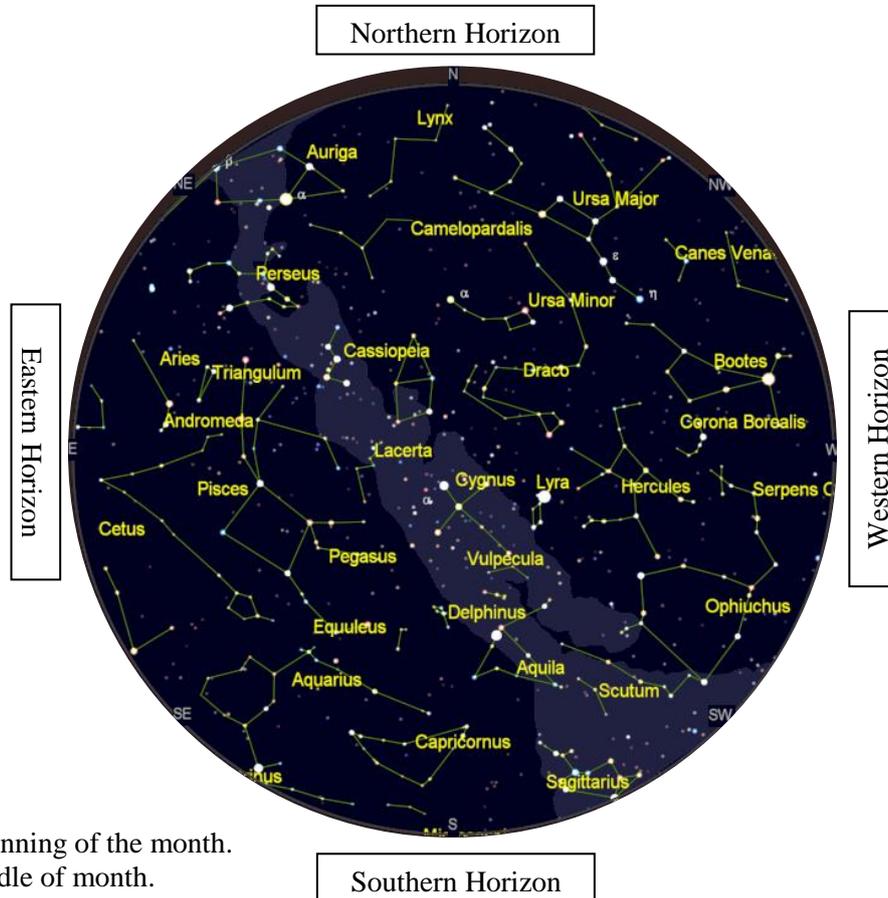




# The Night Sky (September 2020)

BST (Universal Time plus one hour) is used this month.



23:00 at beginning of the month.  
22:00 in middle of month.  
21:00 at end of month

### The General Weather Pattern

September is often mild with an average of 2° or 3° drop in temperature from August, and it can be a quiet, calm month. Any winds carried from the west by depressions usually bring to Wales a mixture of wet and windy weather with cool temperatures. At night it can be quite cool and humid, and during clear, still nights mist and dew usually present a problem. Should you be interested in obtaining detailed weather predictions for observing in this area, log on to [https://www.meteoblue.com/en/weather/forecast/seeing/usk\\_united-kingdom\\_2635052](https://www.meteoblue.com/en/weather/forecast/seeing/usk_united-kingdom_2635052)

### Earth (E)

Throughout this month, the ecliptic is at a very shallow angle of about 15° at sunset. The minimum angle will be around the Autumn Equinox which is at 13:31 on the morning of the 22<sup>nd</sup> this year. In this configuration, the angle of separation of a planet from the Sun, at sunset, translates into lower altitude, and a planet in close line-of-sight and to the east of the Sun would be harder to see; Jupiter is below 16° and Saturn is below 17° at the end of this month. The opposite is true of the dawn when the ecliptic angle is steep and a planet would be high.

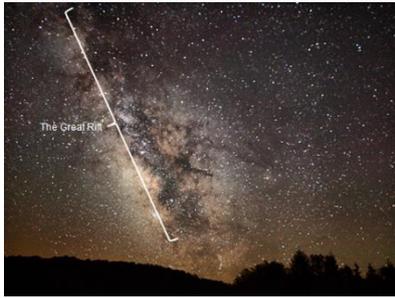
The nights are lengthening most quickly in the last two weeks of September, and thank goodness, the short, hot, bright nights of summer are nearly over! This is a comfortable time of year to observe in the evening. Unfortunately, for beginners, the evening skies in autumn are not up to the standards of winter. However, the end of the month might be a nice time to take a look at the Andromeda Galaxy. There are signs of the glories to come late evening and early morning as the winter sky looms over the eastern horizon.

