

Sun

The apparent diameter of the Sun is at its greatest on the 4th because the Earth is at perihelion at 06:55UT. That is the time when Earth at 147,105,053 km, is closest to the Sun in its orbit. The word perihelion derives from the Greek words, peri meaning 'near' and Helios the Greek god of the sun.

Due to the equation of time the latest sunrise of the year occurs in very late December and early in the year the mornings start to lighten, but you may not notice until near the end of January. Sunsets get noticeably later from the end of December.

The Sun moves from Sagittarius to Capricornus on the night of the 19th/20th. It is also beginning its journey towards more northerly latitudes once more this month, and will eventually become better placed for observing as it culminates higher in the sky. Use appropriate, safe methods to observe the Sun and notify other members if you observe any sunspot activity. Aurorae activity is always quite transient, so share information with other members ASAP. You can receive aurora alerts automatically from the web. Search <https://www.aurorawatchapp.uk> for an app suitable for your location.

Moon

The New Moon is on 2nd at about 18:35 in the constellation of Sagittarius.

The First Quarter Moon is on 9th at about 18:10 in the constellation of Pisces.

The Full Moon is on 17th at about 23:50 in the constellation of Cancer.

The Last Quarter Moon is on 25th at about 13:40 in the constellation of Virgo.

The Moon is at perigee (nearest Earth) on the 1st. The Moon is at apogee (most distant from Earth) on the 14th.

A Luna occultation of Zubenelgenubi takes place on the morning of the 26th. Start observing the double star at 05:15!

The Planets

The only conspicuous planet in the evenings of January is Jupiter, and that is fading.

Mercury, Venus and Mars are very unfavourable this month.

Mercury (Me), at greatest eastern elongation on the 7th will start the month in the very bright evening twilight. By the 23rd it will have reached inferior conjunction and the again it will move into the morning twilight.

Venus (V) too will be at inferior conjunction on the 8th when it moves quickly to become a morning object emerging just before and in the glare of the morning twilight; a dangerous combination to the unwary!

Mars (Ma) appears briefly in the morning twilight throughout January.

Jupiter (J) may be found setting just after the Sun, low down in the evening twilight at the beginning of January, and is best observed early in the month as it makes its way to conjunction in March and will be lost to us soon. It will be observed as a morning object later in 2022; it is in opposition on the 26th Sept, so better observing to be had later this year.

Saturn (S) may also just be found ahead of Jupiter, but closer to the Sun. and being fainter than Jupiter is more difficult to observe for most of January. It reaches conjunction with the Sun on the 4th of February and is in opposition on the 4th August, so better observing to be had later this year.

Uranus (U) culminates in Aries at RA 2h 34m07s, Declination 14° 41' 33" in the middle of January at around 18:40. At a magnitude of 5.74 it may well be found with a good pair of binoculars. You may also just see the planet's cyan (blue-green) hue in a small telescope. Uranus usually has few features visible at such a distance, so little else may be seen even with a larger amateur instrument or by astrophotography.

Neptune (N) is best observed early in the month, low down in the south-west, early evening, but is not best placed for as it moves closer to the Sun from our vantage point, and will be lost to the evening twilight by early February. It can be found in the constellation of Aquarius all month, and on the 1st it will be at RA 23h 27m 34s, Declination -4° 43' 56", at a magnitude of 7.91.

Meteors

For more information about meteors, visit the article entitled 'Observing Meteor Showers' on this web site.

One of the best showers seen from the UK, the **Quadrantids (QUA)** can be seen from 1st to 6th January. The Quadrantids' associated parent body is not known for certain, however, 2003 EH1 (an asteroid) is a strong contender. The ZHR varies between 40 and 110 and is expected to be 80 or higher this year. The radiant, in northern Boötes, is circumpolar and lies towards the star Alkaid in Ursa Major, in a part of the sky that once contained a constellation called Quadrans Muralis; the Mural Quadrant! At about 40 km/s (147,600km/h), these meteors are relatively slow, but brighten just after maximum with occasional green, yellow or blue hues. This year, the Moon (just passed new) sets moments after the Sun; making for a very favourable event. You might get most joy around the evening hours of the 3rd, when it is at its peak.

Constellation Culminations from Usk

The article entitled 'Culminations of Constellations' found on this web site offers detailed information.

