Winter 2021/22 Number 34

Kielder Observatory Newsletter

EDITORIAL

Well, we have seen some rough weather since the last newsletter, but we are still in one piece, something which cannot be said for many of the trees in Kielder Forest! Our radio telescope is working well, and we have had some satellite tracking cameras installed up at the Observatory. Last time we were looking forward to the launch of the James Webb Space Telescope - as I am sure you know, that went flawlessly and the telescope is now in its final position. We await the first images ...

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

E-mail: chairman@kielderobservatory.org
secretary@kielderobservatory.org
admin@kielderobservatory.org

KIELDER OBSERVATORY
Infinite Inspiration

Front cover: Moonrise over Kielder Water - Dan Monk Photography.
Rear cover: The Tanlaw SPIDER radio telescope - Dan Monk.

Bill Macleod has now settled in to his role as a trustee. We were hoping that final trustees meeting of 2021 in mid December would be face-to-face, but sadly Omicron got in the way, so it was back to Zoom! Rather unfortunate really, as it was due to be held in the pleasant surroundings of the Lit & Phil Society in Newcastle.

At the moment the trustees are finalising the accounts and annual report for 2020/21. Our financial year runs from September to August, and the accounts are due to be lodged with the Charity Commission the following May/June, but we like to have them prepared in good time. Our accounts are independently examined by a Charted Accountant. All our annual reports and accounts are public, and can be found on the Charity Commission's website.

One of the trustees' main tasks each year is to set the budget for the next finanical year. The aim is to balance expected income and expenditure, and have a little left over each year to build up our reserves fund. The last year was challenging, to say the least, but we already had some initial experience of lock-down when the 2020/21 budget was set, so we were able to make some reasonable predictions of how the year might go. As a result, although we had to dip into our reserves, we have been able come out of the year in a reasonably healthy position. Our accountant also provides quarterly accounts for the trustees to monitor how our actual position sits relative to the budget throughout the year, and make adjustments if necessary.

One thing we have learnt from the pandemic is the importance of our online presence. You may have already seen some of our regular podcasts, and we have various other projects in the making. Still, you can't beat the real thing, and our tickets for 2022 have been selling really well. At the time of writing, February and March are pretty much sold out, and April is fast going the same way. We do get some cancellations though, so keep an eye out on our Facebook and Twitter accounts.

OBSERVATORY NEWS

Pop-up observing in Hexham! Whilst the Observatory was closed by Storm Arwen, we grabbed some telescopes and cameras and headed for Sele Park.

Storm Arwen raced through the North East on the night of November 26th, causing wide-spread damage. Remarkably, the observatory, including the new radio telescope, came through unscathed. However, many trees were felled, blocking the access road to the observatory, and some of those which were still standing were in a dangerous condition. We were therefore forced to close for two weeks whilst the Forestry England worked flat out to restore access to us and many other locations around the forest. In the meantime, as people couldn't get to the observatory, we took the observatory to the people, with a pop-up event in Hexham Sele Park!

All-in-all it has been a challenging time with the weather - icy conditions at the beginning of January forced another short closure, as did more wind, in the form of Storm Malik, at the end of January. However, with the experience from Arwen, we were able to run two more pop-up events in Sele Park.

OBSERVATORY NEWS

Somewhere beyond [illegible] is an Observatory! The aftermath of Storm Arwen.

The good news is that with the government lifting Covid restrictions in the last week in January, we are able to cautiously increase numbers of visitors to our events (remember we have been restricting numbers during the pandemic). As of 1st Feb, we are adding two extra tickets to all our main events (but not Late Night events, Intro events or Astrophotography events). We will, however, still be asking visitors to wear masks when indoors, and we'll still be carrying out additional cleaning, etc. Covid has not gone away.

For those who still prefer their entertainment on-line, there have been several editions of our Podcasts since the last newsletter. At the end of November, our Director of Astronomy, Dan Pye, took us on a tour of the new SPIDER radio telescope facility, and explained what it will mean for the Observatory. In December, Dr Olivia Jones from the Royal Observatory Edinburgh joined us to talk about the James Webb Space Telescope (since successfully launched of course!). Finally, in the latest edition, Dr Laurence Blacketer from NORSS (Northern Space and Security Ltd) talks about their LOCI (LEO (Low Earth Orbit) Optical Camera Installation) project for tracking space junk. Find our podcasts at https://podfollow.com/kielderobs/view.

Speaking of NORSS, as part of that LOCI project, a team of their engineers and orbital experts have been installing four cameras at the Observatory. The cameras will monitor the behaviour of objects in space and evaluate any potential collisions between satellites and space debris. If a major collision is identified, which could pose a threat to technology on our planet, like satellite navigation, it is flagged up to the UK Space Agency who decide what action to take. There are

OBSERVATORY NEWS

thought to be around half a million items of debris zooming around the Earth at speeds of up to 18,000 miles an hour. We will be designing educational programmes around the issues tackled by this project.

From left to right: Peter Standfield, KOAS chairman, Catherine Johns, our CEO, Kevin May, forest management director, NE Forest District, Forestry England and Sir William Worsley, Chairman, Forestry Commission.

Just before Christmas, we signed a strategic partnership with Foresty England to further develop the astronomy offer in and around Kielder. Together we will devolp a strategy to open up astro-tourism to more diverse communities and create additional stargazing opportunities around Kielder Castle and the wider Kielder location.

On December 21st we invited people who live and/or work in and around Kielder to come and have a mince pie, a hot chocolate and an informal look around the Observatory.

If you haven't see it yet, Helen McGhie, our photographic artist-researcher in residence, has produced a free, online immersive virtual art exhibition, "Another Dimension", which allows you to contemplate the cosmos through photography, film and sound. You can find it at https://kielderobservatory.org/the-observatory/another-dimension.
The exhbition remains open until March 31st this year. Helen is also leading a special arts event at the Observatory on February 7th.

In the media there was a nice article in National Geographic on UK Dark Sky tourism, in which we featured prominently. You can read it at https://www.nationalgeographic.co.uk/travel/2022/01/why-travellers-are-embracing-dark-sky-tourism-for-2022
We even got a mention in the New York Times list of "52 Places For a Changed World" ! https://www.nytimes.com/interactive/2022/travel/52-places-travel-2022.html.

OBSERVATORY NEWS

The snow looks pretty, but can block access.

Our Director of Astronomy, Dan Pye, chatted about Aurora on BBC Radio Newcastle on January 11th. He also seems to have managed to act as a film critic for The Chronicle! https://www.chroniclelive.co.uk/whats-on/kielder-astronomer-dont-look-up-22643484.

