



The Night Sky (July 2021)

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

Northern Horizon



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

Southern Horizon

The General Weather Pattern

July and August have a similar range of temperature as June, usually just a smidgen warmer and on average July is typically the warmest month of the year. The weather in July is often a precursor to August. Temperatures are mostly above 10 °C at night, and when moist hot air arrives from the south humid, hazy nights result. Sultry afternoon weather may well result in thunderstorms, but on average July is one of the driest months of the year, nearly on a par with June.

Should you be interested in obtaining a detailed weather forecast for observing in the Usk area, log on to https://www.meteoblue.com/en/weather/forecast/seeing/usk_united-kingdom_2635052 (Other locations are available).

Earth (E)

Although the nights are getting longer, in the last eleven days of July, astronomical darkness is short at best; from around midnight until 2:40 on the 31st. Consequently, here in South Wales, it will be a while before we notice a difference.

Aphelion, the point at which the Earth in its orbit is farthest away from the Sun, takes place at 22:27 on the 5th July this year. Consequently the Sun is at its smallest diameter at this time of year. The word derives from the Greek *apo* meaning 'apart' or 'away from' and the Greek Sun god *Helios*.

As mentioned last month, this is the best time of year to observe noctilucent clouds.

The Milky Way in the summer

Throughout the evenings of July the centre of our Galaxy can be found in the south; in the constellation of Sagittarius. It lies above and ahead; to the west, of the spout of the asterism called the teapot. It culminates at about 10°, two-thirds of the way through July at 23:00. It is located at RA 17h 45m 40s, Declination -29° 00' 28" in the equatorial coordinate system. At 02:00 the plane of the Milky Way runs through the zenith. The dark regions through the Milky Way, such as the Great Rift in Cygnus, are galactic dust lanes hiding both stars and, at the above coordinates, the core of the Galaxy.

Sun

Each morning or evening, civil twilight takes place between when the Sun is below the horizon, and when the centre of the Sun is 6° below the horizon. Nautical twilight occurs when the centre of the Sun is between 6° and 12° below the horizon, and you've guessed it, astronomical twilight occurs when the centre of the Sun is 12° to 18° below the horizon. As mentioned in May, here in Usk in the last eight days of May, all through June and until the last eleven days in July, the Sun doesn't reach that far below the horizon at night and officially, astronomical twilight is the darkest it gets.

During the summer months at higher latitudes, astronomical twilight inhibits observations of aurorae; the night skies need to be dark and clear. Not surprisingly, as far south as Wales, observations can therefore be restricted.

Mid-month the Sun is in Gemini. Ask experienced members for help if you want to observe the Sun. You can check the level of solar activity before setting up a telescope from the following website: <https://sdo.gsfc.nasa.gov/>.

Moon

There will be two last quarters this month.

The first Last Quarter is on 1st at about 21:10 in the constellations of Cetus.

The New Moon is on 10th at about 01:15 in the constellation of Gemini.

The First Quarter is on 17th at about 10:10 in the constellation of Virgo.

The Full Moon is on 24th at about 02:37 in the constellation of Capricornus,

The second Last Quarter is on 31st at about 13:15 in the constellations of Aries and bordering Cetus.

The Moon is at perigee (nearest Earth) on the 21st and at apogee (most distant from Earth) on the 5th.

The Planets (From the Greek ἀστήρ πλανήτης (astēr planētēs), meaning wandering stars)

Mercury, Venus and Mars are accompanying the Sun and at times, observing them can be impossible or even dangerous.

Mercury is at greatest western elongation on the 4th of the month. It is only 21.6° ahead of the Sun at a shallow angle and neither well positioned nor, in my opinion, safe to observe; it rises in the glare of the morning twilight for the whole of July and moves in on the Sun so that by the 1st of August it is in superior conjunction.

Venus, an evening object, sets about 45 minutes after the Sun and can be found over in the west, just after sunset, throughout July.

Mars appears at dusk this month over the other side of the Sun and is quite small and dim; it is after all making its way to conjunction with the Sun in October. On this trajectory it passes very close to Venus on the 13th at 07:00.

Jupiter can be found in retrograde motion in the constellation of Aquarius throughout July, which renders it poorly placed low in the sky, culminating not much higher than 25° above the horizon. It is what it is, and with a magnitude of around -2.67 may be worth a look, particularly at the month's end. In about 2½ years' time when Jupiter has made more progress in its orbit around the Sun it will be found in Aries, when for a few years, it will be much better placed for observation in winter.

