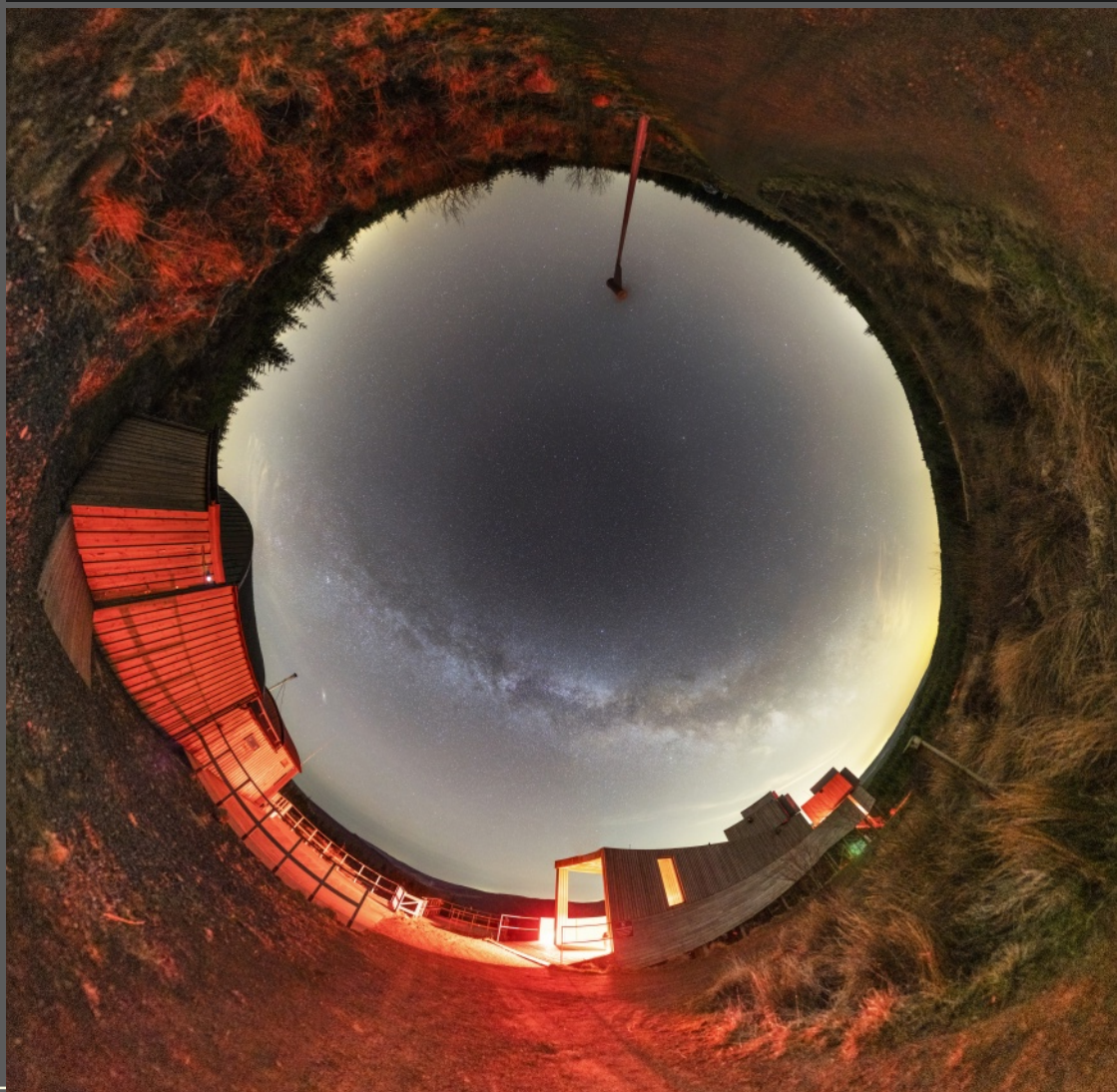


Spring 2021 Number 31

# Kieler Observatory Newsletter

KIELDER  
OBSERVATORY  
Infinite Inspiration



## NEWS

Grant funding  
awarded

## NIGHT SKY

Highlights May/June/  
July

## SCIENCE

New Physics?

## OBSERVING

Dark nebulae



## EDITORIAL

Hopefully, by the time you read this there will not be long to go before the Observatory can open to the public again. This, after all, is what we are all about. Ironically, April was a very dry month with a remarkable number of clear nights. Let us hope the weather continues this way. Space has been very much in the news, with the landing of Perseverance on Mars, a new nova in Cassiopeia (although you will need binoculars for that one), and the BBC running an item on how lockdown has resulted in darker skies, (which featured the Observatory). Meanwhile, despite the cold weather, summer is around the corner and the nights are growing shorter - but there is a partial solar eclipse to look forward to!

*Nigel Metcalfe*

**Editors: Nigel Metcalfe & Robert Williams**

*admin@kielderobservatory.org*

### 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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[admin@kielderobservatory.org](mailto:admin@kielderobservatory.org)

*Front cover: This all-sky image is shot with a 24mm lens on a Sony A7III. Dan Monk.*

*Rear cover: The Milky Way rising over the Observatory. Dan Monk.*



## KOAS NEWS

Despite being forced to close the Observatory for most of the peak visitor season, we're pleased to report that KOAS is still in reasonable financial shape and the team is chomping at the bit to resume events in the very near future.

The trustees continue to meet regularly via Zoom - both as a board and in smaller sub-groups with team members as required - but we're looking forward to being able to do so in person again soon.

Once Covid restrictions start to ease, we'll be recruiting some additional trustees to augment our current board and facilitate succession planning, as some of our longer-serving members approach the end of the maximum period of service allowed permitted by our constitution. If you think

you have the skills and experience needed help the amazing KOAS our amazing team to deliver the exciting future that lies ahead, we hope you'll consider applying. Relevant details will be available shortly, through the careers section of our website or via the office.

Some of you may recall that we used to have a "Friends of Kielder Observatory" membership group. We're now considering this again and would welcome your thoughts (e.g. What benefits would you value most? What should membership cost?). If you have 2 minutes, do please complete our short survey and let us know what you think.

<https://www.surveymonkey.co.uk/r/TYX8YPF>



©KOAS/Dan Monk

***'Tiny Planet' by Dan Monk.  
Amazing what can be done  
with a wide-angle lens and  
some photo-manipulation!  
Compare this with the front  
cover photo and you might  
be able to work out how it  
was done.***



## OBSERVATORY NEWS



***Liam Reed was interviewed by the National Lottery.***

We were delighted to receive the support of the Culture Recovery Fund in their latest round of awards. We were awarded over £23000 in the second round of funding - we even headlined their news page!

