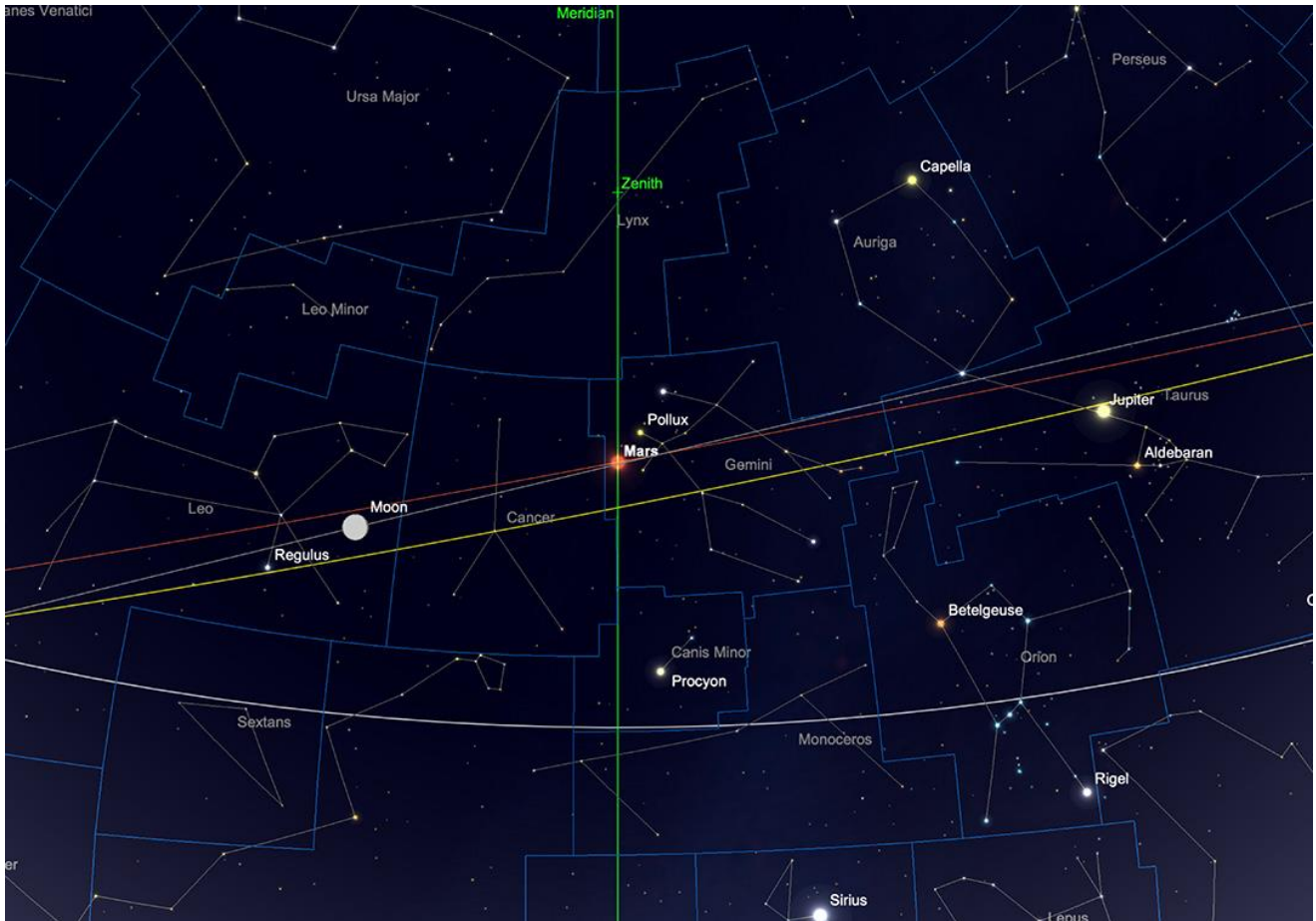


Venus at maximum eastern elongation, sunset, 10th January . Image created with SkySafari 6 for Mac OS X, ©2010-2016 Simulation Curriculum Corp., skysafariastronomy.com.

