NWASNEWS

Volume26 Issue 8

APRIL 2021

Newsletter for the Wiltshire, Swindon, Beckington, Bath Astronomical Societies

A LITTLE PERSEVERANCE AND NOVA

Some exciting times going on in astronomy at the moment, we even had a sudden bright Nova going off in Cassiopeia from the 19th March. I took some pictures of the region on the11th March, but had a strong Halpha filter on so had difficulty resolving the pre out burst star (15th magnitude), but I was looking for the bubble nebula and M52. Since then the Nova is 1,500 times brighter, and I was able to see it easily in binoculars just below M52 cluster. It is still worth a look.

I was putting off the front page of the newsletter while NASA//JP L ran early checks on the drone Inginuity. A few of the members of our societies are also drone flyers (some of us from early days when seat of the pants flying was common. Now imagine flying with a 20minute time lapse between instruction commands being sent and being able to acknowledge that the manouver went as planned (how many left/ right mixes did we make if the drone is flying away or towards us. Well the drone survived the transport to Mars, being dropped on a flat area (there are some hills with sedimentary cliffs local to the rover), and it has survived night time low temperatures and is charging up in day time.

If all goes well with each of the myriad pre-flight checks, Ingenuity's first attempt to lift off from the middle of its 33 -by-33-foot (10-by-10-meter) "airfield" – chosen for its flatness and lack of obstructions – will be no sooner than the evening of April 11.

Wiltshire Astronomical Society Meeting

Time: Apr 6, 2021 07:45 PM London

Speaker Paul Money FRAS, FBIS 'Triumphs of Voyager (part 2) – Where no probe has gone before'.

Join Zoom Meeting

https://us02web.zoom.us/j/82255041779?pwd=aEpjNGM0VU1wR2s0d24yNHRad1IKdz09

Meeting ID: 822 5504 1779

Passcode: 673669

Meeting ID: 822 5504 1779

Passcode: 673669

Clear skies

Andy

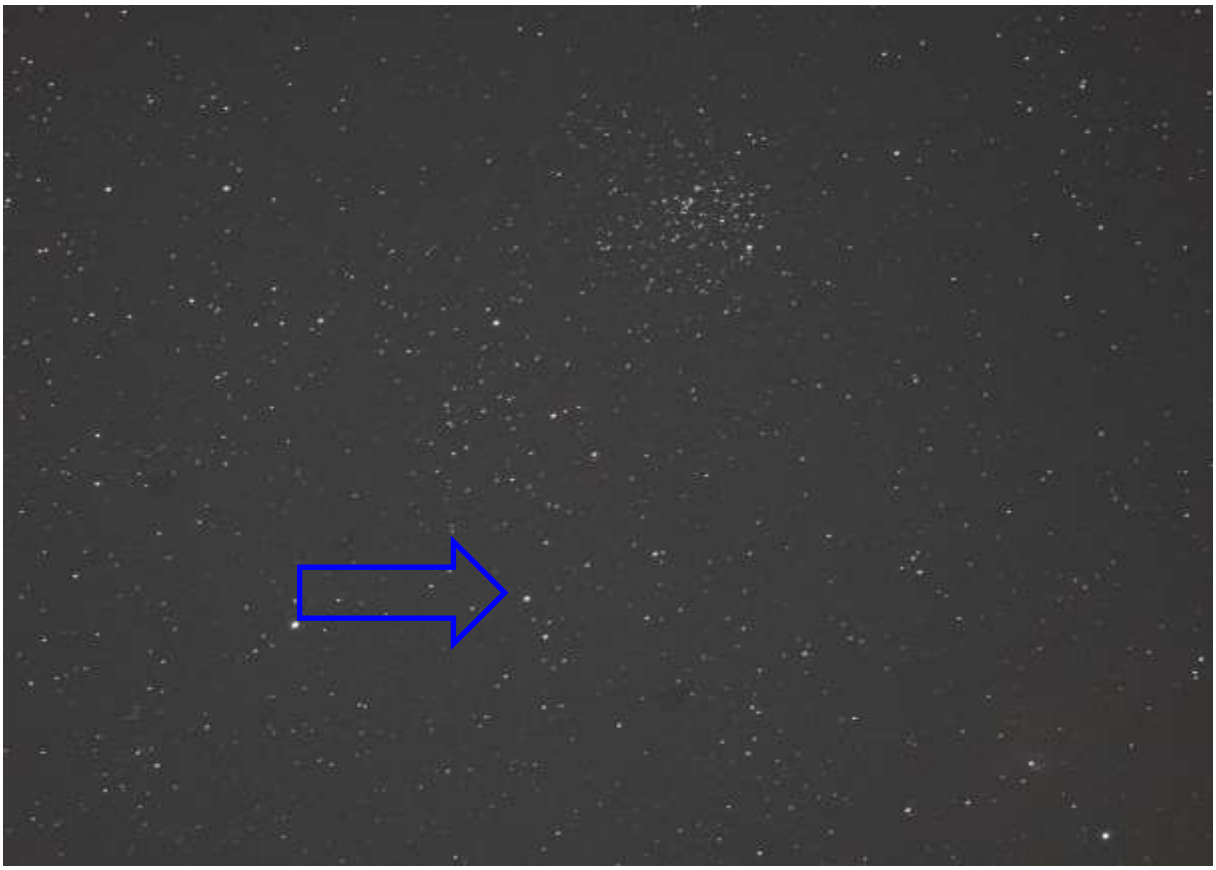
The surprise viewing treat for March was the sudden appearance of a Nova in Cassiopeia.

Sitting on an 'L' shape below messier 52 it suddenly brightened from a near 15th magnitude star into a binocular visible 7.2 magnitude. Nearly 8 magnitudes brighter (1500 times brighter!)

The discovery was made by Japanese observer Yuji Nakamura on the night of March 18th, 2021, and the newly visible star had an initial brightness of +9.6. Now brighter again.

Nikon D810a through 125 esprit telescope.

Andy



Wiltshire Society Page

Wiltshire Astronomical Society
Web site: www.wasnet.org.uk
Facebook members page: https://www.facebook.com/groups/wiltshire.astro.society/
Meetings 2020/2021.
During COVID19 ZOOM meetingd

HALL VENUE the Pavilion, Rusty Lane, Seend

Meet 7.30 for 8.00pm start

SEASON 2020/21
2021
6 Apr Paul Money and 'Triumphs of Voyager (part 2) – Where no probe has gone before'.
4 May TBC
1 Jun Robert Harvey/Understanding the Universe.

Thank you Peter and those that have helped get a list together in the circumstances.

Paul Money FRAS, FBIS, is an astronomer based in Horncastle, Lincolnshire, England. He is well known for his extensive talks and is the reviews editor of the BBC Sky at Night magazine. He broadcasts occasionally on BBC Radio Lincolnshire and Lincoln City Radio. He was awarded the 'Eric Zucker' award for 2002/2003 for contributions to Astronomy by the Federation of Astronomical Societies. In October 2012 he was also awarded the Sir Arthur Clarke Lifetime Achievement Award for 2012 by the British Rocketry Oral History Project for his active promotion of astronomy and space to the public. From 2004 until 2013 he was one of the three Astronomers on the Omega Holidays Northern Lights Flights and was also a Solar Eclipse Astronomer for their 2006 Turkey Solar Eclipse Trip and their 2009 China Solar Eclipse trip. In 2008 he was the Solar Eclipse expert and part of the expedition team for Poseidon Arctic Voyages on board the Russian Nuclear powered Ice Breaker 'Yamal' for the 2 August 2008 Solar Eclipse, viewed from the Arctic ice near the Franz Joseph Lands Islands. He has published a night sky guide called Nightscenes since 2000 and more recently has become a novelist with a Ghost Mysteries series and several Sci Fi works in the pipeline.

He is the reviews editor for the BBC Sky at Night magazine

- He publishes a 40-page sky guide every year called "NightScenes" for amateur astronomers
- He has also written the books 'Nightscenes: Guide to Simple Astrophotography' and 'Nightscenes Companion'.

He is now a novelist with 3 books published so far in the 'James Hansone Ghost Mysteries' series plus a Sci fi novel, 'Fragility of Existence' with others in progress.

Membership Meeting nights £1.00 for members £3 for visitors

Wiltshire AS Contacts

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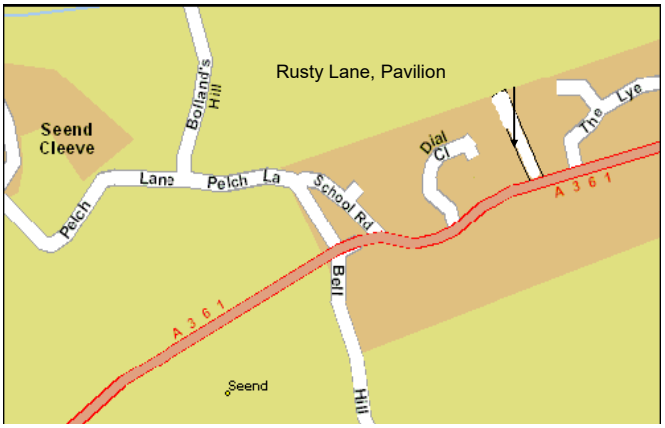
Andy Burns Outreach and newsletter editor.
Bob Johnston (Treasurer) Debbie Croker (vice Treasurer)
Philip Proven (Hall coordinator) Dave Buckle (Teas)
Peter Chappell (Speaker secretary)
Nick Howes (Technical Guru)
Observing Sessions coordinators: Chris Brooks, Jon Gale,
Web coordinator: Sam Franklin
Contact via the web site details.



Observing Sessions see back page

2017 was the 40th anniversary of the launch of the Voyager space probes to the outer solar system. 2021 will be the 42nd anniversary of their flyby of Jupiter.
These two talks takes a look at the remarkable mission and the many discoveries the Voyagers made and continue to make.

Swindon's own astronomy group

Physical meetings suspended

Due to the Covid crisis our meetings, like many other physical meetings have been suspended and replaced with Zoom meetings.

Next Zoom Meeting: Mike Foulkes

Our next meeting will be held on Friday, 16 April when the speaker will be Mike Foulkes, Director of the BAA, Saturn Section. He will be giving a presentation on Herschel's Planet, a subject very much connected with the City of Bath.