<https://www.heritagefund.org.uk/news/over-470-heritage-organisations-receive-culture-recovery-fund-lifeline>

We also appeared in a campaign run by the National Lottery, who interviewed Liam Reed as part of their 'How To' video series

<https://www.national-lottery.co.uk/life-changing/find-the-north-star-with-kielder-observatory>

We were also one of 8 science centres in the UK to win a Project Inspire grant. Our project, "SPIDER Astronomy", addresses the barriers to engagement in radio astronomy by communities, anchored by the new SPIDER radio telescope at Kielder, which is funded by the Tanlaw Foundation.

<https://www.sciencecentres.org.uk/news/eight-uk-science-centres-selected-project-inspire-digital-engagement-and-innovation-programme/>

Covid restrictions have slowed down progress installing the telescope but hopefully the easing of restrictions over the summer will allow construction to resume.





## OBSERVATORY NEWS

Meanwhile, if all goes well, we are very much looking forward to being able to reopen to the public in mid-May. Bookings are now being taken and we are filling up fast, as we will still be running at reduced capacity due to the pandemic. You can book up to a year ahead at the moment.

We have been running plenty of events online though. In mid-February we joined forces with three other local observatories (Battlesteads, Stonehaugh and Twice-Brewed) to live-stream a series of free events/talks for the Northumberland Dark Skies Festival. The full list is still available to watch at

[https://www.youtube.com/playlistlist=PL85tgyJSwNsb\\_VDpkdBN1F6d-LZZclGG2](https://www.youtube.com/playlistlist=PL85tgyJSwNsb_VDpkdBN1F6d-LZZclGG2)

and includes a talk by the Astronomer

Royal, Lord Martin Rees.

One other contribution you will find is 'Escape Velocity with Kielder Observatory'. This was an arts project funded by the Northumberland Cultural Fund, courtesy of Northumberland County Council, which taught people how to image the dark skies with just a smartphone. We are now pleased to host the exhibition of some of the results at

<https://kielderobservatory.org/news/escape-velocity>

Look out for the shooting star over Newbiggin-by-the-Sea!

On Facebook we have been hosting "Night Sky with Naz", a regular night sky guide, with live observing when possible. And, of course, our monthly podcasts continue. We are now up to episode 7,



***A fantastic view of the Milky Way arching over the observatory, taken by our own Dan Monk.***



## OBSERVATORY NEWS

"Space Rocks featuring Steve Arnold and Áine O'Brien". You will find the complete set at

<https://podfollow.com/kielderobs/view>

At the beginning of April you might also have seen us on the BBC, featuring in an item on how lockdown has improved dark skies

<https://www.bbc.co.uk/news/av/science-environment-56634629>

This was broadcast on BBC Breakfast and made it to all their main national news bulletins that day, so was great publicity for us!

Dan Pye welcomed the lads from Top Gear magazine, who dropped by to test the Polestar Electric Vehicle around Kielder, thinking they could navigate by the pole star ... they found they needed some help to actually find it! Check out the May issue of Top Gear magazine to see the coverage.

We also feature in Visit Britain's article on "Night-time adventures in Britain"

<https://www.visitbritain.com/gb/en/night-time-adventures-britain>

For the younger element, apparently North East music duo Wacko and Leedman have been filming at the observatory for Dance Television.



We are recruiting! We currently have a vacancy for a Science Communicator. We will need at least one full-time post for late summer, but we are also happy to consider job share or part-time applicants.

### **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](mailto:admin@kielderobservatory.org)



## OBSERVATORY NEWS

If you feel you might be interested, please go to

<https://kielderobservatory.org/contact/careers/science-communicator>

for full details. The deadline for applications is midnight on 16th May 2021.

a host of new goodies.

Finally, last but not least, there are rumours that somewhere in the North East something is brewing - so keep an eye out for a tasty Kielder tippie!

Elsewhere, Helen McGhee has presented some of her photographic work in partnership with the Observatory at the European Geosciences Union General Assembly. You can find more details on her blog

<https://invisiblestargazing.blog/2021/04/>

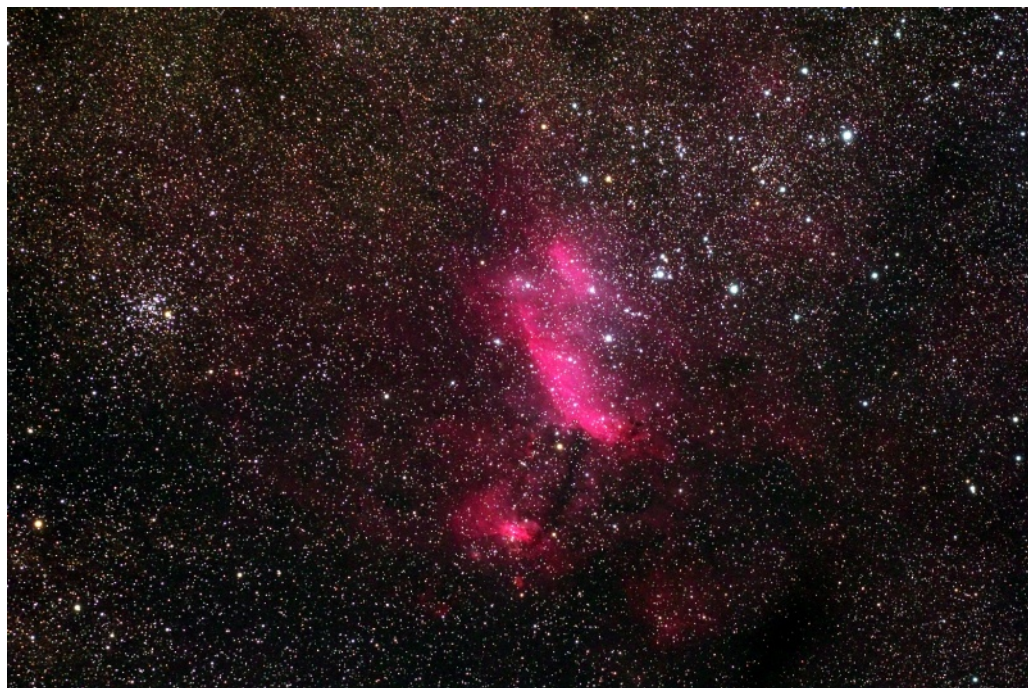


Last call for our iconic T-shirts - there aren't many left now, so sizes and styles are limited. Look out for a brand new T-shirt design when we re-open, along with



## OBSERVERS' SLOT

Out of the darkness comes forth light



***IC4628, the 'Prawn Nebula', located in Sagittarius - too far south to be seen from the North East. Taken in Namibia with a Takahashi FSQ106 refractor and a Canon 60Da.***

In the Universe most stars are born from the collapse of large clouds of cold dust and gas. This process may take many millions of years. Rather unusually, but principally because of the force of gravity, large stars tend to form from large dusty clouds much more rapidly – over not much more than 1 million years – than small stars form from small dusty clouds – which may take over 100 million years.