Saturn, in retrograde motion, precedes Jupiter by about 20° throughout July, and culminates at nearly 20°30' above the southern horizon at 03:10 on the 1st July. By the 2nd of August it will be at opposition. Observers will be pleased with the open ring system through a telescope, however like Jupiter it is low down. It can be found in Capricornus throughout July.

Uranus is best observed before morning twilight at the end of the month; when it can be found in the constellation of Aries at RA 2h 49m 8s, Declination 15° 49' 40"; in the east, at a magnitude of 5.78. Even so it is not well placed.

Neptune rises at 22:00, less than half an hour before Mars at the start of July. By the end it is one hour ahead, and is slightly better placed for dedicated observers. It culminates at the end of the month at around 03:35, at the very beginning of twilight. Found in the constellation of Aquarius at RA 23h 27m 7s, Declination -4° 44' 39"; in the south, it has a magnitude of 7.83. Neptune moves in retrograde motion too until later in the year.

Dwarf Planets

Pluto reaches opposition on the 17th in the constellation of Sagittarius. Dedicated astro-photographers may like to try to produce a few images for future comparison, but at mag 14.32 it is only a spot and being less than 16° above the horizon it requires really good equipment, say a 300 mm reflecting telescope. It can be found culminating at RA 19h 51m 28s, Declination -22° 34' 03"; due south, at midnight when it is best observed. It lies around 15° ahead of Saturn.

Meteors

The minor meteor showers the **Capricornids**, may have three maxima, each with a ZHR of around 5. These yellow-blue meteors emanate from a number of radiants in Capricornus near the 9th, 16th and 27th each year. Around maximum on the 30th of the month, a near third quarter Moon rises in the east at around 23:30 making the event unfavourable.

The **Delta Aquarids** can be seen from about 12th July to 23th August, but are not noted for their brightness. There are two radiants to this shower. The southern stream, radiating from near the star Skat in Aquarius, has a ZHR about 20 around maximum on the 31st July this year. The meteoroids have a medium atmospheric entry velocity and the Moon interferes too so this is less favourable again than the Capricornids.

You may begin observing the **Perseids** in the last week of July, but with the Moon moving through that region at that time they will best be seen between 9th and 14th August, with a ZHR of about 80₊ at maximum around 19:00 on the 12th August. Then they will be very favourable, emanating from the north of Persius. The Perseids are associated with Comet P/Swift-Tuttle.

Culmination of Constellations from Usk

The observability of constellations at this time can be found in the article called 'Culminations of Constellations'.

Hercules (Pronounced HER-kyuh-leez)

In Welsh

Ercwlff (*nm*). Of Welsh origin, literally a man's name meaning 'Hera's Glory', 'Glory of Hera' or 'Great Hera', which is also the meaning of the name Hercules.

Idris Gwar (*nm*). 'Idris the Giant'.

Idris (*nm*). One of four prominent Welsh giants.

Astronomy

Hercules is a large but indistinct constellation which lies overhead around mid-night at the end June. It can be found between Corona Borealis in the west and Lyra in the east. However, there are only two stars brighter than mag 3.0 and even the ethereal insinuation of moonlight or light pollution will render it difficult to observe. Under clear, dark skies of the Brecon Beacons the outlines implied by dimmer stars may be distinguished.