Taurus (Pronounced TOR-us) - The “Bull”.

In Welsh

Y Tarw (*nm*), literally ‘the Bull’, the IAU name as used in Welsh.

Astronomy

Some say that the constellation of the Bull was depicted in caves by humans tens of thousands of years ago to the extent that even the Pleiades were shown. What is certain is that Taurus the Bull, with the Scorpion and the Lion, was portrayed up to 6000 years ago in the Euphrates Valley, in ancient Sumer as one of the constellations found in the zodiac; the band of stars through which the Sun, Moon and planets pass.

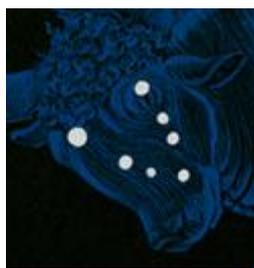
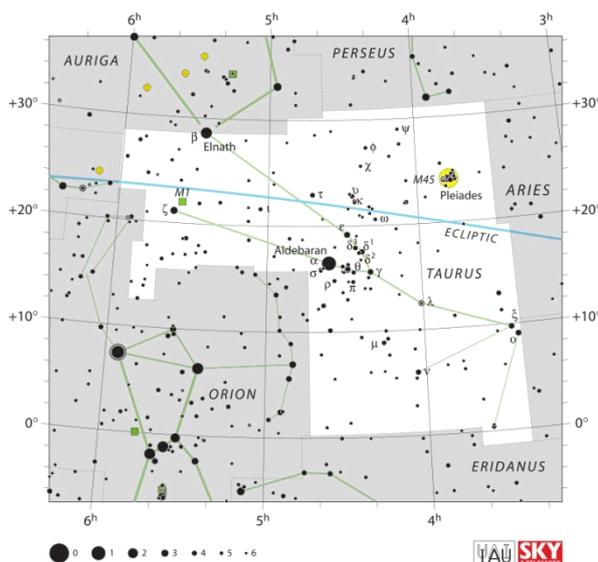


Illustration Credit & © David J Thomas 1997

The vee-shaped face of the bull is a very clear asterism and finding it should be no problem. It is due south at nine in the evening in mid-January. You can also follow the line of the belt of Orion towards the north-west and locate it just before reaching the Pleiades. The asterism is known as the Hyades. Viewing it with even modest binoculars will reveal its true nature, a wonderful open cluster; the nearest to us. Careful examination will show many easy double stars. In fact it is so packed with stars the “V” shape is lost with even very low magnification. The brightest star in Taurus; the red giant star Aldebaran, is prominent in the vee and is described as the right eye of the bull, even though its name means the ‘follower’ of the Pleiades in medieval Arabic. As an open cluster many of these stars have similar distances and are moving with similar proper motions through space.

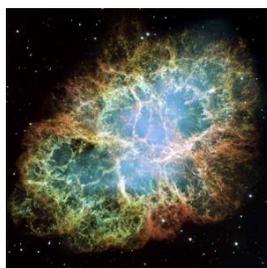
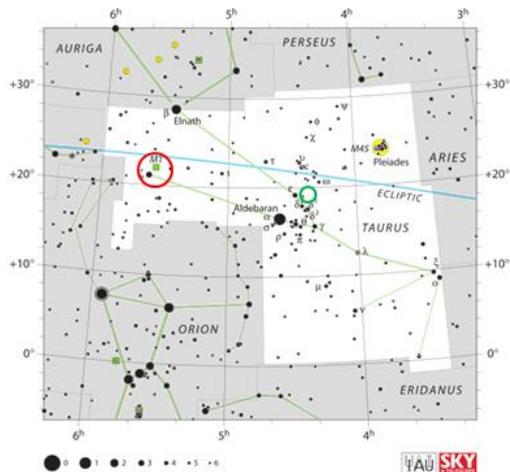


The Pleiades are another example of an open cluster and is worthy of some attention with binoculars, if you have no telescope. Although they are also known as the Seven Sisters and M45 (Messier 45), there are more than 1000 stars in this cluster which lies around 440 light-years away. The oldest of them are about 150 million years old and the slight haze that you see around the stars is a gas and dust cloud through which they are moving. The light from the nearest stars which shines away from us is reflected back towards us off this cloud which then glows producing a spectacle known as a reflection nebula. This reflection nebula is very easy to photograph if you have the kit and is a popular target, but it can also be seen in modest telescopes on good clear nights. The brighter stars appear to have a faint mist around them; many will mistake it for an eyepiece that needs cleaning. Compare the view with other bright stars away from the Pleiades and you should see the mistiness disappear (if it doesn't your eyepiece does need a clean!)



