

Winter 2022/23 Number 38



Kielder Observatory Newsletter



NEWS

Crowdfunding
target reached!

NIGHT SKY

Highlights Feb/Mar/Apr

SCIENCE

Ultra compact
dwarf galaxies

SOLAR SYSTEM

Mars Curiosity rover



EDITORIAL

Well, first of all I am no longer a KOAS trustee, having served my maximum 9 year term allowed by our constitution. There have been ups and downs during those 9 years, but I leave the board with KOAS currently in a great place, and with much to come in the future. I will, however, along with Robert, be continuing to edit this newsletter.

Winter can be a bit of a frustrating time at the observatory, with crisp clear nights often meaning an iced up track and disappointed visitors. However, when this happens we have taken to running free pop up events at easier to reach locations, which at least means we can show the wonders of the winter night sky. The excitement at the moment is comet C/2022 E3 ZTF. If you haven't seen it yet then get your binoculars out and look north ...

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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Front cover: A good covering of frost ...

Rear cover: Popping up at Corbridge ...



KOAS NEWS



2022 was another exciting year, re-opening fully after the pandemic, taking the time to formulate and launch our new strategy, supporting young artists, visiting hundreds of schools, acquiring some amazing new kit, and even working with Father Christmas!

We are proud of what we have achieved to date but it feels as though we are just getting started. We will continue to develop new activities, projects and programmes that convey that very special "Kielder moment" to as many people as possible.

We remain grateful to everyone who supports the work we do: the team of staff and volunteers, the visitors, the schools,

the funders and partners. We cannot do what we do without you.

*Peter Standfield, Chair of Trustees
Catherine Johns, CEO*





OBSERVATORY NEWS



Amazing what you can find at Fenwick's at Christmas ...

The great news is that we have hit our fundraising target for the new wind turbine, with our Spacehive appeal currently standing at nearly £32000! So we will have our new source of sustainable power for the future, which, given the alternative would have been an expensive connection to mains electricity (not to mention the running costs of electricity these days!), is a welcome boost to the observatory.

More good news is that we are one of seven Science and Discovery Centres across the UK to be awarded a Bold Futures Grant by the Association for Science and Discovery Centres. This is for a pilot STEM programme specifically for excluded children. You can find more details of the awards at <https://www.sciencecentres.org.uk/projects/boldfutures/seven-selected-organisations/>



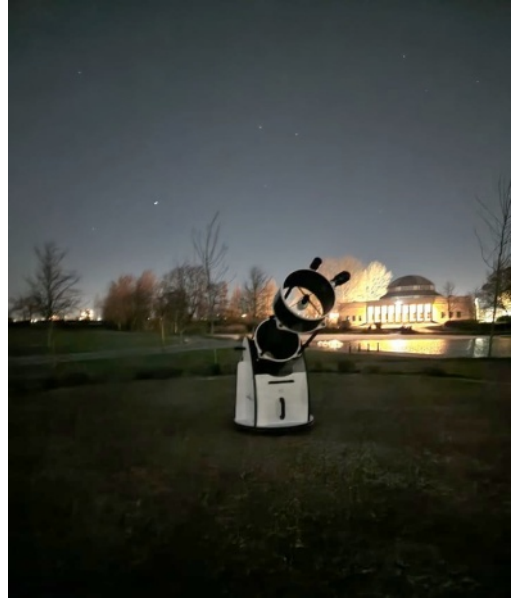
OBSERVATORY NEWS

keep an eye on our Facebook and Twitter feeds to see if one pops up near you. They're proving to be pretty popular!



Deep and crisp and even ...

It's winter, and unsurprisingly we've been plagued by closures due to snow and ice (which makes the track up to the observatory impassable for normal vehicles) in January, but instead we've been running pop up events across the North East. We've been in Northumberland, Newcastle and North Tyneside. These events are free and we encourage people to wrap up and come and join our astronomers for a bit of observing, as a way of introducing them to what we do. For obvious reasons they tend to be arranged at the last minute, so



Preparing for a pop-up at Exhibition Park, Newcastle.

As ever, there have been a good crop of podcasts since the last newsletter. Firstly we have "Winter Astrophotography & Why Wind Is Important to Kielder!", where Dan Pye, our director of Astronomy, explains why the wind turbine is so important, and Dan Monk, our director of Astro Photography, explains a few of the ingredients you need to get a stunning shot of the night sky, as well as some of the things to particularly point your camera at through the winter months.



OBSERVATORY NEWS

Then in "James Wilton Dance & The Universe" our Science Lead, Ellie Macdonald, chats to James Wilson about what inspiration the Universe has had on James Wilton Dance's version of Vivaldi's the Four Season, which is currently touring the UK. Finally we have "Dr Jarita Holbrook - Cultural Astronomy", where Ian Brannan, and astronomers Dan Pye & Ellie Macdonald, explore the relationship between humans and the night sky, with cultural astronomy expert Dr Jarita Holbrook.

All out podcasts can be heard for free at <https://podfollow.com/kielderobs/view>.



In December we also did a live broadcast for the Geminid meteor shower - this is still available on Twitter at <https://twitter.com/i/broadcasts/1gqxvyADbQjJB>

As you can see from our opening photo, there were some curious goings on at the Fenwick's department store back at the beginning of December, with some rather familiar looking elves on the roof top delivering talks about the moon and some 'astrocrafts' for the young ones.



Moon talks at Fenwick's department store.

The observatory features in a new advertising campaign at Newcastle International Airport, delivered by the North East Local Enterprise Partnership and Invest North East England, showcasing why the North East is a great destination to work, learn, live, visit, and invest. So if you are passing through the airport keep an eye open for us ...

Eagle-eyed observers might also spot us on the opening montage of the BBC's Look North news programme!



OBSERVATORY NEWS

Just after the last newsletter went to press we got to welcome former NASA astronaut Susan Kilrain to the observatory! Susan logged over 470 hours in space as her time as an astronaut, taking part in two space flights!