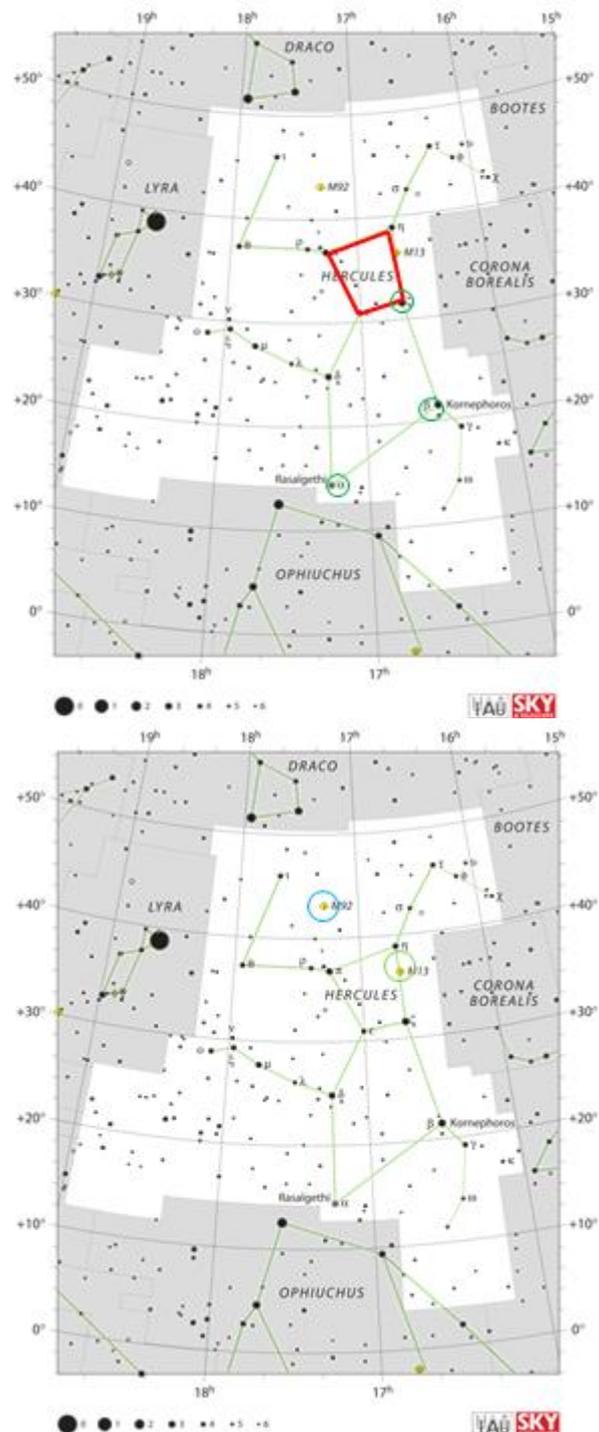
You may find the 'Keystone', a trapezium shaped asterism made by four stars. The south-western of which is Rutilicus, Zeta Herculis, ζ Her, a fine double and the second brightest star in the constellation. Follow the line down the western side of the 'Keystone' passed Rutilicus to find Kornephoros β Herculis the brightest star. Head south-eastward to α Herculis, Raselgethi. With the 'α' designation you would be expected it to be the brightest, but Raselgethi defies this convention. It is a semi-irregular variable star with a magnitude between 3.0 and 4.0 and is an interesting double, the primary of which is likely to be larger than Betelgeuse.

Raselgethi, *Ra's al-Jathi* in medieval Arabic, means 'Head of the Kneeling One'.

The constellation encompasses two vivid globular clusters: M13 , the brightest globular cluster in the northern hemisphere, and M92 , possibly the oldest globular cluster at 13.7 billion years.



M13 



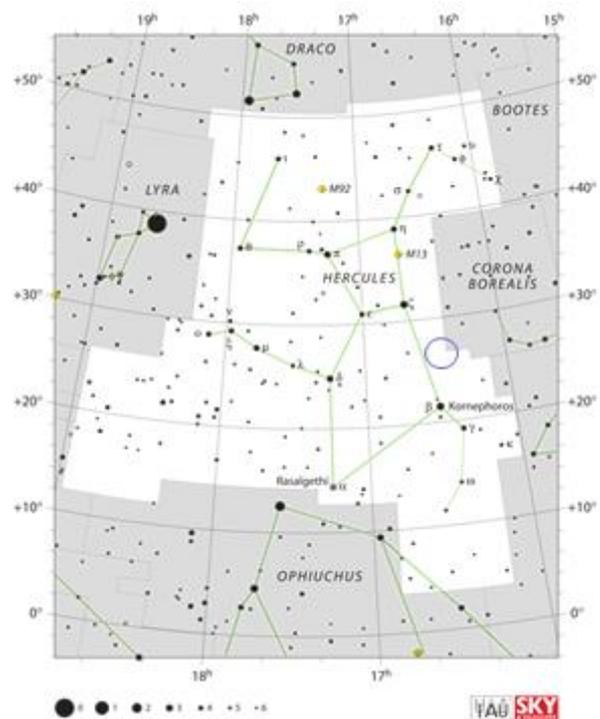
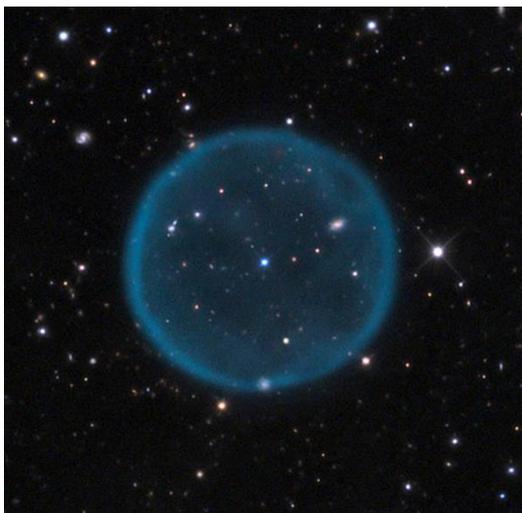
M13 can be found between the stars η Her and ζ Her, and may be detected by the naked eye in good seeing conditions. M13 is a 5.8 magnitude globular cluster which contains several hundred thousand stars. Its large diameter of about 145 light-years at 25,100 light-years distance produces an apparent diameter of some 0.23 degrees; about half the size of the moon and can be found in binoculars. A small telescope will enable discrete stars to be resolved. The cluster's evolved red and blue giant stars show up in yellowish and blue tints.