Ad-hoc viewing sessions postponed

All ad-hoc meetings are currently cancelled until further notice.

Regular stargazing evenings are being organised near Swindon. To join these events please visit our website for further information.

Lately we have been stargazing at Blakehill Farm Nature Reserve near Cricklade, a very good spot with no distractions from car headlights.

We often meet regularly at a lay-by just outside the village of Uffcott, near Wroughton. Directions are also shown on the website link below.

Information about our evenings and viewing spots can be found here:

http://www.swindonstargazers.com/noticeboard/noticeboard06.htm

For insurance reasons you need to be a club member to take part. If you think you might be interested email the organiser Robin Wilkey (see below). With this you will then be emailed regarding the event, whether it is going ahead or whether it will be cancelled because of cloud etc.
We are a small keen group and I would ask you to note that you DO NOT have to own a telescope to take part, just turn up and have a great evening looking through other people's scopes. We are out there to share an interest and the hobby. There's nothing better than practical astronomy in the great cold British winter! And hot drinks are often available, you can also bring your own.

Enjoy astronomy at it's best!

Meetings at Liddington Village Hall, Church Road, Liddington, SN4 0HB – 7.30pm onwards

The hall has easy access from Junction 15 of the M4, a map and directions can be found on our website at:

http://www.swindonstargazers.com/clubdiary/directions01.htm

Meetings for 2021

Friday 16 April 2021 19.30 Meeting or Zoom

Programme: Mike Foulkes: Herschel's Planet

Friday 21 May Meeting or Zoom

Programme: Gary Poyner: Variable Stars and the Double Cluster

Friday 18 June 19.30 Meeting or Zoom

Programme: Graham Bryant: Pluto: from Myth to a Voyage of Discovery

July & August - No Meetings

Friday 17 September 19.30 onwards - Meeting or Zoom

Programme: Dr Elizabeth Pearson: Planetary Rovers

Friday 15 October 19.30 onwards - Meeting or Zoom

Programme: Charles Barclay: Oldest GOTO telescope in the World (Provisional)

Friday 19 November 19.30 onwards - Meeting or Zoom

Programme: TBA

Friday 10 December 19.30

Programme: Christmas Social

Website:
http://www.swindonstargazers.com

Chairman: Robin Wilkey

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BECKINGTON ASTRONOMICAL SOCIETY

Society Details & Speakers programme can be found on our Website www.beckingtonas.org

General enquiries about the Society can be emailed to chairman@beckingtonas.org.

Our Committee for 2016/2017 is

Chairman: Steve Hill (email chairman@beckingtonas.org)
Treasurer: John Ball
Secretary: Sandy Whitton
Ordinary Member: Mike Witt

People can find out more about us at www.beckingtonas.org

Meetings take place in Beckington Baptist Church Hall in Beckington Village near Frome.

See the location page for details of how to find us on our website……

Post Code for Sat Nav is BA11 6TB.

Our start time is 7.30pm

STAR QUEST ASTRONOMY CLUB

This young astronomy club meets at the

Sutton Veny Village Hall.

Second Thursday of the Month.

Meet at Sutton Veey near Warminster.

BATH ASTRONOMERS

Bath Astronomers are holding webinar sessions linking in with Stargazers web sight.

Feb24

Talk by Nora Eisner, Planet Hunters TESS: discovering exoplanets using citizen science

24 Feb - Zoom

Wednesday 24th February – Monthly meeting. This month's talk will be given by Nora Eisner, Department of Physics, University of Oxford. She is a PhD student at the University of Oxford where her research focuses on citizen-powered exoplanet discoveries using NASA's TESS (Transiting Exoplanet Survey Satellite) data. She is working under the supervision of Professor Chris Lintott and Professor Suzanne Aigrain. The talk is entitled "Planet Hunters TESS: discovering exoplanets using citizen science". Nora's research focuses on citizen-powered exoplanet discoveries using TESS data via Planet Hunters TESS. As the leader of this exciting project she collates the returns from the citizen science campaigns, analyse them, and follows-up on the most promising detections using ground based facilities. The analysis of the extremely large time-series data sets has a strong emphasis on applying various statistical processes, as well as using machine learning in order detect exciting new planet systems that were missed by the main pipelines and other teams of professional astronomers. Abstract: Since the first unambiguous discovery of an exoplanet in 1995, over 4,000 more have been confirmed, and studies of their characteristics have unveiled an extremely wide range of planetary properties in terms of their mass, size, system architecture and orbital periods. While dedicated planet detection algorithms are able to identify the vast majority of planets in data obtained with spaced satellites, they miss certain types of planets that are key to the further development of our understanding of how these systems form and evolve. In this talk, I will discuss how we can harness the power of citizen science, and in particular Planet Hunters TESS, to find these more elusive planets with the help of tens of thousands of volunteers. I will present some of our exciting findings, including both planets and exotic stellar systems, and show that human classification still plays a vital role in a world that is becoming increasingly automated. Bath Astronomers monthly meeting for all members and new comers to meet up, enjoy perhaps a new topic and a cup of tea and a biscuit. Held on the last Wednesday of every month online or at the Herschel Museum of Astronomy, 19 New King Street.

Mar31

Talk by Dr Julian Onions - Aperture Fever

31 Mar - Online

Wednesday 31st March – Monthly meeting. Topic: Aperture Fever - does my mirror look big in this? After a very brief review of how telescopes work, we look at some of the existing telescopes, both visible and other wavebands, and consider why they are so big, what they can and can't see and what the telescopes planned for the next few years will deliver.

Talk by Mary McIntyre

28 Apr - Zoom

Wednesday 28th April – Monthly meeting. This month's talk will be given by Mary McIntyre. Mary is a well renown astro artist and astrophotographer. The format is open and comprises an update for the month and a talk on an astronomy topic within the reach of amateurs.

May26

Talk by Pete Williamson FRAS

26 May - Herschel Museum of Astronomy

Wednesday 26th May – Monthly meeting. Topic: From Herschel to Hawkwind

Jun30

Talk by Chris Starr, Cassini and Saturn

30 Jun - Herschel Museum of Astronomy

Wednesday 30th June – Monthly meet

SPACE NEWS APRIL 2021

NASA Perseverance Mars rover investigates 'odd' rock, zaps it with a laser
Amanda Kooser 19 hrs ago

Mars is a haven for meteorites, and it's always notable when a rover comes across one of these emissaries from space. Scientists are currently scrutinizing a rock full of holes spotted by NASA's Perseverance rover. The rock bears a resemblance to meteorites seen elsewhere.

© Provided by CNET NASA's Perseverance rover snapped a view of this odd rock on March 28. If you look closely just to the right of center, you can see a series of tiny marks where the rover's laser zapped it. NASA/JPL-Caltech/ASU

NASA hasn't declared what the rock is just yet, but the Perseverance team tweeted on Wednesday, "While the helicopter is getting ready, I can't help checking out nearby rocks. This odd one has my science team trading lots of hypotheses."

The rover team said the rock is about 6 inches (15 centimetres) long and told space fans to look closely at the image to "spot the row of laser marks where I zapped it to learn more."

Perseverance is equipped with a rock-zapping laser designed to help it collect data on Mars geology. You can listen to the laser in action as heard by a microphone. "Variations in the intensity of the zapping sounds will provide information on the physical structure of the targets, such as its relative hardness or the presence of weathering coatings," NASA said when it shared the laser audio earlier in March.

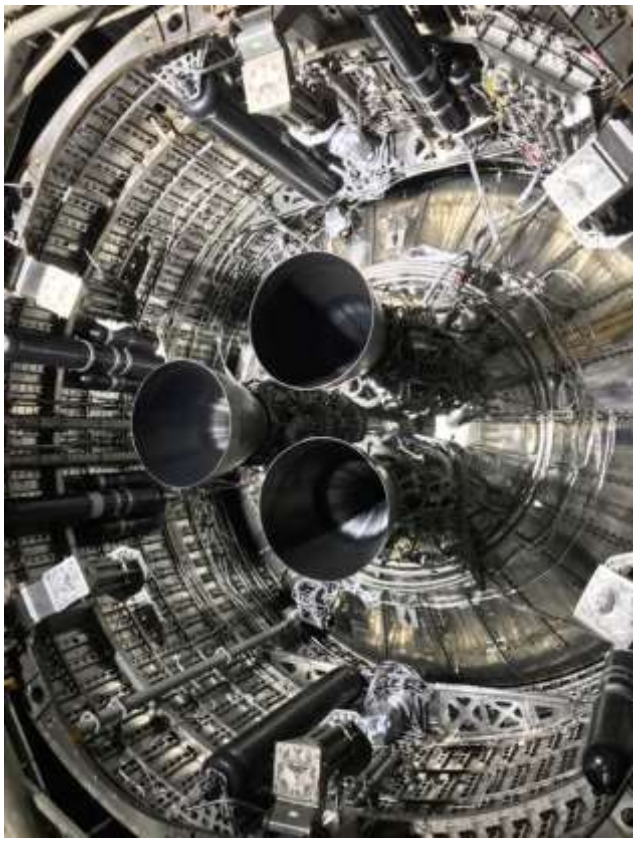
Researchers are already throwing around some ideas about the rock, including that it may be a weathered piece of bedrock, a little chunk of Mars from elsewhere that was flung by an impact event or a meteorite.

Perseverance is already hip to meteorites. There's a tiny slice of a Martian meteorite built into a calibration target used by the rover's Sherloc (Scanning Habitable Environments with Raman & Luminescence for Organics & Chemicals) instrument. So NASA sent a piece of Mars back to Mars.

The rover made time for the rock investigation while it's in the process of unfolding the Ingenuity helicopter so it can set it down on the surface prior to what NASA hopes will be the first powered, controlled flight on another planet.

Musk says methane leak doomed latest Starship test flight

April 5, 2021 Stephen Clark



File photo of the Starship SN8 prototype, which flew last year, with three Raptor engines. Credit: Elon Musk/SpaceX

SpaceX founder Elon Musk said Monday that a “relatively small” methane leak caused the explosion of the company’s latest Starship test rocket last week on an experimental flight over South Texas.

The 164-foot-tall (50-meter) Starship test vehicle, known as Serial No. 11, **took off from SpaceX’s development facility** near Brownsville on March 30 for an atmospheric test flight to an altitude of about 33,000 feet, or 10,000 meters.