Astronaut Susan Kilrain visited at the end of October.

As ever, we are pretty full already in February and March, so we encourage people to book as soon as they can. Our Saturday late night events are currently booked up until May, although it is always worth keeping an eye on our [Facebook](#)

and [Twitter](#) accounts in case of last minute cancellations! Over the Easter holidays we are running the popular "Space Kids - Rockets" events again - there are still some places left for these in April.

Finally, just as we went to press it was announced that we are one of UK 30 organisations chosen to participate in the "[Mindsets + Missions for Museums and Science Centres of the Future](#)" programme. This is a new learning and grants scheme, funded by [UKRI](#), which will support museums and science centres to engage underrepresented groups with knowledge, research and innovation.



Young Explorers – Jan 23

Rubbish weather, freezing cold and blowing a hooley. No chance of seeing anything in the night sky. But had fab, privileged evening with a wonderful team of inspirational experts. We can't wait to come back, whatever the weather.

Michael, Newcastle



ASTRONOMERS' TALES



Hello all, my name's Ishbel and I am just about to finish my 5th month working as an Astronomer and science communicator at Kielder observatory! Where has the time gone! First a little background on me. I just finished my integrated masters in Astrophysics at St Andrews university last June. I had the most phenomenal time there getting to study the planets, stars, galaxies and the universe-it is just absolutely fascinating. Part of the joy of Kielder is we offer the opportunity for other like-minded people to come and wonder too, as it is a poorly represented subject at

school level. I only realised I could study astrophysics at university when I was reading prospectuses, and I thought jack pot , what a loop hole, I get to stare at stars for 5 years and people will think it's a respectable degree and someone somewhere might give me a job after. Turns out it was a lot of maths too, but turns out maths is pretty cool.

I did not think I would get to do something like Kielder, I would say it is very unique as a job and I have absolutely loved it. So far I have led people on tours of the telescopes, shown them some stunning views of our Galaxy, shown them pieces of outer space, touched the moon and stood on mars on a daily basis, taught lessons in schools from reception to teenagers and I even saw the northern lights in October! I have also stacked wood, cleaned toilets, wiped floors, made many many hot chocolates and hair dryer-ed the projector when we can not wait for the room to heat

Secret Lives of Stars – Jan 23

As a woman in STEM, i was in awe of the girls working the night we attended. They were both so captivating discussing their knowledge and so insightful. The whole team were so lovely, and able to help with anything!! It was so lovely being surrounded by people so passionate about their jobs and their field of expertise, it enhanced whatever star gazing we managed to do.

Rachel, Chester-le-Street



ASTRONOMERS' TALES

up from the fire. Variety is the spice of life no?

Through all of this I have gotten to know a wonderful, eclectic group of people I get to call my colleagues. With Kielder being such a small team, it is amazing how well everyone fits into a different cog and propels on the engine that is our observatory, from our directors, to our office staff, to the astronomers and the volunteers – everyone cares so much about this place and the goals we are working to achieve. Whether it's going into schools, hosting private events, our introductory or our late night events everyone puts their all into giving our

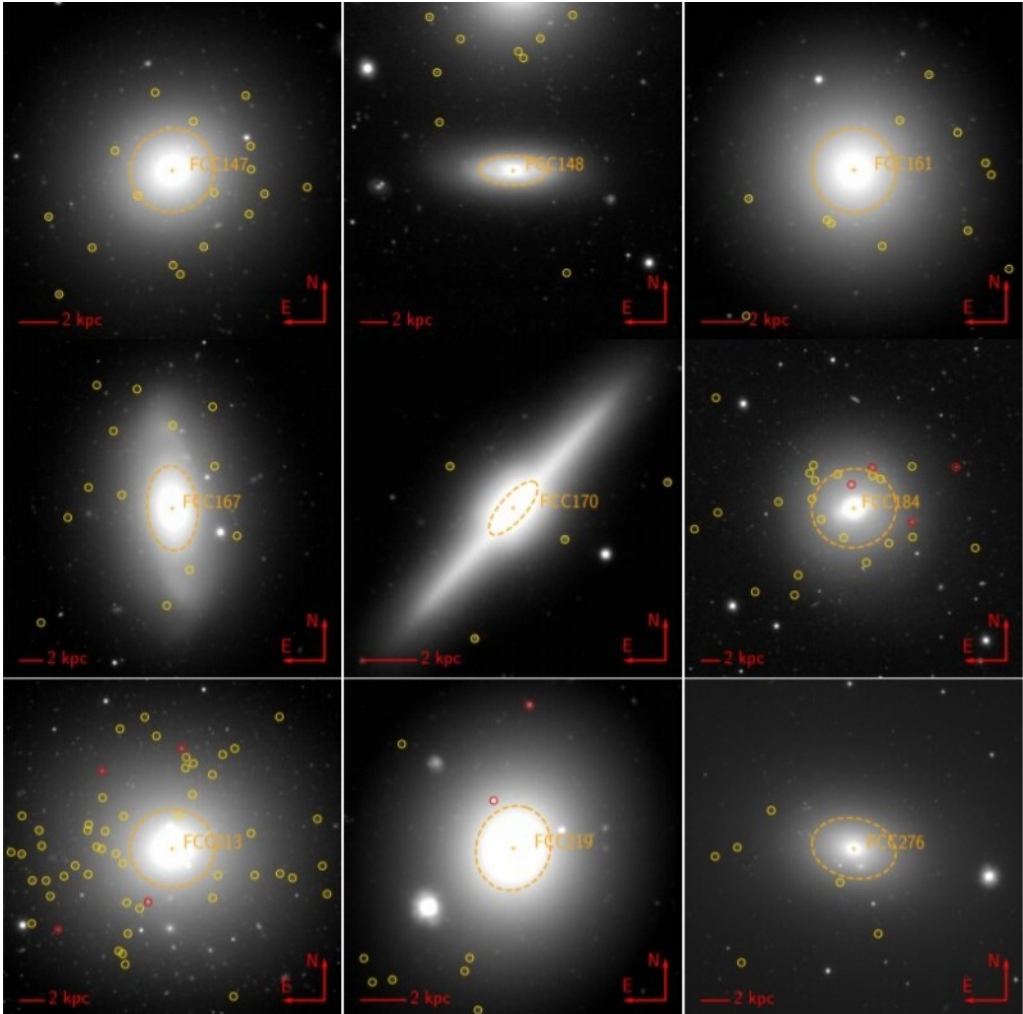
guests the best of what we can offer. I joined at a great time because within the first 3 months we had the annual team day, which was a big meeting followed by, this year, archery, knife throwing and rifle shooting. My team were fantastic at archery but we all were absolutely pants at the knife throwing! We also had awards dinners throughout the end of the year – we won Women in STEM at the WIN awards, making me very proud indeed to have joined this team. And then we had the Christmas dinner as well. It's been a blast and I can not wait to see what happens next – hopefully clear skies!