For many years the associated processes

by which the dusty/gassy clouds began to collapse – before gravity shows its hand – was not well understood. Then, by something of a chance observation – but not from the field of astronomy – it was discovered that a key process is the electrostatic attraction of polarised micron-sized dust particles – to form 'clumps' – that was the 'catalyst', to drawing in gas molecules along with them. On a smaller scale this is also similar to how planets form from the cloudy/dusty/rocky





## OBSERVERS' SLOT

remnants following the formation of their parent star[s].

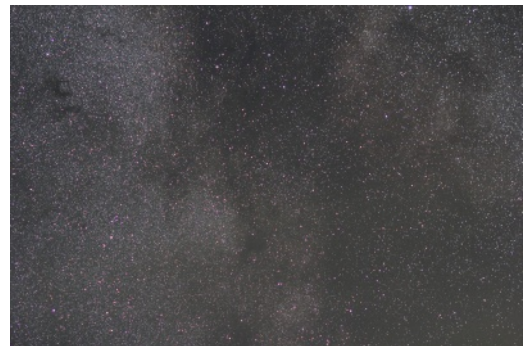
This process was first observed, by accident, aboard the orbiting space-stations, where – in a zero gravity environment – tiny particles were seen to congregate together over a relatively short period of time by electrostatic attraction. Later experiments, in a 'drop-tower' located in the city of Bremen, Germany, confirmed this idea, using high-speed video cameras to film in a simulated micro-gravity environment, which lasts just a few second seconds as the experimental projectile containing the particles (held in a vacuum chamber) is dropped from a height of 120m.

Cold dusty clouds are just that – very cold, typically having a temperature of no more than about 20 Kelvin [about -250°C] and are very rarefied – typically no more than a few tens of atoms or molecules per cubic meter, with a similar concentration of dust. Compare that to our atmosphere which has about  $3 \times 10^{25}$  molecules per cubic meter. However, what these clouds lack in density they make up for in size. For example, Messier 42, the Orion Nebula, has dimensions of about 24 Ly in diameter. The numbers mount up – this dimension works out at a volume of  $7.29 \times 10^{47}$  cubic



***The star cluster Messier 7 and associated nebula.***

meters. So you have a very large inventory of 'stuff' in a typical dusty/gassy cloud. For example  $7.29 \times 10^{47}$  cubic meters of stuff with a density of 10 molecules per cubic meter works out at about  $1 \times 10^{22}$  kg of 'liquid' water in M42 – there is only about  $1.37 \times 10^{21}$  kg of water on Earth [about 14% of the amount in M42].



***Dark nebula B143 taken from Dalby Forest with a 100mm F4 lens and a Canon D60a.***



## OBSERVERS' SLOT



***The Dark Doodat nebula, in the southern constellation of Musca. The nearby globular cluster in NGC4372. Taken from Namibia with a Takahashi FSQ106 and a Canon D60a.***

Luckily for astronomers, there are so many dusty/gassy clouds out there so that we can view these clouds at every juncture in their lifetimes. Clouds start off looking like some of the objects in the Barnard Catalogue, for examples check here....

The Barnard Catalog - In-The-Sky.org  
[<https://in-the-sky.org/data/catalogue.php?cat=Barnard&const=1>] .

A good example is Barnard's 'E' [B142/143] in Aquilla. One of the most

observed/photographed objects of the northern night sky.



***The Rosette Nebula in Monoceros photographed from Kielder.***



## OBSERVERS' SLOT

Another good example – this time from the southern hemisphere – is the 'Dark Doodad Nebula'

[[https://en.wikipedia.org/wiki/Dark\\_Doodad\\_Nebula](https://en.wikipedia.org/wiki/Dark_Doodad_Nebula)],

Sandqvist 149, named after Aage Sandqvist of the Stockholm Observatory.

A more developed dusty/gassy nebula is Barnard 33 – the Horsehead Nebula in Orion

[<http://www.messier.seds.org/xtra/ngc/b33.html>]

and IC4628, the Prawn Nebula in Scorpio

[[https://en.wikipedia.org/wiki/Prawn\\_Nebula](https://en.wikipedia.org/wiki/Prawn_Nebula)],

just out of reach [too far south] of astronomers in the UK.

By viewing these dark objects with infrared imaging systems, and making 'time lapse' re-imaging over a period of months and years, scientists are now able to see

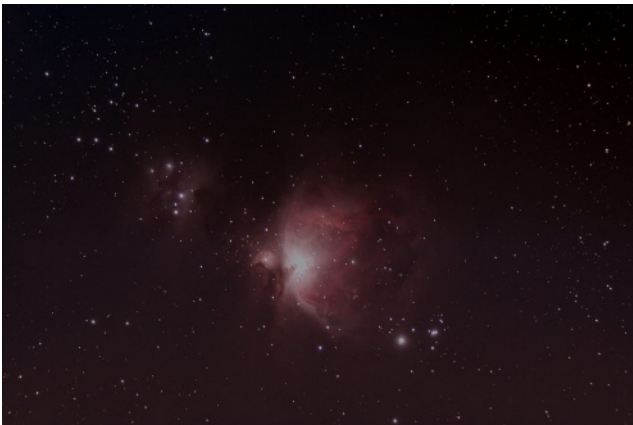
through the dust to see the gas-flow to view the motions of patches of these dark objects as they evolve. These motions are the early stirrings of star formation.

A later stage of development is the Pleiades – M45 – in Taurus where the stars are encased in dust. At about the similar stage of development is the Rosette Nebula in Monoceros, but here the stars are encased in gas which glows because of the starlight from the stars embedded in the cluster.

The final stage is when all of the gas and dust has been hoovered up by the stars, to form open or globular clusters.

Robert Williams

*All photos by the author*



***M42 taken from Norfolk with a Borg 76 refractor and Canon D60a.***



## NIGHT SKY

### MAY 2021 (times in BST)

#### Lunar phases

Third quarter	03/5/2021	20:50
New moon	11/5/2021	19:59
First quarter	19/5/2021	20:12
Full moon	26/5/2021	12:13

#### PLANET SUMMARY

Mercury will be visible in the evening twilight for about 90 minutes. Venus will be a difficult object also in the evening twilight. Mars is an evening object visible from about 22:30 until midnight. Jupiter and Saturn are challenging morning objects visible just before dawn. Uranus is in conjunction with the Sun and not visible this month.

