Autumn 2021 Number 33

Kielder Observatory Newsletter

EDITORIAL

The dark evenings are with us again, so now is a great time to go out and enjoy the night sky. Next month should see the eagerly anticipated launch of Hubble's successor, the James Webb Space Telescope. Fingers crossed that all goes well! Meanwhile, at Kielder, our own slightly less ambitious radio telescope has just been installed and we are looking forward to seeing it in action. In this edition Robert takes a look at the constellation of Orion, and examines the nearest stars to our Sun.

For information: we are changing how we handle our newsletters. For our monthly emails, we currently use a mail system that allows people to unsubscribe at any time, in line with data protection regulations. This quarterly newsletter list will be migrated over to that system in the near future. You will get a separate email asking you to confirm you are happy with this.

Nigel Metcalfe

Editors: Nigel Metcalfe & Robert Williams

Kielder Observatory Astronomical Society

Registered Charity No: 1153570.

Kielder Observatory Astronomical Society is a Charitable Incorporated Organisation. Its aims are to

* Promote interest in the science of astronomy to the general public
* Facilitate education of members of the public in the science of astronomy
* Maintain an astronomical observatory in Kielder Forest to support the above aims

https://kielderobservatory.org

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KIELDER OBSERVATORY
Infinite Inspiration

Front cover: The Tanlaw Foundation radio telescope.
Rear cover: Stargazing - Dan Monk.

In addition to some darker evenings, October also brought the first opportunity for the board to meet together in person since before the pandemic. Sadly, we had to use this opportunity to bid farewell to one of our trustees, Tim Care, whose other commitments have compelled him to stand down from the board. Although perhaps less visible to many of you than some of our trustees, Tim has devoted considerable time and energy to KOAS over the past four years and his significant contribution behind the scenes has been greatly appreciated. We will miss his wise counsel in our board discussions and wish him every success in the future.

We are, however, pleased to welcome Bill Macleod as a new trustee with effect from 1st November. Bill is from Scotland. He loves the outdoors and, while walking and camping throughout Scotland, he's been lucky enough to marvel at the Northern Lights, shooting stars and magical skies full of stars on clear Highland nights.

Bill is also a Chartered Accountant who was a partner at PricewaterhouseCoopers LLP for 25 years. During this time he served as Senior Partner of the Newcastle office, a member of PwC's national Supervisory Board and as the firm's Ethics Partner with oversight of professional ethics and conduct.

Bill has chaired the International Advisory Board at Newcastle University Business School since 2015 and joined the Council of Newcastle University in 2020. He is also a Non-Executive Director at both the Newcastle upon Tyne Hospitals Trust and NewcastleGateshead Initiative, and a member of the Ethics Board of the Institute of Chartered Accountants of Scotland.

Peter Standfield
KOAS Chairman

OBSERVATORY NEWS

Despite the clouds, the beginning of November has seen some great displays of the Northern Lights. This was taken from the Observatory on November 3rd.

As I write this at the beginning of November, despite allowing some modest increase in our capacity since the last newsletter, we are almost sold out until January (which is also selling fast!). Whilst this is good news for us in our attempts to recover from the Covid lockdowns, it does mean you have to plan well in advance to get your tickets. However, we do get last minute cancellations, and these are always offered on our Facebook page, so it is worth keeping an eye out if have some flexibility in your dates.

There have been a couple of science team changes since the last newsletter. We have welcomed another new member of the team: Gregoire Mahaut. Gregoire hails from France and has had a very interesting career in aerospace and engineering before joining the astronomers at Kielder Observatory. We also hope shortly to be appointing an Operations & Marketing Director. Meanwhile, Natasha Lund, who joined us in 2018, has left us for pastures new.

STOP PRESS: our new radio telescope has now been installed! Construction took place in the first week of November and

the SPIDER 500 radio dish is now adorning the Observatory site. There's a way to go in terms of commissioning but having received it just before lockdown, we can't quite believe that it has finally been installed. Look out for "how to" guides coming this winter - everyone will be able to access the telescope in line with the ethos of the donor, the Tanlaw Foundation.
Visitors to the Observatory will have noticed another mysterious addition to the site - all will be revealed...

We had the great privilege of welcoming the Aldrin Family Foundation to the Observatory to explore potential partnerships. It was such a treat to listen to a different perspective of Buzz Aldrin from his own family.

The Aldrin Family Foundation team at the Observatory.

Talking about space to Appletree Gardens First School Year 4 pupils at Monkseaton Middle School.

We are delighted to be back in schools, courtesy of funding from the North of Tyne Combined Authority. Look out for us all over the NTCA area over the coming eight months or so.

We have designed a lesson plan for independent learning all about the moon. This was inspired by our visit to the Museum of the Moon exhibition at Durham Cathedral, the luminous and inspiring artwork that brings us so close to our

OBSERVATORY NEWS

nearest neighbour. The plan is free to access and suitable for all ages - give it a go and let us know how you get on! You can download the plan for free from https://kielderobservatory.org/the-observatory/museum-of-the-moon

Plans are afoot for a spectacular Dark Skies Dance Performance at Kielder next summer, so keep an eye open for the details of that. You can find more information at https://kielderobservatory.org/news/latest-news/214-kielder-outdoor-event

Our podcasts are still proving popular. Our lastest release, on October 7th, is by Dr Natalie Starkey on "Volcanoes of the Solar System". Natalie is the SEPnet Outreach and Public Engagement Officer at the Open University, and writes freelance articles for popular science magazines. She has a PhD studying arctic volcanoes, and has analysed numerous samples of comets and asteroids from NASA and ESA missions. https://podfollow.com/kielderobs/view

On September 30th, our Director of Astronomy, Dan Pye, chatted to Julia Bradbury for ITV's "This Morning" programme about the importance of dark skies and our stunning location in the heart of Kielder Forest and Water Park. Meanwhile, Science Communicator Naz Jahanshahi has written a great piece for the October 2021 edition of The Environment magazine for their Youth Takeover and it's been selected as their cover story. Naz describes her journey to become an astronomy science communicator and the importance of experiencing dark skies for understanding our place in the world.

We even got a brief mention in The Sun last month as a good place to go in autumn!

OBSERVATORY NEWS

Our CEO, Catherine Johns, and Science Communicator Adam Shore contributed some "postcards to our younger selves" as part of the resources for the Durham Book Festival Little Read which this year featured "Look Up!", a picture book which encourages young children to look up at the stars.

We ran a successful open day for prospective new volunteers in October. We do run these from time to time, so if you missed out and fancy helping out, keep an eye open for the next one. They will be advertised on our website.

Hot off the press, a new four-part Channel 5 TV series about Kielder forest will be starting at 7pm on November 16th, and will be featuring the Observatory.

Finally, Christmas is on the way and we have our packs of cards (6 cards with 2 designs) on sale in our gift shop, and our 2022 calendar is due in any day, along with special Christmas gift sets and new mounted prints.

