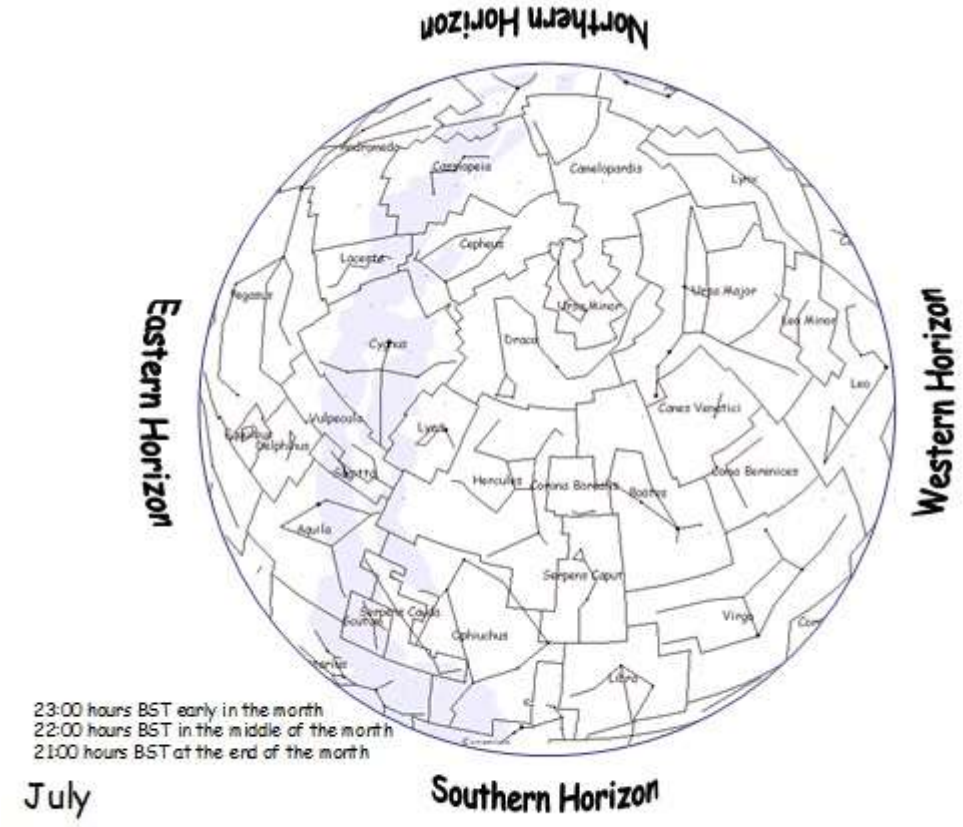
The Night Sky (July 2018)

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



The General Weather Pattern

July is usually the warmest month of the summer, but it is also often the wettest. Temperatures are usually above 10 ºC at night, and when moist hot air arrives from the south humid, hazy nights result. Sultry afternoon weather may well result in thunderstorms.

From Earth

Although the nights are getting longer, astronomical darkness is short at best in the last ten days of July, here in South Wales, and 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 in the early evening of the 6th July this year. Consequently we see it at its smallest diameter at this time of year.

The word stems from the Greek *apo* meaning 'apart' and the Greek Sun god *Helios*.

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 east, 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 -29º 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

Mid-month the Sun is in Gemini. Nautical twilight exists when the centre of the Sun is between the horizon and 12º below the horizon. Astronomical twilight ends or begins when the centre of the Sun reaches 18º below the horizon. In the last ten days of May, all through June and until the last ten days in July, the Sun doesn't reach that far and officially, astronomical twilight lasts all night at the latitude of Usk. Astronomical twilight still lasts for some time, but astronomical darkness will begin in the late

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evening rather than the early morning. Consequently, the noctilucent cloud season, high in the Earth's atmosphere, finishes at the end of July or the beginning of the August.
Also, during the summer months at higher latitudes, the midnight sun inhibits observations of aurorae; the night skies need to be dark and clear. Even as far south as Wales, observations are restricted.
Please inform other members if you hear of any solar activity in July. Solar cycle 24is coming to an end the Sun is headed towards solar minimum, expected to be later this year or early next year (with much uncertainty). Ask experienced members for help if you want to observe the Sun.