Three Raptor engines, each consuming super-chilled methane and liquid oxygen propellants, powered the stainless steel rocket off its launch mount with more than a million pounds of thrust.

After climbing straight up above a dense layer of fog, the Starship shut down each of the Raptor engines in sequence, as planned, before pitching over horizontally to begin a controlled descent back to the ground. Aerodynamic flaps helped stabilize the giant vehicle as it fell back to Earth before the Raptor engines were supposed to reignite and flip the rocket back vertical for touchdown on a landing pad next to the Starship’s launch site.

Dense fog prevented clear views of what happened, but an on-board camera view on SpaceX’s live webcast froze as the Raptor engines fired up for landing. Other camera views showed debris showering the test site, which Musk calls Starbase, after a thundering boom crackled across the facility.

Light debris fragments from the Starship apparently traveled as far as 5 miles (8 kilometers) from the launch site and landed in a public viewing area, although the material may have been shed from the rocket as it climbed toward the apex of its trajectory, and not during the explosion just before landing.

Musk tweeted Monday that the ascent phase of the Starship SN11 test flight went according to plan. The transition to horizontal and control during its free fall back to Earth were also good, he said.

But a small methane leak led to a fire on one of the vehicle’s Raptor engines and “fried” part of an avionics system. That caused a “hard start” in the engine’s methane turbopump at the beginning of the landing burn, Musk said.

“This is getting fixed six says to Sunday,” Musk tweeted.

The explosion March 30 was the fourth Starship vehicle in a

row SpaceX has lost since starting high-altitude test flights in December.
A hard landing on an otherwise-successful Dec. 9 Starship test flight was caused by low pressure from header tanks feeding the vehicle's Raptor engines for the critical burn just before touchdown, and one of the Raptor engines failed to reignite for the landing burn on a test flight Feb. 2.
The SN10 rocket achieved the first soft landing of a full-size Starship vehicle at the end of a March 3 test flight, but the rocket exploded minutes later.
SpaceX is developing the Starship vehicle as the company's next-generation rocket and crew and cargo transporter to eventually replace the Falcon 9 launcher and Dragon capsule. The Starship vehicle now being tested in Texas will form the upper stage of the giant new rocket, which will stand nearly 400 feet (about 120 meters) tall with the Starship stacked on top of a huge booster stage.
The full-size rocket configured for orbital missions will have 28 Raptor engines on its first stage, and six Raptor engines on the Starship upper stage. SpaceX says it will be capable of delivering more than 220,000 pounds, or 100 metric tons, of payload mass to low Earth orbit.
Once in orbit, the Starship will be able to receive a fresh supply of methane and liquid oxygen propellants to continue on and carry its heavy cargo — and eventually people — to more distant destinations, such as the moon and Mars, according to SpaceX
The booster stage, known as the Super Heavy, and the Starship vehicle will be fully reusable to limit launch costs.
But first SpaceX needs to master the Starship landing maneuver, which is much different than the way SpaceX lands its operational Falcon rocket boosters. SpaceX also plans to begin test flights of the first Super Heavy booster prototypes.

Starship SN11 before its March 30 test flight. Credit: SpaceX
SpaceX's next Starship rocket, designated SN15, is preparing to roll out from its assembly hangar at the test site near Boca Chica Beach in South Texas. Once it's on the launch pad, SpaceX engineers will run through a series of checkouts, and likely attempt a fueling test and a hold-down test-firing before proceeding to a test flight.
The Starship production complex is located a couple of miles inland from the launch and landing pads.
SpaceX skipped building SN12, SN13, and SN14 in favor of an updated Starship configuration that will debut with SN15.
"It has hundreds of design improvements across structures, avionics/software & engine," Musk tweeted tweeted last week. "Hopefully, one of those improvements covers this problem (with SN11). If not, then retrofit will add a few more days."
SpaceX aims to launch the first fully-stacked Super Heavy and Starship in on an orbital launch attempt from South Texas in July. "That's our goal," Musk tweeted.
An orbital launch attempt by July is an aggressive goal, like many schedules outlined by SpaceX's hard-charging founder and chief executive.
The next major technology update to the Starship vehicle will come with SN20 later this year, according to Musk.
"Those ships will be orbit-capable with heat shield & stage separation system," Musk tweeted. "Ascent success probability is high. However, SN20+ vehicles will probably need many flight attempts to survive Mach 25 entry heating & land intact."
SpaceX has stacked the first Super Heavy booster testbed, known as BN1, at the South Texas launch site. But Musk said that vehicle is a pathfinder to try out manufacturing and production techniques, and will not fly. Teams are building the second Super Heavy prototype — BN2 — for atmospheric test flights before proceeding with construction of BN3 for a potential orbital launch attempt.

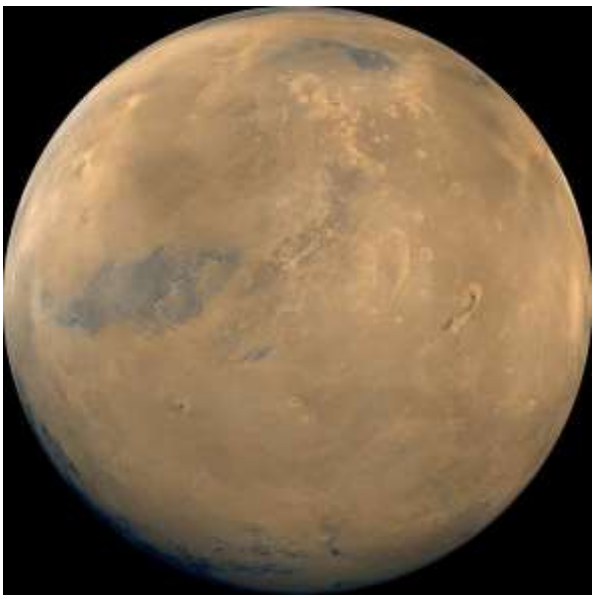
Nasa drops Mars helicopter Ingenuity onto surface from Perseverance rover ahead of pioneering flight

© Provided by The Independent

Nasa's Perseverance rover has dropped Ingenuity, the helicopter that will conduct the first controlled flight on another planet, onto the surface of Mars.

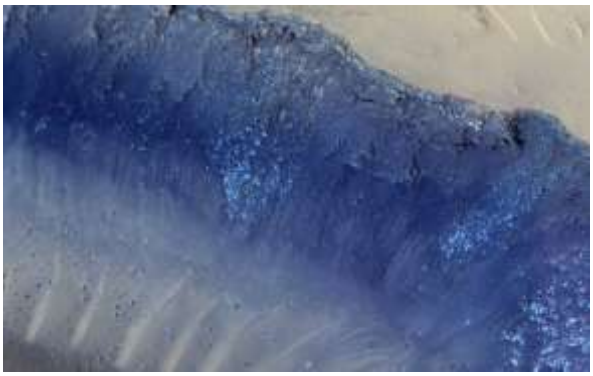
The helicopter fell four inches from the belly of Perseverance onto Mars.
It means that the helicopter is now looking after itself: heating and powering itself, which includes gathering solar energy from panels attached to its body. Temperatures through the night can drop as low as -54 degrees celsius, and an onboard heater aims to ensure that its battery and other components are protected from any damage.
At some point after 11 April, and when preparations are over, Ingenuity will take off for the first ever powered flight on any other planet. It could do so as many as five times over the following month, Nasa said – before its test period is over and it will shut down to lie on the surface forever.
While the four inches from the bottom of the rover to the surface of Mars might seem small, they were among the most critical parts of the mission. They were the end of a process that began with Ingenuity turning around so that it was lying flat to drop onto the surface, and it was key that Ingenuity made it through safely to ensure it could take off.

InSight Detects Two Significant Quakes from the Cerberus Fossae Region on Mars
NASA's InSight lander felt the distant rumble of two major 'marsquakes' in March, originating from a region near the Martian equator known as the Cerberus Fossae. Registering magnitudes of 3.1 and 3.3 on March 7th and March 18th respectively, the quakes cement the Cerberus Fossae's reputation as one of the most geologically active places on the Red Planet today. A pair of similarly strong marsquakes rocked the same region back in 2019.
The Cerberus Fossae region is scarred by a series of massive, nearly-parallel fissures, created when the planet's crust was pulled open by a dramatic volcanic event. Volcanism is the primary driver of quakes on Mars: the Red Planet lacks the tectonic plates that cause most of the quakes we feel here on Earth.
On Mars, the Cerberus Fossae region is one of the major epicenters of such activity, and is a fascinating area to study because of its geological instability, both in the past and in the present day.



The Cerberus Fossae fissures are clearly visible in the dark area to the center-left of this mosaic from Viking Orbiter 1. Image Credit: NASA (Wikimedia Commons).

Our ability to detect marsquakes is very new. Geologists have suspected their existence for decades, but it wasn't until InSight fired up its Seismic Experiment for Interior Structure (SEIS) in early 2019 that scientists were able to incontrovertibly catch a recording of one. The Viking 2 lander observed an event back in 1976 that may have been a small quake, but at that time it was impossible to rule out wind or weather as the cause. InSight, on the other hand, has now found hard evidence of over five hundred seismic events in just the last two years. Most marsquakes detected by SEIS have been small, but those originating from the Cerberus Fossae are among the clearest and strongest yet.



Landslides in the Cerberus Fossae, indicating recent (in geological terms) seismic activity. Credit: NASA/JPL-Caltech/Univ. of Arizona

Incredibly, geologists were able to predict that InSight might hear quakes from the Cerberus Fossae region six years before the spacecraft even landed on Mars. Back in 2012, a research team used imagery taken by the Mars Reconnaissance Orbiter's HiRISE camera to examine the area, and discovered evidence of recent landslides, as well as boulders that had rolled down the steep slopes of some of the chasms. These rockslides seemed consistent with the after-effects of earthquakes here at home, suggesting that a marsquake might recently have occurred. InSight's new detections validate that theory.

The InSight mission received a two-year extension in January, and in that time the team hopes to create a detailed record of Martian seismic activity. To ensure the highest possible quality data, they have begun using the lander's robotic arm to bury the SEIS instrument's cable. Doing so will reduce wind noise, vibrations, and temperature fluctuations, all of which can interfere with the seismometer and disguise possible marsquake detections.