Mars

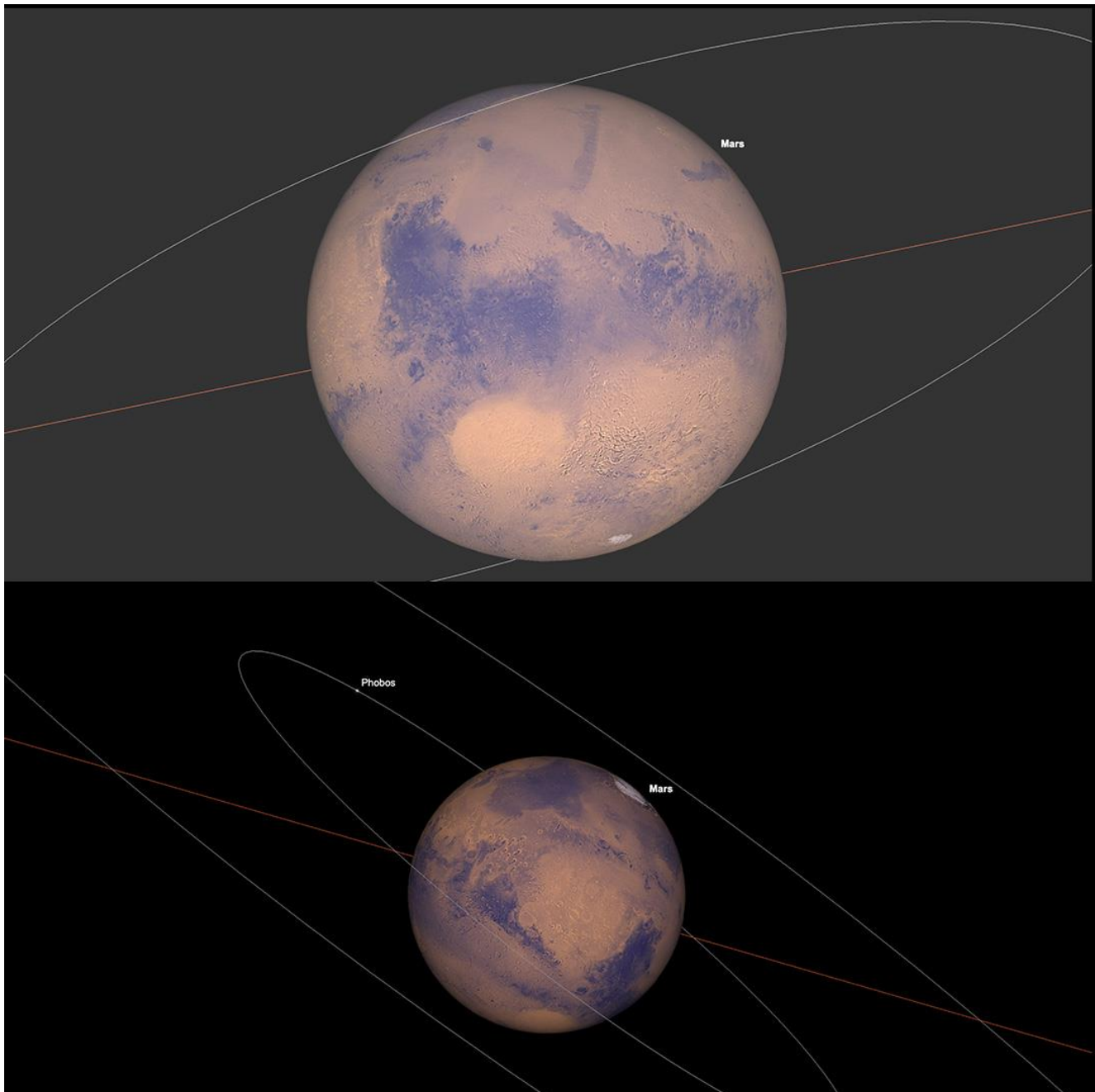
While Venus is brighter, Mars is undoubtedly the highlight of planetary activity during January. It is the month of the long-awaited Martian opposition, which takes place on 16th January.

Mars starts off the month in Cancer, shining at a steady -1.2 magnitude. The planet will display a 14 arc 2nd diameter disc at the beginning of January. It will transit at a little before 2am.



Mars at transit, opposition night, 16th January 2025. Image created with SkySafari 6 for Mac OS X, ©2010-2016 Simulation Curriculum Corp., skysafariastromy.com.

The planet is in retrograde motion in the sky (as all outer planets display) in the lead up to and a little after opposition. By the time we reach opposition night - the 16th - Mars will have crossed the borders over into Gemini and will have increased its brightness to -1.4 , now displaying a 14.6 arc second diameter. Mars will transit at a little after midnight on the 16th, meaning observers will have to brave the small hours to see the planet at its highest point in the sky. Mars makes an impressive 64° (as seen from 51° N) at transit on opposition night. It's worth noting for Southern hemisphere readers, that this opposition definitely favours the northern hemisphere in terms of observing conditions. However, we are at a cycle in time where brighter and closer oppositions of Mars definitely favour the southern hemisphere. This opposition is by no means a bad one - but brighter, more impressive martian showings have occurred in the last 25 years. Most notably in August 2003, when Mars was an impressive -2.9 magnitude at peak and over 25 arc seconds diameter. The rule of thumb for all outer planets opposition is pretty easy: if an opposition occurs in the Winter months, it favours the northern hemisphere, in Summer and the southern hemisphere has a better showing. Mars' rather eccentric orbit is significantly more oval than the Earth's and the current cycle of closest approach oppositions occur in the summer months - hence the southern hemisphere having it better in the current era. This eventually shifts around and in the future it will be the northern hemisphere that will have a better showing. Still, this is not to take anything away from the current opposition, which should be enjoyed by everyone with a telescope.



Mars' comparative size at opposition 2003 (top) and 2024 (bottom). Image created with SkySafari 6 for Mac OS X, ©2010-2016 Simulation Curriculum Corp., skysafariastronomy.com.

By the time we get to the end of January, Mars will have dimmed a little to -1.1 mag and will now show a 13.8 arc second diameter disc. Mars does drop off pretty quickly after opposition in terms of brightness and size, as seen from Earth. Mars is such a comparatively small world. So, unlike the outer gas giants, whose sheer size and large distance from the inner solar system means they never vary in size and brightness anything like the extreme amount that Mars displays. In the light of this, the onus is definitely on observers to catch the window for Mars - it'll be February 2027 before it is at its peak again.