Last, but not least, how about Kielder Observatory in needlework ... https://www.facebook.com/royalneedlework/photos/a.707649942607850/4739617826077688/.

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

Radio Astronomy – Part 1- a Beginners Guide

The electromagnetic spectrum covers a wide range of frequencies, from the very low [Long Wave Radio] to the very high [Gamma rays]. Looking at it a different way, [E=hc/λ], radio waves have very low energy and Gamma rays have very high energy.

Many astrophysical objects emit over – almost – every waveband of light, and that light can be probed to deduce what is happening in that object. The slight complication is that some radiation is absorbed by the water vapour in our atmosphere but that can be used to our advantage for certain type of radio astronomy – also, one possibility is to site a radio telescope on the far side of the Moon some time in the future, which would also protect it from radio interference from the Earth (due to the Moon's – almost – synchronous rotation).

Just as with visible astronomy, radio astronomy can use quite simple techniques - i.e. just 'looking' or much more complex techniques where the radio emission is broken down into individual wavebands and/or across multiple receivers [VLBI - more about that in a later article].

How are radio waves created in Space?

All electromagnetic rays are created as a result of a transition of some sort. Gamma rays are created by nuclear transformations, visible light is created by electronic transitions. Radio waves, being the lowest energy waves, are created when atoms or molecules 'move' – in the broadest sense of that word. This movement includes simple or more complex rotation or vibrations of molecules. This Wikipedia article explains the basics of molecular vibration. This can occur in comets, dust and gas clouds around stars and black holes, nebulae, star forming regions and many more locations. Vibrational waves tend to occur in the microwave or far infra-red part of the spectrum. They are the key to how microwave ovens work.

The wavelength and related properties of the radio wave tells you something about what molecule is moving, how fast it is moving, what type of motion it is undertaking and the environment through which it is moving. In essence it's a bit like super-scaled up none-destructive testing of the Universe.

In space there are a small number of molecules that make up the significant types of objects that emit radio waves.

Hydrogen being the most abundant element in the cosmos is responsible for most of the natural radio chatter in the Universe. There is also some contribution from Carbon Monoxide too.
Hydrogen emits at 1420MHz or 21cm wavelength (see Hydrogen line - Wikipedia). At this wavelength it can penetrate even the darkest / thickest clouds of inter-stellar material. This is because it can only be attenuated by particles larger than its own wavelength.
The transition that causes this radiation is the simple flipping of the atom's single electron from 'up' spin to 'down' spin. It can be detected from all directions in space.
The strength of this line can be used to determine the absolute mass of a galaxy, to estimate the scale of the gravitational constant G and to study the dynamics of galaxy interactions.
Carbon monoxide radiates at a wavelength of 2.6mm [115.27 Ghz] and can be used to probe more violent events within a galaxy, such as giant star/nebulae formation (see, for example, this ESO article - messenger-no21-20-22.pdf), including NGC3372, the Eta Carina nebula. Because of its smaller wavelength it is less able to permeate through dusty clouds.
So, lets start a journey to look at what radio astronomy can tell us about our local Universe – in the Solar System.
One of the most powerful techniques for examining our local environment is RADAR (RAdio Detection And Ranging), so let's take a look at this first.
RADAR was invented in the early 1940's for the purpose of locating aeroplanes – and other similar objects - in the sky.
Sir Bernard Lovell was a pioneer in this field – along with many other brilliant scientists.
The basic principle is that a beam of radio energy is directed from a source toward a target and the reflected echo tells you some details about where that object is [in 3 dimensions] – i.e. distance; how fast it is moving and – using triangulation techniques – which direction[s] it is moving in. If the object is large enough, it can also tell you something about the morphology – i.e. shape – of the object.

" The visibility couldn't have been worse, however the night was still very informative and educational. We both agree'd despite the conditions we still had a fantastic night."

Brent, Newcastle

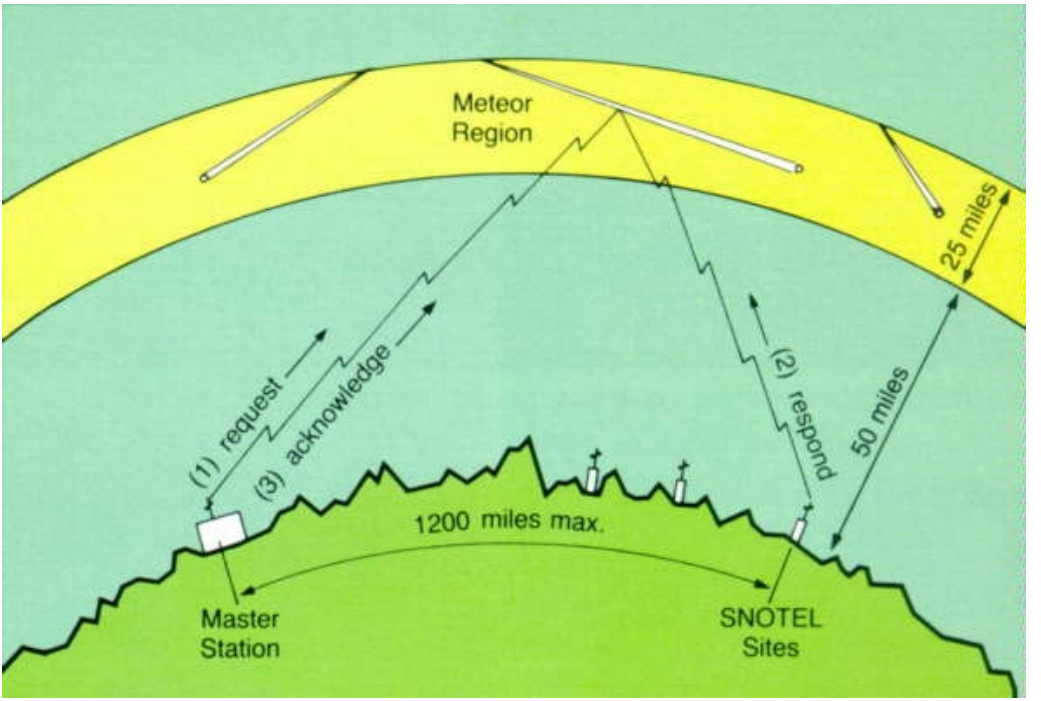
SCIENCE SLOT

This was put to good use when he moved equipment to Jodrell Bank after the end of WW2, following the successful deployment of the first radar equipment to detect the position, elevation, direction and speed of enemy aircraft.