### Artificial Satellites or Probes

If you are interested in observing the International Space Station or other space craft, log on to <http://www.heavens-above.com> to acquire up-to-date information for your observing site.

## The Milky Way In Welsh

Llwybr Llaethog *nm.* Modern; literally the Milky Way.



As was mentioned last year, recent research suggests that 60% of Europeans and 33% of mankind no longer see the Milky Way due to worsening light pollution. Throughout September, in the hours of darkness, the Milky Way lies within 20° of the zenith. On two occasions each night, around 23:00 and 05:00, the plane of the Milky Way can be found above you, at the zenith.

This is a wonderful time of the year to observe our Galaxy. For instance, dark regions of dust and gas which obscure light from more distant stars can be seen along the galactic plane from dark-sky locations, such as the Brecon Beacons. In September the Great Rift can be found along the plane of the Milky Way from Sagittarius in the south through Cygnus at the zenith. In this case, it is one of the

dust lanes which delineate the spiral arms of our Galaxy.

There are other nebulous regions. Historically, both unresolvable clusters of stars and galaxies were known as nebulae until, in the twentieth century, technology revealed them for what they are. In some nebulae, stars are being formed and in others there are remnants of dead or dying stars. Most nebulae on the other hand are enormous, but very tenuous clouds of gas (made up mostly of hydrogen and helium and other ionized gasses) and dust in interstellar space.

Their name is taken from the Latin for cloud or mist, and they exist in a remarkable array of shapes, colours and sizes. Most of those we see from Earth are found within our own Galaxy, consequently most can be observed along the band of the Milky Way making them some of the most magnificent and captivating objects that amateurs might observe.

Any single nebula can exhibit an assortment of different features, depending on the mechanisms which brought it into being. Here is an example for you to find in each of the five general categories; 1) dark nebulae, 2) emission nebulae, 3) reflection nebulae, 4) planetary nebulae and 5) supernova remnants.

*Dark nebulae – absorption nebulae (e.g., Horsehead Nebula in Orion)*



*Credit ESO*

A dark nebula is opaque enough to block out and absorb the light from stars deeper in space in an irregular nebulous fashion.

The Horsehead Nebula can be found just south of Alnitak, the easternmost star in Orion's Belt, and the red backdrop is an active star-forming H II region of hydrogen ionised by the light from the star Sigma Orionis. The Horsehead is only 1375 light-years away.

*Emission nebulae – (e.g., Orion Nebula – M42 in the Sword of Orion)*



*Credit: NASA, ESA, J. Hester and A. Loll (Arizona State University)*

Emission nebulae are large diffuse clouds containing ionized hydrogen which emits red light at its principal emission frequency, when hydrogen atoms lose energy. Photons at ultraviolet frequencies from hot stars within the nebula re-energize the hydrogen.

Emission nebulae are usually the sites of recent and ongoing star formation, of which M 42 is a good example of a stellar nursery, and is one of the easiest nebulae to find and observe even with binoculars; the Orion Nebula is only 1,500 light-years away. It is the middle 'star' in the sword of Orion. Also within it is an H II region, with reflection nebulae.

*Reflection nebulae (e.g., region around stars in the Pleiades)*



*Credit: NASA/ESA/AURA/Caltech*

Reflection nebulae are clouds of dust and gas which are simply reflecting the light of a nearby star or stars. They are usually blue because the scattering is more efficient for blue light. Reflection nebulae and emission nebulae are often seen together and are sometimes both referred to as diffuse nebulae and are also usually sites of star formation

The stars in the Pleiades are known as a cluster and in this case are traveling through a diffuse nebula off which the blue starlight is reflected.

### Planetary nebulae (e.g., The Ring Nebula in Lyra)

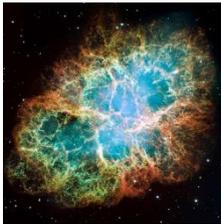


In the final stages in the life of a low-mass star it will become unstable. Shells of gas shed off the dying star in this process to produce a planetary nebula. With a huge array of variables the resultant nebulae can exhibit some of the most beautiful shapes based on a sphere.