Jupiter

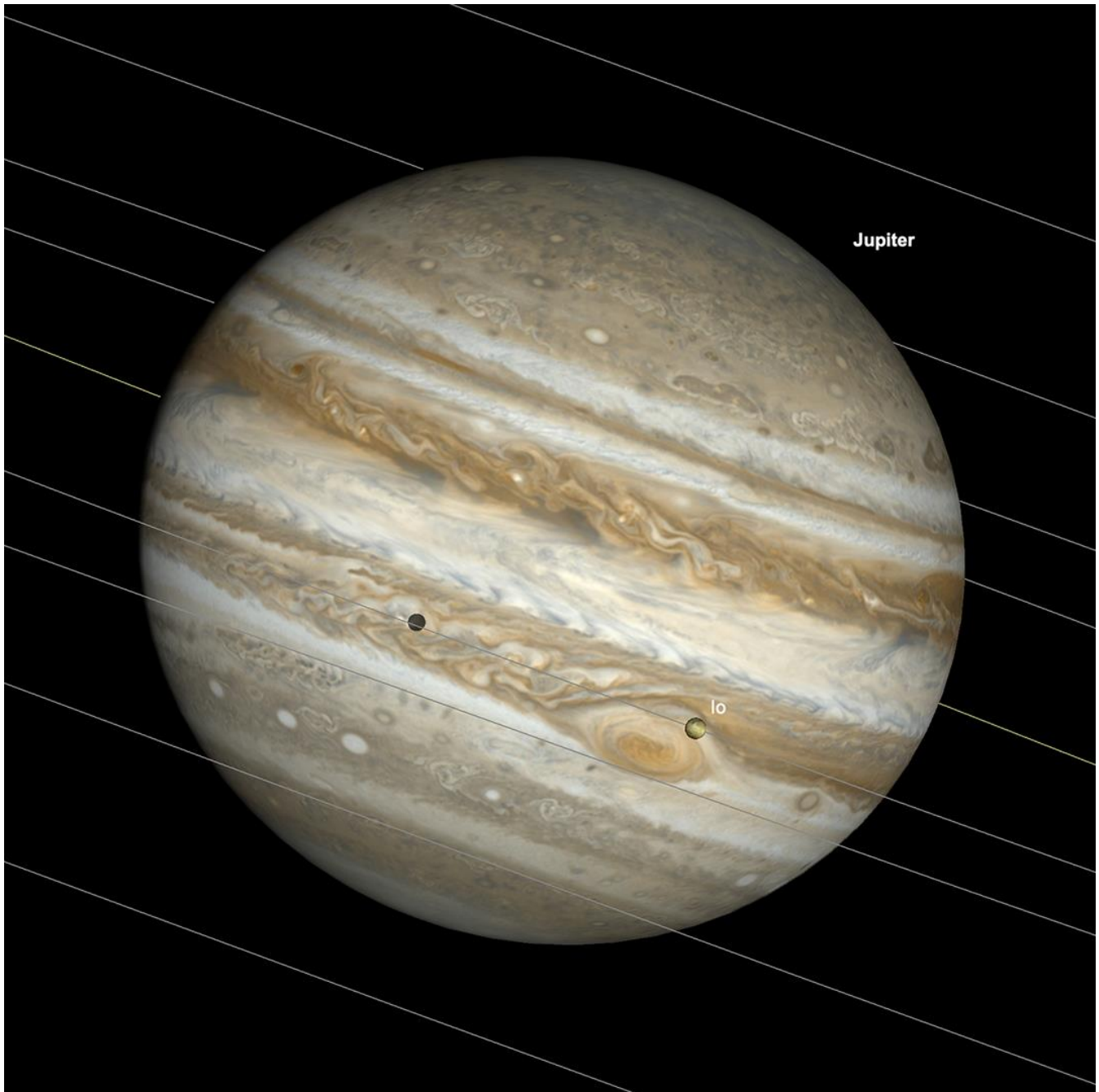
The ever-brilliant Jupiter is just next door (comparatively speaking) to Mars in Taurus during January. Although now a little past the peak of late last year's opposition, it is still extremely bright, at -2.7 mag and shows an impressive 47 arc second diameter disc. It will transit at a little past 10 pm (GMT) and is very well placed for later evening observations. As Jupiter is so

high in the sky at present for northern hemisphere observers, it is really worth staying up a little later in early January and making sure it is at its closest to transit point before making really high power observations with any type of telescope. Tempting as it is to catch it in the early evening, the benefit of waiting until later will definitely be seen at the eyepiece.

By the time we get to mid-month, Jupiter will have dimmed fractionally to -2.6 mag and now displays a 45.5 arc second diameter disc. The planet will now transit at a little after 9 pm (GMT).

Fast forward to the end of the month and Jupiter will now be -2.5 mag - still extremely bright - and shows us a 43.4 arc second diameter disc. By this point of the month, Jupiter will transit at just after 8pm. This makes it a fantastic target for early evening observing.

As usual there are a few mutual transit events worth catching from a European perspective. The evening of the 11th sees a fine Great Red Spot, Io and Io mutual shadow transit, starting a little before 6.30 pm (GMT). There's another Great Red Spot, Io and Io shadow transit, starting a little before 8 pm (GMT) on the 18th. There's another Great Red Spot, Io and Io mutual shadow transit, starting a little before 10 pm (GMT) on the 25th. There's a Great Red Spot and Ganymede mutual transit, starting a little before 10.30 pm (GMT) on the 27th.



Jupiter, GRS, Io and Io Shadow transit, 18th January. Image created with SkySafari 6 for Mac OS X, ©2010-2016 Simulation Curriculum Corp., skysafariastronomy.com.

Saturn

Saturn starts 2025 in Aquarius - not far east of the significantly brighter Venus, which can be used as a useful waypoint for finding the Ringed Planet. At +1.1 magnitude it is still brighter than any star in its immediate vicinity. Saturn will be transiting at around sunset at the beginning of the month and will thus be ideally placed for early evening observing. At over 31° of elevation, at transit (as observed from 51° N), Saturn is briefly over the 30° mark that statistically improves telescopic viewing conditions. Of course the further north you are, the lower Saturn will appear in the sky. But this is significant, as it has been some time since Saturn's position in the sky has placed it in such a reasonable observing situation for those in mid-northern latitudes. As time goes by, the planet will move further north within the ecliptic plane, improving the view for northern hemisphere observers yet further. As we've mentioned in previous sky guides, the ring system is currently closing up from our perspective here on Earth. We will cross the ring plane of Saturn in March, so telescopically observers will only

see a very thin sliver of ring at present, but it is still bright enough to be seen with small telescopes at present. It is only when we are really near ring plane crossing that the famous ring system becomes a much trickier target to observe. As we have draw closer to ring plane crossing, the inner moons (and their shadows) of Saturn's enormous family of satellites have started to transit the planet. These are more challenging events to observe than those of Jupiter's Galilean moons, but if you have a medium sized telescope, it is worth seeing off you can make one of these out. From early February to early May, Saturn's largest Moon, Titan, will start to transit the Saturnian disc. Because of Titan's significant size, when compared to other moons, this will be the easiest transit even to see. We'll cover these in forthcoming sky guides.