Image Credit: NASA, ESA, AURA/Caltech, Palomar Observatory

The ecliptic (the path of the Sun) passes between these clusters; within 5° or so of both, and the Moon and sometimes the planets can present a lovely photo-opportunity. A lunar occultation can be particularly satisfying to observe.



NASA/ ESA/ J. Hester and A. Loll



Illustration Credit & © David J Thomas 1997

At the end of the right horn of the Bull, in the east of Taurus is M1 (Messier 1) (O). It was here in 1054 that Chinese astronomers saw a new star, a *stella nova*. Its remnant, known as the Crab Nebula, is very hard to see even with big binoculars unless the transparency is exceptional, it has a low surface brightness and being a supernova remnant nebula (e.g. UHC or OIII) filters do not enhance it. Try searching for it with a 100mm (4”) telescope which should readily show it using low power. Find Elnath at the end of the horn; M1 is just above and to the west. It has a magnitude of 8.40. At its core lies a neutron star spinning at 30 times per second, spraying out radiation like a lighthouse; a pulsar. This is the first supernova remnant to be identified with its historic supernova explosion.

It was predicted in 1980 that a new type of supernova was possible. As of June 2021 evidence of such electron-capture supernovae was forth coming, and it is thought that M1 is of this class.

North-west of Aldebaran, next to the Bull's left eye, Ain, is a variable star called T Tauri (O) which is the prototype of a class of pre-main-sequence stars. Near T Tauri is NGC 1555, a reflection nebula known as Hind's Nebula or Hind's Variable Nebula is illuminated by T Tauri, and thus also varies in brightness.

T Tauri stars are around 100 million years old when they go through this phase, just prior to main sequence burning.

It is in this locality of Taurus and into Auriga to the north that we find the Taurus-Auriga complex, one of the nearest regions of active star formations to us.



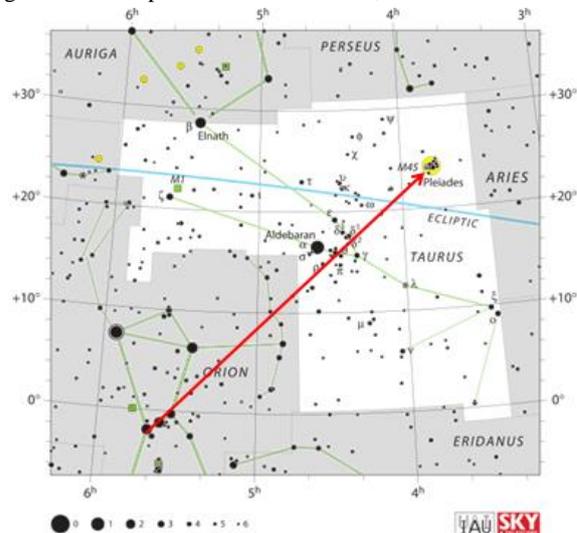
File:Ngc1555.jpg
From Wikimedia Commons,

The Pleiades (pronounced ply' uh deez) - The "Seven Sisters". The Pleiades is a magnificent example of an open cluster. **In Welsh** - Y Twr Tewdws, literally 'the Thick Group'. Y Saith Seren, literally 'the Seven Stars'. Y Saith Seren Siriol, literally 'The Seven Bright Stars', some say cheerful stars. Y Saith Chwaer, literally 'The Seven Sisters', revealing its classical origins.

Follow the line of the famous Orion's Belt north-westerly through the vee-shaped asterism in Taurus, to find the Pleiades nebula.



Image Credit: NASA, ESA, AURA/Caltech, Palomar Observatory



The name Pleiades has multiple roots. One derivation is from the Greek $\pi\lambda\epsilon\acute{\iota}\nu$ plein, meaning 'to sail', since the heliacal rising of the Pleiades in May marked the beginning of the ancient navigation season. However, the Greek pleios, or 'many', would also appear to have a strong and logical influence on the naming of this asterism, or star group. Nine of the most visible stars have a Greek name after seven ancient Greek mythical sisters and their parents. Today, the Pleiades are designated M45 in the Messier catalogue.