When they were first observed, they were mistaken for planets, or stars with planets forming around them; which is what they look like in a small telescope.

Image Credit: NASA, ESA, Hubble Legacy Archive

### Supernova remnants (e.g., Crab Nebula in Taurus)



Probably the most famous of supernova remnants, M1, the Crab Nebula is the result of a massive star ending its life in a spectacular explosion as seen from Earth in 1054. At its core is a spinning neutron star spewing out radiation like a lighthouse; a pulsar. The filaments of debris in the outer regions of the nebula form a snapshot of the explosion.

Supernovae spend some days emitting as much energy as a whole galaxy. In the process, a large proportion of the star is blown away from the star and forms the supernova remnant. A typical supernova remnant is at most a few light-years across. (M1 shown)

Credit: NASA, ESA, J. Hester and A. Loll (Arizona State University)

### Sun

Sunspot and all other activity is still very low indeed, there are a few prominences, just more than one per day on average but spots are few and far between.

Mid-month on the 16<sup>th</sup> the Sun moves from Leo into Virgo. On the 22<sup>nd</sup> the Sun passes into the southern celestial hemisphere; the centre of the solar disc crosses the celestial equator at the First Point of Libra (13:31 UT). It was defined in 130 BCE by Hipparchus when it was located in the constellation of Libra. Because of precession, it has migrated into the constellation of Virgo where we find it in modern times, also known as the Autumnal Equinox. Equinox derives from the Latin *aequinoctium*; *Aequus* meaning "equal" and *nox* meaning "night". Autumnal from *autumnus* means autumn, for the Autumnal Equinox, divulging its historical origins in the Northern Hemisphere.

Some scientists have come to the conclusion that cycle 25 is already underway, but this is a new science and as yet there is no clear definition with which to compare. It is clear, however that it is imminent; sunspots positioned at higher latitudes on the face of the Sun (indicative of a new cycle) are being observed with reversed magnetic polarity (another indicator). Solar cycle 24 has been the fourth least active cycle on record. You may like to notify other society members if you observe sunspot activity and don't forget to use approved methods to observe the Sun. A good place to check out the solar activity "today" is this NASA website <https://sdo.gsfc.nasa.gov/data/>. Ask experienced members for help if you want to observe the Sun.

### Moon

The Full Moon is on 2<sup>nd</sup> at about 05:20 in the constellation of Aquarius.

The Last Quarter is on 10<sup>th</sup> at about 09:25 in the constellation of Taurus.

The New Moon is on 17<sup>th</sup> at about 11:00 in the constellation of Virgo.

The First Quarter is on 24<sup>th</sup> at about 01:55 in the constellation of Sagittarius.

The Moon is at perigee (nearest Earth) on the 18<sup>th</sup> and at apogee (most distant from Earth) on the 6<sup>th</sup>.

### The Planets from the Greek ἀστὴρ πλανήτης (astēr planētēs), meaning wandering stars

In September Jupiter, Saturn, Neptune, Mars, Uranus and Venus parade across the southern sky, and the ecliptic rises throughout each night, generally making for better observing of these planets.

♿ **Mercury (Me)** sets just half an hour after the Sun throughout September and is in the full glare of evening twilight and does not present itself for observation this month.

♀ **Venus (V)** is a morning object throughout this month, appearing in the east about 03:30, a good 2½ to 3½ hours before the twilight. Dedicated observers could still be up, but otherwise it might be a nice uplifting sight if you are back in work and on a night shift. An extra special sight might be the Beehive Cluster lying between Venus and the Moon on the morning of the 14<sup>th</sup>. Venus passes from Gemini into Cancer as it rises on the morning of the 4<sup>th</sup>, then into Leo on the 22<sup>nd</sup>.

♂ **Mars (Ma)** increases in size throughout this month as earth catches up with it on an inner orbit, and can be found in the south-eastern corner of Pisces. Mars culminates reasonably high, more than degrees higher than Jupiter or Saturn, on the same night - because it is so much further east. This will be a big benefit to observers in September/October. It is best observed later in the month of September when it is closer to opposition on the 13<sup>th</sup> October and it rises before 21:00. On

the morning of the 6<sup>th</sup> the Moon lies close to Mars. On the 10<sup>th</sup> Mars changes direction against the 'fixed stars' having reached its first stationary point and proceeds westward; in retrograde motion.