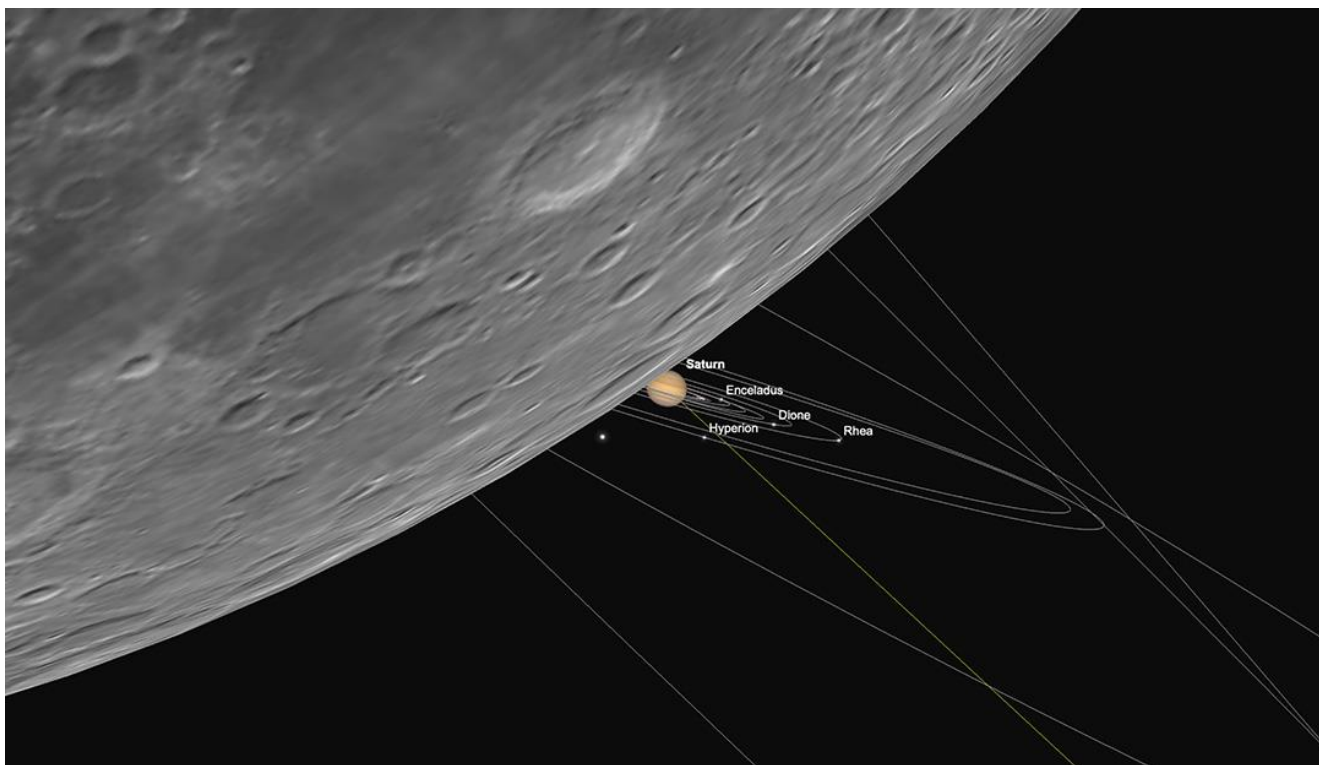
Saturn will set at a little before 10 pm on the 1st January.

Saturn is occulted by the Moon in the early evening of January 4th. This even starts at a little after 5.15pm and ends at around 6.27pm (GMT). Lunar occultations like this are always worth looking out for , no matter what size your telescope is. As we've remarked in previous sky guides, these events really give us an insight into the scale of the solar system and are pretty spectacular to watch as they unfold. If the weather is co-operative, we thoroughly recommend catching this one.

By mid-month, Saturn will transit in daylight, but will still be at a significant altitude from mid northern latitudes for observations at sunset (a little after 4.30pm from Greenwich). It will set at a little past 9pm (GMT), giving a reasonable window of observing opportunity.

Saturn and Venus come into conjunction, with the closest approach being on the evenings of the 18th and 19th, with the two worlds being separated from each other by around 2 degrees. This will be in the same field of view of many binoculars and the low power eyepieces of certain shorter focal length telescopes. This is naturally a line of sight effect from our perspective here on Earth. The two planets are separated from each other by distance of over 1.4 billion km.

By the time we get to the end of January, the observing window of Saturn has shrunk considerably. The planet remains stable in brightness at +1.1 mag and shows a disc of 16 arc seconds diameter. It will stand around 25° high at sunset as observed from 51° N) at a little after 5pm and will set at 8.15pm. So the onus for observers is definitely skewed towards the earlier part of the month. It will not be long before we lose Saturn in the evening twilight - superior conjunction occurs in mid-March - so make the most of this time.



Saturn emerging from lunar occultation, 6.27pm (GMT) January 4th. Image created with SkySafari 6 for Mac OS X, ©2010-2016 Simulation Curriculum Corp., skysafariastromy.com.