M92 is a globular cluster of magnitude 6.3, 26,700 light-years from earth. It is one of the oldest globular clusters known to us, at 13.7 billion years it is nearly as old as the Universe. In binoculars it appears to be a fuzzy star, but at its core it maintains an intense, distinct nucleus of stars, some of which can be resolved in a medium-aperture telescope.

M92 

Also within the borders of Hercules is the beautiful Abell 39 , a nearly spherical planetary nebula. It is a photographic object, you just might wish to progress to.

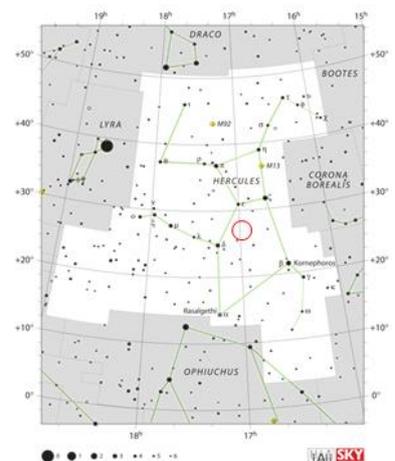


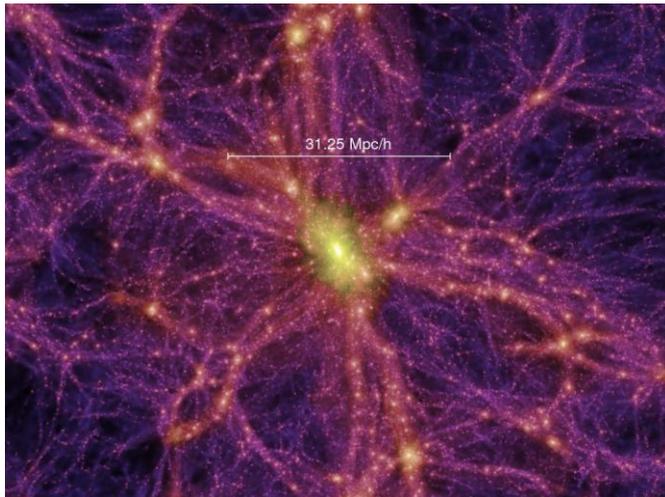
Double stars

Hercules has an impressive collection of double stars, Sissy Haas, in her excellent book “Double Stars for Small Telescopes”, lists 54. Some easy doubles to start with - κ Her is an easy wide pair 27” apart with an orange and a red star. α Her is a brilliant orange-red star almost being touched by a bluish star 4.8” away. δ Her is a “Sun yellow” star with a tiny pale blue companion 11” away.

Hercules–Corona Borealis Great Wall (rough centre)

When it was encountered in 2013, (while analysing data from the Swift Gamma-Ray Burst Mission), it became evident that an extremely large supercluster which contained many billions of galaxies and covers a huge proportion of the sky had been discovered. At ten billion light-years long and running through over 20 constellations as seen from Earth, it is the largest known structure in the observable universe. It was found in a region bordering the constellations of Hercules and Draco, but misleadingly named the **Hercules–Corona Borealis Great Wall**. In a later paper, it acquired the name the **Great GRB Wall**; the Great Gamma-Ray Burst Wall. Both names are used today.