SCIENCE SLOT

Ultra-compact Dwarf Galaxies



UCD/GCs around the brightest galaxies in the Fornax cluster.

Credit: Saifollahi et al., 2021.

Ultra-Compact Dwarf Galaxies [UCDs], are a relatively new type of galaxy discovered only a few years ago. The reason for this is – as their name

suggests – they are both very small and also very compact – so are challenging to discern from the glow of nearby – much larger - galaxies.



SCIENCE SLOT

When first discovered – within the past 20 years – it required the great resolving power of massive optical telescopes and telescope systems to separate them as distinct objects away from their neighbouring larger and – consequently brighter – companions. Now that a number of UCDs have been observed and characterised – the method of their formation has finally been pinned down.

Dwarf Galaxies – as their name suggests – are essentially smaller versions of well understood normal-sized galaxies. They do have some peculiarities in often being irregular in shape – such as for example the Large and Small Magellanic Clouds which are dwarf companion to the Milky Way.

UCDs are very different to the LMC, the SMC and also dwarf irregular galaxies. The basic mechanism for their formation is that UCDs are the left-overs from the collision of two parent galaxies, whereby the spiral arms of the one [less massive] galaxy is stripped away by the more massive galaxy. This leaves an UCD – which in essence is the progenitor galaxy bulge – i.e. core - of the galaxy – from which the spiral arms became lunch for the larger galaxy.

As a consequence UCD Galaxies have some unique properties:

- 1) They resemble Elliptical Galaxies in having mostly old – red – stars in their core.
- 2) They do not have spiral arms.
- 3) They may not have a Supermassive Black Hole in their centre – because it may have been assimilated by the SMBH of the galaxy having it for lunch.
- 4) The density of stars within their galaxy bulge is rather high compared to other galaxies.
- 5) They contain no cool gas or dust – but only superheated hot gas caused by the radiation from their central SMBH – and so are not forming new stars or nebulae.



The ultra compact dwarf M60-UCD1, taken with the HST.

Credit: NASA, ESA & A. Seth (Univ. of Utah)



SCIENCE SLOT

Being dwarf galaxies their mass is in the region of ~200 million solar masses, and around 50% of this mass is concentrated within the innermost ~100 Ly, resulting in star densities some 15,000x that of Orion Arm of the Milky Way [Earth's neighbourhood]. In otherwords, the stars are not light years away from one-another, but light-months!

These galaxies are also strong sources of X-rays which may be a clue to the processes that have taken place during the stripping process in the collision that created the UCD or what came after the stripping process had finished. This also suggests that the interaction that created the UCD happened a long time ago and

that the UCD is currently in some form of suspended life.

M60 UCD1 is an interesting example. This is a companion to the well-known galaxy Messier 60 in the Virgo Cluster. For comparison M60 has the following properties:

Number of Stars: 400 billion

Diameter: 120 million Ly [Ratio~ 3,000:1] whereas M60-UCD1 has the following properties:

Number of Stars: 140 million

Diameter: 400 Ly [Ratio~350,000:1]

UCDs have been located around other Galaxies. They are located in a number of



Hubble Space Telescope image of the Blue Compact Dwarf Galaxy SBS 1415+437.

Image credit: ESA / Hubble / NASA / Alessandra Aloisi, STScI / Nick Rose.



SCIENCE SLOT

galaxy clusters, such as those in Virgo, Coma and Fornax and Abell 1689. The Virgo Cluster is known to contain over 100 UCDs. A UCD in Messier 59 [in Virgo] is the most densely packed UCD yet discovered.

Blue Compact Dwarf Galaxies



The compact dwarf galaxy VCC 848 taken with MegaCam on the Canada–France–Hawaii Telescope.

Credit: Zang et al, 2020.

young hot massive stars. A good example is UGC11411. The blueness of the stars indicates that these galaxies are only in the order of 10 million years old – or less – and – because the stars are blue – they must be forming at a prodigious rate. BCDs contain little or no dust and are metal-poor, so must have formed or must be forming from fresh hydrogen gas which has not been already cycled through any previous star forming activity.

As a consequence research on this type of object is quite recent, for example., this paper from 2020 ...

[The Blue Compact Dwarf Galaxy VCC 848 Formed by Dwarf–Dwarf Merging \(ApJ Letters\)](#)

For more information about what is known about BCDs please take a look at this link ...