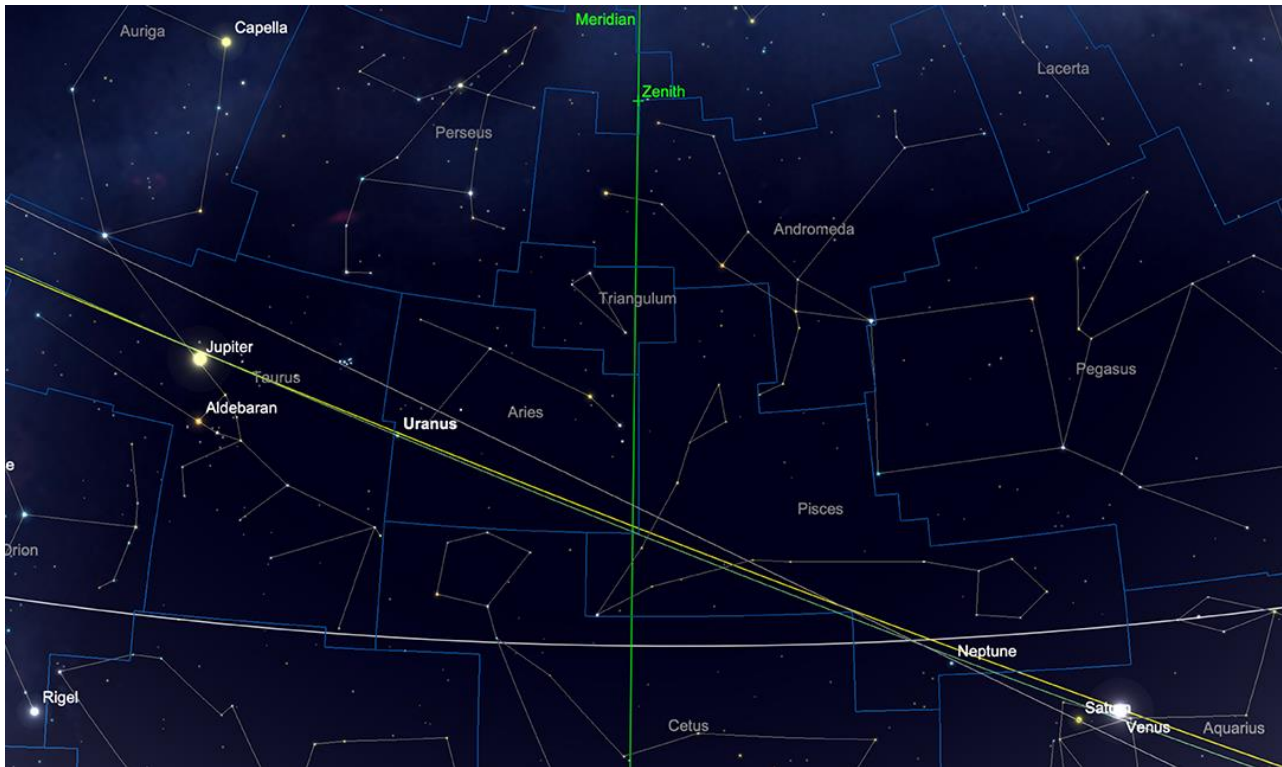
Uranus and Neptune

The outer gas giants, Uranus and Neptune are residents of Aries and Pisces respectively. Neptune is the further west and is found in approximately the same area of sky as Saturn and Venus. At +7.9 mag and just 2.2 arc seconds across, it will be a much more demanding observing target than any of the other of the solar system's true planets. Neptune's relative faintness means that it is best practise to wait until the beginning of true darkness - after astronomical dusk - before starting observations. It's not impossible to find the planet before this by any means, but a truly dark sky will aid observations of this outer world significantly.

Neptune will transit at a little before 4:30 pm (GMT), setting at a little past 10 pm on the 15th of January. The proximity of Venus and Saturn around this point will make Neptune easier to find and indeed the planet will come into close conjunction with Venus on the 30th. The two worlds will be separated by around 3° in Pisces and observable in the early evening.

Uranus is much further east and higher in the sky in Aries. At +5.7 magnitude and displaying a 3.7 arc second diameter disc, Uranus will be much easier to find and observe than Neptune. While technically a naked eye object, Uranus is still a challenge for most of us, even from very dark locations. However, it is easy to find in binoculars and the brighter Jupiter and the Pleiades star cluster, just over the borders to the east, in Taurus, gives us a good indication of roughly where to find Uranus.

Uranus will transit at around 8 pm, mid month and set at a little after 3:30 am the following morning.



Uranus and Neptune relative positions, mid January 2025. Image created with SkySafari 6 for Mac OS X, ©2010-2016 Simulation Curriculum Corp., skysafariastronomy.com.