♃ **Jupiter (J)** and Saturn, at the beginning of the month first appear in the evening twilight about 15° above the southern horizon. At this time, Jupiter can be observed from roughly 20:00 until it sets around 01:00; later in the month it appears about 19:00 and sets at around 23:00. When an object is as low as Jupiter the large air mass absorbs almost half the light, not bad for visual (although the seeing is also then dodgy which is bad for visual) but for imaging you want as much light as you can get and imaging Jupiter at present from the UK is a real challenge, all the best pictures are currently coming from the southern hemisphere. It can be found in the constellation of Sagittarius throughout September, and returns to direct motion on the 13<sup>th</sup>. Most of the night, apart from the Moon, it is the most prominent celestial body, however, Saturn can be found following 8° behind. A photo-opportunity occurs in the evenings of the 25<sup>th</sup> and 26<sup>th</sup> when the waxing gibbous Moon joins the pair.

♄ **Saturn (S)** and Jupiter both culminate below 17° in the constellation of Sagittarius. By the end of the month Saturn culminates just after 20:00 and will be most conveniently placed for casual observers when it can be seen earliest. Observers may be pleased to see the open ring system through a telescope. Saturn also reaches its second stationary point on the 29<sup>th</sup>.

♅ **Uranus (U)** is best observed in the early mornings at the end of the month; it just becomes visible trailing 18° behind Mars in the east from around 22:00 on. At this time it can be found in the constellation of Aries at RA 2h 30m 36s, Declination 14° 20' 00", at a magnitude of 5.68. It rises around 19:30 at the end of the month and is becoming more convenient to observe as it moves towards opposition on 31<sup>st</sup> October.

♆ **Neptune (N)** arises in the evening twilight and should appear around 20:00. It is at opposition on the 11<sup>th</sup> September, when it can be found culminating in the constellation of Aquarius at RA 23h 21m 32s, Declination -5° 21' 18" at around 23:30. It only has a magnitude of 7.82 and may need a 150mm or greater telescope with decent magnification to even get a glimpse, but you might like to try with a good pair of binoculars on a tripod. Neptune and Uranus will be better placed later in the year.

### Meteors

September is a poor month for meteor showers, but sporadic meteors are more evident at this time of year, building up to an annual maximum in November. Sporadics are loners, not associated with any one part of the sky, entering our atmosphere from all directions and therefore they require much more patience to observe than do showers which emanate from one part of the sky.

### Constellation Culminations from Usk

Constellation	Convenient Culminations	Midnight Culminations	Observability
Lyra	24:00 Late July in twilight	Late July	Nearly at zenith
Sagittarius	23:00 Early August	Late July	Unfavourable - partially hidden
Aquila	21:00 Late September	Early August	Whole constellation
Sagitta	21:00 Late September	Early August	Whole constellation
Cygnus	20:00 Mid-October	Mid-August	Whole at zenith
Delphinus	20:00 Mid-October	Mid-August	Whole constellation
Vulpecula	20:00 Mid-October	Mid-August	Whole constellation
Equuleus	20:00 Late October	Late August	Whole constellation
Capricornus	20:00 Late October	Late August	Whole but poor; low in the murk
Microscopium	20:00 Late October	Late August	Unfavourable and partially hidden

**Cygnus** (Pronounced sig' nus) The "Swan".

#### In Welsh

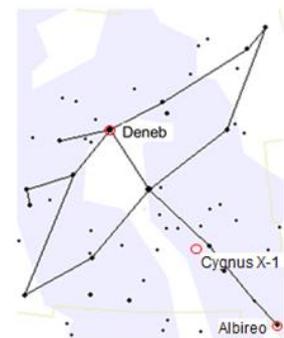
Yr Alarch *nm.* Modern; literally the Swan.

#### Astronomy

From the Latin for 'the Swan', the constellation Cygnus lies immediately above our heads in mid-September, at about 22:00 BST. Locating it is easy at this time, the asterism known as the Northern Cross lies at its core. The cross stretches from Deneb, the tail star, through the body and neck to Albireo at the head. The arms of the cross attach to Sadr, the body of the swan.