KIELDER OBSERVATORY
Infinite Inspiration

Not been to Kielder Observatory yet?
Then why not book one of our events for you or your family?
Advanced booking is essential. Weekend events can fill up several weeks in advance. Please book online at https://www.kielderobservatory.org/our-events/.
We can also be contacted at admin@kielderobservatory.org

SCIENCE SLOT

Our Neighbourhood of Stars

Every astronomer has their own liking of one type of astronomical object, whether that be the Moon, the Sun, the brighter – or indeed fainter – Planets, Asteroids, Comets, Shooting stars, minor-Planets, the Aurora Borealis, star groups, clusters, nebulae, constellations, galaxies or Supernovae – have I missed anything/any group? Quite probably. There is a lot to choose from out there and no matter what equipment you may have – in fact for some you do not need any equipment at all – you can enjoy many years or decades of observing and you may not need to observe the same object twice – unless you want to of course. With good clear, moonless and light-pollution free skies you can often pick any object from any of the above mentioned groups on any night of the year to observe.

Let's though look at the Sun's neighbourhood:

The Sun is a G8 class sub-dwarf star – one of the most common types of stars in our Galaxy – the Milky Way.

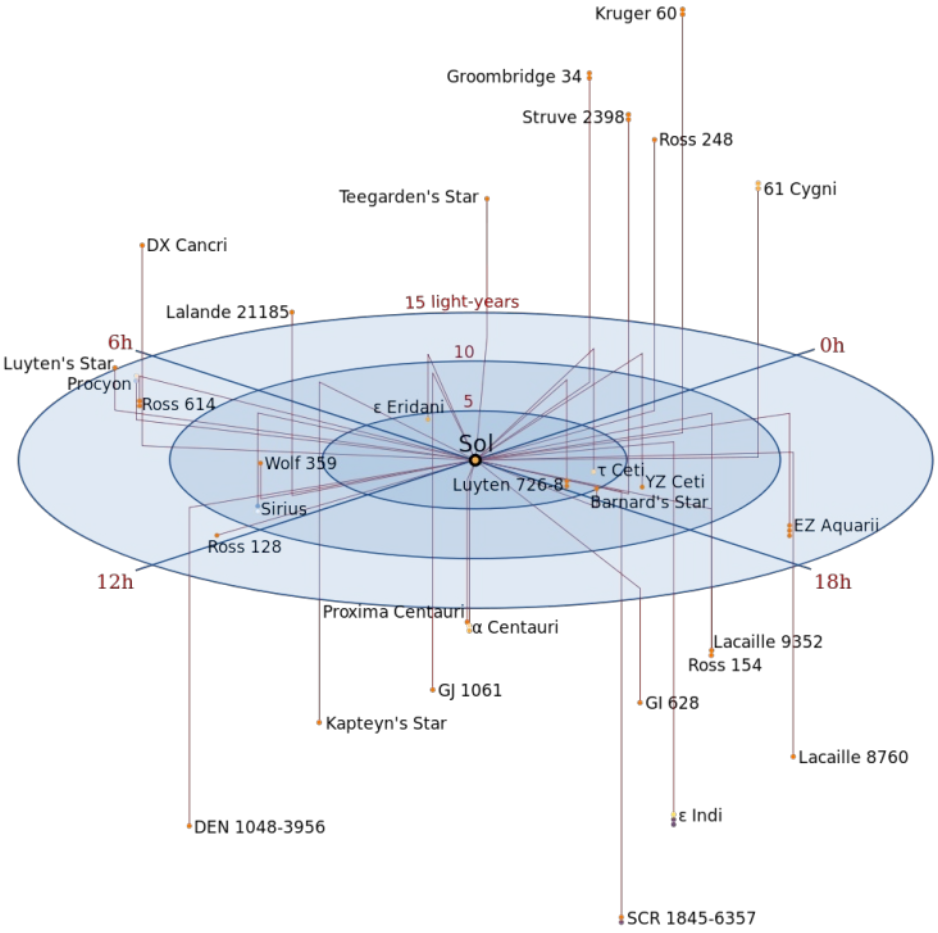
Beyond the Sun there are abut 30 stars within a distance of 13 light-years (ly). Some of these are moderately interesting:

The Sun's closest neighbouring star is Proxima Centauri, at a distance of 4.3 ly. It is a very dim star of spectral class M5e – a red dwarf star (the 'e' signifies emission lines). It shines with an apparent magnitude of +10.7, making it about 10,000x fainter than Sirius – the brightest star we can see in the northern hemisphere – more about Sirius to come later. Proxima Centauri has an absolute magnitude of 15.1 – again making it about 10,000x fainter than our Sun. This is because it is both small, cool, very red and slowly fading away – over perhaps a trillion years or more, so it is very much in its infancy.

Late Night Dark Skies - October 2021

"All the people we met were warm, well informed and patient in explaining the complexities of astronomy to those who have little knowledge! Great experience in the middle of the night. Excellent presentations, hot chocolate and opportunity to use the telescopes as the skies cleared miraculously!"

Pip, Macclesfield



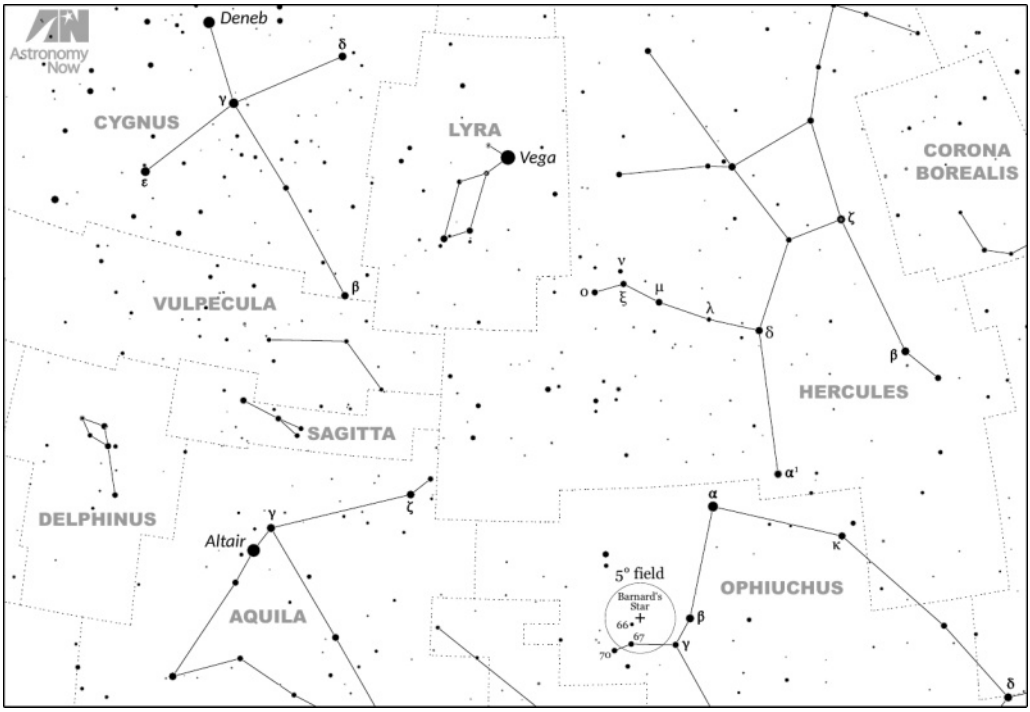
A 3D representation of every star within 14 light-years of the Sun - source: Wikimedia Commons

We cannot see it from the UK and its southerly declination (-62°) means that it can only be observed from south of latitude +28°.