#### THE STARS AT 10PM

North – Perseus, Cassiopeia and Cepheus are nicely placed. Andromeda, Cygnus and Lacerta are near the horizon. East – Bootes, Hercules and Lyra are nicely placed, with Ophiuchus and Serpens near the horizon along with Libra containing Jupiter in the south east. South – Coma Berenices, Leo and Cancer

are high up, Virgo is nicely placed. The southerly constellations of Crater – the Cup, Corvus the Crow, Sextans and Hydra the Water Snake hug the horizon. West – Cancer, Gemini and Auriga are nicely placed, along with Perseus. Orion skirts the horizon.

#### METEOR SHOWERS

The Eta Aquarids, which are associated with Halley's Comet, will peak around May 6th this year.

#### COMETS

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

*Night Sky credits:*

*Data sourced from Cartes du Ciel,*

*<https://www.timeanddate.com/moon/phases/>*

*and <https://in-the-sky.org/>.*

#### The Planets 15/5/2021

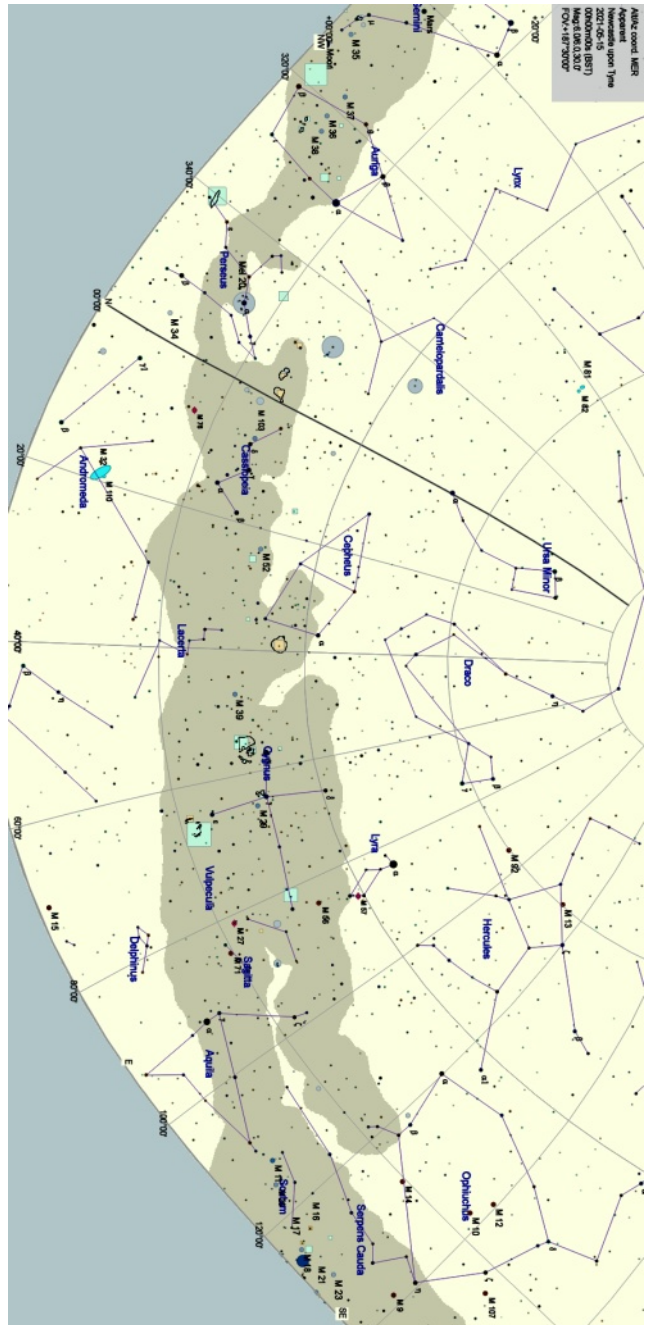
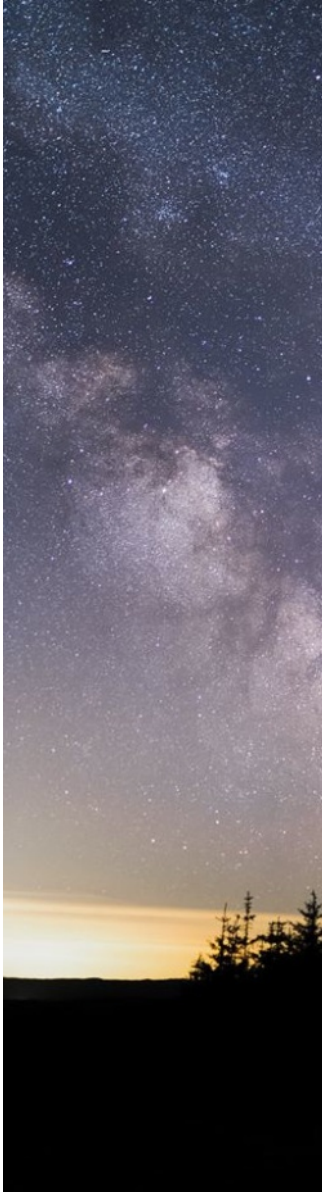
	Sun	Moon	Mercury	Venus	Mars	Jupiter	Saturn	Uranus
Rise	04:59	06:54	05:37	05:29	07:43	02:50	02:21	04:39
Set	21:07	00:19	23:24	22:16	01:14	12:34	06:57	19:45





## NIGHT SKY

*The sky chart for  
Newcastle looking NNE at  
midnight on 15/5/2021.*





## NIGHT SKY

### JUNE 2021 (times in BST)

#### Lunar phases

Third quarter	02/6/2021	08:24
New moon	10/6/2021	11:52
First quarter	18/6/2021	04:54
Full moon	24/6/2021	19:39

#### PLANET SUMMARY

Mercury is too close to the Sun to be glimpsed this month. Venus is an evening object visible low in the west after sunset. Mars will be visible low in the west after sunset and will make for a nice contrast with Venus not too far away. Jupiter is a morning object visible from about 0200 until dawn. Saturn is a morning object visible from about 0130 until 0300. Uranus is a morning object visible low in the east before dawn.

#### THE STARS AT 11PM

North – Cepheus is nicely placed with the two Bears high up. Near Cepheus are the not-well-known constellations of Lynx and Camelopardalis. Auriga, Perseus and Andromeda skirt the horizon.

East – Hercules, Lyra and Cygnus are

nicely placed. Ophiuchus along with both parts of the Serpent are nicely placed in the south eastern sky.