InSight's robotic arm scoops soil to bury the seismometer's tether. The image was taken on April 3, 2021. Credit: NASA/JPL-Caltech

InSight is also still struggling with dust-covered solar panels, meaning some of the lander's instruments, like its weather station, will have to be powered down temporarily. Insight still has enough energy to keep SEIS running for another month or two, after which it too will have to go into hibernation. This low-power state will remain until a dust devil cleans the panels, or until Mars moves closer to the Sun in its orbit, which should happen shortly after July.

In the meantime, researchers are excited about the detections coming from the Cerberus Fossae, and are hoping that stronger quakes are yet to come. If InSight hears a 'Big One,' the vibrations may go deep enough to interact with the planet's mantle and its core. Listening to such an event would teach us more about the planet's internal structure – something we currently know very little about.

Interstellar Comet Borisov is so Pristine, it's Probably Never Been Close to a Star Before

By comparing our local Comet Hale-Bopp to the interstellar visitor 2I/Borisov, a team of astronomers have concluded that the interloper is perhaps one of the most pristine comets we've ever seen.

"2I/Borisov could represent the first truly pristine comet ever observed," says Stefano Bagnulo of the Armagh Observatory and Planetarium, Northern Ireland, UK, who led the new study published recently in *Nature Communications*.

Many comets pass at least once through the inner solar system in their lifetimes. When they do, they encounter the solar wind and any other random pieces of microscopic junk floating around. This contaminates them to such a degree that astronomers can determine how many passages a comet has made since it formed.

Comet Hale-Bopp, which wowed stargazers in the late 1990's, was amazingly pure. Astronomers estimated that prior to its entry in the late 20th century, it had only passed close to the sun once before.

Using the FORS2 instrument at the European Southern Observatory's Very Large Telescope in Chile, a team of astronomers carefully studied the interstellar comet 2I/Borisov. That visitor was discovered by amateur astronomer Gennady Borisov in August 2019, and was the second known interstellar interloper to our solar system. The research team found that Borisov and Hale-Bopp were remarkably similar.

"The fact that the two comets are remarkably similar suggests that the environment in which 2I/Borisov originated is not so different in composition from the environment in the early Solar System," says Alberto Cellino, a co-author of the study, from the Astrophysical Observatory of Torino, National Institute for Astrophysics (INAF), Italy.

Olivier Hainaut, an astronomer at ESO in Germany who stud-

ies comets and other near-Earth objects but was not involved in this new study, agrees. “The main result — that 2I/Borisov is not like any other comet except Hale–Bopp — is very strong,” he says, adding that “it is very plausible they formed in very similar conditions.”
2I/Borisov may not have ever passed close to its parent star before getting ejected into interstellar space and making its way to our own solar system.
“The arrival of 2I/Borisov from interstellar space represented the first opportunity to study the composition of a comet from another planetary system and check if the material that comes from this comet is somehow different from our native variety,” explains Ludmilla Kolokolova, of the University of Maryland in the US, who was involved in the Nature Communications research.
The truth is, we don’t know much about the lives of comets, especially interstellar ones. But future missions may help paint a fuller picture.
Bagnulo hopes astronomers will have another, even better, opportunity to study a rogue comet in detail before the end of the decade. “ESA is planning to launch Comet Interceptor in 2029, which will have the capability of reaching another visiting interstellar object, if one on a suitable trajectory is discovered,” he says, referring to an upcoming mission by the European Space Agency.

Satellites Have Brightened the Skies by About 10% Across the Entire Planet

New research has found that as the number of satellites in Earth orbit continues to increase, their accumulated light pollution will brighten the night sky – making it much harder to do fundamental astronomy.
The continued launch of so-called “mega-constellations” of satellites, used to power global internet access, has been met with concern by astronomers worldwide. Those astronomers worry that individual exposures of distant objects will be ruined by a satellite crossing in front of the telescope.
But new research recently appearing in the *Monthly Notices of the Royal Astronomical Society* paints an even more grim picture. As more and more satellites go up, they each contribute a small amount to the overall brightness of the sky, something called light pollution.
“Our primary motivation was to estimate the potential contribution to night sky brightness from external sources, such as space objects in Earth’s orbit,” said Miroslav Kocifaj of the Slovak Academy of Sciences and Comenius University in Slovakia, who led the study. “We expected the sky brightness increase would be marginal, if any, but our first theoretical estimates have proved extremely surprising and thus encouraged us to report our results promptly.”

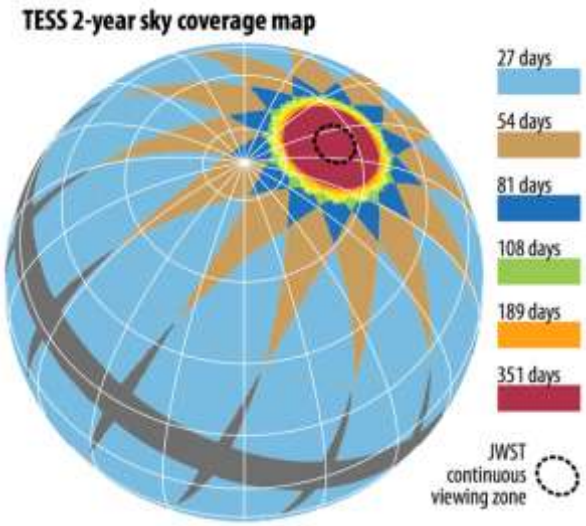
If all the planned mega-constellations go up, within just a few years our sky will be 10% brighter across much of the planet. To estimate this result, the research team took into consideration the individual shape, reflectivity, and orbit of the satellites, as well as the contribution of random space junk, like spent rocket boosters.
The end result is that even the most pristine places on Earth, far away from any cities, will still suffer.
“Unlike ground-based light pollution, this kind of artificial light in the night sky can be seen across a large part of the Earth’s surface,” explained John Barentine, Director of Public Policy for the International Dark-Sky Association and a study co-author. “Astronomers build observatories far from city lights to seek dark skies, but this form of light pollution has a much larger geographical reach.”
The researchers hope that this will spurn satellite makers to take the worries of astronomers seriously, and continue to develop aggressive mitigation strategies.
“Our results imply that many more people than just astronomers stand to lose access to pristine night skies,” Barentine said. “This paper may really change the nature of that conversation.”

TESS has Found 2,200 Potential Exoplanets so far

Exoplanetology has been on a tear recently. This is largely due to an abundance of data collected by a new generation of satellites, one of which is the Transiting Exoplanet Survey Satellite (TESS). Now the project has reached a new milestone with another release of data – 2,200 planet candidates collected, far surpassing the 1,600 expected candidates in the mission’s first two years. Now comes a potentially even more daunting task – following up with each of them.

That follow-up is where the real potential lies, according to Natalia Guerrero, the lead author on the paper releasing the latest findings. The paper itself catalogues all the planets collected during the 2 year “primary mission” of TESS, from 2018 to 2020. Now the satellite is on an extended mission, completing an “all-sky survey” over both the northern and southern hemispheres.

Even though it was only able to observe a relatively small patch of the northern hemisphere for a significant length of time, TESS was still able to find thousands of potential exoplanets. There might even be more planets than the number TESS found hiding in that small patch of sky. Planets with longer orbital periods, such as Neptune or Jupiter, might have been completely missed, as their half orbital period (which is when TESS would have been able to observe them) was longer than the 350+ days TESS spent on the most observed patch. If the planets don’t happen to pass in front of the star in that period, their transit would not have been recorded.
Even with the limitations of the data it collected, TESS still found an amazing variety of planets, which are catalogued in a recent press release from NASA. Ranging from Earth-sized planets in the habitable zones of their stars to planets surrounding white dwarves, there are plenty of interesting places to look both for exobiologists and planetary scientists.



Globe showing what part of the sky TESS spent its viewing time on.
Credit: NASA / MIT / TESS

What might be even more interesting is the selection of where TESS spent most of its observing time. It overlaps the observing window of the (hopefully) soon-to-be launched James Webb Space Telescope (JWST). JWST will be able to observe the atmosphere of some closer exoplanets directly, leading to even more insight into some of our closest exoplanet neighbors.

The process of finding exoplanets is showing no signs of slowing down any time soon. TESS still has more data to release from its extended mission, and even more space missions are on the horizon, with the Nancy Grace Roman Space Telescope planned to launch in about 4 years. With luck, the 2200 candidates TESS found will just be a drop in the ocean of the total number of exoplanets located in the coming years. There would be a lot more follow up work at least.

The Debris Cloud From a Supernova Shows an Imprint of the Actual Explosion

Computer models are continuing to play an increasing role in scientific discovery. Everything from the first moments after the Big Bang to potential for life to form on other planets has been the target of some sort of computer model. Now scientists from the RIKEN Astrophysical Big Bang Laboratory are turning this almost ubiquitous tool to a very violent event – Type Ia supernovae. Their work has now resulted in a more nuanced understanding of the effects of these important events.

Type Ia supernovae are a type of supernova that occur in binary star systems – specifically systems with a white dwarf star. Eventually the white dwarf will run out of fuel to power its nuclear reaction. However, in some cases, matter from the companion star can reignite the reactions of the white dwarf, which could then cause a runaway nuclear fusion event, resulting in a Type Ia supernova and creating all of the naturally occurring heavy elements with atomic weights larger than iron.

When the white dwarf explodes, it creates a shockwave known as a remnant. These remnants are known to vary along with the explosion that created them, but it has not really been clear how or why.

That is where the computer simulation comes in. The team at RIKEN, led by physicist Gilles Ferrand, actually developed two different models – one for modeling the supernova explosion itself and one modeling the remnant.

Spectacular example of a supernova remnant.
Credit: NASA

There were two main variables that the RIKEN team wanted to control as part of the explosion model. The first was how exactly the runaway reaction that caused the supernova is ignited. The second was how that explosion propagates itself through the collapsing star.

Outputs from the various models created using this methodology were then fed into the simulation of the supernova remnant. Dr. Ferrand and his team noticed that there were four main categories the remnants could be categorized into, based on some variable details of the actual explosion that spawned them.

The first was the number of points at which the supernova explosion begins to take place. The two broad categories for this variable are that the explosion would either start in a few, distinct places, or multiple places simultaneously throughout the star.