The very first astronomical observations using basic equipment discovered that a radio antenna could be used to detect meteors. This is because as the particle of space rock etc. falls through the atmosphere it generates an ionisation trail which generates light and also reflects a radio pulse.

Soon after it was realised that, by using triangulation, it was also possible to detect meteors by the reflection of distant radio stations many 100's of kilometres away.

The figure below shows the basic principle...

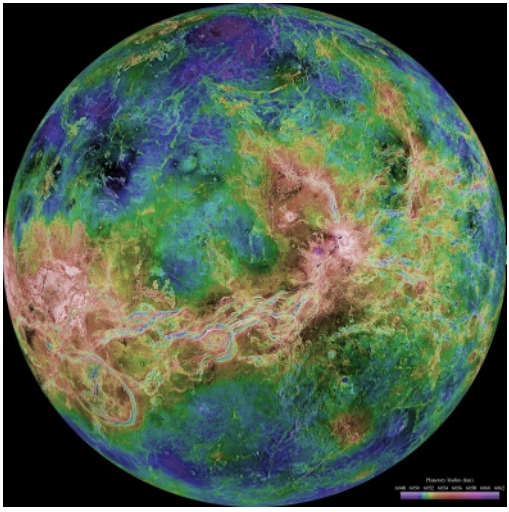


The principle of meteor burst communications as used by SNOTEL (the US automated snow telemetry programme). Each site transmits a radio signal into the sky which bounces off a band of ionized meteorites about 50 to 80 miles above the Earth. This technique allows communication to take place between remote sites and a master station up to 1200 miles away.

During the heyday of medium wave radio it was possible to pick up 'chirps' from radio stations in eastern Europe if you tuned into e.g. Radio Warsaw. See, for example, 'Detecting Meteors Using Radio' (meteorwatch.org) and if you want to try making some kit then, look here: 'Radio Meteor Observing – Meteor Section' (popastro.com). On the nights of the brighter meteor showers more 'chirps' can be heard. Here is a link to more information about the best radio stations to tune into for particularly active meteor showers visible during the year: G0ISW Radio Astronomy (qsl.net).

From the source the radio wave heads into the atmosphere and as the meteor falls and begins to burn up at altitudes of typically 75km to 125km, the ionisation reflects the radio waves. In this way it is possible to detect perhaps up to 10x more shooting stars than by visual observing alone.

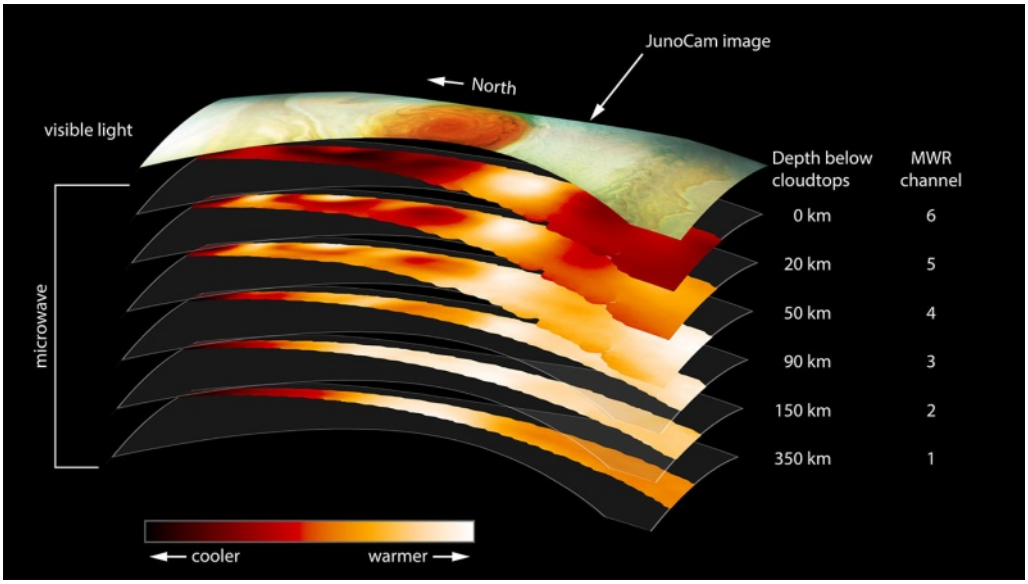
Another radar technique has been used to extensively to examine the distance to and surface details of nearby astronomical objects – such as the Moon – as well as during asteroid flybys and, when the equipment is installed on a spacecraft, hidden objects such as the surface of Venus (by Magellan - see Wikipedia), which showed a dramatic volcanic landscape, with 'corona' cones, lava channels and other features that, whilst they were volcanic in origin, because of the high atmospheric pressure on Venus, [~90 Bar or ~1300psi] were dramatically different to those on Earth or Mars.



RADAR image of the surface of Venus. Blueish areas are smooth, brown areas are rough. Credit: NASA/ JPL/USGS.

Radar has already been used to examine every planet as far out as Saturn including its rings system, numerous asteroids and comets, from which their spin-rates can also be determined. So far more than 800 objects in our solar system have been investigated using radar, principally using the Arecibo Radio Dish Arecibo Observatory - see Wikipedia. Unfortunately it was damaged in 2017 by a hurricane and there are ongoing discussions about

SCIENCE SLOT



Jupiter's Great Red Spot, using data from the microwave radiometer instrument onboard NASA's Juno spacecraft. Each of the instrument's six channels is sensitive to microwaves from different depths beneath the cloud. Credit: NASA/ JPL-Caltech/SwRI.

whether to renovate or decommission this historic telescope. However, further damage in 2020, caused by the failure of numerous support cables, destroyed the dish, so the only way forward is for a completely new telescope, especially since the commissioning of the 500m dish in China (FAST – the Five-hundred-meter Aperture Spherical Telescope - see Wikipedia) as well as the ongoing upgrades to other recent systems.

Radar can distinguish between surfaces that are rough which look dark due to scattering – such a volcanic features or impact craters – and smooth such as bodies of 'water' [or similar liquids] or 'ice', which look bright because of the higher reflectivity of a flat surface to radio waves. It can also detect how the material is flowing by virtue of the 'speed trap' effect caused by Doppler shifting, so it can also detect 'waves' and ridges.