South – Hercules, Bootes and Coma Berenices are nicely placed along with Ophiuchus, Libra – with Jupiter – and Virgo. To the lower LHS of Libra can be found the claws of the Scorpion.

West – Virgo, Leo, Cancer and Gemini cut a swathe across this view. Auriga is low in the NW.

#### METEOR SHOWERS

There are no major meteor showers in June.

#### COMETS

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

#### ECLIPSE

There is a partial eclipse of the Sun visible from the UK on June 10th. From Newcastle it starts at 10:09 and ends at 12:31, with maximum eclipse (about 40%) at 11:18.

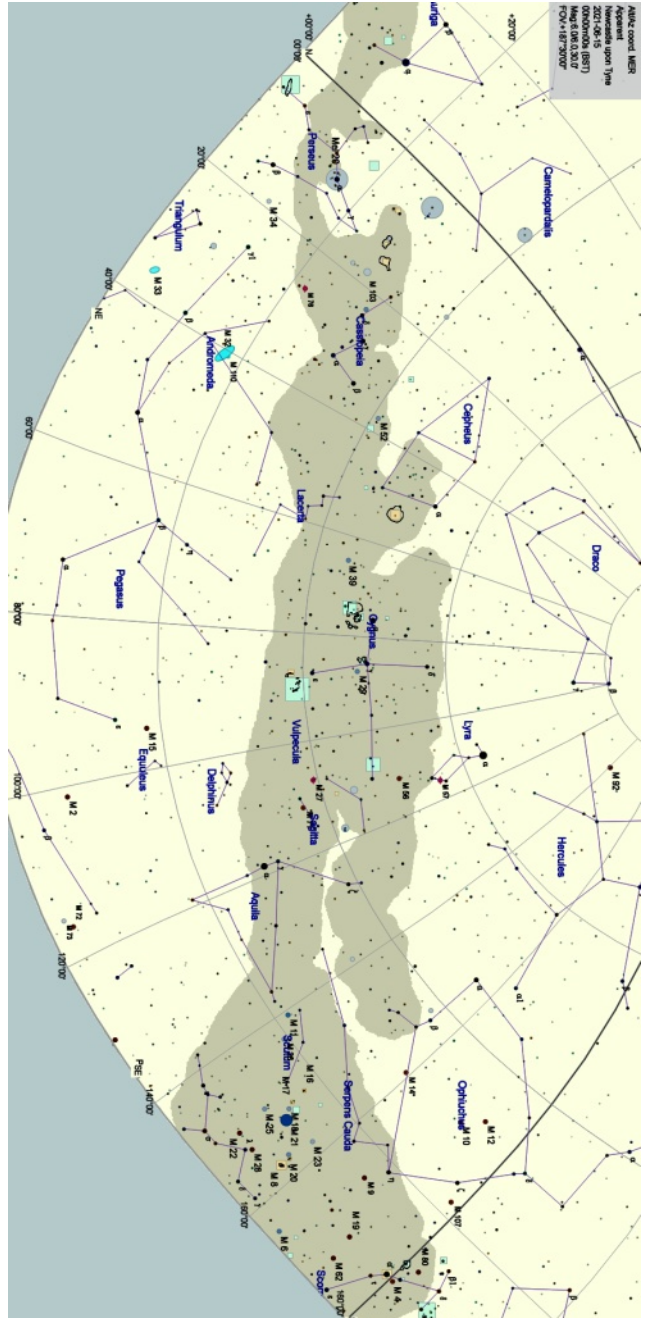
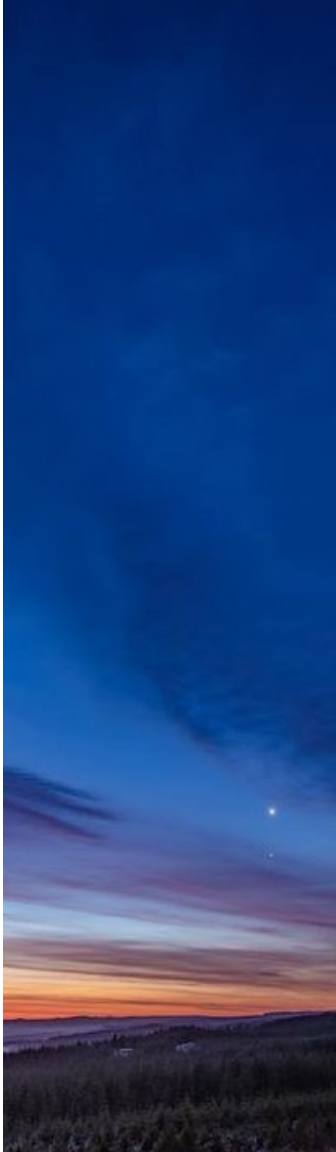
#### The Planets 15/6/2021

	Sun	Moon	Mercury	Venus	Mars	Jupiter	Saturn	Uranus
Rise	04:25	09:03	04:40	05:56	07:29	00:54	00:19	02:40
Set	21:29	01:01	20:45	23:21	00:05	10:45	08:53	17:53



## NIGHT SKY

*The sky map looking E  
from Newcastle at  
midnight on 15/6/2021.*





## NIGHT SKY

### JULY 2021 (times in BST)

#### Lunar phases

Third quarter	04/4/2021	11:02
New moon	12/4/2021	03:30
First quarter	20/4/2021	08:58
Full moon	27/4/2021	07:41

#### PLANET SUMMARY

Mercury will be a difficult morning object rising in twilight in the east. Venus will be low in the west after sunset, with Mars very close by and almost in conjunction – separated by only ~1 deg. Jupiter is an evening object visible for most of the hours of twilight darkness. Saturn will also be visible throughout the night, once it gets dark. Uranus is a morning object.

#### THE STARS AT 10PM

North – Corona Borealis and Bootes are high up, with Coma Berenices and Canes Venatici nicely placed. Virgo and Leo are close to the horizon.

East – The Milky Way cuts a swathe across the sky at this time. From Perseus in the east, through Cassiopeia, Cepheus, Cygnus – in the south – into Sagitta and

Vulpecula, towards Aquila, Scutum and Sagittarius in the west. Low down are Andromeda and Pegasus.

South – Cygnus, Lyra, Hercules and Bootes are nicely placed with Aquila, Ophiuchus and Virgo still worth a look. You may see the body of Sagittarius and the head of the Scorpion near the horizon.

West – The two Bears, Corona Borealis and Hercules are well placed. Libra (with Jupiter), Virgo and Leo are still visible with Cancer setting. Venus, the Moon and Mercury make a nice group close to the horizon, in the constellation of Leo.