Deneb, the dimmest of the three stars that comprise the 'summer triangle', is in fact one of the most luminous of visible stars. Its distance is not known with any degree of certainty, but is of the order 2600 ly, compared to Vega at only 25 ly. It is clear how intrinsically bright it must be, with an estimated absolute magnitude of -8.38 it is approximately 60,000 to 200 000 times brighter than the Sun. It has a visible magnitude of about 1.3.

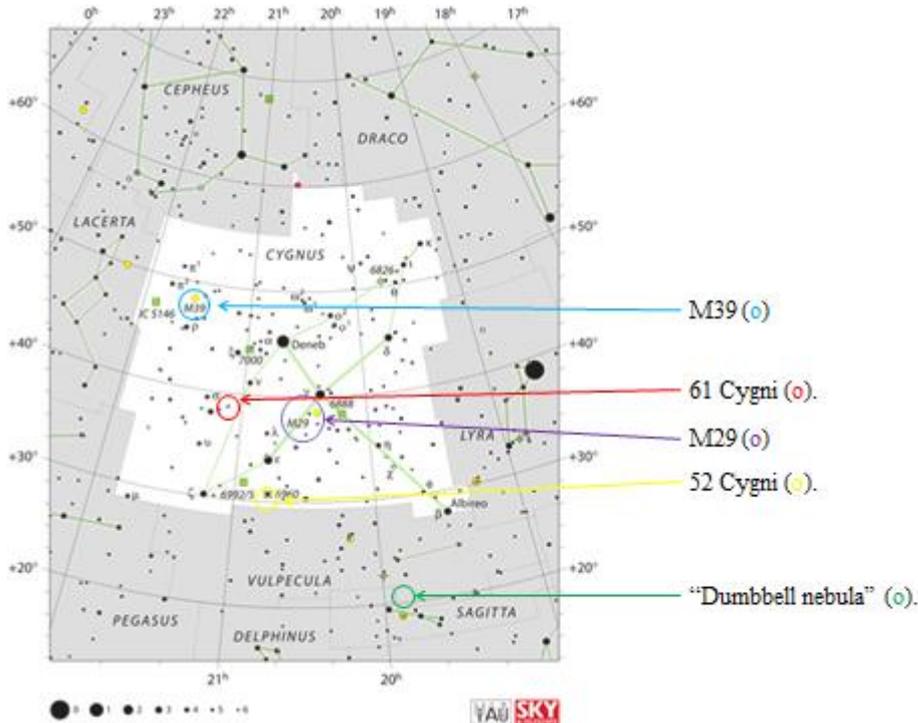
Next to Eta Cygni, in the neck, lies a blue supergiant, HDE 226868, at a distance of about 6,100 light years. It was discovered in 1964 that this region is also a source of powerful X-rays. Not only that, but HDE 226868 also wobbles under the influence of a companion with a mass some 9 to 10 times that of the Sun. There is considerable evidence that Cygnus X-1, as the hidden, compact companion is designated, is a black hole. Consequently, you may find its position, but will not be able to observe it!





Albireo in a low-power, amateur telescope

Albireo is the primary star of a magnificent double with a separation of 34 arcseconds from its companion star  $\beta$ 2 Cygni. Even a small telescope can separate them so that you can distinguish their individual gold and blue colours. Another star in Cygnus although quite dim at magnitude 5.2 has historical fame. 61 Cygni ( ) was the first star to have its distance measured by the parallax method in 1838 by Friedrich Bessel. He obtained a figure of 10.4 light years whereas the figure accepted today is 11.4 light years – Bessel had achieved a triumph of 19th century astrometry. This is the main method still used today for accurately measuring the distance to stars.



While we're in the area of Cygnus a prominent deep sky object is M27 or the "Dumbbell nebula" ( ). This is a planetary nebula. Technically it is in Vulpecula a rather insignificant constellation. It is easily visible in binoculars and very easy to find with any telescope. It looks more like a misty bow-tie rather than a dumbbell. As planetary nebulae go it is one of the easiest to observe and was in fact Charles Messier's first planetary, he discovered it in 1764. It is around 1227 light years away and is the remains of a dead star that has puffed layers of gas into space; it has a white dwarf at its centre. It is very easy to locate just above the small arrow of Sagitta.