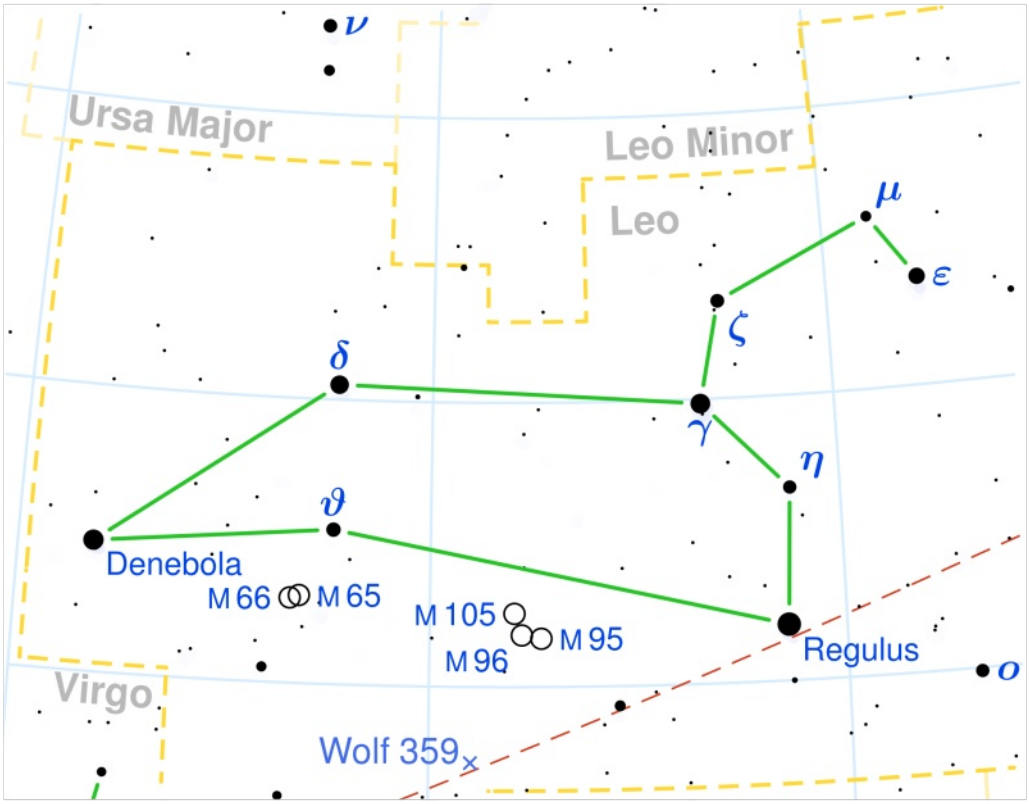
Next comes Alpha Centauri. Another southern hemisphere star not visible from the UK. This star is actually a binary star, with components A and B. Star A is a G4 class star, slightly hotter than our Sun. In fact with an apparent magnitude of 0 and an absolute magnitude of 4.4 it is very much like our Sun – a yellow sub-dwarf. Star B is a K5 subdwarf – much cooler than our Sun and about 3x fainter.

Next comes Barnard's Star [RA17^{h}57.4^{m}, Dec +04^{d}41^{m}]. It lies in the constellation of Ophiuchus, so is not well placed to view from the UK. It is though viewable low in the west after sunset in September. Its claim to fame is that it has a high proper motion [motion relative to other stars in the same direction of view] at a little over 10 arc minutes per year relative to the Sun. This star is an M5 class – red dwarf – at 5.8 ly and with an apparent magnitude of 9.5 and an absolute magnitude of 13.2. So it is best seen in a 150mm class telescope.

No.5 on the list is Wolf 359. This is the 359th star in the catalogue of Max Wolf. Like E.E.Barnard, he used photography to catalogue the objects in the night sky. His catalogue of 1500 stars was published in 1919. The key trait of these stars is low luminosity, cool temperature [red dwarf] and high proper motion.



Finding chart for Barnard's Star, currently in Ophuichus, and quite low in the south from Kielder.



Finding chart for Wolf 359. The star lies in the constellation of Leo, and is best seen in the spring.

No.6 is Lalande 21185. Lalande was a very famous star cataloguer of the 19th century. Another M-class red dwarf with about 0.5 $M_{\odot}$, there have been claims of an orbiting planet around this star and indeed modern observations suggest there may be more than one in orbit around Lalande 21185. The star is located at coordinates RA $11^{h}03^{m}20^{s}$, Dec $+35^{d}58^{m}11.6^{s}$ – in the constellation of Ursa Major to the north east of Allula Borealis, in the 'ankle' of the Great Bear's back leg. Moving on we come to Stars 7 and 8 – Sirius and the Pup. Alpha Canis Major is an A0 class stars – somewhat hotter and intrinsically brighter than our Sun [about 2000°C hotter and with an absolute magnitude of 1.4 about 8x brighter]. It lies

at a distance of 8.7 ly. The Pup - which was not discovered until relatively recently, is a White Dwarf located very close to Sirius. It is ~10 magnitudes fainter than its companion – as viewed from Earth – and is almost 12 magnitudes fainter in reality. It is interesting to note that whilst Sirius is probably somewhere near middle aged, the Pup has already lived its life and is much closer to retirement.

No 9 and 10 are UV Ceti A and B. Located in the constellation of Cetus the Sea monster. These are both M6e class stars – red dwarfs, which are dim and cool. They are about 50,000x fainter than our Sun and shine near 16th magnitude making them invisible to all but sizeable amateur telescopes in the 300mm+ class. Located 8.9 ly away they are visible in the autumn sky.

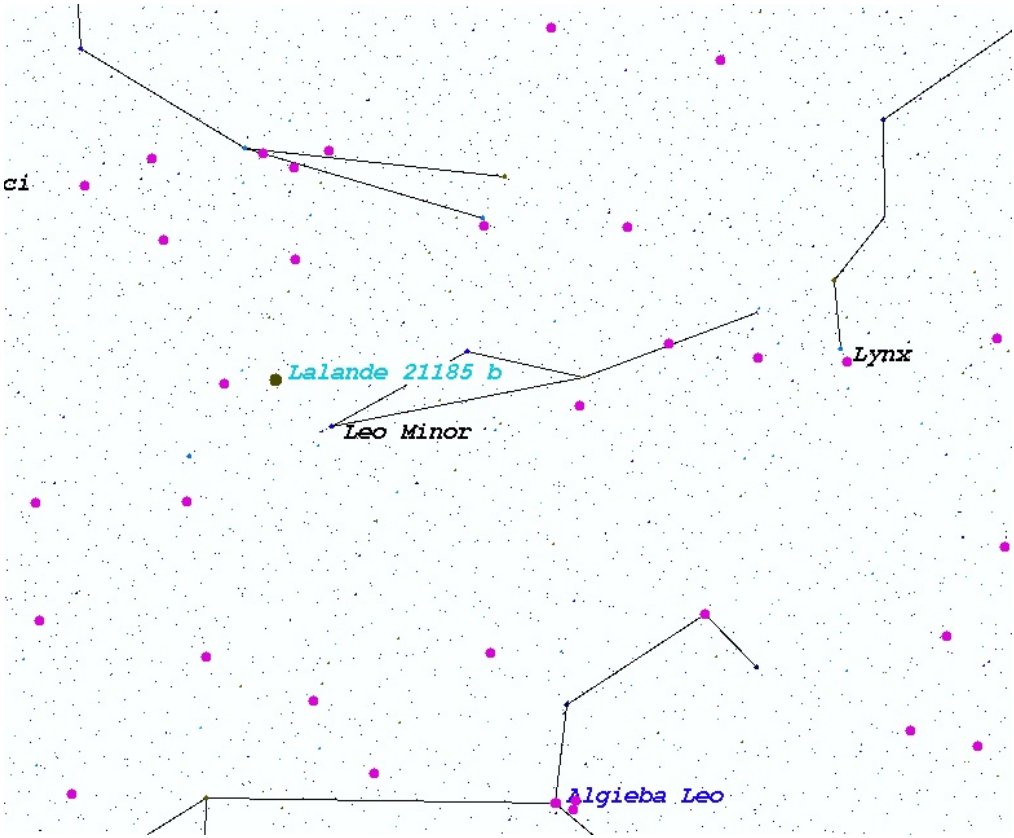
No11 star is Ross 154 – V1216 Sag is located too far south for us to see well. With a declination of -23 it culminates at only 14 degrees above the southern horizon – and in mid-summer – so it is best seen by going well south of the UK. This is another M6 class red dwarf.