#### METEOR SHOWERS

There are no major meteor showers in July.

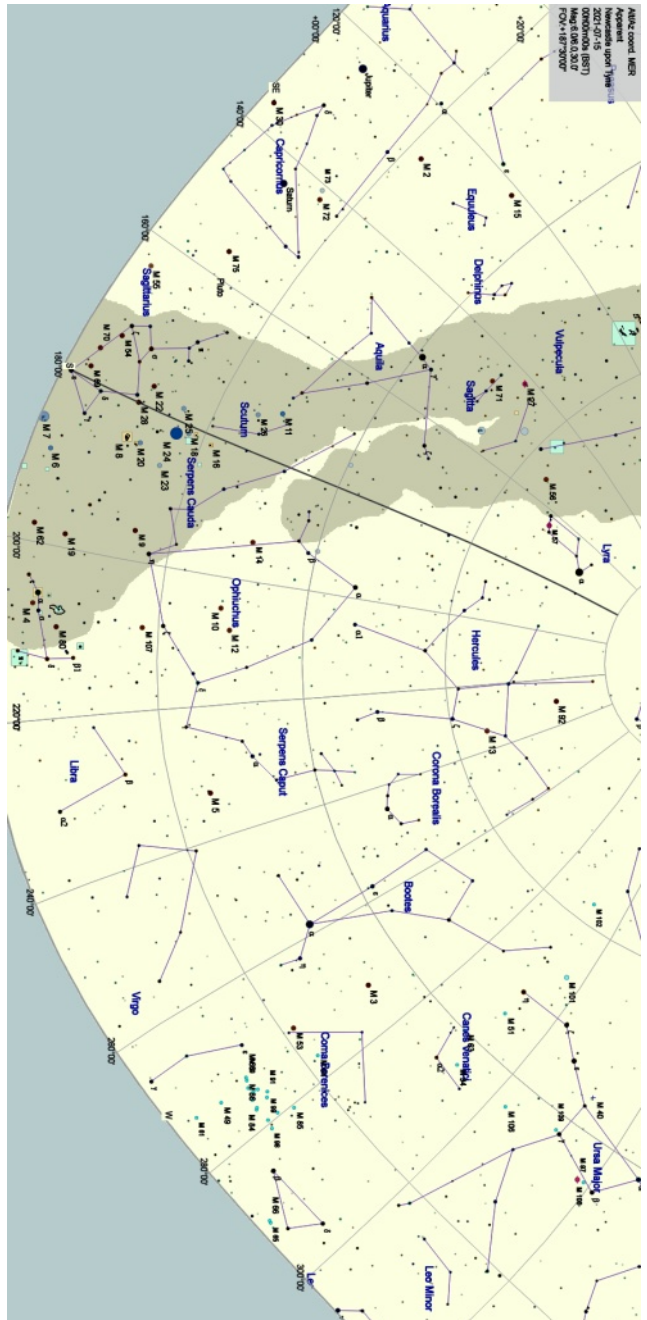
#### COMETS

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

#### The Planets 15/4/2021

	Sun	Moon	Mercury	Venus	Mars	Jupiter	Saturn	Uranus
Rise	06:03	07:27	06:05	06:18	07:27	04:41	04:15	06:31
Set	20:09	23:49	19:33	20:31	23:49	14:08	12:47	21:30







# SCIENCE SLOT

## New Physics?

As with everything around us, the Universe is governed by a set of laws and rules. Everything around us is made from particles. As early as 2,500 years ago Greek philosophers understood the principle that there was a limit to the smallest unit from which everything is made. The word 'atom' comes from the Greek for 'indivisible'. Even in the time of Galileo or Newton this view had not changed and it was not until 1897 when J J Thompson discovered the electron – by observing the shadow cast by a target within a cathode ray tube – that a whole new vista was opened up into what all matter is made from. Later, in 1909, Millikan worked out the charge of an electron by using his Oil Drop experiment, which resulted in the mass of the electron [ $9.1 \times 10^{-31}$  kg] being elucidated.

Subsequently, other particles were discovered:  
1909 – the proton was discovered by Ernest Rutherford by observing the back scatter from alpha particles [Helium Nuclei] when they were fired at a gold foil target.  
1932 – the neutron was discovered by James Chadwick, by observing the forward scatter of particles from a Beryllium target exposed to energetic alpha particles, which were transmitted through a paraffin wax detector. He based his work on experiments conducted by W Bothe and H Becker in 1930, which were a modification of work done by Irène and Frédéric Joliot-Curie.  
From this some fundamental constants were found:

Particle	Symbol	Charge	Mass
Electron	$e^-$	$-1.6 \times 10^{19}$ C	$9.1 \times 10^{-31}$ kg
Proton	$p^+$ (H $^+$ )	$1.6 \times 10^{19}$ C	$1.672 \times 10^{-27}$ kg
Neutron	$n^0$	0.0 C	$1.674 \times 10^{-27}$ kg



## SCIENCE SLOT

Since the 1930s – using machines capable of generating higher and higher energies – many more particles have been found, and until recently the magic number was 23. These are the basis for the Standard Model of Particle Physics. Each of these 23 particles is composed of a collection of smaller sub-atomic particles. These sub-atomic particles can be subdivided into separate classes/groups:

There are three types of fermions - particles that carry mass - totalling 12 distinct particles, and two types of bosons - particles that carry force - totalling 5 distinct particles.

The 12 mass-carrying particles are split further into 2 groups of 6. Quarks – Up, Down, Strange, Charm, Top and Bottom [also known as the Beauty Quark] - and Leptons – Electron, Muon, Tau, Electron Neutrino, Muon Neutrino and Tau Neutrino.

The force carriers are of 5 types – Gluon, Photon, Z-Boson, W-Boson and finally the Higgs Boson.

Since its start-up in September 2008, the Large Hadron Collider has been at the forefront of a worldwide search for the fundamental particles that make up matter. The machine is basically an atom/particle

smasher. Beams of protons/anti-protons or lead nuclei are accelerated around a 27 km diameter ring at almost the speed of light and are then collided inside giant detectors to see what is created. Presently the LHC is shutdown for maintenance and upgrades but when it is switched back on it will collide beams of particles with energies approaching 15 GeV.

For most of us, we operate in the slow lane compared to particles. We do not experience any of the amazingly weird effects that travelling at near light speed brings. In the early part of the 20th Century, Albert Einstein developed two ground breaking theories, his General and Special Theories of Relativity, about what happens when objects are accelerated to very high speeds.