Another popular target in Cygnus is the Veil nebula also known as NGC6992 and NGC6950. This is believed to be the remains of a star that exploded some 8000 years ago and had a mass 20x that of the Sun. It is a large object covering some 3 degrees of sky and is in a number of parts. You will need a very dark night to spot it and the use of an UHC or OIII filter helps a lot. NGC6960 is a favourite of amateur astrophotographers, it is also known as the witches' broom. It appears as twisted filaments of gas in the region of 52 Cygni ( ), which is the signpost for finding it. The Eastern Veil is possibly the easiest part to spot although it still needs a dark night but can, with care, be spotted with 50mm aperture binoculars. It appears a faint curved patch of light. With a telescope use a very low power, say 20X and preferably an OIII filter to emphasise it. On a really dark night in say the Brecon Beacons with good transparency it can be quite obvious.

M29 ( ) is an open cluster just to the east of Sadr. It can be found with binoculars or a low power telescope.

M39 ( ) is another open cluster that like many others is probably best observed with binoculars. With such objects that cover a relatively large area (about 1/2 degree for M29) it is very easy to "look through" the cluster with a telescope. Also as with many open clusters M39 and M29 are in the Milky Way and can get lost amongst all the other stars with too much magnification. There are about 11 open clusters in Cygnus in addition to many double stars and nebulae; it is a very rich constellation for observers whatever the instrument they are using.

Lines drawn between the bright stars Deneb, Vega and Altair form the Summer Triangle, a prominent formation of stars, which is known as an asterism not a constellation.

**Deneb**, in the tail of Cygnus, is a very luminous blue-white supergiant and, although there is some uncertainty, is believed to lie at a distance of about 2,600 light years.

**Vega**, in the constellation of Lyra, is 25 light years away. It was the pole star around 14000 years ago; due to the precession of the Earth.

**Altair** in Aquila is about 17 light years away. *The Summer Triangle*



## Myths

The location of Cygnus has been associated with a bird even by the Mesopotamians and to early Greeks like Eudoxus it was known as a bird or hen constellation, as it was some time later to some Arabic authors. The name Deneb derives from Arabic phrase Dhanab ad-Dajājah, which means “the tail of the hen”, Dhanab, meaning "tail".

The constellation of Cygnus, pictured by us as a swan flying along the plane of the Milky Way, comes down to us from a number of Greek myths. The most repeated, once again, involves the promiscuous god, Zeus who, you may recall, lusted after the beautiful Leda and visited her on her wedding night disguised as a swan to seduce her. Her marriage to Tyndareos was consummated the same night and as a result she bore two sets of twins. Each pair enclosed in a single, huge egg; one containing Polydeuces (later Pollux) and Clytemnestra who were Zeus's children and immortal; the other Castor and Helen (of Troy), the mortal children of Tyndareus.

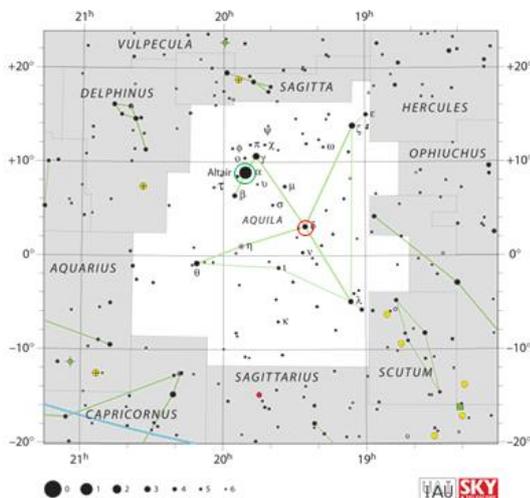
Castor and Pollux are portrayed by the twin constellation Gemini, and Zeus in the guise of a swan, is symbolised by Cygnus.

**Aquila** (pronounced uh-QUILL-uh) The “Eagle”

### In Welsh

- 1) Yr Hebog (*nm*), literally the ‘Receiving Hawk’.
- 2) Gwalchmai (*nm*), literally the ‘Hawk of May’, the name of the ‘Receiving Hawk’.

## Astronomy



Altair, the brightest star in the constellation was known to the Babylonians and Sumerians as ‘the Eagle Star’. So the historical connection for this constellation’s name is ancient. The Greeks, following the Babylonians, called this region *ἄετός* (Aetos) meaning ‘eagle’. Eudoxus mentions it in the fourth century BCE as an eagle. By the second century CE it was recorded by Ptolemy as one of 48 constellations in his treatise known today as *Almagest*. It was also known to the Romans as *Vultur volans* the ‘Flying Vulture’. Aquila is Latin for eagle, and is the one name which descended through the millennia into modern usage; it is the IAU designation for this constellation.