No.12 is Ross 248. Also known as HH And, it is best seen in the autumn sky in the UK. At RA $23^h41^m55^s$, Dec $+44^d10^m38^s$, it is located close to the Milky Way. Another red dwarf, with an apparent magnitude of 12.2 [abs mag 14.7] it is again a target for those with sizeable instruments. Because of its HH moniker it is a variable star too, with regular variations over a period of 4.2 years.

No.13 is Epsilon Eridani. Eridanus is a morning constellation in September and is best seen in the Spring. Sited to the bottom right of Orion it never rises very high in the UK. Epsilon Eridani is an orange dwarf star with a spectral class of K5. It is about 30x fainter than our Sun in reality and sits at a distance of 10.7 ly from the Sun.

No.14 is Ross 128. This is a red dwarf in the constellation of Virgo, a spring constellation. Ross was a 20th Century astronomer who catalogued many faint very red stars. Ross 128 is 1/6th the mass of the Sun and is one of the oldest stars in our galaxy. It has been recorded to flare – which is a common characteristic of many red dwarf stars. Unusually the orbit of this star around the galaxy centre is elliptical so it will approach the Sun more closely in the future, then recede again.

No. 15 is Luyten 789-6. Very similar in nature to Ross 128, it is located at RA $22^h35.7^m$, Dec -16^d05^m, placing it in the constellation of Aquarius. It is best viewed after dark in late Summer from the UK. It is another M7 class red dwarf with an



Despite its proximity to Leo Minor, Lalande 21185 is actually in Ursa Major

absolute magnitude of 13.3. Also known as EZ Aquarii, this is a triple star system, with each component being red dwarfs, two of which emit X-rays due to some kind of interactions. This is because the innermost two are a binary pair with the 3rd component orbiting their barycentre.

No.16 and 17 are 61 Cygni A and B. These are a binary pair of K class orange stars. With an apparent magnitude of 7.5 and 8.4 they require binoculars to show any detail, such as their colours. They are both dwarfs some 50x fainter than our Sun. In addition there is a very low mass 3rd component in this system, which may be a brown dwarf.

No.18 is Epsilon Indi in the far southern

SCIENCE SLOT

constellation of Indus. This is a K5 class orange-red dwarf some 8x fainter than our Sun.

No.19 and 20 are Procyon A and B – Alpha Canis Minor. One of the most prominent star systems we can see in the Winter and Spring months. Component A is an F5 class giant some 2.5 x more massive and 8x brighter than our Sun and somewhat hotter. Component B is a faint White Dwarf [with a luminosity 5/10,000ths [0.0005] that of the Sun and is classified a type DQZ [Helium atmosphere over a Carbon core]] which orbits A every ~40 years in a highly elliptical orbit. It was discovered by Friedrich Bessel in 1844. It has a mass of 60% of the Sun. Recent X-ray surveys suggest that matter is being transferred from the A star to the B star. Sometime in the future this may trigger a supernova explosion, but not for many years.

Of the next 10 nearest stars, the majority are faint red dwarfs, with the exception of Tau Ceti [No. 26 on the list] which is an orange sub-dwarf with an apparent magnitude of 3.5 [visible to the unaided eye] but is in fact only 40% as bright as our Sun.

Enclosed are a few star finder charts for a few of these objects. Get out and track them down.

And finally:

In the past few years, astronomers have come across a new phenomenon – inter-stellar objects passing through our solar system.

Officially designated as 1I/2017 U1, Oumuamua was discovered using the PANSTARRS telescope on Hawaii on

Discovering New Worlds - Oct 2021

"All of the team were really great, full of enthusiasm for their subjects and clearly explaining some pretty complex things without talking down to anyone. Thanks for everything and for the advice regarding how to use a telescope that I have never managed to set up properly. Absolutely fascinating. We were not lucky with the weather as it was raining and constant cloud cover, however 3 hours just flew by because the presentations were just so engaging and delivered with such enthusiasm. The hot chocolate was a lovely bonus."

David, Staffs

19th October 2019, 40 days after perihelion. By that time it was about to cross the orbit of Mercury on its way out of the solar system. Shaped like a torpedo its orbit is rather extreme. Its orbit is hyperbolic, with a perihelion distance of 0.255 AU, a semi-major axis of -1.2723 AU and an eccentricity of 1.201, this object will never return to our Sun.

So where did it originate from – the data suggest it started from somewhere near the nearby star Vega – in the constellation of Lyra. It is estimated that the journey took ~600,000 years and may have originated from one of the star systems on Carina or Columba in the southern hemisphere, though other data suggested it originated from a free-floating planetary system – one not bound to a star.

The second interstellar object was Comet 2I/Borisov. This comet was originally discovered in 2019 and given the Comet designation C/2019 Q4 Borisov. The orbit of this comet has an eccentricity of 3.39 – the highest of any hyperbolic object so far discovered, with a perihelion distance of 2.00 AU and a semi-major axis of -0.851 AU. Even so, following its discovery subsequent follow-up observations have shone some light on this mysterious object.

Why do we see them?

The simple answer is the effect of gravity from stars on objects that roam near the outer edge of their influence. Using the 3-body problem – described in a previous newsletter – it can be shown that under very low gravitational influences any object can feel influence from a far off larger body.

It is now becoming clearer that the Sun captures small objects – such as comets, Kuiper Belt Objects (KBOs) or similar – from neighbouring stars, possibly one of those mentioned in this article. It is equally possible/likely that nearby stars capture KBOs from the Sun's back yard too. Perhaps this process is one of the mechanisms by which comets such as Hale-Bopp [Comet C/1995 O1] – in 1997 – can be nudged into the inner solar system. However, Comet Hale-Bopp will not be back until around the year 4385.

Robert Williams

NIGHT SKY

NOV 2021 (times in GMT)

Lunar phases

New moon	04/11/2021	21:14
First quarter	11/11/2021	12:45
Full moon	19/11/2021	08:57
Third quarter	27/11/2021	12:27

PLANET SUMMARY

Mercury will be a difficult morning object. Venus will be visible low down after sunset in the west. Mars will be close to mercury but difficult to spot in the morning twilight. Jupiter is an evening object, visible from about 6pm until 9.30pm. Saturn is near Jupiter but sets by 9pm, their separation beginning to widen. Uranus is visible for most of the hours of darkness and is near opposition. There is a partial lunar eclipse on the early morning of November 19th, but this it is badly placed for the UK and is better seen in the US.