Although only six stars are readily visible to the naked eye, they comprise part of a relatively young, open cluster of something like a 1000 to 3000 stars situated at about 440 light-years distance from us; one of the closest to us. 25% of the cluster consists of brown dwarfs; objects not massive enough for nuclear fusion reactions to take place. Very few are likely to be born as stars as we think of them. Dominating the Pleiades are hot, blue and extremely luminous stars some of which may be up to 100 million years old and stellar radiation pressure should have dissipated the original gas and dust. If these stars were human beings, they would be middle aged.

However, long exposure photography shows large bright areas of nebulosity surrounding the brightest stars, revealing a dust cloud through which the cluster is moving; towards southern Orion. Strong radiation from these young stars repels the dust particles; large particles less than small, generating stratification and filaments. The clouds behind the stars reflect the cluster's starlight producing this beautiful blue reflection nebula, popular with amateur astronomers.

At the end of the age of the dinosaurs, the Pleiades would have looked something like the Orion Nebula does to us today. It is estimated that this cluster will endure for maybe 250 million years, before it dissipates under the influence of interstellar interactions.

Orion (Pronounced oh-RYE-un)
In Welsh *Orïon (nm)*.



Astronomy Orion is a magnificent constellation, which stands out amongst the southern stars in winter time. Finding Orion should be no problem; its stars are some of the most familiar in all the heavens and lie due south at 22:00 in mid-January. The famous Orion's Belt marks the centre of the constellation and helps us find other stars of



Photograph Credit&©: Nick Busby

interest. When Orion is orientated in this way, follow the line of the belt south-easterly to find Sirius, the brightest star in the night sky, and north-westerly to find the Pleiades nebula, a magnificent open cluster.

As well as dominating the winter sky with its size, and definition of shape, Orion has more to offer the observer than most other constellations. Observe the glorious red giant Betelgeuse, the equally brilliant blue-white giants, Rigel and Bellatrix, and the nebulous beauty of the Great Orion nebula in the sword.

Orion's bright, right shoulder is famously called Betelgeuse, one of the largest and most luminous of observable stars. Betelgeuse is frequently described as the 'Armpit of the central one'; however modern authorities suggest the name derives from the Arabic *Jad al-Jauza* meaning 'Hand of *al-Jauza*' (the Arabic name for Orion). Betelgeuse, which lies about 640 light years away, is a red supergiant with a luminosity some 100,000 times that of the Sun and a diameter 1,000 times that of the Sun.

Betelgeuse is reaching the end of its life and pulsates, both in size and brightness. Right now it is the dimmest it has been in a hundred years. Kean observers may wish to chart its brightness at this interesting time.

Another famous star in Orion is his left foot, Rigel, from *Ar-risha* meaning 'the foot'. This bright star is different to Betelgeuse as it shines blue rather than red. This is due to the surface temperature of the star, blue stars are much hotter, and Rigel is about 16,000 °K, whilst cooler Betelgeuse averages 2,700 °K. Rigel is part of a multiple star system and in a telescope of around 75 mm aperture or more it is easy to spot one of its companions 9.5" away and with a magnitude of 6.5 it is 400x dimmer than Rigel itself, but not difficult to spot.

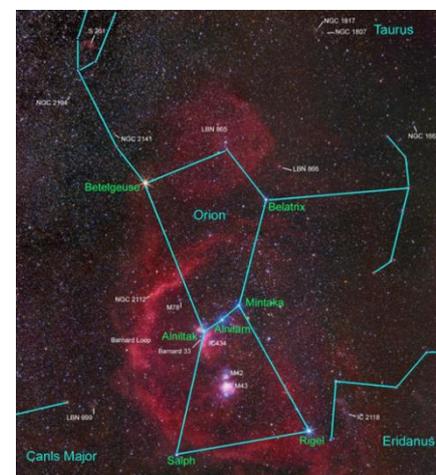
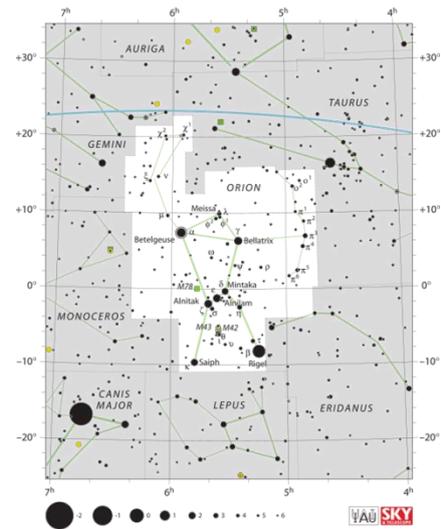
Take a look at the three stars that make up the belt, the one on the right is known as Mintaka, and the one on the left is Alnilak. Both names derive from the Arabic meaning 'the Belt'. Alnilam, the central star means 'The string of pearls'.