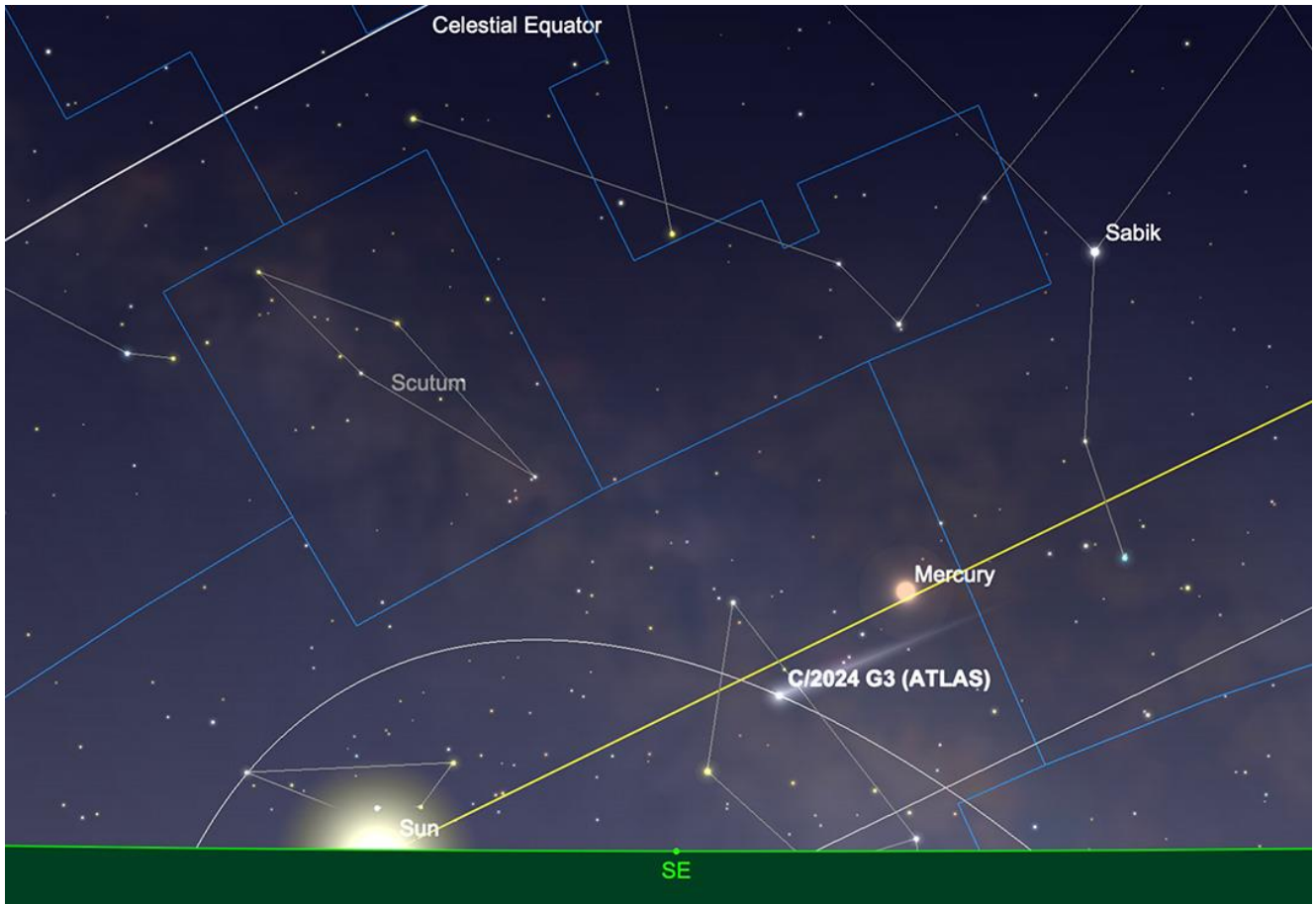
Comets

We have been fortunate enough to have had a recent bright comet, in the guise of C/2024 A3. However, there's a new comet on the horizon: C/2024 G3 (Atlas). This object looks as if it could be briefly spectacular in mid-January. Some of the higher brightness estimates suggest it could reach a peak magnitude brighter than -20 . Median predictions even suggest a brightness of around -12 magnitude. However, we sound a note of caution here: if current brightness estimates extrapolate in the rate they have been, then it is likely the comet will peak practically around -7 . This will still be quite a spectacular object if this is the case.

The comet will reach perihelion very close to the Sun, so there's a reasonable chance it won't survive the intense environment of the inner solar system. However, if it does survive, it could become a truly prominent object for a short time. As with all comets, we must remain cautious in our expectations.

At the time of writing, the comet is visible only to southern hemisphere observers and is around 8th magnitude. It is predicted to brighten significantly as it approaches perihelion, with the rate of brightening increasing as we move into the second week of January. It's still possible C/2024 G3 (Atlas) will vanish entirely by early January. However, if it survives perihelion on January 13th, it might turn into something extraordinary.

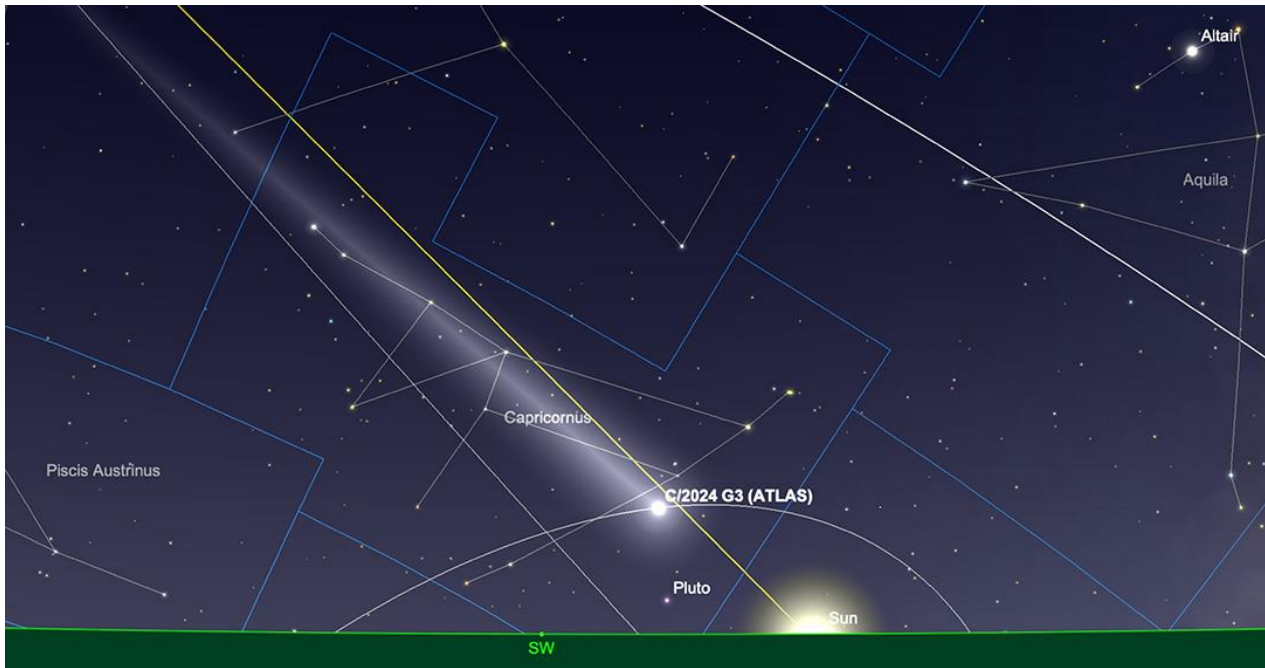
The first week of January will see the comet a morning target for northern hemisphere observers. It will be very low in the sky and very difficult to see, but beyond the 7th, may have risen to a reasonable altitude as the Sun rises, to be able to be observed from mid northern latitudes.