THE STARS AT 8PM

North – Cepheus is high overhead, with Draco and the two Bears nicely placed. East – Cassiopeia and Andromeda are high up with Perseus nicely placed. Taurus is near the horizon and to its top RHS is Aries.

South – Pegasus is nicely placed with Pisces. Aquarius is low down and you can find Formalhaut in Pisces Austrinus – a bright star that is the most southerly placed bright star we can see from the UK.

West – Cygnus dominates this view along with Sagitta, Vulpecula and Lyra. Low down you can find Hercules.

METEOR SHOWERS

November hosts two meteor showers:

1) Taurids – around the 1st to 6th of November – this is a short shower but the particles are quite 'large'. The Taurids tend to be few in number but they make up for this by being bright slow moving and often quite colourful, with occasional fireballs. With a new moon this year it could be a good time to view this shower as there may be some colourful fireballs to be seen. Editors note - the brightest Taurid I have seen was in 1999 when a magnitude -10 [as bright as the Full Moon!] fizzed across the sky as viewed from Sinai Desert, Egypt

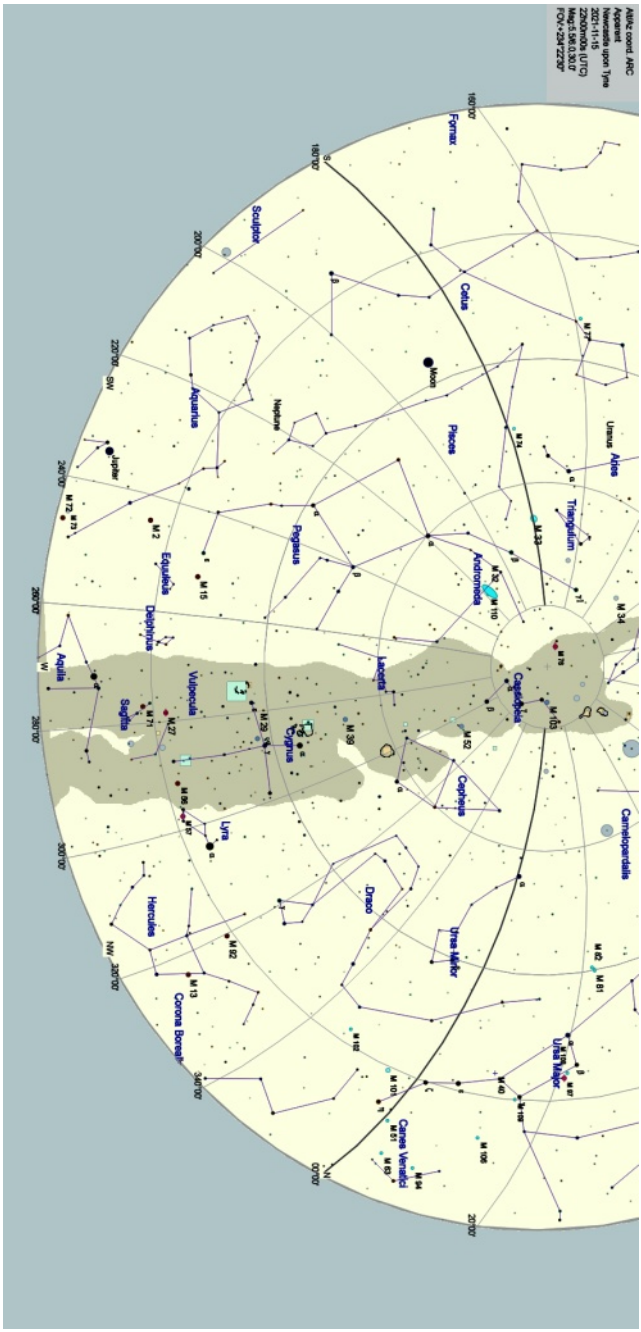
The Planets 15/11/2021

	Sun	Moon	Mercury	Venus	Mars	Jupiter	Saturn	Uranus
Rise	07:37	15:12	06:49	12:07	06:25	13:37	13:04	15:32
Set	16:05	04:03	15:50	18:08	15:38	22:49	21:16	06:41

2) Leonids – on the 16th, 17th and 18th November – another annual shower that usually puts on a good show of 50 to 100 meteors every hour. These particles are fast moving and 'small' and so the meteors are quite faint. With a near Full Moon in 2021 it will be difficult to see these fast, faint shooting stars.

COMETS

Comet 67P/Churyumov-Gerasimenko returns to the inner solar system and may reach 8th magnitude this month. It can be found in the constellation of Gemini.



The sky chart for Newcastle looking W at midnight on 15/11/2021.

NIGHT SKY

DEC 2021 (times in GMT)

Lunar phases

New moon	04/12/2021	07:44
First quarter	11/12/2021	01:36
Full moon	19/12/2021	04:35
Last quarter	27/12/2021	02:24

PLANET SUMMARY

Mercury will be a challenging morning object in the twilight. Venus will be nicely placed for viewing after sunset. Mars is a morning object visible in twilight. Jupiter is an evening object, visible until about 8pm. Saturn is also an evening object visible until about 8pm. Uranus is visible for most of the hours of darkness, until about 3am.

THE STARS AT 8PM

North – Cepheus is overhead, with the two bears nicely placed. Hercules is low in the NW and Cancer low in the NE.

East – Perseus is overhead, with Auriga nicely placed. Taurus, Gemini and Orion are well placed for observation.

South – Triangulum and Aries are overhead. Pisces – with Uranus – and Cetus are nicely placed. Aquarius is low down in the SW

West – Lacerta is overhead with Cygnus nicely placed for viewing. Pegasus is nicely placed in the SW. Hercules and Lyra are low in the SE.

METEOR SHOWERS

The main meteor shower of December is the Geminids which are visible on the night of the 13th/14th December with some activity a few days either side. This shower is unusual in that it originates from an Asteroid – Phaethon. With a near FQ Moon setting at around midnight then the best time to view this shower is between midnight and dawn in 2021.

Later in the month – on Christmas Day the Ursids are active. Expect up to 5 per hour from this weak shower. It will be visible all night but best seen after midnight, however the LQ Moon will interfere in 2021.