In essence as speed increases towards the speed of light [ $c \sim 3 \times 10^8$  m/s], the internal clocks of all objects run more slowly. However significant effects only take place when the velocity is a substantial fraction of 'c'. Also, the object gains a significant amount of extra mass in this realm too. For example, if you travel down a road at 100 km/hr then you will age more slowly by about one quadrillionth of a second every second you travel, compared to your twin brother or sister watching you drive by.



## SCIENCE SLOT

You will also gain a very small amount of mass [about 0.00000000000000000001g].

If you travel to Mars at 100,000km/hr [about 30,000m/s or ~0.01% 'c'], by the time you return one year later you will be 10 nanoseconds younger than your Earthbound brother or sister.

Then you discover a way to move more rapidly at 10% 'c'. Now the dilation factor..... ' $v^2/c^2$ ', becomes a lot more significant.

At 0.1 'c' the dilation factor is now 0.01. So if you travel to Alpha Centauri at 0.1 'c' and back again, the round trip [about 9 Ly] will take you 90 years. You will return to Earth to be greeted by your great-grand children [possibly even your 2 x great-grandson or granddaughter]. However, you will have aged only 89 years.

If you were able to travel at 0.5 'c', the trip would take you ~18 years, so you would see your grandchildren and you would have only aged ~14.5 years.

At 0.75 'c' the trip would now take 12 years and you will have aged 6 years on your return.

By 0.9 'c' the trip is now 10 years and you will age only 2 years.

By 0.99 'c' the trip is now just fractionally over 9 years and you will age a little over 2 months.

However, the LHC is able to accelerate particles to about 0.9999 'c' – each particle travels round the 27km circuit 11,235 times per second!. At this speed the dilation factor is now approximately 0.99995 so particles will last about 20,000 times longer than they would if they were at rest. However they are also 20,000 times heavier than their rest mass. To put this into perspective. If you were hit by 12 grams [1 mol for those who know that stuff] of Carbon travelling at this speed, it would be the same as being hit by a brick travelling at 100 km/hr. Another way of looking at this is that if you were able to travel at 0.9999 'c' your weight would change from a rest mass of [say 100 kg] to 10,000 kg – about the weight of two large elephants.

Anyway, back to the new physics. The Higgs boson is named after Peter Higgs. In 1964 he theorised that there would be a boson – a force carrier – particle that would create a field that would confer mass onto fermions that interacted with it. It has zero spin, no charge and no colour. On its own it decays into other elementary particles. Over a number of years of operation at the LHC results [using data from the CMS and ATLAS detectors] suggested that a particle with the





## SCIENCE SLOT

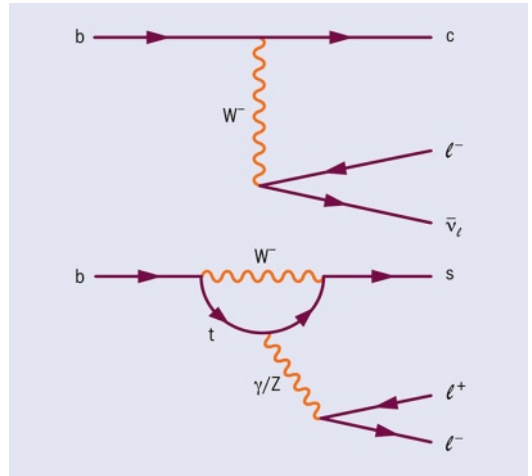
expected mass [i.e. energy] was being created in the machine and this particle matched the theorised properties of the Higgs boson to an uncertainty of less than 3 parts in 10,000,000 – the so-called holy grail of certainty known as 5-sigma. This basically states that the chance of the result being a fluke is less than 3 parts in 10,000,000.

Peter Higgs and his co-worker Francois Englert, were subsequently awarded the 2013 Nobel Prize in Physics.

In 2021 some new results on the decay of the Beauty Quark from the LHC suggested that the Standard Model was incomplete. The Standard Model does not explain dark matter, nor can it explain the weakness [relatively] of gravity – two hot potatoes in the science community at the moment. The Beauty Quark seems to have magical properties. It is not created in nature but only in atom smashers such as the LHC. The Standard Model predicts that the Beauty Quark should decay into precisely equal number of electrons [e-] and muons [ $\mu$ ]. However, the measurements released in March this year show more electrons than muons are created.

Presently the culprit is thought to be the Lepto-quark, which favours the production

of the electron from the decay of the Beauty Quark. The Beauty Quark has a mass of about four times that of the Proton. The LCHb detector is designed to identify the Beauty Quark – [hence the 'b'].



Here you can see the two methods to identify the Beauty Quark:

- Top - the Beauty Quark decays into an anti-W Boson and a Charm Quark. The anti-W Boson then decays into an electron and anti-electron neutrino
- Bottom – the Beauty Quark decays into a Tau neutrino and an Anti-W Boson. The Tau Neutrino ejects a Gamma ray or Z Boson. The Tau Neutrino with lower energy then recombines with the Anti-W Boson to form the Strange Quark. At the same/ similar timeline the Gamma Ray/Z Boson decay into an electron/positron pair.



## SCIENCE SLOT

This finding has got many if not all particle physicists rather excited about the prospect of a new understanding of the Universe. This is because of [at least] two interesting observations:

a) That in the very early Universe – due to a process known as CP violation – more particles were formed than antiparticles – and without this we would not exist because the Universe would just have annihilated itself in a big 'flash'. And .....

b) Scientists think there is a so-called Grand Unified Theory ['GUT'] that unified all forces at the very beginning of the Universe. As time elapsed each force split off from the others and manifested itself in its own particular way. The Electromagnetic [that creates 'light'], the Weak [responsible for radioactivity] and the Strong Force [that creates protons, electrons, neutrons and the nucleus of atoms] were once unified. Even further back in time gravity was unified with these as well, but this split has not been discovered .... yet! It is thought that to explore the connection that gravity has with the three other fundamental forces an even larger particle collider will be required – one that may have to be built in space. When, where, how and by whom it will be built are difficult questions to answer. For the latest news about the LHC check

this out.....