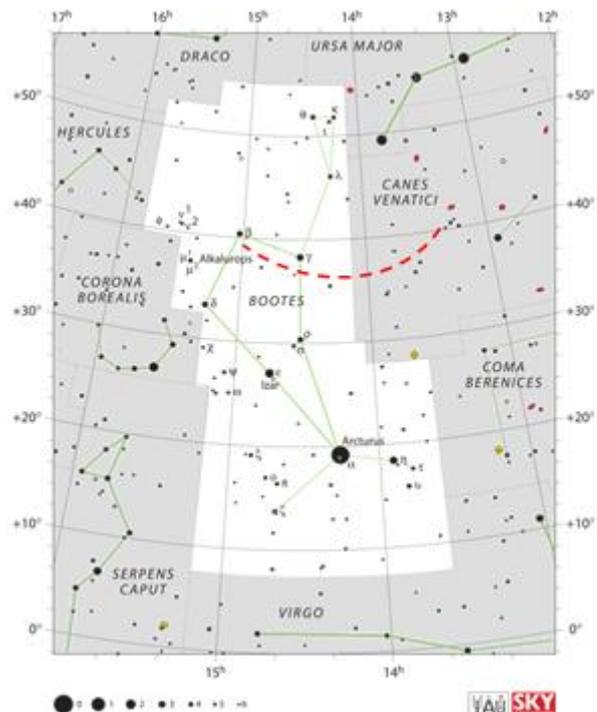
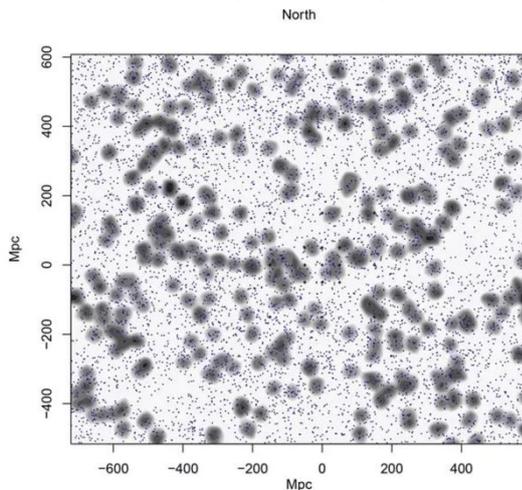


The Wall appears to be roughly cylindrical in cross-section with a major axis of 10 billion light-years and minor axis of 7 billion light-years. Because of its size and age, it has generated more questions than it has provided answers. How such a feature had enough time to evolve so quickly after the big bang is a mystery and some theoretical cosmological models have been strained by its discovery.

It may well prove to be part of a 'sheet' of innumerable superclusters of galaxies connected via nodes of intersecting strands of other superclusters of galaxies which describe the general structure of the universe. The search is on for more examples of these structures for they challenge and inform some models we have of the universe.

Incidentally, another such feature was discovered and announced this year. Known as the Giant Arc it is around 3.3 billion light-years long at a distance of 9.2 light-years, smiling down from Boötes and Canes Venatici.

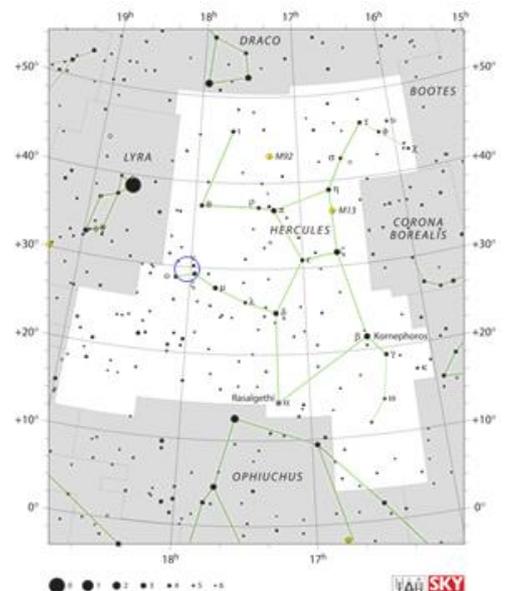
Obviously, you will not be able to observe it for yourself, but you could impress your friends if you wish.



Solar Apex **O**

The solar apex, which is located just inside the border of Hercules from Lyra, refers to the direction that the Sun travels with respect to the Local Standard of Rest.

The speed of the Sun towards the solar apex is about 20 km/s. This speed is not to be confused with the orbital speed of the Sun around the Galactic centre, which is about 220 km/s and is included in the movement of the Local Standard of Rest. Local standard of rest or LSR follows the mean motion of material in the Milky Way in the neighbourhood of the Sun. The solar antapex, the direction opposite of the solar apex, is located near the star Zeta Canis Minoris.



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Ancient Myths

The folklore concerning Hercules may very well date back to the time of the mythical Sumerian hero Gilgamesh who shared the same characteristics and is likely to be his precursor. Subsequently there is some evidence that this region of the sky is associated with a Babylonian tradition of 'Standing Gods' and 'Sitting Gods', which evolved into a kneeling character known to the early Greeks as 'On His Knees', Engonasin (Ἐγγόνασιν) 'the Kneeler'.