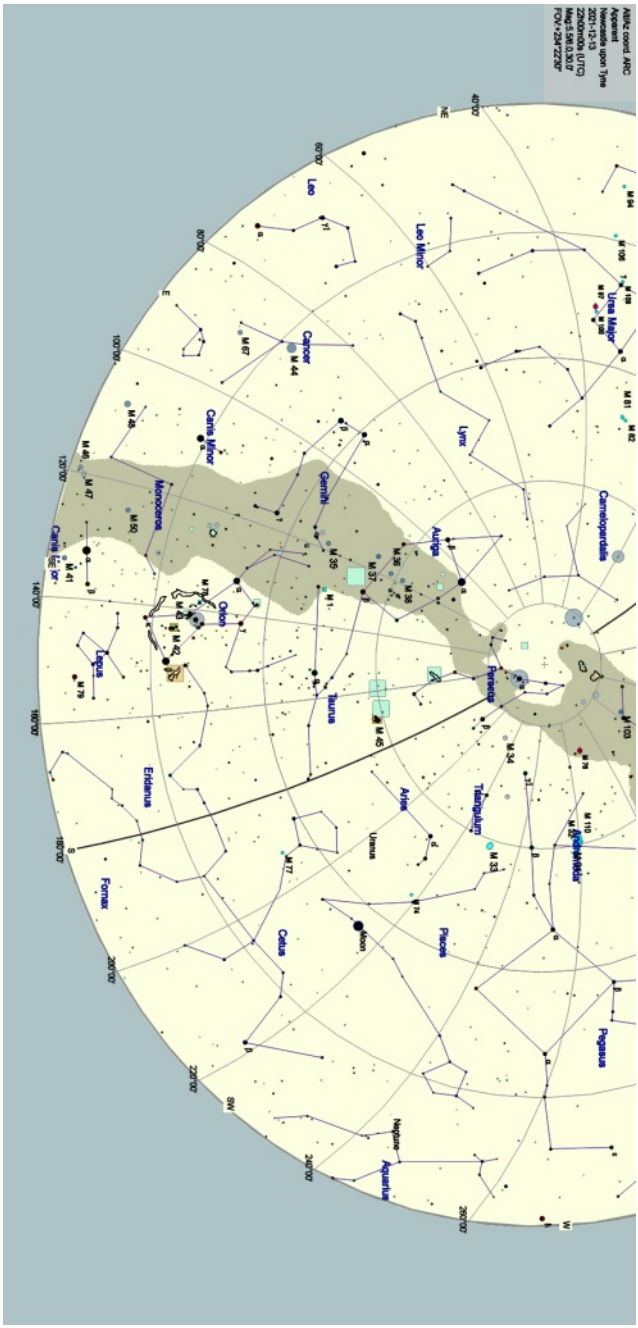
COMETS

Comet 67P/Churyumov-Gerasimenko, now in Cancer, is starting to fade in December at 9th magnitude.

The Planets 15/12/2021

	Sun	Moon	Mercury	Venus	Mars	Jupiter	Saturn	Uranus
Rise	08:23	13:53	09:27	10:36	06:31	11:46	11:11	13:29
Set	15:39	05:36	15:57	18:06	14:26	21:26	19:32	04:35

Weekly comet updates can be found at http://aerith.net/comet/weekly/current.html or https://in-the-sky.org/data/comets.php



The sky map looking SE from Newcastle at midnight on 15/12/2021.

NIGHT SKY

JAN 2022 (times in GMT)

Lunar phases

New moon	02/01/2022	18:33
First quarter	09/01/2022	05:46
Full moon	17/01/2022	23:48
Last quarter	25/01/2022	13:40

PLANET SUMMARY

Mercury will be a challenging evening object, low in the sky at twilight at the start of the month. Venus will be visible only in daylight but care must be taken to locate it as it is close to the Sun in the sky. Mars is an evening object visible between dusk and midnight. Jupiter too close to the Sun to see this month as is Saturn. Uranus is visible from dusk until midnight.

THE STARS AT 8PM

North – Draco is prominent splitting up the two Bears. Hercules is low in the NNE. Cepheus is nicely placed in the NW with Cygnus just below it.

East – Auriga is overhead with Gemini nicely placed. Orion is prominent in the NE with Lepus – the Hare, Monoceros the Unicorn and Canis Major – and Minor - beginning to show themselves again.

South – Taurus and Orion are well placed for observing. Eridanus and Cetus are low down. Aries and Pisces are high up in the SW

West – Andromeda is overhead with Lacerta just below it. Pisces, Pegasus and Cygnus are well placed as is Pisces – with Mars.

METEOR SHOWERS

The major meteor shower of this month are the Quadrantids on the 4th January. Muralis Quadrans was a constellation introduced in the early 17th century, but as the use of the quadrant circle diminished it was absorbed back into Bootes.

The Quadrantids meteor shower is a very short, sharp peak of very bright and often colourful shooting stars.

It may only last for a few hours but if you catch a Quadrantid fireball then it will be worth the wait.

These particles can be both bright and colourful but the shower may only last a few hours around midnight on the 3rd or 4th January. With a New Moon on the 2nd January, 2022 could be an excellent opportunity to view this shower.

The Planets 15/01/2022

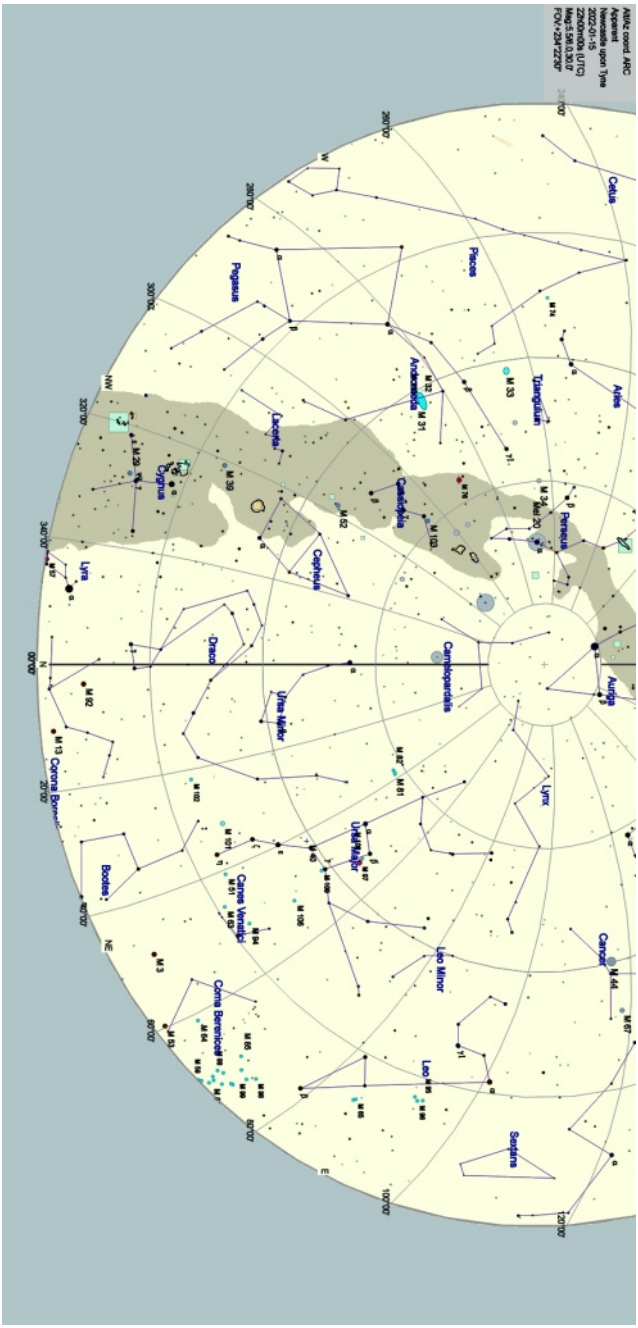
	Sun	Moon	Mercury	Venus	Mars	Jupiter	Saturn	Uranus
Rise	08:20	13:26	09:16	07:29	11:03	08:54	08:47	11:20
Set	16:12	07:59	17:31	14:40	01:56	17:04	16:48	02:05

COMETS

Comet 67P/Churyumov-Gerasimenko is still in Cancer, but is now leaving the inner solar system and will be fading, but may still be 9th magnitude.