The second variable deals with a concept know as deflagration, which is defined as “a turbulent fire that moves slower than the speed of sound.” Alternatively, these deflagrations can occasionally devolve into an extremely fast moving detonation. Deflagration fires are caused by the explosions that kick off the supernova, but the speed with which they move could have profound impacts on the remnant.

Supernova G292.0+1.8. Like most supernovae it detonated within a host galaxy – in fact ours. Credit: Chandra.

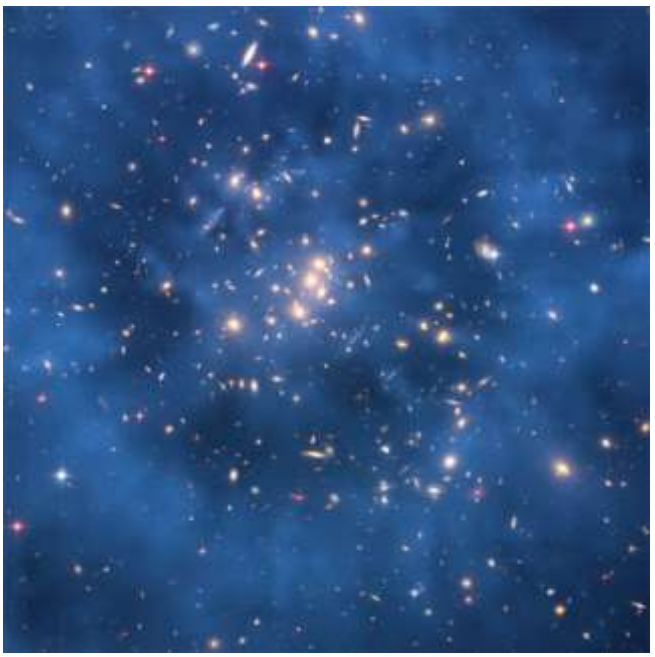
Combining all these variables into a full remnant model allows the researchers to define four distinct types of remnant that result from four different types of explosions. Since remnants

are still visible hundreds of years after the supernova that created them takes place, understanding their form and then backtracking to the type of supernova that caused it in the first place could be particularly useful for understanding the frequency of different types of stellar explosions.
Someday there might even be a computer model that can accurately predict what kind of remnant would be created by a given supernova before it is even visible. Sounds like some good follow-up work for Dr. Ferrand and his team.

The Closest Star Cluster to Earth is Being Dismantled in Front of our Eyes

Star clusters are interesting inhabitants of the sky. They vary in sizes, distances, and number of stars, but almost all are spectacular to look at. And most of them are in the process of being torn apart. That is certainly the case for the Hyades star cluster – the closest one to Earth at only 153 light years away. The problem is, there is something causing a lot more destruction than would be expected given the mass and energy in the surrounding space. Now, a team of scientists from ESA have a theory as to what the cause of the destruction might be – a mysterious dark matter sub-halo.
This novel theory extends from findings gleaned from data collected by GAIA, ESA's star mapping satellite. The GAIA team expected to see what are called "tidal tails" trailing and leading the star cluster as it moves throughout the galaxy. These tails are formed when some stars are forced to the outer edges of the cluster, and then pulled by the gravitational pull of the galaxy itself, pushing some stars forward in their journey through the galaxy, while other stars are pulled further behind.

The GAIA team did find tidal tails on either side of the Hyades cluster when they observed it. However, they were extraordinarily long – thousands of light years across the galaxy, each holding thousands of stars. Observing them in their entirety was only possible because of the GAIA data and a computer model that Dr. Tereza Jerabkova, an ESA research fellow, developed with her colleagues.
That model had several added advantages over previous efforts to map the tidal tail of the Hyades. Without the model, thousands of stars that had been left behind by the cluster hundreds of millions of years ago would not be included in the tail due to changes in their orbit during that time. But there was something even more interesting hiding in the data that the model failed to predict.
Another ESA video discussing how the Hyades star cluster has evolved over the last 600 million years.
Credit: ESA YouTube Channel
There seemed to be huge holes in the tidal tail, where stars were completely missing. One of the nice things about well-written simulations is that it is possible to quickly adapt them to new data, and that is exactly what Dr. Jerabkova did. Changing parameters to try to account for the missing stars, she realized that the presence of an object weighing 10 million solar masses could have caused the disruption seen in the tidal tail pattern. Only there wasn't any object of that size anywhere near the missing stars.
Realizing that they couldn't see any object, the researchers turned to something that they couldn't actually see – dark matter. Scientists have long theorized about dark matter sub-halos – invisible clusters of dark matter that exert gravitational forces throughout the galaxy. But so far, no one has ever seen them in action.

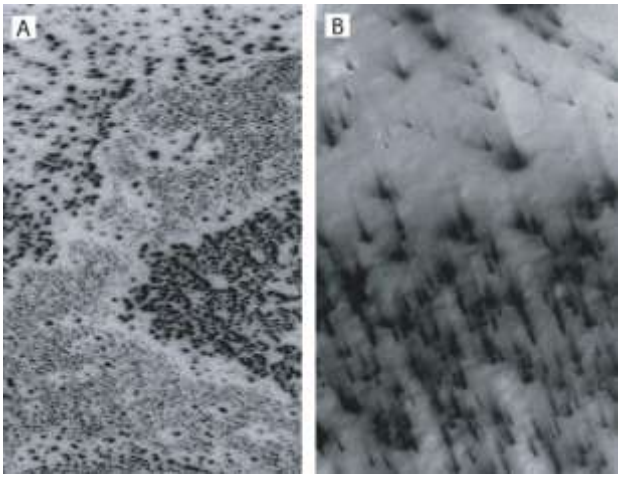


Here's an image from Hubble of a "dark matter ring".
Credit: NASA, ESA, M.J. Jee (John Hopkins University)
If the ESA team's models are correct, a sub-halo could be the cause of the disruption in the Hyades' tidal tail. While this would be exciting new evidence for the presence of such understudied massive structures, it is far from certain that they are the sole cause of the Hyades' disruption. As always, more data is needed, and GAIA is still patiently collecting data on more than a billion stars. Maybe the next round of data will hold some additional insight on what exactly is happening to this spectacular star cluster.

Mars Spiders Form as Spring Arrives on Mars. But why?

A person suffering from arachnophobia might think their fear would stoked on a trip to Mars. However, there is such a thing known colloquially as a Martian "spider". It is much more innocuous than the eight legged animal that strikes fear into the hearts of millions, but its origins have only been theorized until recently. Now, a team led by a group at Trinity College Dublin has determined that these "spiders" are actually topological troughs formed when dry ice directly sublimates to a gas.

The "spiders", or to give them their proper name, "araneiforms" have been known for some time. These spider-life features of the Martian terrain form in the spring, but are not known to form at all on Earth. Araneiforms have been captured by various satellites orbiting Mars for the last 20 years. Their transitory nature makes them particularly interesting to scientists looking to better understand Martian seasonality and weather patterns.



Araneiforms are seen on the Martian south polar cap in two high-resolution MOC images taken in southern spring. Each image is about 2 miles wide.
Credit: NASA/JPL/MSSS

For a long time, there has been a theory about where araneiforms came from. That theory, known as Keiffer's hypothesis, named after Hugh Kieffer formerly of the US Geological Survey, centred on the idea that the sun would cause the ground under blocks of dry ice to heat up, eventually sublimating the dry ice it is in contact with. Pressure would then build up in the ice block, eventually rupturing it and allowing the gas to escape. The quick escape of the gas then forms the dendritic pattern characteristic of araneiforms in the dust of the Martian surface.

The only problem with this theory, which has been widely accepted in the scientific community, is that it was never demonstrated experimentally. Coverage of the Martian surface is not continuous enough to be able to catch an ice block in the act of sublimating. Therefore, the theory, though widely accepted, was never truly proven.

That is where the team from Trinity College Dublin come in. They teamed up with other scientists as Durham University and the Open University, which conveniently had an important piece of kit known as the Mars Simulation Chamber. This experimental setup is able to recreate environments at pressures and temperatures similar to that found on the Martian surface.

However, the Mars Simulation Chamber wasn't the only interesting piece of experimental equipment the team used. Taking a note from arcades, they used a claw similar to that found in the frustratingly designed games where kids regularly fail to pick up toys. After drilling holes in blocks of dry ice, the team used the claw to suspend them directly over a granular bed. They varied the size of the grains in the granular beds to adjust for particular surface conditions on Mars.

The research team took inspiration from a classic arcade game.
Credit: Wikipedia User Nlan86

Using another well understood process, known as the Leidenfrost Effect, the team was able to get some of the dry ice to directly sublimate when it came in contact with the granular surface, which was heated. The gas thus created quickly escaped through a central hole the team had drilled in each ice block to simulate the fracturing that is believed to take place in the dry ice blocks on the Martian surface.

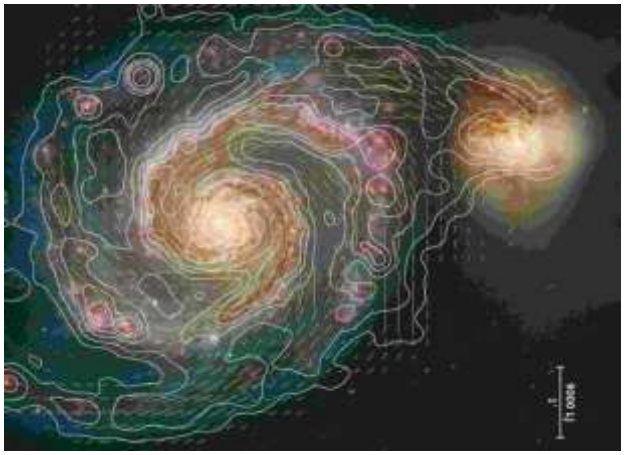
After each experiment, a very discernible araneiform pattern was visible in the granular bed once the dry ice block was lifted. This provided the first experimental evidence for the creation of these patterns resulting from the sublimation process described in Kieffer's original theory.

That result is likely the best scientists will be able to do short of observing the actual process directly on Mars. Even once they finally do, arachnophobes can rest assured that any Martian spiders are most likely just terrain patterns caused by rushing CO_2 gas. At least as far as we can tell from here.