Presently, Radar is being used to examine the surface internal structure of Jupiter by the Juno instrument MWR Microwave Radiometer (see Juno - Wikipedia) in the microwave waveband, at depths up to 600km. Its primary aims are to identify the

types of gases in this layer of Jupiter and to determine their dynamics [i.e. speed, direction and flow both laterally and vertically]. It is the first Jupiter bound spacecraft to be fitted with this type of instrument. Already a number of new findings have been reported, including changes in the temperature of the Great Red Spot (GRS) in layers below the viisble surface of the GRS as well as changes in the composition of the cloud structures both inside and outside the GRS. In this region of Jupiter, Oxygen, Nitrogen and Sulphur compounds are subject to pressures of about 1000 Bar and water is also present. MWR consists of 3 types of antenna.
More about radar astronomy can be found here: Radar astronomy - Wikipedia.

To be continued ...

Robert Williams

The Tanlaw SPIDER telescope and the Milly Way. Credit: Michael Autun.

"Everyone was excellent and hugely knowledgeable. Our 8 year old son loved it"
Craig, Houghton le Spring

"Lovely, friendly people, and was the perfect level of explanation/detail for me to keep up."
Laura, Birmingham

NIGHT SKY

FEB 2022 (times in GMT)

Lunar phases

New moon	01/02/2022	05:46
First quarter	08/02/2022	13:50
Full moon	16/02/2022	16:56
Third quarter	23/02/2022	22:32

PLANET SUMMARY

Mercury will be a difficult object low in the east at down. Venus will be higher in the eastern sky and will shine brightly just before sunrise. Mars will be close to Venus and so Venus will act as a good signpost to locate the much [10x] fainter Mars. Jupiter will be visible in the evening twilight. Saturn is close to solar conjunction and not visible this month. Uranus is an evening object and visible, in the west, from around 7pm until 10pm.

THE STARS AT 9PM

North – Cassiopeia and Cepheus are nicely placed with the two Bears. Cygnus and Hercules are low down.

East – Gemini is high up with Leo and Cancer nicely placed. Virgo is just beginning to rise.

South – Auriga is high up. Orion and Monoceros are nicely placed. Canis Major and Lepus are low down.

West – Taurus and Perseus are high up. Andromeda is nicely placed. Pisces and Pegasus are low down.

METEOR SHOWERS

There are no bright meteor showers this month.

COMETS

After the stunning appearance of Comet C/2021 A1 Leonard over Christmas – though mostly for southern hemisphere observers, and into January, there are few moderately visible comets to track down this month:

1) Comet Borelly - 8th Magnitude, crossing the constellation of Pisces during February, near the 'V' of the fishes tails, heading in the direction of Aries which is reaches in March.

2) Comet 67P/Churyumov-Gerasimenko - 9th Magnitude, crossing the 'top' of Cancer during February

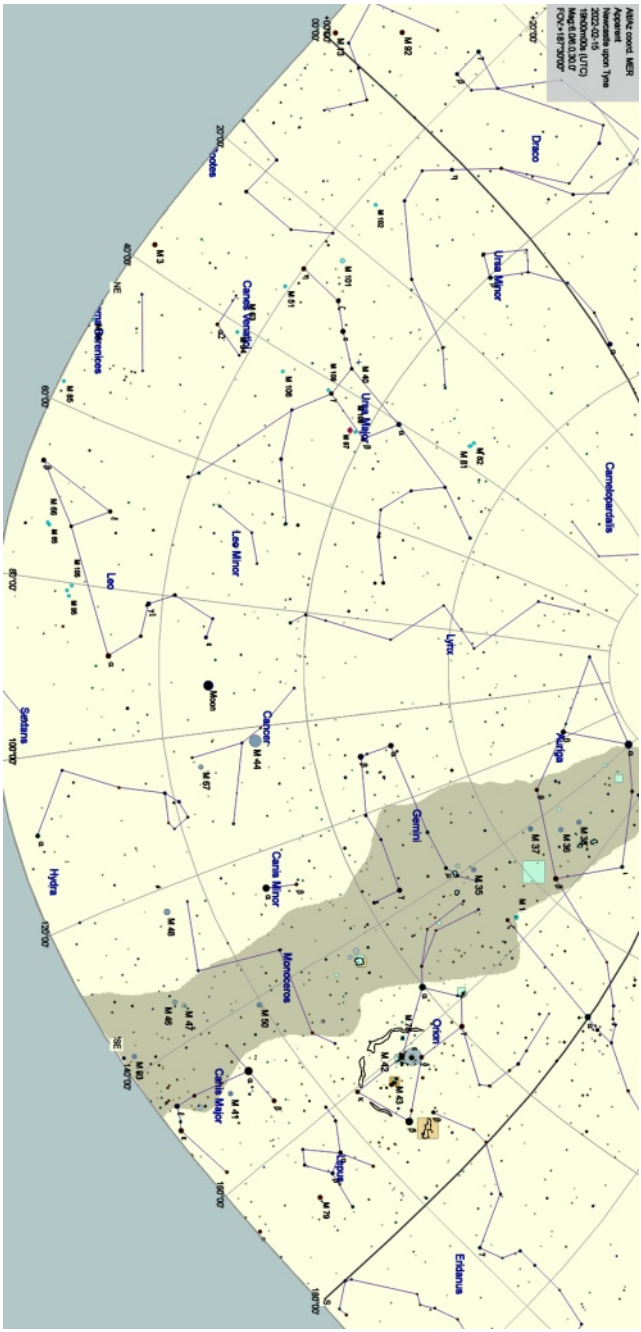
3) Comet C/2019 L3 Atlas - 10th Magnitude, traversing across Gemini

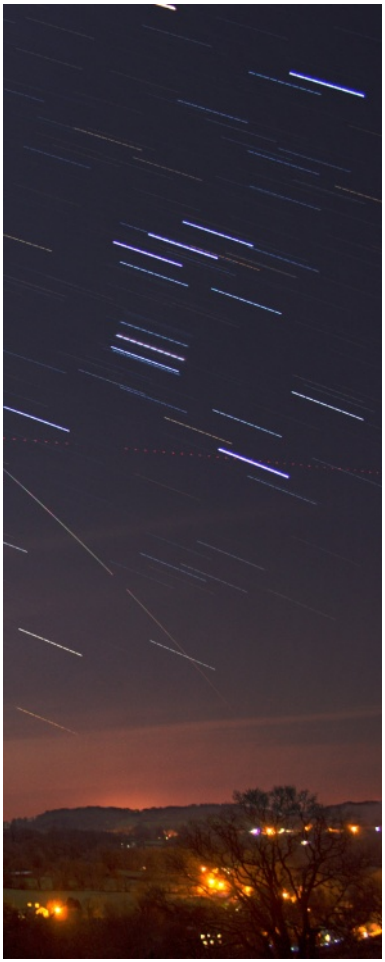
There are no other comets brighter than 10th magnitude visible at this time of year.