[Papaderos_UCM_May2010_Lecture2.pdf](#)

Robert Williams

In the past few years the Hubble Space Telescope has discovered a completely new type of Compact Dwarf Galaxies. BCD Galaxies are typically around 1/10th the size of a normal spiral galaxy. Unlike UCDs they consist of almost entirely



NIGHT SKY

FEBRUARY 2023 (times in GMT)

Lunar phases

Full moon	06/02/2023	18:30
Last quarter	13/02/2023	16:03
New moon	20/02/2023	07:09
First quarter	27/02/2023	08:06

PLANET SUMMARY

Mercury is too close to the Sun this Month. Venus will be a challenging object visible in the twilight at dusk. Mars is a morning object visible from 7pm until 2am. Jupiter is visible in the evening twilight from 1900. Saturn is in conjunction with the Sun this month. Uranus is visible from around 7pm until 11pm.

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

Comet C/2022/ E3 ZTF reached its closest to the Earth on February 1st, and could be visible to the naked eye from a dark site. It is very well placed, being high in sky in Camelopardalis around 9pm. Plenty of astrophotographers will be after this one! It will remain visible in binoculars for the rest of this month as it travels through the constellations of Auriga and Taurus (passing only 1.5 deg from Mars on the 10-11th). There are no other comets brighter than 9th magnitude in the sky.

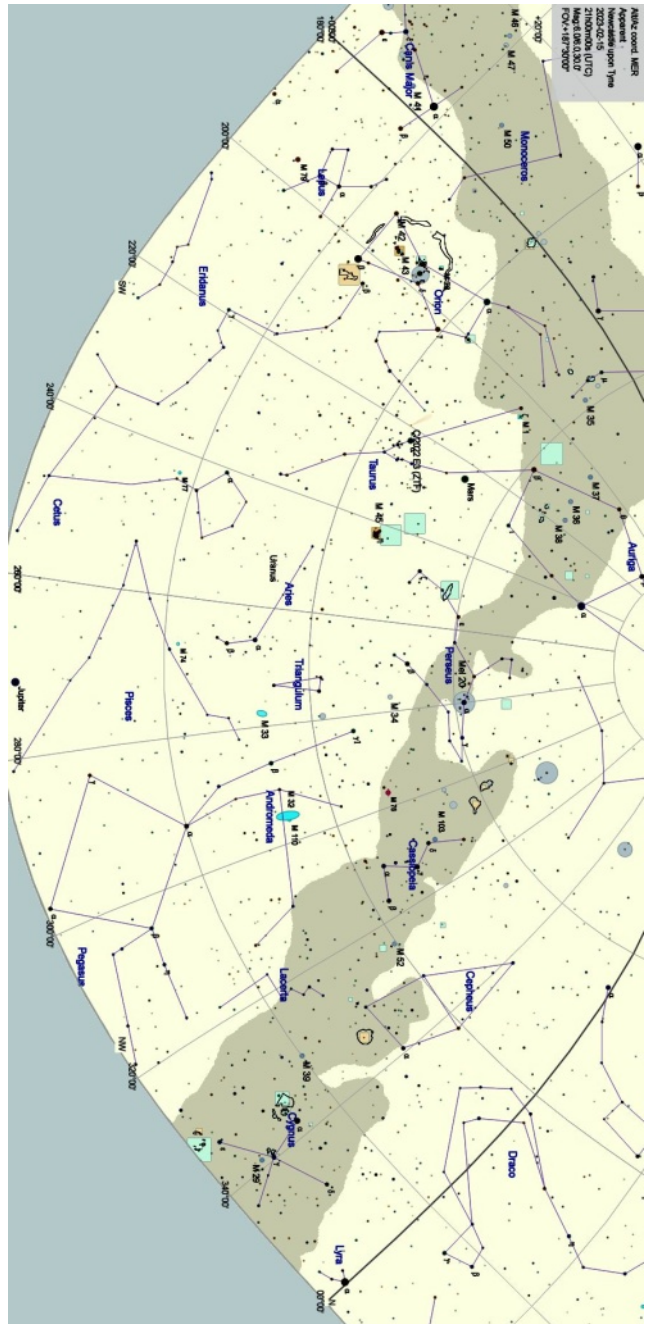
The Planets 15/02/2023

	Sun	Moon	Mercury	Venus	Mars	Jupiter	Saturn	Uranus
Rise	07:28	04:13	06:59	08:20	10:20	08:40	07:41	09:33
Set	17:11	10:34	14:56	19:47	04:05	21:16	17:08	00:55



NIGHT SKY

*The sky chart for Newcastle
looking W at 9pm on
15/02/2023.*





NIGHT SKY

MARCH 2023 (times in GMT)

Lunar phases

Full moon	07/03/2023	12:42
Last quarter	15/03/2023	02:10
New moon	21/03/2023	17:06
First quarter	29/03/2023	03:34

PLANET SUMMARY

Mercury is in conjunction with the Sun.

Venus will be a nice object in the early evening sky after sunset. Mars will be visible from around 19:30 until 01:30.

Jupiter will be a challenging object in the evening twilight. Saturn is in conjunction with the Sun. Uranus will be visible in the evening sky from 19:30 until 21:30. It will be near Venus for most of the month.

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

Comet C/2022/ E3 ZTF should be still visible [8th Magnitude] in binoculars during this month as it travels along the border between the constellations of Orion and Eridanus. It is now fading as it moves away from the Earth. There are not expected to be any other comets brighter than magnitude 10 in the sky in March.