The Event Horizon Telescope has Revealed the Magnetic Field Lines Around M87's Central Black Hole

In 2019 astronomers captured the first direct image of a black hole. It was an image of the supermassive black hole at the heart of M87. And when many folks saw it, their reaction was "that's it?" Which is understandable, given that the image is just a blurry, donut-shaped smudge. It isn't much to look at. But an astronomical image is a small fraction of the data gathered by astronomers. Recently more of that data has been analysed, including both the polarization of the light and the magnetic field surrounding the black hole.

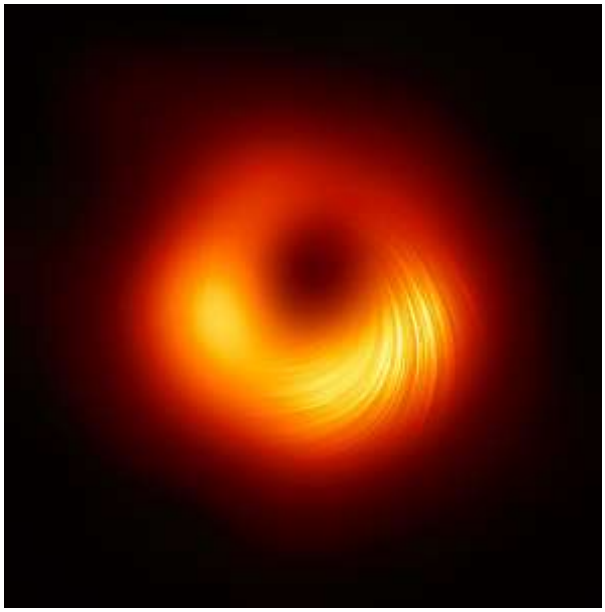
Polarization is a basic property of light, just like wavelength or intensity. If you imagine light as a wave that oscillates as it travels through space, then polarization is the orientation of that oscillation. Light waves may oscillate up and down, left and right, or even spiralling clockwise or widdershins. When light comes from hot source, such as the material surrounding a black hole, lots of polarizations are jumbled together so that the light is basically unpolarized. But when light passes through ionized gas, different polarizations interact with the gas more strongly or more weakly. As a result, the light that reaches Earth is polarized. By studying the polarization of light near the M87 black hole, we can learn about the surrounding material.



M51 (Hubble) overlaid by 6cm radio intensity contours and polarization vectors (Effelsberg and VLA) Credit: MPIfR Bonn

In the case of radio astronomy, there is also a polarized source of light known as synchrotron radiation. This occurs when electrons are trapped by magnetic field and move along the field lines in tight spirals. The polarization of synchrotron radiation tells us the orientation of the magnetic field lines.

In this latest work, astronomers measured the polarization of light observed near the M87 black hole, and found it had a twisted spiral pattern. This is somewhat expected, because we know the black hole rotates. As it does, it drags nearby space around it. The overall pattern is indicative of the gravitational structure of the black hole.



An image of the M87 black hole with polarization indicated. Credit: EHT Collaboration

But what's interesting is that most of the light observed *isn't* polarized. Only about 15% or so of the light is polarized. Most of the light from near the black hole is unpolarized. That's unexpected, because ionized gas near the black hole should be highly magnetized, so we'd expect the light reaching us to be strongly polarized. So what gives?

It seems that gas near the black hole *is* magnetized, but rather than having a magnetic structure that is large and simple, the magnetization is a chaotic jumble at smaller scales. The scale at which the magnetization has a random -like orientation is smaller than the resolution of the Event Horizon Telescope. So things blur out. All the small scale polarizations blur together to appear unpolarized.

Results like these are important because they give us tremendous insight on the material and magnetic fields near black holes. As we understand more, we will be able to the complex processes that creates active black holes and how they interact with the surrounding galaxy. All of that information is buried in the data, and it's more than meets the eye.

New Binocular Nova Cas 2021 Flares in Cassiopeia

A 'new star' erupted into visibility over the past weekend, and continues to brighten.

It began, as all modern astronomical alerts seem to, with one tweet, then two. Early on the morning of Friday, March 19th, we started seeing word that a nova was spotted in the constellation of Cassiopeia the Queen, near its border with Cepheus. At the time, the nova was at magnitude +10 'with a bullet,' and still brightening. A formal notice came that same night from the American Association of Variable Star Observers (AAVSO) with Alert Notice 735 on the discovery of the first nova in Cassiopeia for 2021, Nova Cassiopeiae 2021, or N Cas 2021.

The discovery was made by Japanese observer Yuji Nakamura on the night of March 18th, 2021, and the newly visible star had an initial brightness of +9.6.

Current visibility: Will Nova Cassiopeiae 2021 continue to brighten?

As of writing this, N Cas 2021 is still brightening at around magnitude +7. That puts it in easy range of binoculars, and if it brightens much more, it'll be within naked eye visibility from a dark sky site.

Nova Cas 2021 (marked) brightening on March 19th. Image credit and copyright: Filipp Romanov.

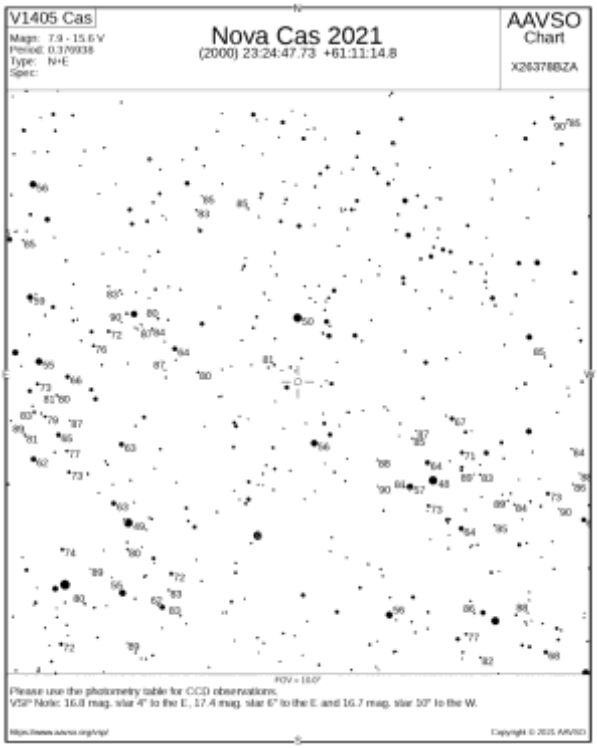
In late March, Cassiopeia is low to the northwest for northern hemisphere observers at dusk, sinking towards lower culmination near local midnight before gaining elevation to the northeast in the early dawn hours. The Moon is now waxing towards Full on March 28th , after which, it will wane and begin to leave the dusk scene.

Nova Cas 2021, in the same field with the open star cluster Messier 52. Image credit and copyright: Filipp Romanov

The +5th magnitude star 4 Cassiopeiae is nearby, making a good guide star. Another familiar deep sky target is just over half a degree from Nova Cas 2021, the +6.9 magnitude open cluster Messier 52. Nova Cas 2021 is approximately equidistant between the naked eye stars Beta Cassiopeiae and Iota Cephei.

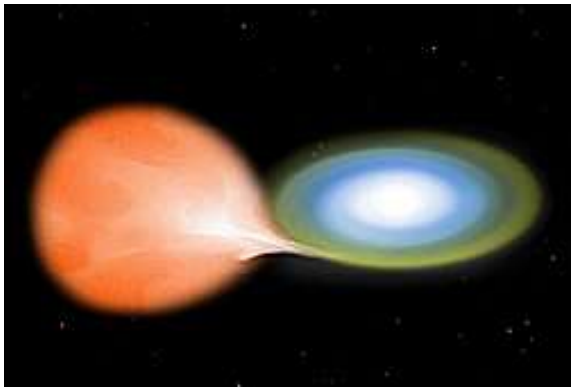
A widefield finder chart for Nova Cas 2021. The red inset is the field for the close-in chart (below) Credit: Dave Dickinson/Stellarium.

The coordinates for Nova Cas 2021 are Right Ascension (R.A.) 23 Hours 24 minutes and 48 seconds, Declination +61 degrees 11 minutes and 15 seconds. Star hop through the field and compare the nova with nearby stars of known brightness to find the nova and gauge its magnitude. You can make your own custom finder charts for Nova Cas 2021 at the AAVSO website.



A 'true view' (versus inverted) 10 degree finder chart, centred on Nova Cas 2021. Credit: The AAVSO

This particular nova is about a degree off of the galactic plane, a standard region along which novae typically appear. Classical novae occur when a white dwarf orbits a main sequence star in a tight embrace, drawing in material which then accretes or concentrates around the white dwarf. The material then compresses around the white dwarf, heats up, and eventually ignites in a runaway fusion process. A sub-category of repeating eruptive variable stars are known as cataclysmic or recurrent novae. T Pyxidis and U Scorpii are good examples of this subclass.

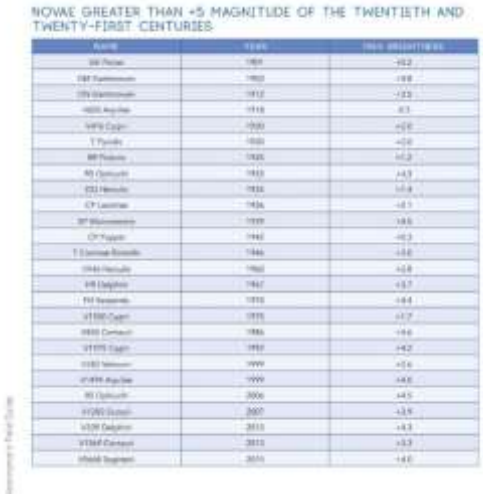


An artist's conception of a nova in the act of formation. NASA/CXC/M. Weiss

The exact distance to Nova Cas 2021 isn't yet known, but most of these tend to peak around an absolute magnitude of -8 and—like extra-galactic supernovae—hold promise for use as standard candles to measure distance. 'If' +7th magnitude is the peak for Nova Cas 2021, that would suggest it's about 30,000 to 32,000 light-years distant, out at the edge of the Outer Arm of the Milky Way Galaxy, just beyond the Perseus Arm… but if it brightens, it may be considerably closer.