The Planets 15/02/2022

	Sun	Moon	Mercury	Venus	Mars	Jupiter	Saturn	Uranus
Rise	07:27	15:21	06:31	05:09	05:58	07:58	07:19	09:25
Set	17:00	08:04	14:36	13:53	13:08	18:27	16:07	00:20

The sky chart for Newcastle looking E at 7pm on 15/02/2022.





NIGHT SKY

MAR 2022 (times in GMT)

Lunar phases

New moon	02/03/2022	17:34
First quarter	10/03/2022	10:45
Full moon	18/03/2022	07:17
Last quarter	25/03/2022	05:37

PLANET SUMMARY

Mercury is in solar conjunction and not visible this month. Venus will be visible in the morning twilight. Mars will be close to Venus but being substantially fainter may be lost in twilight. Jupiter may be visible in the evening twilight but is only ~15 degrees away from the Sun so care must be taken to track it down with a telescope. Saturn is close to Mars and Venus so may be spotted by first locating Venus and navigating to Saturn. Take care though as it is near the Sun in the sky. Uranus is an evening object visible until round 9pm, once the sky has got sufficiently dark [after 6pm].

THE STARS AT 10PM

North – The two Bears are high up. Cepheus and Draco are nicely placed.

Cygnus, Lyra and Hercules are low down.

East – Leo and Coma Berenices are nicely placed. Virgo is low down. You can also find Hydra, Crater and there is Corvus near the horizon.

South – Virgo, Leo, Cancer and Gemini are nicely placed. Orion, Canis Major, Monoceros and Lepus are low down.

West – Gemini, Auriga, Perseus, Orion and Canis Major are nicely placed. Pisces is near the horizon.

METEOR SHOWERS

There are no major meteor showers in March.

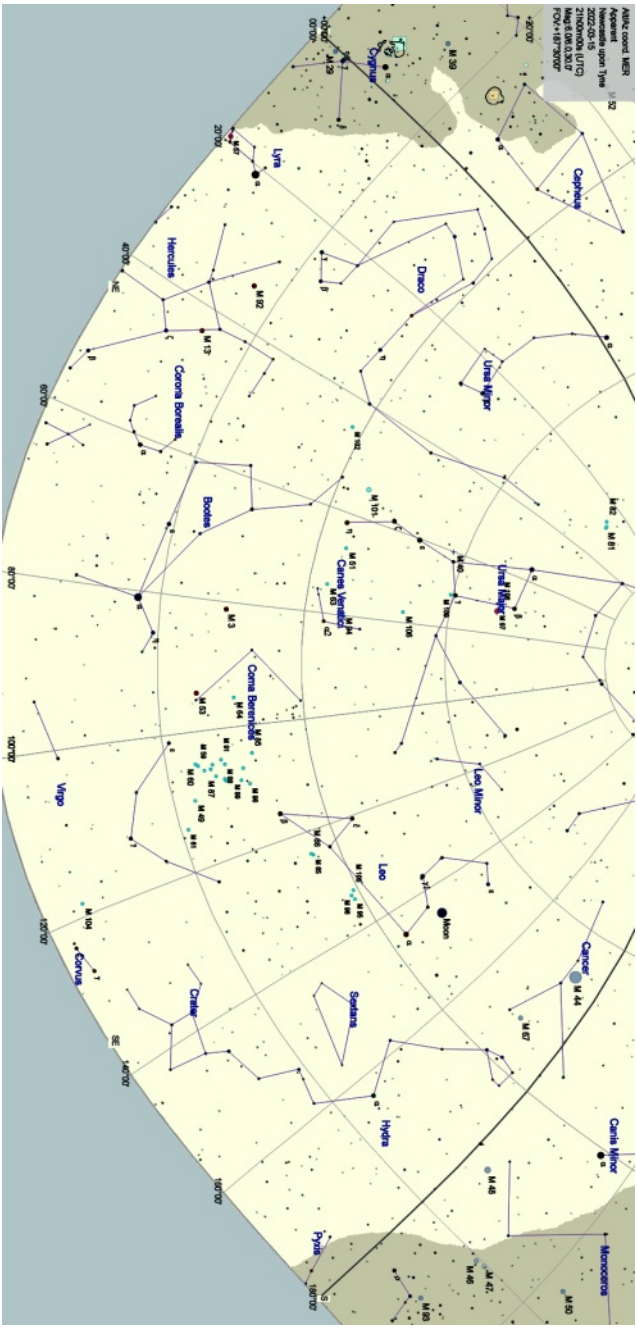
COMETS

There are no comets brighter than magnitude 10 in the sky this month. Weekly comet updates can be found at http://aerith.net/comet/weekly/current.html or https://in-the-sky.org/data/comets.php

The Planets 15/03/2022

	Sun	Moon	Mercury	Venus	Mars	Jupiter	Saturn	Uranus
Rise	06:20	14:19	06:15	04:44	05:08	06:08	05:35	07:37
Set	16:09	06:25	16:21	13:43	13:14	17:18	14:35	22:46

The sky map looking E from Newcastle at 9pm on 15/03/2022.



NIGHT SKY

APR 2022 (times in BST)

Lunar phases

New moon	01/04/2022	07:24
First quarter	09/04/2022	07:47
Full moon	16/04/2022	19:55
Last quarter	23/04/2022	12:56

PLANET SUMMARY

Mercury begins is evening apparition but is only ~20 degrees from the Sun so care has to be taken to locate it in evening twilight. Venus will be a difficult morning object visible in twilight. Mars is close to Venus this month, so once you have located Venus then Mars may be relatively easy to locate. Jupiter is close to Venus in the morning sky so the two can be used to locate Mars and Mercury. Saturn rises almost 90 minutes before sunrise so it can be used as a signpost to successively locate Mars, Venus and then Jupiter as they rise in that order. All four planets are located in a patch of sky around 15 degrees across. Uranus will be an evening object visible in the western twilight after sunset.

THE STARS AT 8PM

North – Perseus, Cepheus and Cassiopeia are nicely placed with the two Bears high up.

East – Draco, Bootes and Virgo are nicely placed. Lyra, Hercules and Serpens Caput are near the horizon.