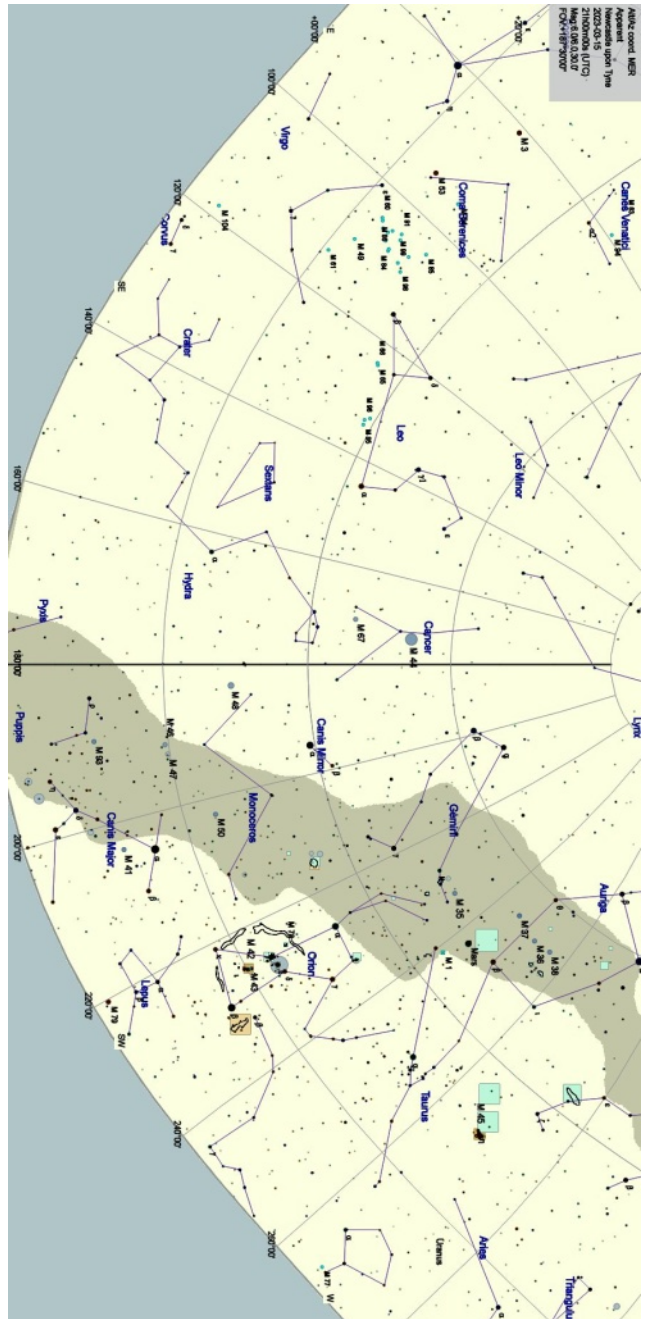
The Planets 15/03/2023

	Sun	Moon	Mercury	Venus	Mars	Jupiter	Saturn	Uranus
Rise	06:20	03:22	06:31	07:11	09:13	06:59	05:57	07:45
Set	18:08	09:12	17:48	21:25	03:10	20:03	15:38	23:10



NIGHT SKY

*The sky map looking S from
Newcastle at 9pm on
15/03/2023.*





NIGHT SKY

APRIL 2023 (times in BST)

Lunar phases

Full moon	06/04/2023	05:37
Last quarter	13/04/2023	10:12
New moon	20/04/2023	05:15
First quarter	27/04/2023	22:21

PLANET SUMMARY

Mercury will be challenging object in the evening twilight. Venus will be visible in the west after sunset. Mars will be visible from 2130 until 0130. Jupiter is in conjunction with the Sun. Saturn is not visible this month. Uranus may be glimpsed low in the evening twilight, after sunset.

THE STARS AT 10PM

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 waning/ waxing Moon this year it should be possible to see this shower, at some time during its active dates.

COMETS

There are no comets brighter than 10th magnitude visible this month.

The Planets 15/04/2023

	Sun	Moon	Mercury	Venus	Mars	Jupiter	Saturn	Uranus
Rise	06:20	05:10	06:12	07:09	09:25	06:08	05:00	06:46
Set	20:09	13:28	22:13	00:14	03:09	19:45	14:55	22:17

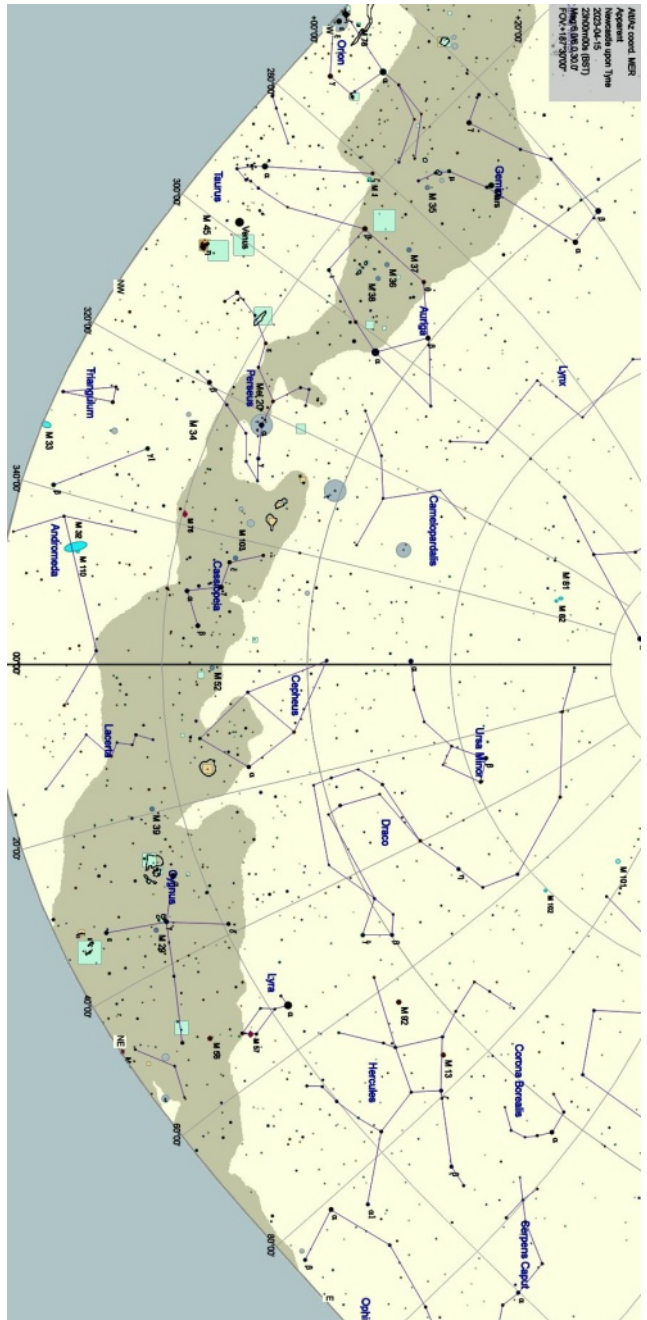


NIGHT SKY

The sky map looking N from Newcastle at 11pm on 15/4/2023.