Photograph Credit & © Nick Busby 2017

Even with the naked eye, it can be seen that the central 'star' in the three 'stars' marking the dagger hanging from Orion's belt appears to be a fuzzy patch rather than a star. This is the Orion Nebula (M42), perhaps the most photographed deep sky object in the heavens, a vast nebula of gas and dust exquisitely lit by the internal and surrounding stars. This is a stellar maternity ward, in which more young stars will appear from this wealth of cosmic matter during the next tens of millions years. Take a pair of binoculars to this part of the sky, inside the nebula can be found a small, fascinating four-star asterism known as The Trapezium.

There are many nebulous (cloudy) regions in and around Orion. Barnard's loop, the Horse head and many other nebulae are all part of the huge molecular cloud situated in that part of the sky. Unfortunately with the exception of the Great Orion Nebula, they are all quite difficult to observe by eye. That is because the eye is not very sensitive to the wavelengths of the emitted light. However modified digital SLR (internal filters removed) cameras are very sensitive to these wavelengths and photographing the nebulae with an ordinary camera lens is easier than you might think.



Photograph Credit: © S. Guisard & R. Gendler

In larger telescopes the semi-circular Barnard's Loop and just a smidgen south of Alnitak, the Horsehead Nebula present rewarding challenges for the observer. The prominent horse-head portion of the nebula is a popular target for amateur astronomers. The Horse Head was first recorded in 1888 by Scottish astronomer Willamina Fleming on photographic plate B2312 taken at the Harvard Observatory. The Horsehead Nebula is approximately 1500 light years from Earth. It is one of the most identifiable nebulae because of the shape of its swirling cloud of dark dust and gases, which bears some resemblance to a horse's head when viewed from Earth. The Horsehead Nebula appears to be a region devoid of stars, surrounded by a distinguishing cloud of stars. However, in reality, this is a dark molecular cloud which is obscuring the starlight from the brighter nebula, IC 434, situated beyond it. It is a region within the larger Orion molecular cloud of ionised atomic hydrogen called HII regions.



*Photograph Credit &
© Nick Busby 2017*

The Great Orion Nebula was the first such HII region (pronounced "H two") discovered (1610). Such zones are important star-forming regions and can readily be seen in other active galaxies because they tend to be very large. The Horse Head, Great Orion and Running Man nebulae, to mention a few are examples of HII regions.

Associated with it and enveloping it is Barnard's Loop, which can be seen extending from the centre of the picture, around toward the bottom. Although it was named the 'Orion Loop' by E. E. Barnard, and then renamed in his honour for its discovery, it was possibly detected by William Herschel in 1786.

Positioned about 1600 light years away and stretching several hundred light years across, there are a number of speculations as to the origin of this huge bubble. It may be a supernova remnant or possibly it was formed by a series of supernova explosions. It could also have developed when a density wave, associated with the structure of the Milky Way, moved through the Galactic disk. While difficult to observe visually, it can be effectively photographed on long exposures as can be seen in the above (top) image by Nick Busby, chair of Usk Astronomical Society.

Many amateur astronomers use special ultra-high contrast filters (UHC) to enhance views of such regions. In particular they emphasises ionised oxygen (OIII) which has a greenish colour. Although intended to be screwed onto the barrel of the eyepiece they can also be held between the eyepiece and the eye and moved in and out to reveal the nebulae and are highly recommended

Incidentally, the Orionid meteor shower can be seen emanating over the eastern horizon at about 11.00 pm between 16th to 27th October.