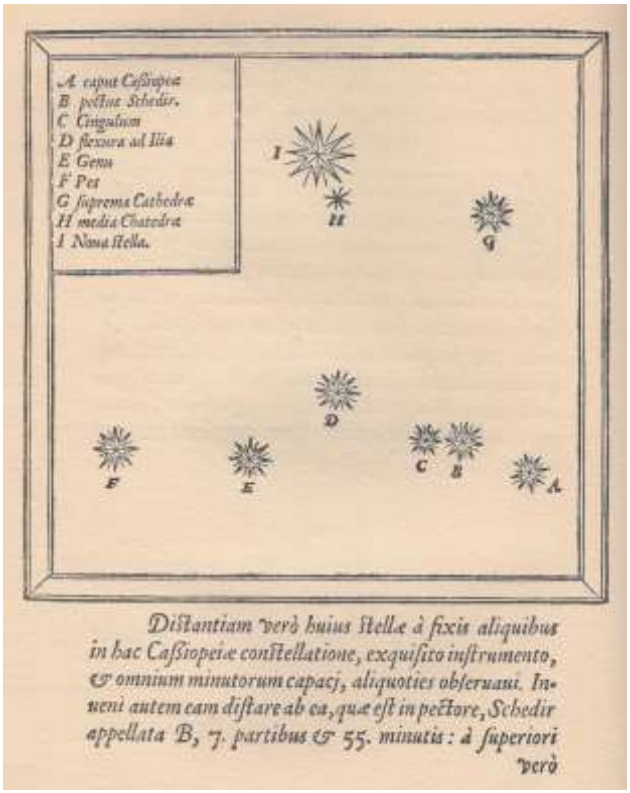
The last good naked eye nova for the northern hemisphere was Nova Delphini 2013 in the tiny cetacean constellation of Delphinus the Dolphin about eight years ago. On average, we get a good naked eye galactic nova about roughly once per decade or so.

Here's our list of novae observed over the past century:



20th and 21st century naked eye novae. Adapted from our latest Deep-Sky Field Guide. Credit: Dave Dickinson

If the patch of sky currently hosting Nova Cas 2021 seems familiar, it might be because it's only six degrees from the site of Tycho's supernova, noted by astronomer Tycho Brahe in 1572.



Tycho's Star, seen in 1572. Wikimedia Commons/Public Domain.

Unfortunately, galactic supernovae are much rarer cosmic beasts. Though we see several per year in distant galaxies, we haven't had a good one in our own galactic neighborhood since the advent of telescopic astronomy, four centuries ago. Spica (Alpha Virginis) and Betelgeuse are good nearby candidates, though both are far beyond the 50 light-year 'kill zone,' and will simply put on a good show. Betelgeuse gave us all pause in late 2019 through early 2020 when it dimmed markedly, but seems to be back to its old self, for now.

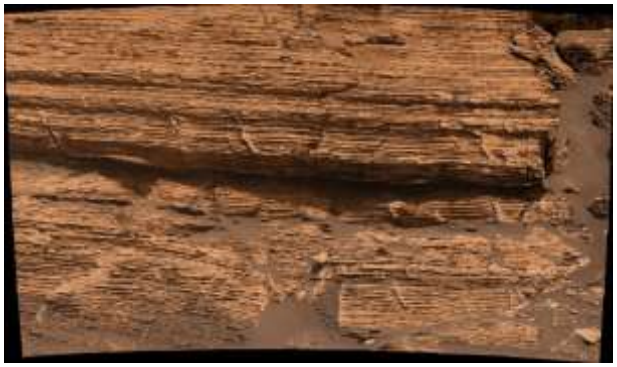
Mont Mercou on Mars

Here are a few stunning views of the Curiosity Rover's current location, Mont Mercou in Gale Crater on Mars. This towering outcrop provides a great look at layered sedimentary rock structures. On Earth, it's common to find layered rock like the ones within this cliff face, especially where there were once lakes. The pancake-like layers of sediment are compressed and cemented to form a rock record of the planet's history.

This colour image is from one of our favourite image editors, Kevin Gill. He assembled 202 raw images taken by MSL's MastCam between sols 3057 and 3061. You can see Kevin's full mosaic on Flickr.

Gale Crater was specifically chosen as the destination for the Curiosity rover from approximately original 60 candidate sites, because data from orbiting spacecraft determined that Mount Sharp – the big mountain in the middle of the crater – is created from dozens of layers of sedimentary rock, perhaps built over millions of years. These layers are telling the story of Mars' geological and climate history, and planetary geologists are having a field day with Mont Mercou.

Clouds have been showing up in recent Curiosity rover images, too and Sean Doran put it all together in this great shot:



MSL Sol 3057 – Mars Curiosity MastCam image, close up view of Mont Mercou. Credit: NASA/JPL-Caltech/MSSS/Kevin M. Gill

"Humans minds don't easily comprehend the vast eons of time that separate us from the places we explore in space with robots like Curiosity," wrote Scott Guzewich, Atmospheric Scientist at NASA's Goddard Space Flight Center, and a member of the Mars Curiosity rover science team, in a blog post about the current activities of Curiosity. "When we explore Mars, we're roving over rocks that formed billions of years ago and many of which have been exposed on the surface for at least tens or hundreds of millions of years. It's a gap of time that we can understand numerically, but there's no way to have an innate feel for the incredible ancientness of the planet and Gale Crater."

We'll quite likely hear much more about Mont Mercou in the days and weeks ahead, as scientists begin to process the various findings here from Curiosity's science instruments. You can read all the latest mission updates from Curiosity here to find out which instruments are being employed, and find all the raw images taken by the rover's various cameras here.

China and Russia Will Be Partners in a Lunar Research Station

There are many paths to the Moon, and not all of them go through the Lunar Gateway. This week, the heads of the Russian Space Agency (Roscosmos) and the China National Space Administration (CNSA) signed an agreement to cooperate on a Lunar research station of their own.

According to a statement released by the CNSA, the International Lunar Research Station (ILRS) will be "a comprehensive scientific experiment base with the capability of long-term autonomous operation, built on the lunar surface and/or on the lunar orbit."

When complete, use of the research station will be open to all interested nations. As for China and Russia, their decision to cooperate on a Lunar base is not altogether surprising. They've been signaling their intent to collaborate in Lunar science for a while now, and have already signed agreements to work together on their respective Chang'e 7 and Luna 27 missions, both expected to explore the Moon's South Pole in the mid-2020s. No timeline has been set for the ILRS yet, but Roscosmos indicated that they will "jointly develop a Roadmap" for building the station with the CNSA in the near future.

The move comes not long after Russia began distancing itself from the Lunar Gateway, a Lunar orbital research station being planned in partnership between the American, Canadian, Japanese, and European space agencies. Roscosmos had been slated to provide the Gateway with an airlock, but backed away from that commitment in recent months after Roscosmos head Dmitry Rogozin called the Gateway "an American project with limited participation of external partners. We are not interested in this," he said. China, meanwhile, was not invited to participate in the Gateway in the first place, as American law currently does not allow for cooperation in space between NASA and the CNSA without special congressional approval.

An early concept for the Lunar Gateway, showing Roscosmos' now cancelled contribution of an airlock module. Credit: NASA.

Despite the disagreements, NASA and Roscosmos are still cooperating as partners on the International Space Station (ISS). Both also agree that the Lunar Gateway should use an international docking adapter, allowing a Soyuz vehicle to dock with the station in the future if necessary. Interoperability benefits everyone involved, even if Roscosmos' priorities lie elsewhere.

The newly proposed ILRS, meanwhile, promises to give Russia, China, and any other partners who participate access to new deep space research capabilities. According to the CNSA, some of the activities the ILRS will facilitate include "lunar exploration and utilization, lunar-based observation, basic scientific experiment and technical verification." It's an ambitious project, and aligns with China's and Russia's long-term priorities in space exploration.

China's Yutu 2 rover on the far side of the Moon. Credit: CNSA; IAU.

In the near term, Russia will be launching the first major upgrade to the ISS in over a decade in April. The new module, called Nauka (Russian for science), will replace the old Pirs docking port, which will be discarded. Meanwhile, China is currently operating a rover on the far side of the Moon, and is set to attempt to land a rover on Mars in May or June this year. Both countries are also designing and testing new heavy-lift launch vehicles to enable their deep space ambitions, including the newly announced ILRS.

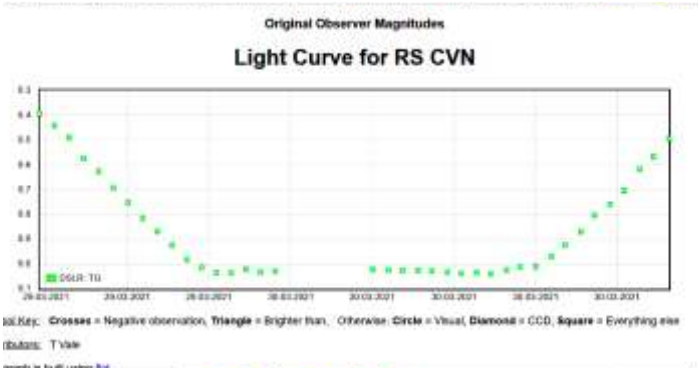
E Mails Viewings Logs and Images from Members.

Obtaining the Time of Minimum of the eclipsing binary RS Canum Venaticorum (RS CVn) from the primary eclipse of the night of 29th to 30th March 2021

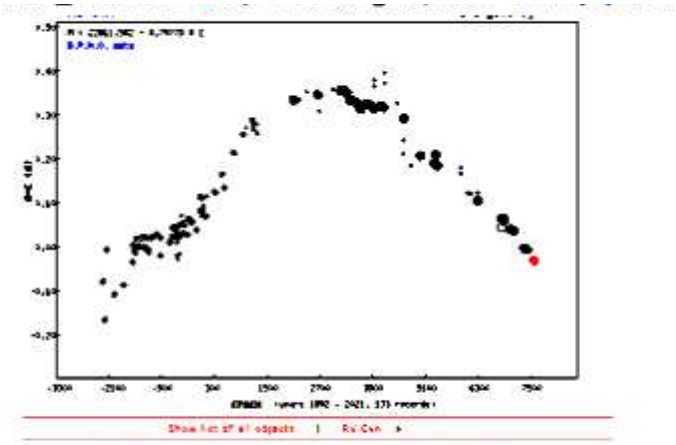
RS CVn is an Algol type eclipsing binary with a period of 4.8 days and a primary eclipse duration of 13 hours involving a reduction in magnitude from around 8 to 9. Algol eclipsing binaries are generally well separated with spherical or only slightly ellipsoidal components. They show little variation in magnitude between eclipses and the beginnings and ends of eclipses are well defined. However, the RS subtype (named after RS CVn) show can show variability between eclipses due to significant Chromospheric activity or star spots.