Greco-Roman

In early Greek myth his original given name was Alcaeus. As you may know the principal Greek god, Zeus, was a very naughty boy and it was he who was the father of Heracles. The wife of Zeus, Hera, was not his mother, but his step-mother and was not best pleased. At every turn she gave Heracles a hard time of it. At her bidding Heracles was set ten labours or tasks by his cousin King Eurystheus which for various reasons became twelve. He performed amazing heroic deeds and became known for his good works despite her bitterness towards him. In response to the hatred Hera showed him, he endeavoured to make good of his life. He became known as Herakles meaning 'Glory of Hera' or 'Great Hera' the most famous of Greek heroes not in spite of, but because of, his struggles with her.

The Roman name for Heracles is Hercules, a hero with similar myths attached to his character. And as you know our modern constellations often take the names of their Greco-Roman predecessors.

One traditional order of the Labours of Hercules is:

Slay the Nemean lion.

Slay the nine-headed Lernaean Hydra.

Capture the Ceryneian Hind.

Capture the Erymanthian Boar.

Clean the Augean stables in a single day.

Slay the Stymphalian birds.

Capture the Cretan Bull.

Steal the Mares of Diomedes.

Obtain the girdle of Hippolyta, Queen of the Amazons.

Obtain the cattle of the monster Geryon.

Steal the apples of the Hesperides.

Capture and bring back Cerberus.

It is said that on his way back to Mycenae from Iberia and having achieved his tenth labour, acquiring the cattle of Geryon, Heracles became embroiled in a battle with two giants. Heracles prayed on his knees to his father Zeus for help and so won the battle. Heracles was accordingly known as "the Kneeler", a name which echoed down the centuries. Even the star α Herculis (Raselgethi), *Ra's al-Jathi* in medieval Arabic means 'Head of the Kneeling one', rendering Hercules upside down.

Regarding the tenth labour, another Greek myth tells of Heracles's seduction by the besotted Celine in exchange for sex, she would reveal where she had hidden Geryon's cattle from him. The resultant Celtus was the progenitor of the Celtic people.

Celtic

There are four giants prominent in Welsh myths, one of whom, Idris, is said to be associated with Celtic tradition surrounding the giant Hercules. The folktale climaxes in the 7th century CE with Idris ap Gwyddno a Welsh prince commonly referred to as Idris Gwar, 'Idris the Giant', who famously sat on his chair on the mountain, Cadair Idris.

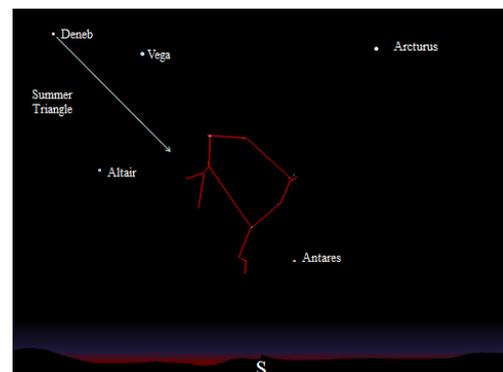
Ophiuchus (pronounced OAF-ee-YOO-kus in English and Welsh)

In Welsh

Rhian Non (*nf*), literally means 'Non of the stream'. The Welsh origin of this constellation's name is that Non is, in Welsh Christian tradition, the 6th century CE mother of Dewi Sant, the patron saint of Wales. She herself became a saint.

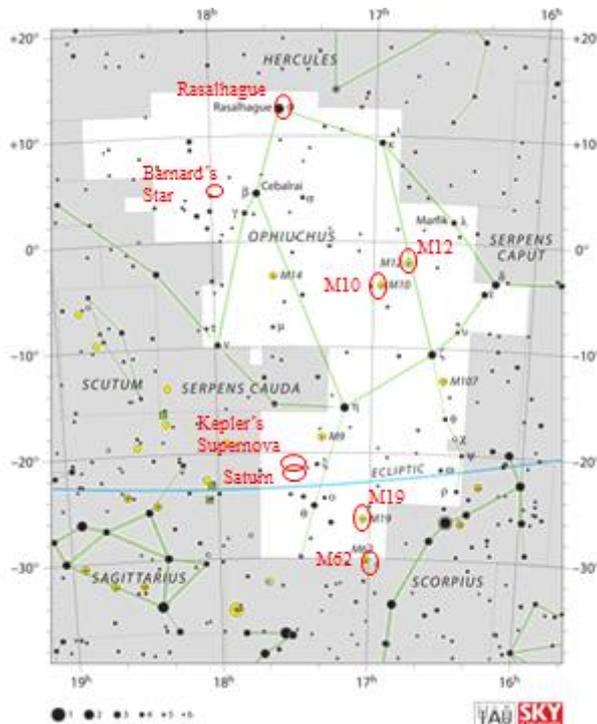
Astronomy

Ophiuchus is a large, ancient, but indistinct constellation which culminates around 23:00 at the end of June, beginning of July. It sits about 40° above the horizon, above the star Antares which is in Scorpius. Serpens lies to the east and west and intertwined with Ophiuchus making it more difficult to discern. To find it, first find the 'Summer Triangle'. Bisect the angle between Vega, Deneb and Altair and follow through towards Antares to find Ophiuchus.