South – Virgo, Leo, Cancer and Gemini are all nicely placed. Corvus, Crater, Sextans and Hydra are near the horizon.

West – Monoceros, Canis Minor, Gemini, Auriga, Perseus and Cassiopeia are all nicely placed. Canis Major, Orion and Taurus are all near the horizon with Venus in Aries just setting.

METEOR SHOWERS

There is the April Lyrids – active between the 16th and 25th of April – with a last quarter Moon on the night of maximum it will be a challenge to see any of these shooting stars.

COMETS

There are no comets brighter than magnitude 10 in the sky this month.

The Planets 15/04/2022

	Sun	Moon	Mercury	Venus	Mars	Jupiter	Saturn	Uranus
Rise	06:20	18:26	06:17	05:02	04:53	05:17	04:39	06:38
Set	20:09	06:15	21:31	15:38	14:31	16:38	13:50	21:53

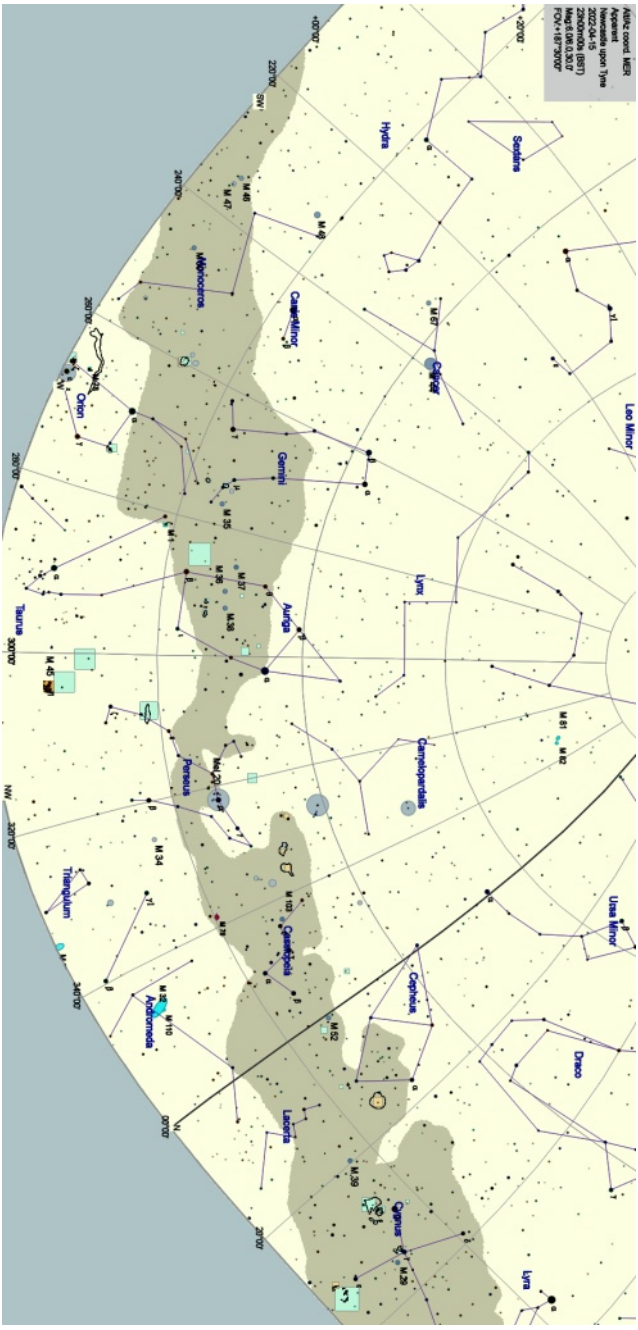
The sky map looking NW from Newcastle at 11pm on 15/4/2022.

Night Sky credits:

Data sourced from Cartes du Ciel,

https://www.timeanddate.com/moon/phases/

and https://in-the-sky.org/



OBSERVERS' SLOT

The Constellation of Virgo

Following Leo, one of the most prominent constellations of the Spring night sky is Virgo. The two share a number of similarities:

a) They both have fairly obvious shapes, closely matching their 'mythical' origins

b) They both contain a number of interesting stars and related objects

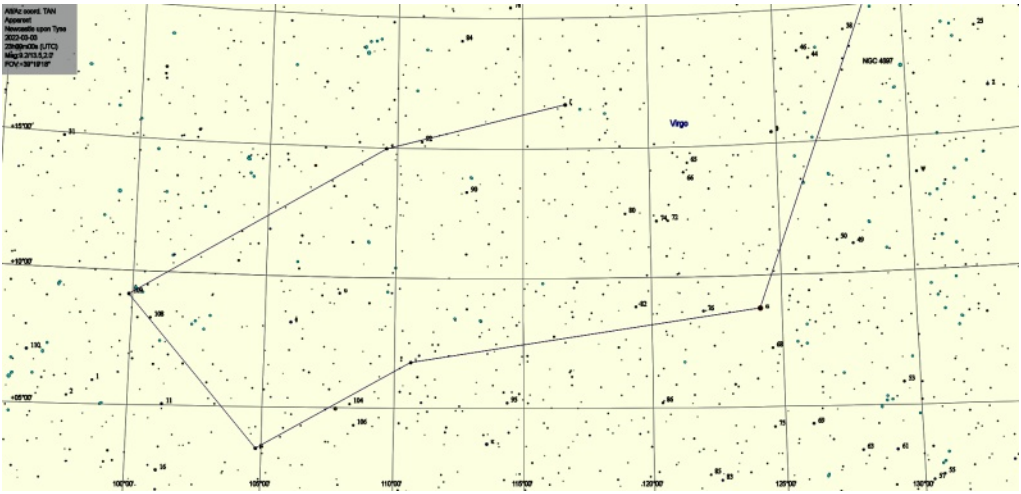
c) They are home to a Galaxy Super-cluster of over 100 objects

So lets go and explore this constellation.

The brightest star in Virgo is alpha Virginis – Spica - at magnitude 0.98 and slightly variable. It is a B9 class giant white star about 500x more luminous than our Sun. It is located at ~300Ly away.

Next comes Beta Vir, Zavijava. This shines at magnitude 3.6 but is fainter than a number of other stars in Virgo indicating that it may have faded somewhat since first marked onto star charts. It is an F8 class yellow sub giant some 33 Ly away from us.