Night Sky credits:

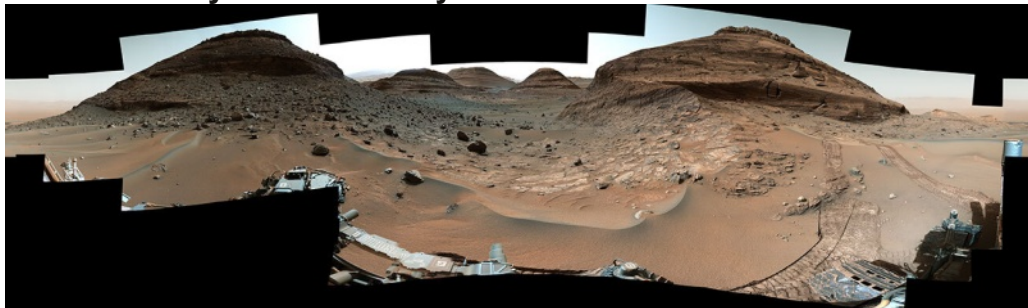
Data sourced from [Cartes du Ciel](https://www.timeanddate.com/moon/phases/),
<https://www.timeanddate.com/moon/phases/>
 and <https://in-the-sky.org/>





SCIENCE SLOT

Mars Curiosity Rover and beyond ...



Curiosity's View of Paraitepuy Pass. The floor of the Gale Crater is visible in the background in the upper right.

Credit: NASA/JPL-Caltech/MSSS

With quite a lot of focus being on the Artemis un-manned mission around the Moon and back – as well as the steady trickle of images now being sent back by the James Webb Space Telescope – a rather special anniversary has gone a little under the radar.

The NASA Curiosity Rover has recently had its 10th anniversary exploring the surface of Mars. Launched in November 2011, and landed by sky-crane in August 2012, Curiosity was sent on a mission to locate areas where there may have been past-life on Mars – or at least evidence that there were conditions present under which life may have existed in some form for a reasonable length of time.

The mission had 4 major goals:

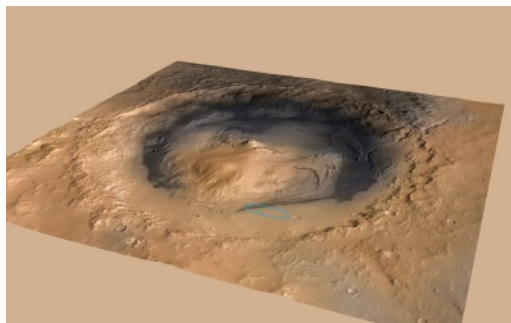
- 1) Determine if there has ever been past life on Mars.
- 2) Characterise the climate on Mars

over the past 4 billion years.

3) Characterise the geology on Mars over the past 4 billion years.

4) Prepare for exploration of Mars by astronauts in the future.

Its first target was to explore [Gale Crater](#) – an asteroid impact feature. Gale Crater is – probably – a dried up lake bed located



Curiosity's landing site on Gale Crater (green dot inside the blue ellipse of the target area).

Credit: NASA/JPL-Caltech/ESA/DLR/FU Berlin/MSSS



SCIENCE SLOT

at 5.4S 137.8E on the Martian surface, near the Aolis Quadrangle.

It is a very old structure estimated to be around 3.8 billion years in age. Aolis Mons is the central mountain peak and is around 18,000 ft high. Aolis Palus is a plain like structure that connects the crater rim to the central peak of Gale Crater.

Using data from the THEMIS mapping orbiter, a geological map was prepared prior to the arrival of Curiosity, to provide a route map of exploration so that the rover

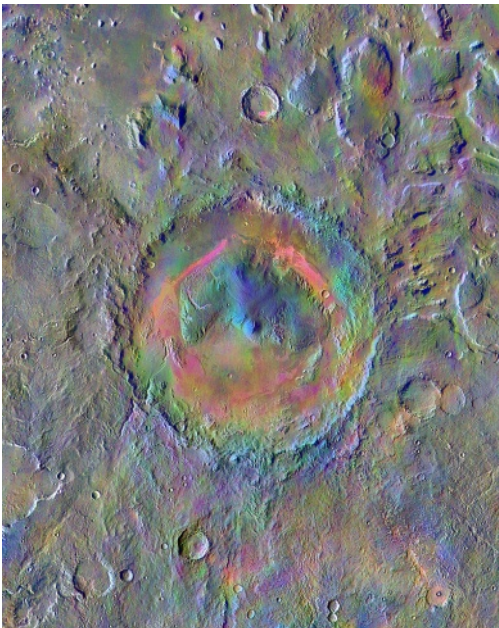
could follow the path most likely to encounter a varied selection of rock types, for analysis by the onboard laboratory.

As well as basaltic rocks extruded by volcanic activity, this area contains sedimentary structures ['Mount Sharp'] and anhydrite type rocks created by evaporation of salty brines.

About 1 month after the rover began its survey the first main results were published indicating the presence of rocks containing water, sulphur [volcanic in origin] and chlorine [from salty brines].