The constellation of Ophiuchus has five stars brighter than mag 3.0 however; it is highest on the meridian around the summer solstice when, unfortunately, it never gets astronomically dark. Even the slightest suggestion of moonlight or light pollution will render it difficult to find. Find somewhere with clear, dark skies, like the Brecon Beacons to distinguish the dimmer stars. This year, Jupiter makes life easier for us. It lies due south of Ophiuchus, to the north - east of Antares.

The brightest star at the head of the constellation is Rasalhague (Alpha Ophiuchi shortened to α Oph), which is a binary star system at some 49 light-years distance with an apparent magnitude of +2.08. The primary, Alpha Ophiuchi A, is a giant with a mass of more than two solar masses, whilst the secondary, Alpha Ophiuchi B, is still on the main sequence and has a mass just a little bit less than our star, the Sun.



radial motions reveals a velocity of 142 km/s relative to the Sun.

Barnard's Star is a red dwarf with an apparent magnitude of 9.51 and is therefore not easy to find. However if you have a telescope up to the task, you might like to observe its position change over a year.

There are a number of globular clusters to be found in the constellation, all of which need the darkest skies you can find at this time of year. With an apparent magnitude of 6.4 for M10 and an apparent magnitude of 6.68 for M12 these globular clusters are visible through binoculars and are probably the easiest in Ophiuchus to find in a small telescope.

M10, at a distance of 14,300 light-years in the direction of the galactic centre, is about 83 light-years across with a bright core approximately half that size at 35 light-years across. This nucleus encompasses a number of blue-stragglers, most of which formed between 2 and 5 billion years ago. In terms of the abundance of elements heavier than hydrogen and helium, M10 is moderately metal poor.

M12 was also described by Charles Messier as a 'nebula without stars'. At a similar distance of 15,700 light-years, it is slightly smaller than M10 at 75 light-years across with a less dense core than M10. M12 has an apparent magnitude of 6.68 and can be found using binoculars, however resolving stars requires a 20 cm reflector. It has been found in this cluster, that low mass stars are rare, leading to a speculation that they have migrated away under gravitational interactions with the Milky Way.

M19 (NGC 6273) is a 7.2 magnitude globular cluster, just visible as a hazy dot through 50 mm binoculars. In a 25 cm reflecting telescope it can be discerned as an oval. The cluster is located 7.6° east of Antares at RA 17h 3m 41s, Declination -26° 17' 26". Near the galactic centre it is about 28,700 light-years away from Earth. It has a diameter of 140 light-years, a mass of over a million solar masses and is estimated to be nearly 12 billion years old.

M62 is at a distance of 22,500 light-years from the Sun, and is some 100 light-years across. Denser than average for a globular cluster and with most massive stars migrating inwards, it's very dense core has been a place of interest for professional astronomers for some years. The first black hole found in a Milky Way globular cluster was discovered here in 2013 and designated M62-VLA1. There are a large number, some 89, variable stars in this cluster many of which are RR Lyrae type. In addition a large number of X-ray sources, thought to be caused by binary stars and millisecond pulsars.

With an apparent magnitude of 7.39, M62 is just visible using binoculars and was described by Messier himself as a 'Very beautiful nebula, discovered in Scorpio, it resembles a little Comet, the centre is brilliant & surrounded by a faint glow'.

There are some interesting objects in Ophiuchus. In 1604 a new star, brighter than Mars or Jupiter, was observed from various places around the world, and Johannes Kepler studied it quite intensely, for which it became known as Kepler's Star, even though he was not the discoverer. Now known to be a type Ia supernova, Galileo used its temporary manifestation to dispute Aristotle's thesis that the heavens never changed. Today its remnant is at RA 17h 30m 42s, Declination -21° 29' 35" (within half a degree north of Saturn on the 1st of the month this year). No further supernovae have since been observed with certainty in the Milky Way.