Above 4th magnitude [I.e. visible to the unaided eye] are 7 other stars, including Eta, Zaniah, an A class white star some 10x brighter than our Sun., some 100Ly away. Arich, Gamma Virginis, is a double star of two F-class components only 35Ly away and 3rd magnitude. Minelauva, Delta Vir, is 3rd magnitude and a red



Virgo is a large constellation, and much of it lies low in the sky from the North East. Its principle star, Spica, never rises more than about 25° above the horizon. This chart shows the lower half of the constellation from Newcastle at 11pm at the beginning of March.

giant some 150Ly away. Vindemiatrix, Epsilon is an Sun-like star about 100Ly away. Theta, Apami-Atsa is a white giant about 150Ly away. Heze, Zeta Virginis, is an A-class star of 3rd magnitude some 1100Ly away. Syma, iota Virginis, is a yellow giant some 70Ly away. Khambalia, Lamda Virginis, is a 4th magnitude yellow star some 67Ly away and Rajl al Awwa, Mu Virginis, is a yellow giant also about 70Ly away.

Of the other stars the most interesting is 61 Virginis which is similar to our Sun and is only 30Ly away.

Many of the stars of Virgo are set in groups at distances of ~30Ly, ~100Ly and at ~300Ly away from us.

Variable stars

Virgo has 6 variable stars brighter than 7th magnitude [at peak]. They are mostly Mira class though one [X Vir] is not yet confirmed.

• X Virginis varies from 7th to 11th magnitude over an uncertain period.

• SS Vir varies from 6th to 10th magnitude over 355 days.

• R Vir varies from 6th to 12 magnitude over 146 days.

• U Vir varies from 8th to 14th mag over 207 days.

• S Vir varies from 6th to 13th mag over 377 days.

• RS Vir varies form 7th to 14th mag over 353 days.

Double stars

Virgo contains a number of double stars and amongst them is one of the finest in the sky – Gamma. The full list of double stars which are all in binocular range [brighter than 10th magnitude] is as follows:

• 17 Vir – 7th and 9th mag components separated by 20" at PA 337°.

• Gamma Vir – Porrima – consists of 2 x 4th magnitude yellow stars with a separation of 3" and PA 287°. They are a true binary pair with an orbital period of 171.4 years. This one of the nicest and brightest pairs in the sky. They are currently near their closest – apparent - approach in the sky and getting wider. For more details check here: Gamma Virginis - Wikipedia.

• Theta Vir – 4th and 9th mag stars separated by 7" at PA 343°.

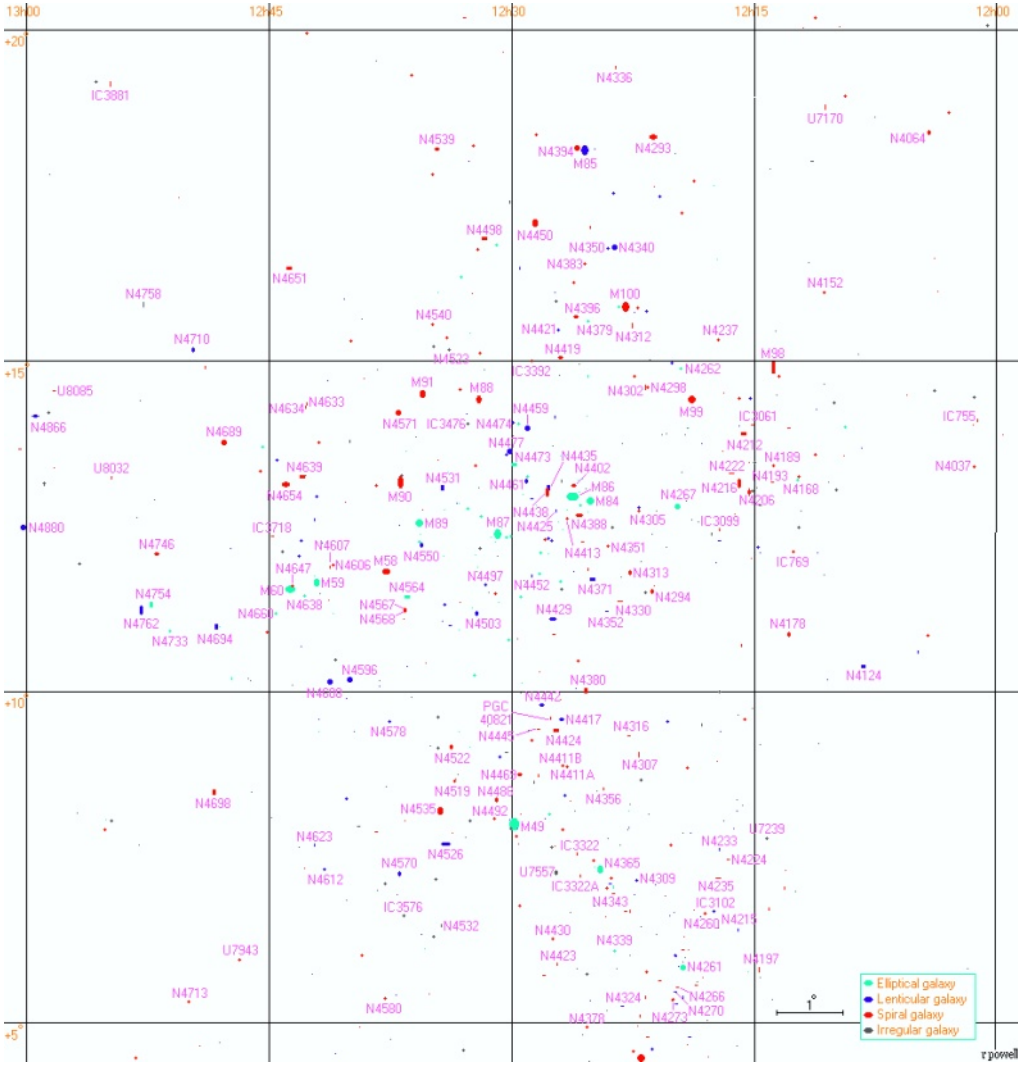
• 73 Vir – two 7th mag stars separated by 0.1" at PA183°.

• 84 Vir – 6th and 8th mag stars separated by 2.9" at PA 229°.

• Tau Vir – 4th and 10th mag stars separated by 80" at PA 290°.

• Psi Vir – 5th and 9th mag stars separated by 4.8" at PA 110°.

OBSERVERS' SLOT



Finding chart for the many galaxies in the Virgo Cluster. Although the most well known region is that around M87, there are a large number of galaxies stretching to the south which are often overlooked. Unfortunately they lie quite low in the sky from Kielder.