Moon

There is a lovely photo opportunity as the moon rises in the full shadow (umbra) of the Earth on the 27th.
The Last Quarter is on 6th at about 07:50 in the constellation of Cetus.
The New Moon is on 13th at about 02:50 in the constellation of Cancer.
The First Quarter is on 19th at about 19:55 in the constellation of Virgo.
The Full Moon on 27th at about 20:20 in the constellation of Sagittarius will be fully eclipsed.
The Moon is at perigee (nearest Earth) on the 13th and at apogee (most distant from Earth) on the 27th.

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


Mercury progresses towards greatest eastern elongation on the 12th, and it is best observed the week before. Unfortunately the ecliptic angle at sunset reduces throughout the month of July. The planet is only just above the shallow ecliptic and as a result, when it just about appears in the evening twilight, it is only about 3° above the horizon at its best; not a favourable position. By the middle of the month Mercury sets in the glare of the Sun.


Venus appears in the west at sunset throughout July, and will become brighter as it moves closer to Earth on its inner orbit. A thin crescent moon sets with Venus on the evening of the 15th. Beware of the Sun, if you are tempted to observe.


Mars reaches opposition on 27th July and is closest to Earth a few days later. It travels in retrograde motion at this time, just 7° south of the ecliptic, only 13° above the horizon. Oppositions at this time of year are poorly placed low down; however, photo opportunities present themselves when a waning gibbous (near-full) Moon accompanies Mars in the early hours of the 1st, and a near-full Moon lies adjacent to Mars on the night of the 27th / 28th.


Jupiter can still be found in the constellation of Libra throughout July. Like Mars it also travels in retrograde motion until it reaches its second stationary point on the 11th and its recent opposition at this time of year also renders it poorly placed. It is, however, what it is and it will only get worse as the year wears on so take a look while you can. At the end of the month Jupiter first appears in the evening twilight about 14° above the south-western horizon. In the evening twilight on the 20th Jupiter is accompanied by the Moon just past first quarter for a photo-opportunity in July.


Saturn culminates at less than 16° above the southern horizon at midnight, in the mid-July, and is still progressing westward, in retrograde motion, against the background of 'fixed stars'. For casual observers, Saturn will be most conveniently placed at the end of the month and observers will be pleased with the open ring system through a telescope. It can be found in northern Sagittarius throughout July and is accompanied by the Moon in the night of the 24th / 25th.


Uranus is best observed at the end of the month; in the east at around 04:00. At this time it can be found in the constellation of Aries at RA 2h 02m 10s, Declination 11º 50' 39"; in the south-east, at a magnitude of 5.79.


Neptune rises over an hour before Uranus and is slightly better placed for dedicated observers. It culminates at the end of the month at around 03:45, and can be found in the constellation of Aquarius at RA 23h 10m 05s, Declination -6º 25' 19"; in the south. It has a magnitude of 7.83. Neptune moves in retrograde motion until the end of November.

Dwarf Planets

Pluto is at opposition on the 12th in the constellation of Sagittarius. Dedicated astro-photographers may like to try to produce a few images for future comparison, but at mag 14.2 it is only a spot and being low in the sky it requires really good equipment, say a 300 mm telescope.
It can be found at RA 19h 26m 35s, Declination -21º 46' 35"; in the south-south-east at 01:15 on the 12th.

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. The earlier ones are most favourable this year, but later in the month the Moon will grossly inhibit observations.
The **Delta Aquarids** can be seen from about 15th July to 20th 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 maximum around about 29th July. The ZHR is about 20 with a medium atmospheric entry velocity.
You may begin observing the **Perseids** in the last week of July, but they can best be seen between 9th and 14th August, with a ZHR of about 75. The max on the 13th is very favourable this year, emanating from the north of Persius. The Perseids are associated with Comet P/Swift-Tuttle.