Another object of distinction is Munich 15040, Barnard's Star, found at RA 17h 58m 40s, Declination 4° 44' 35" at this time, is 5.94 light-years away. Our three nearest stars are in the Alpha Centauri system, so this is our fourth nearest star. Its close proximity means that we can measure its movement, 10.3 seconds of arc per year, against the background of 'fixed stars'. Commonly named after Edward Emerson Barnard who measured its motion in 1916, it still has the largest measured proper motion. A hundred years later on the 1st February 2017, the International Astronomical Union officially approved the name Barnard's Star.

Barnard's Star has a blue shift signifying that it is moving in our general direction at 110 km/s. Combining the lateral and

Bear in mind that instruments of the time were more limited than today's when it is visible in binoculars. Unfortunately, it is positioned towards the stellar rich regions of the Milky Way nucleus rendering it easy to overlook.

There are thirteen constellations through which the Sun passes each year. The Sun takes nearly three times longer to travel through the constellation of Ophiuchus as through its neighbour constellation, Scorpius, highlighting the arbitrary nature of the zodiac zones. The boundaries of modern constellations were defined in 1930 by the International Astronomical Union (IAU) based on regions of the sky developed from ancient tradition. For instance, around 3000 BCE Mesopotamian writings on clay tablets began to tell of early constellations, with most developing between 1300 to 1000 BCE. The classical Zodiac evolved around 800 BCE from earlier traditions. Some of you may have noted that at the time of Messier, M62 was regarded by him as in the constellation which is now called Scorpius.

Double stars

Ophiuchus has a good selection of double stars and Sissy Haas lists 33 of them. Some of the more notable ones are as follows. ρ Oph is a close (2.9") pair of amber stars of about magnitude 5. They will need a reasonably high magnification (>120) and at least 75mm of aperture to see well. λ Oph is a pair of yellow stars almost touching. They are only separated by 1.6" so again high magnification is called for. With such close doubles good seeing is usually required and also telescopes with a relatively high f ratio, say f10, work well. Long focal length refractors are particularly good as they have good contrast and will often be able to split close doubles with a much smaller aperture than would be required with say a fast reflecting telescope. A wider pair can be seen in δ Oph, which are a pair of bright (mag 6) stars 20.6" apart and next to γ Oph. δ Oph is a lemon yellow star (mag 4) with a much dimmer white companion (mag 8.1) 54" away.

Myths

Mesopotamia

There is some evidence that this region of the sky was associated with a Babylonian 'Sitting Gods' constellation, which may have represented a serpent-god, Nira, with a human torso and serpents for legs.

Greek

It appears from Aratus's (of Soli) poem on astronomy, that Eudoxus of Cnidus mentioned Ophiuchus by name in the 4th century BCE, describing his struggle with the Serpent as he stands on the Scorpion.

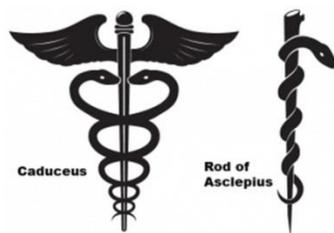
To the early Greeks the constellation symbolized Apollo guarding the Oracle of Delphi; wrestling a huge snake.

Greco-Roman

A myth with which he is usually associated is that he was Asclepius (Greek Asklepios, Latin Aesculapius) 'the healer', son of Apollo and Coronis. When Coronis was found to be unfaithful to Apollo he shot her with an arrow and cut the unborn Asclepius out of her womb as she lay on her funeral pyre. He was given to the wise centaur Chiron, who treated him as a son and taught him many things including the art of healing in which Asclepius became so proficient he could even resurrect the dead.

Hades was not best pleased at this threat to his underworld, and asked his brother, Zeus, to intervene. You've guessed it; Zeus cast a thunderbolt and killed Asclepius. However Zeus rewarded Asclepius for his goodness and avoided any feud with Hades and Apollo by placing him in the sky, and to this day the symbol of the staff and serpent of Asclepius represent medicine.

Ophiuchus gets his name from the Greek Ὀφιοῦχος *Ophioukhos* meaning 'Serpent-bearer'.



The symbol of a single serpent winding around the 'Rod of Asclepius' (without wings) represents medicine.

Two serpents winding around a staff, which may have two wings, is the Caduceus a symbol of Hermes, which is often mistaken for the 'Rod of Asclepius'.



Statue of Asclepius

The Museum of Epidaurus Theatre.

Photograph by Michael F. Mehnert

Medieval Islamic Astronomy

The constellation was known as Al-Hawwa 'The Snake-charmer', in Azophi's Uranometry (10th Cent.).

The brightest star at the head of the constellation is Rasalhague, which derives its name from the medieval Arabic ra'is al-ḥawwā meaning 'Head of the Snake-charmer'.