The Large Hadron Collider:

<https://home.cern/science/accelerators/large-hadron-collider>

Robert Williams

*Since this article was written, another challenge to the Standard Model has arisen. A measurement of how muons react in magnetic fields has been released by the Fermilab National Accelerator Laboratory in the US which shows a discrepancy with the Standard Model predictions. However, it is too early to say if this means new physics. A new paper refining the theoretical value to be in closer agreement with the data was released at almost the same time as the experimental value!*



## 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](mailto:admin@kielderobservatory.org)

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



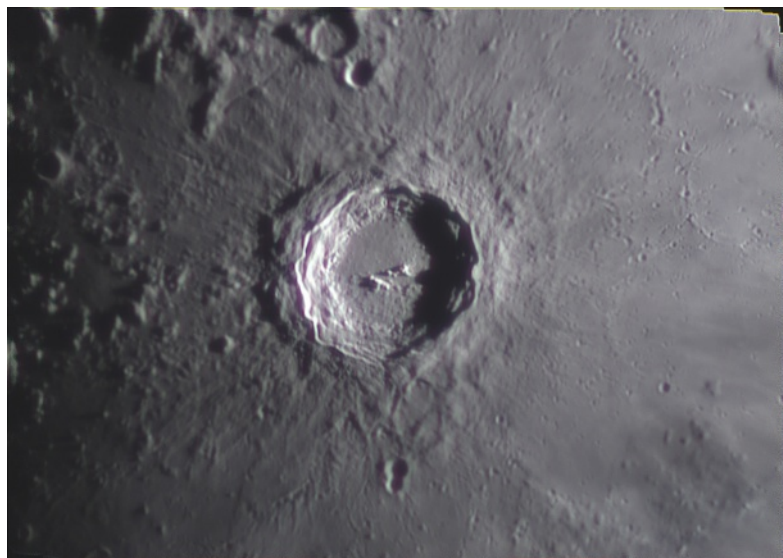
***The sun, taken on April 25th using a Lunt 50 H $\alpha$  telescope and a ZWO 445M camera. The original black & white image has been artificially coloured. Although you can take pictures of the sun with an ordinary telescope (providing you take suitable precautions), it is possible to buy specialised solar telescopes which make the job much easier. The Lunt is one such - it has a built-in filter which means only the light emitted by hydrogen atoms reaches the camera. As a result it is much easier to see prominences and flares. Credit: Jürgen Schmoll***



## GALLERY



*Spring is galaxy season, and one of the finest examples is Messier 51, the Whirlpool Galaxy. This shot was taken over two nights with a 14" SCT and a Canon EOS40D camera (total exposure 33x5 minutes). Credit: Jürgen Schmoll.*

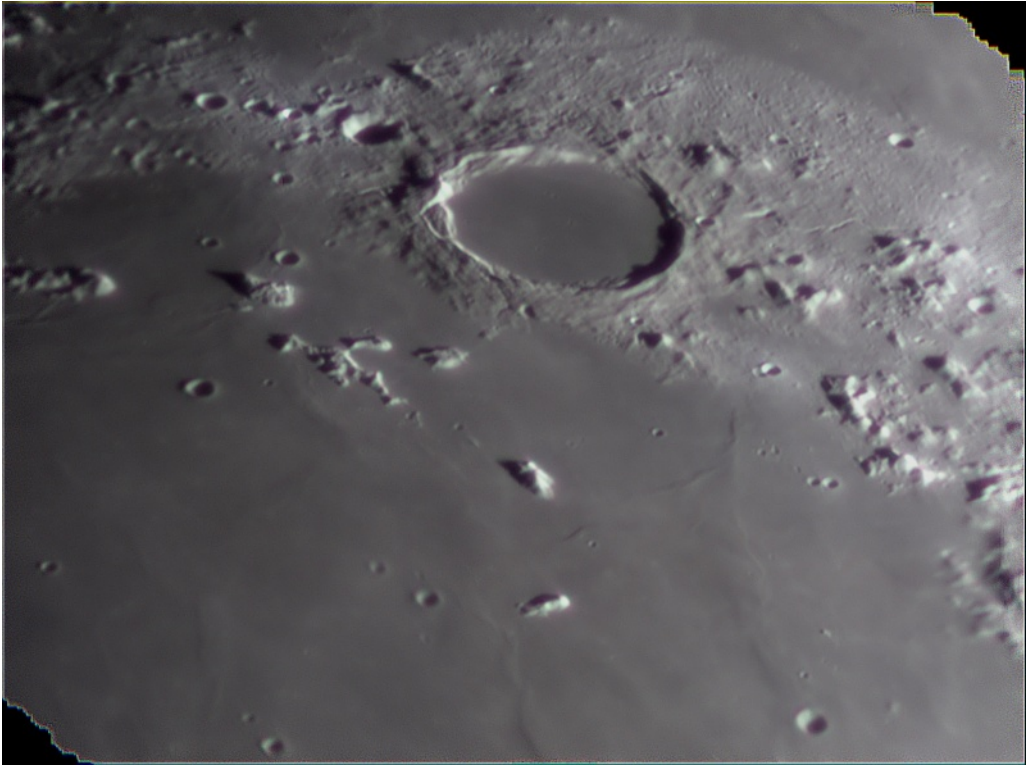


*The crater Copernicus on the moon. Taken using a 200/5000mm refractor and a ZWO ASI120MC camera on the evening of April 21st, 2021. Credit: Jürgen Schmoll.*



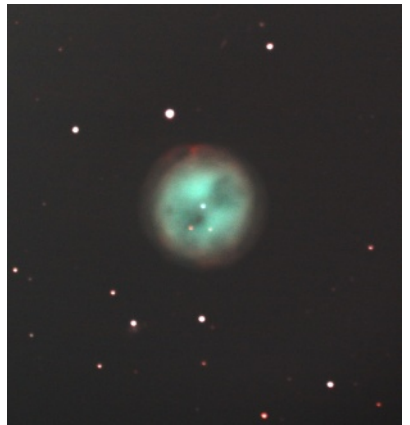


## GALLERY



*The crater Plato on the moon. Taken using a 200/5000mm refractor and a ZWO ASI120MC camera on the evening of April 21st, 2021. Credit: Jürgen Schmoll.*

*Not all notable Spring objects are galaxies. Here is the planetary nebula M97 (the Owl Nebula, in Ursa Major). Taken with a 14" SCT using a Canon EOS40D camera and a UHC filter on April 21st. Total exposure 19x5 minutes. Credit: Jürgen Schmoll.*





## GALLERY



***This is the galaxy M106 in Canes Venatici. A total of 60 mins of exposure through 12" F4 Newtonian using a Canon 1000D camera. Credit: Nigel Metcalfe.***



***Messier 63, the Sunflower Galaxy, is another favourite at this time of year. Again it is in the constellation of Canes Venatici. This is 45 minutes' worth of exposure through a 12" F4 Newtonian with a Canon 1000D camera. Credit: Nigel Metcalfe.***



## GALLERY



***Another fine set of Spring galaxies are M65 and M66 in Leo (M65 is to the top). This shot is a total of 34 minutes taken through a 12" F4 Newtonian using a Canon 1000D camera. Credit: Nigel Metcalfe.***





*Kielder Observatory - a beacon for dark skies*

<https://kielderobservatory.org>

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