C/2024 G3, sunrise, 7th January. Image created with SkySafari 6 for Mac OS X, ©2010-2016 Simulation Curriculum Corp., skysafariastronomy.com.

As the comet moves closer to the Sun, reaching perihelion on the 13th (when it will potentially be at its brightest), C/2024 G3 will appear to loop to the north of our parent star, becoming an evening object in the process. If the comet survives, the week after the 13th will be a very interesting and potentially spectacular one.

We have no way of knowing for sure if C/2024 G3 (Atlas) will truly deliver for us. But it'll be very interesting finding out. There is such a limited window for seeing this comet at its best, that we can only hope the weather does not conspire against us to spoil the view.



C/2024 G3, sunset, 15th January. Image created with SkySafari 6 for Mac OS X, ©2010-2016 Simulation Curriculum Corp., skysafariastronomy.com.

Meteors

The Quadrantids, the primary meteor shower of January, are known for their high Zenithal Hourly Rate (ZHR), but relatively faint meteors when compared to other major showers. They originate from the northern sky near Bootes, Draco, and Hercules, in an area once home to the now-defunct constellation Quadrans Muralis. The shower is likely seeded by Minor Planet 2003 EH1, thought to be an extinct comet first observed by Chinese astronomers around 500 CE.

At their peak, the Quadrantids can exceed a ZHR of 200, though fewer meteors will be visible from any single location. This year, the peak on January 3rd/4th coincides with a three day old very thin Crescent Moon. Setting at a little after 8:30 pm in Capricornus, the Moon will be well out of the way for most of the night - leaving observations free of moonlight, offering the best chance for viewing the shower.

While the Quadrantids occasionally produce meteor storms, the debris cloud that fuels them is often disrupted by planetary influences, making predictions challenging. This year's peak ZHR is expected to be around 120.

Deep Sky Delights in Auriga

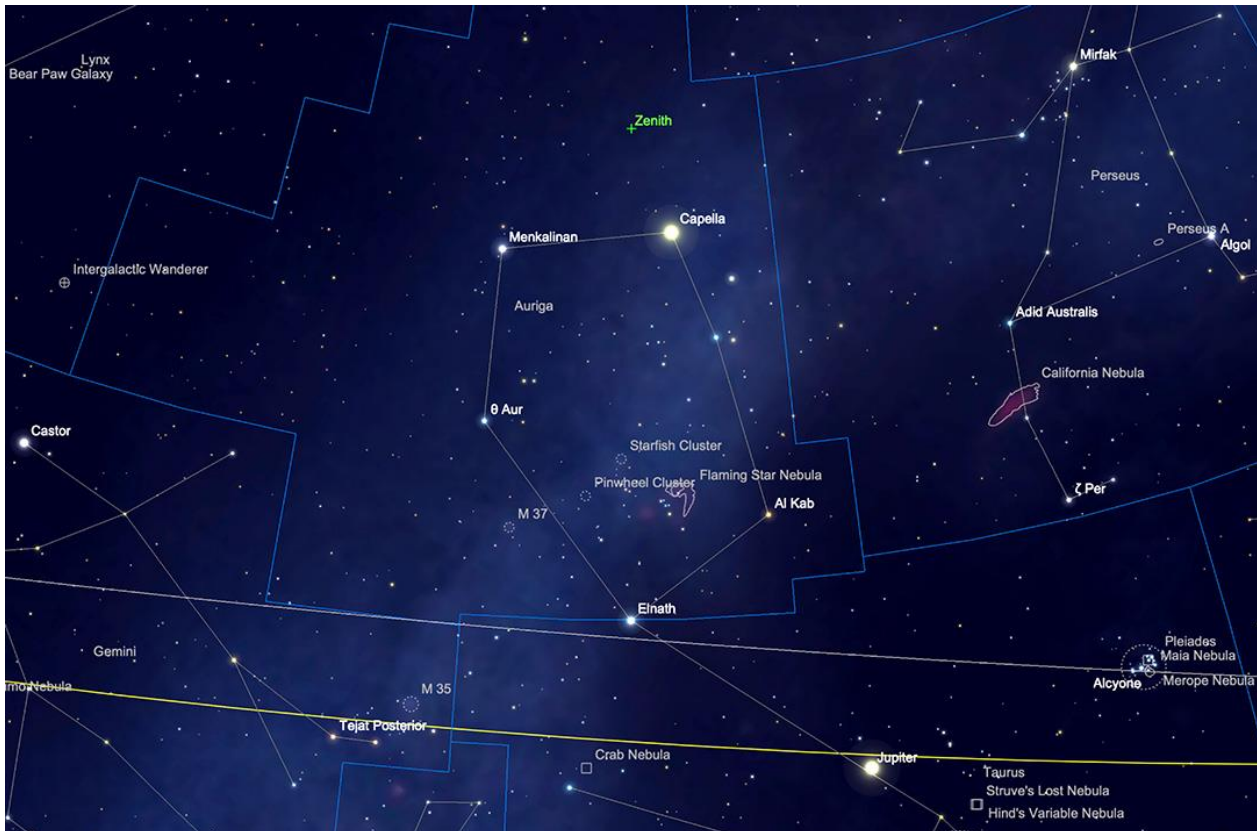


Image created with SkySafari 6 for Mac OS X, ©2010-2016 Simulation Curriculum Corp., skysafariastronomy.com.