In December 2013, NASA confirmed that Gale Crater did at some time in its past contain a freshwater lake. One year later Curiosity had also sent back information that suggested that the level of methane in and around Gale Crater was not constant. Methane is an interesting molecule as it has both biogenic [sourced from living organisms] and chemo-genic [sourced from processes that are not based on living organisms] origins, such as [Serpentinisation](#).

In 2017 Curiosity reported that, from a study of the layered structure of Mount Sharp, there was evidence that the composition of the layers changed by depth – and hence time of deposition – from oxidising to reducing showing that the climate of Mars has undergone a



An image of Gale crater made using data from the Thermal Emission Imaging System on NASA's Mars Odyssey orbiter. The colours indicate different mineral deposits.

Credit: NASA/JPL-Caltech/Arizona State Univ.



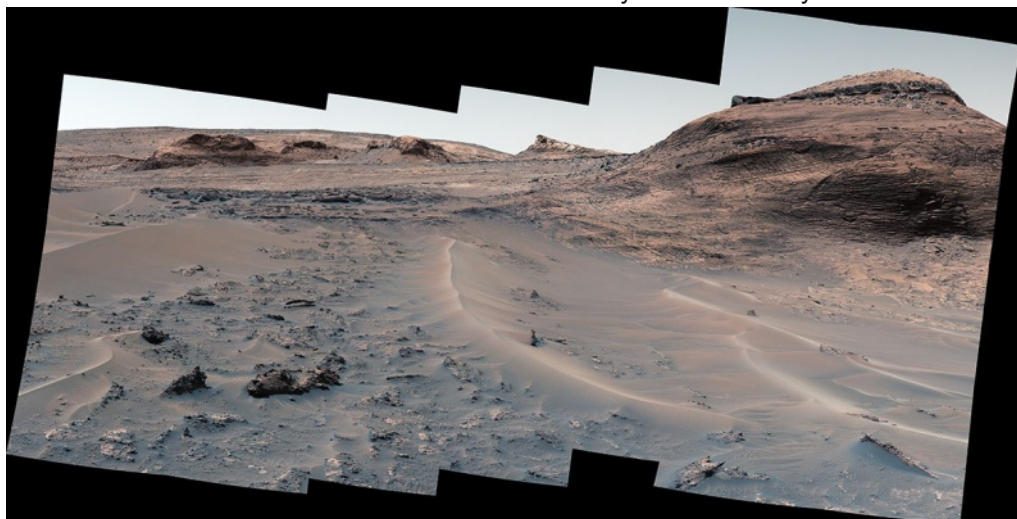
SOLAR SYSTEM SLOT

significant change in the last 4 billion years. The rover also confirmed that these conditions would have been suitable to support microbial life – though it did not report finding any bugs that were still viable!

In June 2018 the rover located evidence of

past, just that the conditions were – probably – conducive to the ability of life to survive.

In November 2020, further evidence of the – temporary – presence of water in Gale Crater was put forward, based around the discovery of sedimentary structures



Curiosity's view of the hill "Bolívar" and adjacent sand ridges.

Credit: NASA/JPL-Caltech/MSSS

the presence of organic molecules in ancient rock strata. Later that year [November] further evidence obtained by the rover supported the idea that Mars was once a 'wet world', broadly similar to what Earth is today, based on the discovery of carbonate minerals. Once again carbonate minerals have both biogenic and chemogenic origins, so this does not necessarily indicate in any certainty that there was life on Mars in the

consistent with large volumes of floodwaters moving through the region in which Gale Crater is located. These structures indicated that water with depths of up to 25 meters and more, flowing at 10 meters per second, moved through this region of Mars some 4 billion years ago. Curiosity uses an array of instruments that are grouped into a number of types:

1) Cameras, including MastCam that is used to guide the rover around the



SOLAR SYSTEM SLOT

surface.

2) Spectrometers – used to analyse the mineral content of the rocks the rover examines, including SAM – the onboard chemical lab.

3) Radiation detectors – including detectors analysing the nature of the solar radiation reaching the surface of Mars and a neutron detector for determining the water content of Martian rocks.

4) Environment sensors – essentially a Martian weather station.

5) Martian Atmosphere composition – the MEDLI instrument – specifically used to monitor the conditions during the high velocity entry of the SkyCrane payload as the probe was landed.

The Rosalind Franklin Rover

Originally planned to be launched in 2022, the [ExoMars mission](#) – renamed Rosalind Franklin Rover – is currently on hold. No date has yet been set for its launch. Because of Mars's orbit compared to

Earth's, the next favourable launch window will not open until late 2024 or early 2025. Other delays have now resulted in an anticipated launch date some time in 2028.

Originally a joint venture between ESA and the Russian Space Agency, the system is now being redesigned to use a different launch system.

Essentially a scaled down version of Curiosity, ExoMars is a 6-wheeled all terrain mobile laboratory. The principle difference between the two rovers is that ExoMars is designed to drill much deeper into the Martian soil, potentially reaching down to 2 m, compared to Curiosity's drill which only goes down about 20 cm. Early tests on Earth using simulated Martian soil have showed that the drill system can reach 1.7 m depth without any problems. ExoMars is designed to move up to 70 m per days to achieve its goal of covering as much surface as possible during the expected lifetime of the rover. Over the expected lifetime [~210 days] the mission

Not been to Kielder Observatory yet?

Then why not book one of our events for yourself and/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



SOLAR SYSTEM SLOT

scientists are hoping it will move up to 4 km away from its landing site. ExoMars partners up with the orbiting TGO satellite to send and receive data. Since it can only do this twice per Sol (a Martian day), the rover is designed to think for itself.

Onboard ExoMars will be the following instruments:

- * Pancam – panoramic camera – digital terrain mapping – sending information to the AI which controls the rovers movement across the Martian surface. Using two wide angle cameras as stereoscopic vision in conjunction with a high resolution colour camera for imagery, it will link with other instruments to obtain the rich quality data that the mission is seeking.