Night Sky credits:

Data sourced from Cartes du Ciel, https://www.timeanddate.com/moon/phases/ and https://in-the-sky.org/



The sky map looking N from Newcastle at midnight on 15/1/2022.

OBSERVERS' SLOT

The Constellation of Orion

The constellation of Orion is a familiar one to view in the Autumn, Winter and early Spring night sky. From the UK, it can best be seen at the following seasons/times

1) Autumn – rises at 2am in September and by 8pm in November, setting after dawn.

2) Winter – visible all night from December and until 2am in February.

3) Spring – visible from sunset until 11pm.

Orion contains a microcosm of all types of stars and nebula, but because of its location within the Milky Way there are no bright galaxies to be located. Of all of the constellations, once people have got to know the Plough [Ursa Major] then Orion ranks probably second in line in the familiarity stakes.

Like the Plough/Ursa Major, Orion contains 7 prominent stars, but unlike the Plough, Orion contains a fascinating collection of – fairly – bright Nebulae and there is a collection of less well known objects worth tracking down too. So let's take a look at the main components of this constellation [All data sourced from The Guinness Book of Astronomy]:

Principal Stars

Orion contains 15 stars brighter than 4th magnitude – these stars can be seen from a relatively light-polluted sky. The principal ones are:

The Orion Nebula, M42, with the Running Man nebula above - credit Robert Williams.

1) Beta Orionis – Rigel – at magnitude 0.12 this is among the top 10 brightest stars of the whole sky. Rigel [bottom RHS corner star] is a B8 class blue supergiant and is placed at a distance of 280 parsecs (pc) [912 ly] away from Earth. With an absolute magnitude of -7.1 this is one of the most intrinsically brightest stars of our galaxy. It forms Orion's right foot – as we view the Hunter from his back!

2) Alpha Orionis [Betelgeuse/Betelgeux] – at magnitude 0.5 – and definitely variable [see later in this article], Beta is a Red Supergiant and appears only marginally fainter than Rigel. The key

difference is that Alpha Orionis has an M2 class spectrum – very red – and has an absolute magnitude of -5.6 and is placed only 95 pc [310 ly] away. So Rigel is 3x more distant and ~81x more truly luminous than Betelgeux.

3) Gamma Orionis, Bellatrix, is the top RHS star of Orion [Orion's right shoulder]. This star is magnitude 1.64 and has a B2 class spectrum – a little cooler than Rigel, but not by much – another Blue Giant star, with an absolute magnitude of -3.6, it is about 15x fainter than Rigel in reality.

4) Kappa Orionis [bottom LHS star]. Orion's left foot/knee. Some star charts depict Orion kneeling down. Kappa is a magnitude 2, class B0.5 stars [blue] and is also known as Saiph.

5) Zeta Orionis [LHS of the belt]. Orion's left waist star – Alnitak – is another brilliant star, with an 09.5 class spectrum [very blue]. It has an absolute magnitude of -5.9 and is 340Pc [~1100Ly] away.

6) Epsion Orionis – the centre star of the Belt] is also known as Alnilam. This star is a magnitude 1.70 B0 class star [blue] and is in reality almost as bright as Saiph. It is 370 pc [1200 ly] away.

7) Delta Orionis – RHS of the belt – Mintaka – is 2.23 magnitude and slightly variable. Very similar in nature to Alnitak [they are almost twins!]. It lies at a distance of 720 pc [2350 ly].

Collectively these stars form part of the Orion OB1 Association, as they were created from a common cloud of gas and dust.

Some other notable stars in Orion include the following:

8) Orion's Shield/the Nemayen Lion – depending upon which Myth you look at there is an arc-shaped group of stars to the right of Orion's Belt that represents the shield used by Orion in battle or the skin of the Nemayen Lion, which was one of his conquests. This group consists of the following stars: 15-Orionis [top] followed [heading south] by 11-Orionis, and π2, π3, π4 and π5. 11-Orionis is an A0 class [white] star and is magnitude 4.7 – just about visible from light-polluted skies. Of all of the stars of Orion it is one of the closest at only 26 pc [~85 ly] away. Being so close [relatively] it is some ~250x fainter in reality than Orion's belt stars.

π2, π3, π4 and π5 Orionis are all around 4th magnitude but are an eclectic bunch. π2 is an A0 class star [white] and about 25x more brilliant than our Sun at a distance of around 85 ly. π3 is an F6 star [yellow] and is only 7.7 pc [25 ly] away from our Sun. π4 is a B2 [blue white] class star and is placed ~900 ly away. π5 is a twin to π4 in terms if its properties and distance.

OBSERVERS' SLOT

Navigating from Alpha Orionis and moving 'up' [North] you come to a line of stars:

μ-Orionis is a 4th magnitude white star [A0] located 37 pc [120 ly] away. It bears a close resemblance to our Sun though with a surface temperature somewhat hotter.

ξ-Orionis - is a 4th magnitude blue star [B3] located 170 pc [~550 ly] away.

ΰ-Orionis – Thabit – is a 5th magnitude blue star located 560 pc [~1450 ly] away.

X-Orionis – is a 4th magnitude star – very similar in character to our Sun and is located 9.9 pc [~32 ly] away from us. Very close to this star [on the sky] and slightly to its east is U-Orionis.....

These stars form the main shape of the constellation. How many of these stars you can see on any one night is a good judge of:

a) How much light pollution is in your neighbourhood,

b) Your eyesight [visual acuity] and

c) The clarity of the sky on that particular night.

Variable stars in Orion

Orion has 5 variable stars above 8th magnitude [at their brightest].

1) W-Orionis is a Carbon Star. It is located to the west of the belt – in an almost direct line as drawn between Zeta, Epsilon and Delta Orionis and is about as far away [spatially] from Delta as Zeta is. It has a range from magnitude 5.9 to 7.7 over a period of ~212 days and is classed as semi-regular – in other words the cycle is not smooth but may have smaller humps and valleys over a shorter/longer period. It is classed as an N-class star – [Hot -> WOBAFGKMRNS -> Cool] – one of the reddest stars in the sky.

2) S-Orionis is a Mira class star and is an AGB type star located just above Messier 42 in the sky, close to Sigma Orionis. It is located 480 pc [~1560 ly] away. It varies between magnitude 7.5 [binoculars] and 13.5 [>=150mm telescopes] over a period of 419 days. It is an M-class Giant star some 12.5 x as luminous as our Sun.

3) CK Orionis, located very close to Messier 42 in the sky, is a K-class star some 120 pc [~390 ly] away. It is a semi-regular variable star with a range from magnitude 5.9 to 7.1 [binoculars].

4) Alpha – Betelgeuse [Betelgeux] – is an M-class supergiant and has slight variability [magnitude 0.1 to 0.9] over a period of ~2110 days. It gained fame in 2019/2020 for substantially [by ~1 magnitude!] dimming, raising the possibility that it could have been about to go supernova. It recovered and now it is thought to be just another episode

in the life of this star. Being 95 pc [310 ly] away, even if it went SN today we would not see the light until the year 2330-ish.

5) U-Orionis – is a Mira class variable. Located adjacent to X-Orionis. At its brightest [magnitude 4.8] it is visible to the unaided eye. However at its faintest [magnitude 12.6] it requires a >=150mm class telescope to see it. U-Orionis has a period of ~272 days and is another M-class star – very red in colour.