Last month's Deep Sky section was a trek around the multiple delights of Taurus. This month we will examine the Taurus' "conjoined" constellation of Auriga.

We start in Auriga, the Charioteer, with its principle star, Capella, or Alpha Aurigae. This is the sixth brightest star in the sky at +0.08 magnitude and the brightest, most northerly star in the sky. Capella is actually a binary star and once of the first to be found by spectroscopic observation, where it was found to have two spectra, overlaid on top of each other, which appeared to doppler shift in relation to each other - hence it became known as a spectroscopic binary. The two stars in the system are orbiting each other by 0.75 AU - three quarters of the distance of the Earth to the Sun. As they are so close, even lying at a comparatively close 42 light years, they cannot be split, even with the largest telescopes on Earth. The system also comprises of two additional red dwarf stars lying much further out. The two main components are similar spectral class to our Sun (G class), but much bigger and classed as giants. They are thought to be much further along their lifespan than the Sun is and have run out of hydrogen as nuclear fuel and are now "burning" helium and in the case of one, carbon. Neither are thought to have enough mass to go supernova at the end of their lives and are likely to end up as planetary nebulae.

Moving to the southern part of the constellation, we find to the Flaming Star Nebula, IC405. Found just under 12 degrees almost due south of the Capella, this object is a partial emission, partial reflection nebula, meaning that one part of its structure glows under excitement from radiation, whereas the other part merely reflects light from the stars imbedded in the object. Measuring around 30 x 19 arc minutes, IC405 is centred around the star AE Aurigae, a star which was ejected from the nearby Orion Nebula under 3 million years ago. At +10 mag, it is not an intrinsically bright object, but condensed enough to be seen in

small telescopes from a decent location. It is unsure if any of the material that makes up the Flaming Star Nebula was once a part of the Orion Molecular Cloud - it is more likely that it is material that the star is merely passing through. As previously mentioned, this is an area rife with gas and other star forming material. IC405 lies some 1500 light years from Earth.



The Flaming Star Nebula by Mark Blundell. Image used with kind permission.

Just under 3 degrees to the NE of the Flaming Star lies the first of Auriga's three great open star clusters, the lovely M38, otherwise known as the Starfish Cluster. It's difficult to see exactly what resemblance this +6.4 mag, 20 arc minute diameter collection of stars has to the titular marine invertebrate, but it is certainly a pretty sight in any sort of optical instrument. M38 was first recorded by the preeminent Sicilian astronomer Giovanni Batista Hordierna in 1654 and re-squired much later by French observer Le Gentil in 1749. Le Gentil's observations alerted Charles Messier to M36's location and it was included in his original list in 1764.

At over a third of a degree angular diameter, M38 is ripe for observation in most telescopes and binoculars. Observers will note long chains of stars, many of which are blue, but there are also some lovely contrasting yellow and gold-coloured members. In total, M38 has around 100 stars as members and lies around 4200 light years from us. It is thought to be around 200-225 million years old.



M38 by Mark Blundell. Image used with kind permission.

2 and 1/3 degrees to the SE of M38 we come to the second of Auriga's great clusters, M36. This cluster is a good deal more compact than its neighbour at 10 arc minutes diameter and slightly brighter as a resultant +6 mag. Through a telescope, this collection of hot white stars can appear quite brilliant in comparison to M38 - indeed, it is said that if M36 were placed in the position of the Pleiades, it would outshine them by a factor of three. M36 was again discovered by Hordierna, in 1654, rediscovered by Le Gentil and added to the Messier list in 1764.

This cluster is a good deal younger than its neighbour and contains many young hot blue main sequence stars, of spectral type B2 and B3. There are no older population stars to speak of in M36, so it is thought to be just 25 million years old. Lying at around 4300 light years hence, M36 is one of the many objects that share the moniker "The Pinwheel" - though apart from a circular collection of stars to the NE side of the cluster, it is difficult to see why it has picked up such a name - especially in the light of the other "Pinwheels" in the sky. Perhaps we should come up with a new more original nickname for this great cluster - it deserves better.



M36. Image credit: ESO/Dss2, Giuseppe Donatiello. Creative Commons/Public Domain.

The last of Auriga's fine open clusters is its best - the spectacular M37. There are many great clusters in this area of sky: the much nearer Hyades, Pleiades, Beehive, the nearby M35 in Gemini and the Double Cluster in Perseus - but M37 is one the most beautiful of these and is a lovely sight is any telescope or binoculars. At a quarter of a degree in diameter, M37 is about the same angular size as the Full Moon in the sky. It is also the brightest of Auriga's "Trio" at +5.59 mag and the oldest at an estimated 300 million years of age. Like its neighbours, M37 contains many hot blue stars, but also significantly many more mature yellow , orange and red giant stars. This more evolved stellar population makes for some fine viewing for we astronomers here on Earth as the blues of the newer, hotter population contrast superbly with the warmer tones of the older stars.

M37 was again discovered by Hodierna, though almost inexplicably was missed by Le Gentil - Messier himself found it again at catalogued it in 1764. M37's total stellar population is thought to number in the 500+ levels, of which maybe 150-or-so are observable in amateur telescopes. It is the furthest lying of Auriga's clusters at 4500 light years distance and the largest at 25 light years across.



M37 by Jim Mazur <https://www.skyledge.net/Messier37.htm> Creative Commons.