- * ISEM – an infra red sensitive instrument – characterising the mineralogy of rocks and seeking water based rocks and related minerals. As with PanCam it will be used to identify targets for more detailed study by the other instruments

- * WISDOM – ground penetrating radar used to identify rock layering and identification of buried [depth < 3 m] targets for drilling and analysis by the other instruments and to support the drilling activities

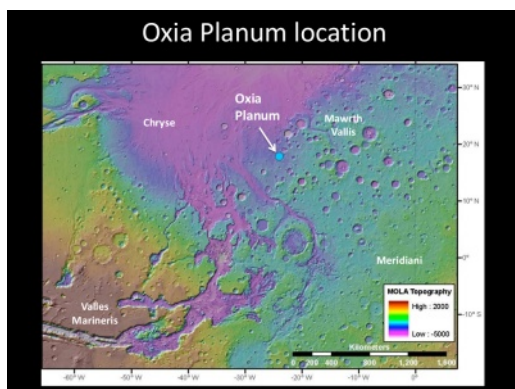
- * Adron-RM – Neutron spectrometer – searching for buried water and hydrated

mineral deposits. Teams up with WISDOM to locate suitable targets for more detailed study.

- * CLUPI – drill-head imager to investigate close-ups of drill targets at < 1 mm resolution.

- * Ma_MISS – Infrared spectrometer and part of the core drilling rig. For investigating the layering inside holes being drilled, measuring the chemical make-up of the regolith and measuring the depth at which water is found in liquid form.

- * MicrOmega – Infrared Raman spectrometer associated with samples drilled out from rocks. To study grain size, grain morphology [i.e. rounded=water formed/angular=wind formed] and get



The topology of the Oxia Planum landing site. Colours represent the height of the terrain.

Credit: P. Thollot et al., 2020.



SOLAR SYSTEM SLOT

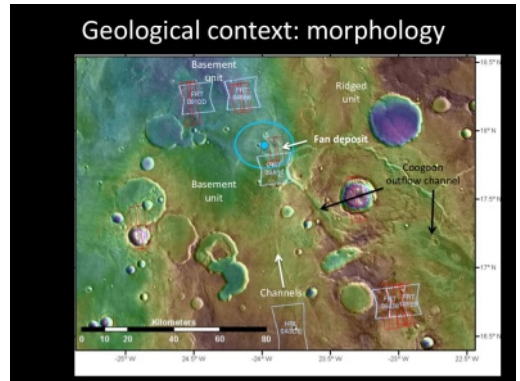
data about when there were sudden changes in the type of grains being formed on the surface Mars climate history.

* RLS – Raman Laser Spectrometer – complementary to MicroOmega – examining the nature of hydrated minerals, locate organic species and indicators for biological activity currently and in the past.

* MOMA – search for organic molecules using laser heating [LD] and thermal volatilisation of samples, coupled to GCMS systems [a very sensitive technique used to separate components of a mixture and use powerful technique to identify each components chemical make up].

Drill system – the drill is 10mm bore and 30mm long at the end of the 2m long probe. The system is designed to take each core sample and transfer it to a secure station. From here the sample is crushed and then segregated into a number of smaller samples for analysis by MicroOmega, RLS, MOMA both LD and GCMS systems.

Landing site – this has been chosen as Oxia Planum, a 200 km-wide clay-bearing plain on the eastern border of Chryse Planitia, in the northern equatorial region of Mars. It was chosen because of its



A close up view of the geology of the Oxia Planum landing site. Note the very different scales of this and the previous image.

Credit: P. Thollot et al., 2020.

relatively smooth topography and its abundance of hydrated minerals.

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.



***The Moon using a
25mm Pocket Borg
refractor, 25mm
Kelner eyepiece and
a Google Pixel 3a
phone.***

Credit: Kevin Hubbard



GALLERY



© KOZ

Mars and the Moon converging over the North Sea, taken from Seaton Carew.

Credit: Kevin Hubbard.



GALLERY



The Sun rising over Holy Island, Northumberland.

Credit: Kevin Hubbard.



GALLERY



**Comet C/2022 E3
ZTF taken
through a 12"
Newtonian
telescope with a
Canon 1000D
DSLR on
January 25th
2023. Exposure
30x30 sec. It is
moving quite
fast!**

Credit: Nigel Metcalfe

*This one was taken up at the
observatory the same night. The
orientation isn't quite the same,
but you should be able to match
up the stars in the two photos!*



© KOAS



GALLERY



The Northern Lights made an appearance in mid-January. This lovely image was taken at the observatory by one of our volunteers, Michael Auton.

Aurora Night - Dec 22

The evening was very informative and professionally delivered. At first, prior to attending, I was sceptical about how three hours could be filled. During and after the evening, I'm left wondering if three hours were enough. This was our first visit to the Observatory, and now we can't wait to visit again! Great evening and our thanks go out to the team, as well as those behind the scenes.

Ian, Nottingham



GALLERY



December 8th 2022 saw an occultation on Mars by the Moon (where the Moon passes between us and Mars, thus hiding the planet from view). You can see some video of the event taken at the observatory on our [Facebook page - the-moon-passing-in-front-of-mars](#) but here is a single image taken the same night when the two were close together on the sky.

Credit: Dan Monk.



Jewels of the Universe
- Jan 23

Very enjoyable and memorable evening , we had a great time and learnt loads. We are so inspired now to get out and look at the night sky! In fact we have been out tonight (the night after our visit) with binoculars and star maps looking at what's out there.

Everyone who gave the talks was so passionate - it was really inspirational in spite of the weather which was sleeting and blowing a gale so we didn't actually get to look at the sky. Thank you all so much!

Katherine, Harrogate

Kielder Observatory - a beacon for dark skies

<https://kielderobservatory.org>

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Infinite Inspiration