Deep Sky Objects

Virgo is home to a Galaxy Supercluster, one of a number of constellations in our skies that is host to such a structure. There are – at least – 40 galaxies brighter than 12th magnitude – i.e. are within the observing view of even modest amateur telescopes. The brightest of the group is Messier 87 – at 9th magnitude– a giant elliptical [class E1] galaxy – about 7" across in the sky - with has a voracious black hole which has recently been imaged by the Event Horizon Telescope.

The jet emitted from the black hole in M87. Credit: Nigel Metcalfe.

John and William Herschel were the first astronomers to recognise the concentration of objects in this part of the night sky in 1863 and it has been known since the mid-1920s that many of these galaxies are in a cluster at a common distance (now known to be just over 50 million light years). It was Hubble who first coined the term 'Virgo Cluster' in 1931. However, in the 1950s it became apparent that the cluster was part of an even larger structure, which became known as the Virgo Supercluster.

The other Messier objects in Virgo are:

- M61 is a 10th magnitude Sc1 type galaxy.
- M84 is a 9th magnitude E1 type galaxy.
- M86 is a 9th magnitude E5p galaxy – indicating that it has interacted with a 'neighbour' in the past.
- M49 is an E4 class galaxy of 8th magnitude.
- M89 is an E0 galaxy of 10th magnitude.

M104 from Namibia. Canon 60Da and Takahashi FSQ106 telescope. Credit: Robert Williams.

OBSERVERS' SLOT

• M90 is a 9th magnitude Sb galaxy of 10th magnitude.

• M58 is another Sb galaxy of 10th magnitude.

• M104 – the Sombrero Galaxy - is an 8th magnitude Sb glass galaxy.

• M59 is an E3 elliptical galaxy of 10th magnitude.

• M60 is an E1 galaxy of 9th magnitude.

The "Eyes Galaxies", NGC4435 and NGC4438. Credit: Nigel Metcalfe.

Of the other bright galaxies in Virgo, the most interesting are :

• NGC4438 – a 10th magnitude class Sap – indicating it has undergone an interaction with a neighbour, NGC4435. The pair are commonly known as the "Eyes Galaxies".

• NGC4442 – 10th magnitude class E5p – again indicating an interaction with a neighbour.

• NGC4753 – 10th magnitude classified as Peculiar – as a result of a more intense interaction with a neighbour.

• NGC5363 – 10th magnitude class Ep.

• NGC5364 – 10th magnitude class SB+p …... it does appear that NGC5363 has disrupted NGC5364 (see NGC 5364 - Wikipedia).

For more details about peculiar galaxies please check out these links: Peculiar Galaxies (hubblesite.org) and Atlas of Peculiar Galaxies - Wikipedia.

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.

KIELDER OBSERVATORY
Infinite Inspiration

M13, the great globular cluster in Hercules. Shot with an 80ED refractor on an HEQ5-Pro mount by one of our volunteers. Total exposure time: 4.75 hours.

Credit: Michael Auton

"Event team were amazing, and their enthusiasm and passion for the cosmos was truly contagious. Even though we didn't get to use the telescope (due to the weather) they made the visit unforgettable."

Marta, Carlisle

Two more shots by Michael Autin with the 80ED. Above: M42, the Orion Nebula. Below: M31, the Andromeda galaxy.

The slightly curved streak of light in the upper centre of this picture is the James Webb Space Telescope (JWST), captured moving along its final orbit against the background stars of Canis Minor. Imaged over a 2 hr spell around midnight on Friday Feb 4th, this is a stack of 52x2min exposures using a 14" SCT reduced to 2.6m focal length and a Canon EOS40D camera. If you look carefully, just below centre there is a weak trail crossing the whole image horizontally - this is a geostationary satellite. Taken from a back garden in West Cornforth, County Durham.

Credit: Jürgen Schmoll.

GALLERY

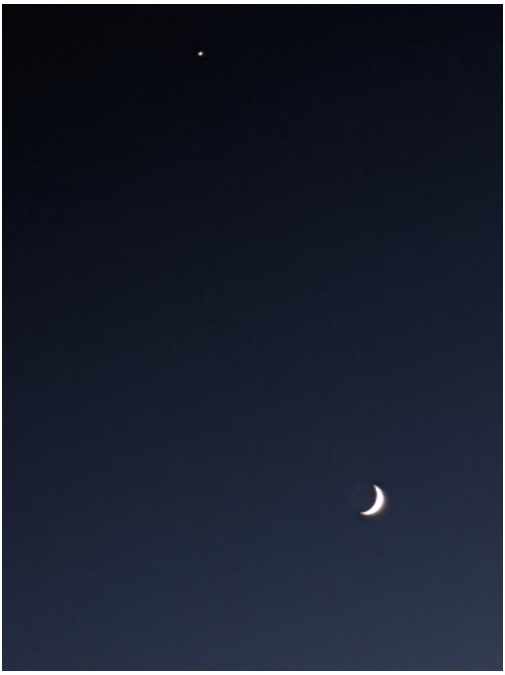
Above: M33, a galaxy in Triangulum. Below: the Pleiades star cluster (M45). Both shot using a DSLR & 300mm telephoto on a tracking mount without a telescope by another of our volunteers.

Credit: Ant Perkins

The moon and Venus, taken through the Little Tern sculpture at Horden, County Durham. Credit: Kevan Hubbard.

Another 300mm telephoto shot from Ant Perkins, showing Messier 81 and 82. You might also spot neighbouring galaxies NGC2976 and NGC3077.

GALLERY



Some more photos by our regular contributer Kevan Hubbard.
Above left: the full moon over the sea, taken from Whitley Bay, Northumberland.
Above right: Jupiter and the Moon using a Google Pixel 3a smartphone and 3x Black Eye lens (about 5x zoom in all).

The nearly full moon captured through one of our telescopes on Jan 16th. The colours have been enhanced to bring out the geology of the lunar surface.

Orion over Tynemouth Abbey, Northumberland Taken with a Google Pixel 3a smartphone at 1x. Credit: Kevan Hubbard.

"Not just knowledgeable, but enthusiastic and able to present the information in a really accessible and engaging way. I feel like I could go back tomorrow and the same team could give me a completely different load of information. Plus, they all clearly love the job and it shows! Just brilliant. Very well done for making us barely miss the stars (we had nothing but cloud all night and it was still a really excellent evening). Glad to have an excuse to come back"

Sian, Nenthead

Kielder Observatory - a beacon for dark skies

https://kielderobservatory.org

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