Constellation Culminations from Usk

A celestial body or region of the sky is said to culminate when it crosses an observer's meridian (an imaginary line drawn overhead and through both poles). All other things being equal it is usually best observed in this position as the light from it travels through the least amount of atmosphere.

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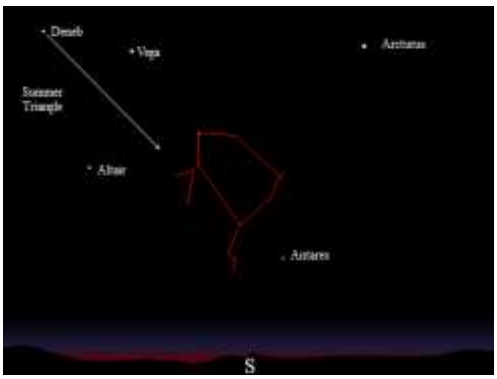
Constellation	Convenient Culminations	Midnight Culminations	Observability
Scorpius	24:00 Late June in twilight	Late June	Unfavourable - partially hidden
Ophiuchus	24:00 Early July in twilight	Late June /Early July	Whole constellation
Serpens (Cauda)*	24:00 Mid-July in twilight	Mid-July	Whole constellation
Scutum	24:00 Late July in twilight	Late July	Whole constellation
Lyra	24:00 Late July in twilight	Late July	Nearly at zenith
Sagittarius	23:00 Early August	Late July	Unfavourable - partially hidden

*Serpens is a divided constellation which occupies regions either side of Ophiuchus. The eastern area was traditionally known as Serpens Cauda meaning 'serpent's body' and the western zone was Serpens Caput meaning 'serpent's head'.

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

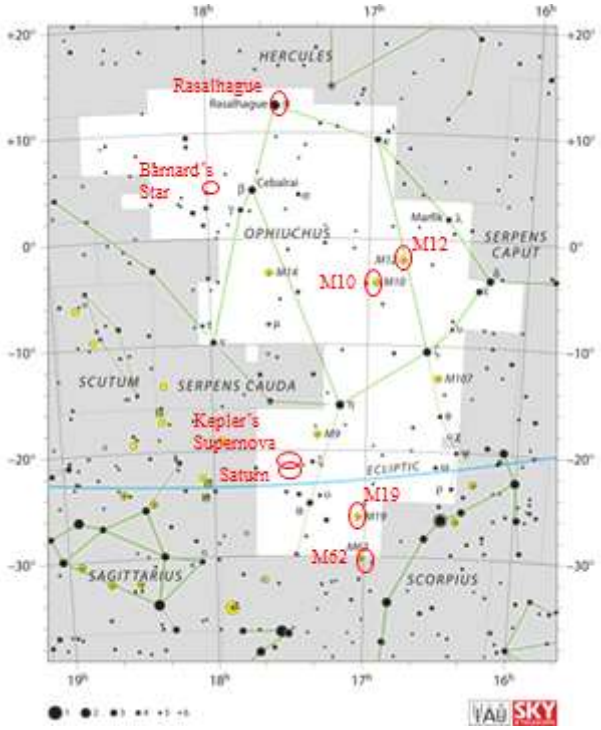
Astronomy



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, Saturn makes life easier for us. It lies due south of Ophiuchus, to the east of Antares. On the 7th the Moon sits next to Saturn too, offering more guidance to find this constellation, but also more extraneous light.

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.



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 1a 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 -21º 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 4º 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 is moving in our general direction at 110 km/s. Combining the lateral and 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.

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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 -26º 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'. 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.

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

Statue of Asclepius
The Museum of Epidaurus Theatre.
Photograph by Michael F. Mehnert

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Hermes, which is often mistaken for the ‘Rod of Asclepius’.

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 raʾis al-ḥawwā meaning ‘Head of the Snake-charmer’.

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