Aquila is best observed late in August and until the end of September when it can be found over 40° above the southern horizon at a reasonable time in the evening. The best times will be around 22:30 in August and around 20:30 in September. Jupiter and Saturn are good markers for it at this time; they are about 30° below δ Aql (○).

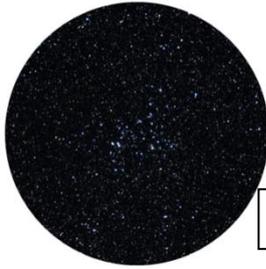
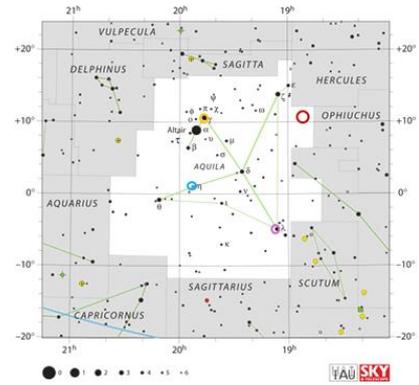
Aquila has many rich star fields, which is not surprising, as it is positioned within the band of the Milky Way.

Altair α Aql (○), is the southern-most star of the three stars that make up the asterism known as the Summer Triangle. The others are Deneb in Cygnus and Vega in Lyra. It derives its name from the Arabic *al-nasr al-tair* meaning the ‘flying Eagle’.

Altair has a magnitude of 0.75 and is the brightest star in the constellation of Aquila. At a distance of 17 light-years to the Sun it is one of the closest of visible stars. Although Altair is twice the diameter of the Sun it spins once every six and a half hours compared to the suns 24.5 days. As a consequence theory has it that it must be quite an oblate spheroid. That is it bulges significantly at its equator.

Positioned about 2° to the north-west of Altair is  $\gamma$  Aql (☉), Tarazed an easy naked-eye star. It has a mass nearly six times that of the Sun and is rushing through its life cycle. It has only taken something like 100 million years to reach its present stage; ‘burning’ helium into carbon in its core and has expanded to become a giant star 95 times the diameter of the Sun. To us 395 light-years away, it has an orange tinge. When it runs out of nuclear processes it will become a white dwarf.

$\eta$  Aql (☉) is a multiple, probably triple, star system the primary of which ( $\eta$  Aql A) is a Cepheid variable. A yellow-white supergiant at a distance of 1200 light-years, it is one of the brightest of such stars and can be observed even with the naked eye varying in magnitude from 3.5 to 4.4 over a period of 7.177 days.



NGC 6709

Over to the west of the constellation on the border with Ophiuchus one of the brightest star clusters in Aquila is located. The open cluster NGC 6709 (☉) can be found with binoculars, but is best observed with a small telescope, located at RA 18h 51m 18s, Declination 10° 19' 06".

By chance Aquila is the direction in which Pioneer 11 is moving. In about 4 million years it is likely to pass in the vicinity of  $\lambda$  Aql (☉).

Planetary nebulae are plentiful in Aquila, more than in any other constellation, however, most are very faint and merge into the haze that is the Galactic plane.

The Hercules–Corona Borealis Great Wall the largest known structure in the Universe extends into Aquila.

### Myths

#### Babylonian

Some say the Babylonian Eagle constellation in this region transported the ‘Dead Man’, another constellation, in its claws. This myth is reminiscent of later classical stories of Ganymede who was abducted by Zeus in the guise of an eagle to serve as a cup-bearer to the gods.

#### Greek

As mentioned above, but with a slight twist, in legend it was Aquila the ‘Eagle’ who was dispatched by Zeus to carry Ganymede to Olympus where he eventually became Zeus’s personal water-bearer. It is said that Ganymede was eventually placed in the sky by Zeus to become the constellation of Aquarius the ‘Water Bearer’.

Another rendition of the Aquila myths is that *Αετός Δία* (Aetos Dios) the ‘Eagle of Zeus’ it was who carried Zeus’ thunderbolts.

#### Roman

The Romans Myths about Aquila are similar to those of the Greeks. A famous Greek with Roman citizenship, Ptolemy called the star *Aetus*, which is Latin for “eagle.

#### Arabic

The name Altair the brightest star in Aquila, comes to us from the Arabic *al-nasr al-ta'ir*, which means ‘Flying Eagle’ or ‘Vulture’.