Double Stars in Orion

Orion has 11 double/multiple star systems that can be tracked down by small telescopes. These are:

1) Pi3 Orionis – has components of 3rd and 9th magnitude separated by 94.6 arc seconds at a position angle (PA) of 138 degrees

2) Beta [Rigel] has a 7th magnitude companion separated by ~10 arcsec at a PA of 202 degrees. In many respects this system resembles Sirius and the Pup in Canis Major, though with rather different primary stars.

3) Rho Orionis – has a 5th and 8th magnitude stars separated by 7 arcsec at a PA of 64 degrees.

4) Eta Orionis – has triple components of 4th, 5th and 9th magnitude. A and B are separated by 1.5 aecsec at a PA of 80 degrees and A and C are separated by 115.1 arcsec at a PA of 51 degrees.

5) Delta Orionis – is a doublet with components of 2nd and 6th magnitude, separated by ~53 arcsec at a PA of 359 degrees.

6) Lambda Orionis – is a doublet of 4th and 6th magnitude. The separation is 4.4 arcsec at a PA of 43 degrees.

7) Sigma Orionis is a 5-star system comprising a twin [A+B] interacting with stars C, D and E. A [4th magnitude] and B[6th] are a close binary [0.1 arcsec] and have a 170 year orbit. C is a 10th magnitude star separated from AB by 11.4 arcsec and at a PA of 238 degrees. D is an 8th magnitude star separated from AB by 12.9 arcsec at a PA of 84 degrees and E is a 7th magnitude star at a ~43 arcsec separation from AB at a PA of 61 degrees.

8) Omicron Orionis is a 4-star system comprising a twin [A+B] interacting with stars C and D. A [7th magnitude] and B[8th] are a close binary [8.8 arcsec, PA 31 degrees]. C is a 13th magnitude star separated from AB by 12.8 arcsec and at a PA of 132 degrees. D is a 7th magnitude star separated from AB by 21.5 arcsec at a PA of 96 degrees.

9) Iota Orionis – is a double star with 3rd and 7th magnitude components. They are separated by 11 arcsec at a PA of 141 degrees.

10) Zeta Orionis – is a triple star system

with components A [2nd mag] and B [4th] in a binary system with a separation of 2.4 arcsec and a period of 1509 years. Component C is a 10th magnitude star located at 57.6 arcsec separation and PA 10 degrees.

11) Mu Orionis – is a double star with 4th and 6th magnitude components. The separation is 0.4 arcsec at a PA 23 degrees.

Open Clusters

Probably the least obvious deep sky objects in Orion are its 4 open clusters:

a) NGC1981, located near [spatially] the Orion Nebula complex. This has 20 stars and is 5th magnitude.

b) NGC2112, located near the belt stars. This has 5 stars and is 9th magnitude.

c) NGC2175, located near ζ Orionis. This has 60 stars and is 7th magnitude.

d) NGC2186, located near Alpha Orionis. This has 30 stars and is 9th magnitude.

Nebulae

Orion has 3 prominent bright nebulae [all

The Flame Nebula next to the bright star Alnitak (part of Orion's Belt), with the Horsehead Nebula below - credit Robert Williams.

parts of the Orion OB Association] as well as a very well known dark nebula:

a) Messier 42 – the Orion Nebula – possibly the most photographed/observed deep sky object in the whole sky – it is visible from north and south of the equator at some time of the year. Positioned between the belt stars and Orion's 'feet', it is located ~1340 ly away and we only see the 'visible' part of this object, but there is so much more with the 'invisible' parts. It has been investigated by almost every major telescope and observatory on/above the Earth. For example see Orion's Messier 42 (M42) Region at the SOFIA Science Center.
But follow the instructions at The Orion Nebula at different wavelengths
and you will see a whole new vista of this amazing object.

b) Messier 43 – if it wasn't for Messier 42 then Messier 43 would still be a stand-out celestial object in its own right. It is a prominent HII star-forming region, lit up by the star NU Orionis.

c) Messier 78 – often overlooked because of its two well known associates, Messier 78 is nevertheless quite an interesting object. Similar to the nebula around Messier 45 in Taurus, M78 is a reflection nebula. Because of the dust this object shows up better in infra-red light which can see into the dusty clouds around existing and 'soon to be born' baby stars. Both Hubble and ESO's 'Dustbuster' telescope give clear views of the M78 nebula. Even so it is a popular target for amateur imagers.

d) Barnard 33 Horsehead Nebula – This is a dark [dusty] nebula, located near Zeta Orionis with a backdrop of hydrogen emission – another popular target for amateur imagers, it has also drawn attention from the professionals. For example, see the CFHT Astronomy Image Of The Month for Jan 2017.

e) The Flame Nebula is an emission nebula located ~1000 ly away. It is lit up by Alnitak and is part of the Orion Molecular Complex which includes the Horsehead Nebula. When imaged with infra-red and X-ray telescopes from space this is the view you get:
Inside the Flame Nebula.

Galaxies

There are no galaxies easily visible to the amateur in Orion, the brightest being around 13th magnitude.

Robert Williams

GALLERY

We would love to display your images here, whether they are taken up at Kielder or not. Please send them to

admin@kielderobservatory.org

along with a brief description of how and when they were taken.

Aurora! The Sun has been quite active in the last few weeks and Dan Monk, Director of Astro-Imaging, captured this shot at Dunstanburgh Castle.

"Amazing! We were lucky enough to have good skies, and we were able to see Saturn, Jupiter and 4 moons, the Ring Nebula and the Moon, as well as have some constellations (and satellites) pointed out to us. Moonrise was stunning, and the team were so enthusiastic and knowledgeable - and if one didn't know the answer to a question, another would. Great hot chocolate too - a unique experience"

Martin, Portugal - August 2021

GALLERY

A couple of shots taken at Cragside by one of our volunteers. Credit: Stuart Tye.

GALLERY

Another of our volunteers, Julie Winn, took this shot near Keswick, in the Lake District.

Close to the star Gamma Cassiopeiae (the middle star of the 'W' shape of the constellation) - both on the sky and physically in space - lies the little emission nebula IC63. It is sometimes known as the 'Ghost of Cassiopeia'. It is a cloud of gas and dust, glowing due to the intense radiation it is receiving from Gamma Cassiopeiae.

Credit: Nigel Metcalfe

The Museum of the Moon exhibition at Durham Cathedral. The globe measures seven metres in diameter and features 120dpi detailed NASA imagery of the lunar surface. At an approximate scale of 1:500,000, each centimetre of the internally lit spherical sculpture represents 5km of the moon's surface.

Credit: Nigel Metcalfe

The Milky Way stretches above the village of Hawes in Wensleydale.

Credit: Nigel Metcalfe

"We booked the Space Kids Rockets & More experience with our 5 and 13 year old children. I really wasn't sure what to expect but actually this turned out to be the best experience of the 1 week trip to Northumberland. Really interesting and engaging talks, nice and comfortable experience and the staff did a fantastic job. Even though it was a completely cloudy evening, we still enjoyed just learning about the telescope and pointing it at different stars (more exciting than it sounds). A truly memorable evening that we will cherish for a long time."

Alistair, Leeds - August 2021

Kielder Observatory - a beacon for dark skies

https://kielderobservatory.org

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