RS Cvn was discovered in 1914 by Madame Lydia Ceraski who was the wife of the Director of the Moscow observatory. Her role there was similar to that of the Harvard "computers". Although the discovery was published under her husband's name he gave her full credit for it.

The observation was made with a short focus 4 inch refractor and a Canon D600 DSLR. The observing run began around 20:45 UT on 29th March and ended around 04:45 UT on 30th March. The telescope was cleared of dew around at the same time as a manual meridian flip was carried out so there is an interruption in the sequence of about an hour. Because of the relatively bright target and to avoid saturation an ISO of 100 and exposure time of 50s was selected and 460 raw images with these settings were obtained. IRIS software was used to reduce these images and to stack them in groups of 12. Each datapoint therefore represents 10 mins of integration time. AstroimageJ was used to perform photometry. Probably because this star has been poorly observed in recent times there are only two AAVSO comparison stars in the field which is insufficient for ensemble photometry. Additional stars were therefore selected from the TYCHO catalogue (TYC 2541 666, TYC 2534 705, TYC 2534 1713). The results were posted to the BAAVSS and AAVSO databases with average errors of less than 0.02 magnitudes. A screen shot of the BAAVSS lightcurve is shown here :-



From the light curve it can be seen that the eclipse was already underway at the start of the observation and continued after it had ended. The extended flat minimum suggests the secondary was completely eclipsed for about 4 hours. The time of minimum can be determined from this light curve using a number of different techniques. In this case, Fourier, Kwee and van Woerden and symmetry were averaged giving a time of minimum of 2459303.5399 +/- 0.00043 JD or 00:57:27 UT. Adding 0.00438 JD to this result converts it to Heliocentric Julian Day to adjust for the annual variation in light path from the target as the earth orbits the sun. This result can be plotted on an Observed less Calculated diagram (O-C diagram) using the O-C Gateway of the Czech astronomical society as shown below in red (the bottom rightmost point if not in colour). The chart shows observations since the late nineteenth century , including photographic, visual and in recent years CCD/DSLR observations. It shows that the star has not been very well observed, especially in recent decades but there is a clear pattern.



A changing gradient in these charts indicates mass exchange taking place between the components or mass loss from the whole system. A constant gradient indicates a stable period. Recently, the period looks to have been constant but over a longer timescale a sinusoidal variation with a suggested period of 122 years becomes apparent. This may indicate the likely presence of a third body in the system. Possibly a small, dim component orbiting some way out. Future observations should reveal more.

Tony Vale

Hi Andy,
I hope you are well.
Sky Snappers South West Facebook Site
Firstly, an invitation to post astro images to a new Facebook site – Sky Snappers South West.
A neighbour interested in astrophotography has set up a new Facebook group site to showcase images of the sky using mainly budget equipment. It is a friendly site. If any WAS members would like to post astro images please send a group member request to Sky Snappers South West | Facebook to get started.
Here are my submissions for the April 2021 WAS Newsletter.
16/03/2021
10.9% Lit Waxing Crescent Moon
Canon SX50HS 1200mm, ISO 400, F6.5, 1/100 sec
80 raw images converted to tiff in Canon DPP, cropped and centred in Pipp, stacked and wavelet in Registax 6 and post processed in Affinity Photo.

29/03/2021
Orion, Betelgeuse, Mars and Aldebaran

This was a quick grab and go experiment with a Double Fog 3 filter which I used to try to enhance the brighter stars and bring out the Orion constellation. Betelgeuse, Mars and Aldebaran formed a triangle composition.
Canon G16 (Star Mode) with fog filter, 28mm, ISO 800, F1.8, 15 sec

29/03/2021
ISS 19:24 UTC (20:24 BST) UK Flyby
Sunset was at 18:35 UTC (19:35 BST). The flyby was at 19:24 UTC (20:24 BST) so only 49 minutes after sunset. The sky was still bright and the stars were hardly visible. This is probably the closest to sunset/sunrise I have captured an ISS flyby.
20 images stacked and post processed in Affinity Photo

Canon 1100D, Rokinon 8mm Fisheye (effective focal length 13mm)
ISO 200, F3.5, 5 sec.
Clear Skies
John

Satellites have brightened the night sky by 10% - and it's getting worse

Rob Waugh

Tue, 30 March 2021, 3:47 pm·3-min read

Satellites are brightening the night skies (Getty)

Man-made objects orbiting the Earth have already brightened the night sky by 10%, far more than previously believed, new research has shown.

The new research means that Earth has already passed a threshold that was set by astronomers 40 years ago, meaning our planet is "light polluted".

The researchers warn that the brightening of the sky is getting worse thanks to new satellite technologies such as 'mega constellations'.

It could mean that star-gazers can no longer pick out iconic sights such as the clouds of the Milky Way, the researchers have warned.

Read more: Mysterious "rogue planet" could be even weirder than we thought

The new research is the first to be based on the overall impact of space objects, rather than the effect of individual satellites.

The study included both functioning satellites, plus assorted debris such as spent rocket stages.

The research was published in Monthly Notices of the Royal Astronomical Society: Letters.

Miroslav Kocifaj, of the Slovak Academy of Sciences and Comenius University, said: "Our primary motivation was to estimate the potential contribution to night sky brightness from external sources, such as space objects in Earth's orbit.

"We expected the sky brightness increase would be marginal, if any, but our first theoretical estimates have proved extremely surprising and thus encouraged us to report our results promptly."

While telescopes and sensitive cameras often resolve space objects as discrete points of light, low-resolution detectors of light (including the human eye) see only the combined effect of many such objects.

It means that the overall increase in brightness may obscure sights such as the glowing clouds of stars in the Milky Way, even away from the light pollution of cities.

Hi Andy,

Viewing logs and pictures (ISS over Swindon and ISS going pass M45) for the mag.

Peter

Viewing Log for 16th of March

Again I would be doing my viewing from the back garden and after the success of using the 98mm refractor on the Skywatcher EQ6 mount I would be using my 127mm Meade 5000 refractor instead with a 10mm Televue Delos eye piece. Setting up the mount was quite heavy work when you put on a triplet telescope as well, it got the heat beating a bit for a few minutes as the front end of this

telescope is fairly heavy and you have to be very careful when attaching it to the mount. Started setting up at 20:50 and about 35 minutes to get everything fitted balanced first telescope and then the mount using the counter balance weights to cancel out the weight of the scope. With Polaris in the eye piece I was ready to do the star alignment, I decided to do one star alignment and the handset said alignment failed, what! Switch off the handset and retry using three alignment and this time alignment was okay? Off to my first target and Mars, it was a good few degree's out, strange? Tried on another star and again it was out? Time for a coffee and see what I was doing wrong. After having the coffee I tried again this time with two star alignment and alignment was okay according to the handset, off to Mars again and yet again it was out, tried M44 in other direction and it was out on this open cluster, managed to manually slew to this object. With this scope being an f7.5 I was actually looking thru the cluster, it was too big for the field of view. Tried on some other objects but these were out as well! What was I doing wrong? Could not figure anything out of the normal? I gave it one more try and got the same result, by now it was not far off of 23:00 and I decided to give up on the session.

Only thing I could come up with is the scope is TOO heavy for the mount but the counter weights were not at the end of the balance bar? Might need help from someone to see if they can see where I am going wrong with my set ups?

Will try again with this mount but using the 98 mm scope instead the next time I have a clear sky and free evening.

Peter Chappell

Viewing Log for 17th of March

The following night was also clear and as I had nothing planned I thought I would do another session in the back garden and using the 98mm refractor instead of the 127mm refractor. I started setting up at 19:35 with a temperature of 4.8 °C and humidity of 22%. I had the set up done and completed within 25 minutes, fitting a 98mm scope is much easier than fitting a 127mm? This time I would be using a Televue 14mm Delos eye piece instead of the 10mm from yesterday, this would give me a bigger field of view to look at and the 98mm scope is an f6, so this also increased the field of view.

Using the three star alignment on Capella, Algol and Castor the handset said alignment failed, what not the same troubles as the last session? Thought I would try with two star alignment using Capella and Pollux, alignment okay this time. Thought I would check using Alcor in Ursa Major, this double double star was just out of the eye piece view, should be able to live with that but should be better than that?

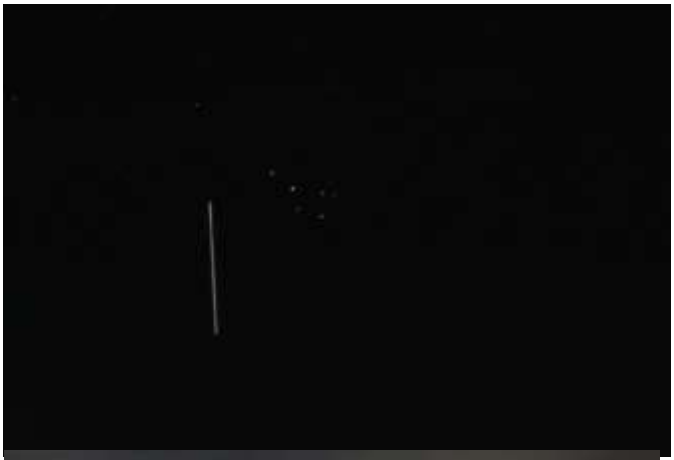
First target was Mars, could not make out any details on this planet probably getting to far away now and was starting to sink into the western horizon. Onto M45, the Pleiades open cluster (O C), this cluster filled the eye piece with stars, good to look at! Time to bag another few O C's starting with M36, this is a loose O C with a star pattern that looks like a ships anchor? Onto M37, a compact and dim O C followed by M38 (also in Auriga), this O C was large and loose to look at, this also had a pattern of stars that looked like a ships anchor? Next was M35, again large and loose. All of these O C's were nearly overhead so I was on my knees viewing them. Normally these clusters are a bit brighter using my Meade telescope but with waxing crescent Moon (currently behind the house) and street lights it would dim any deep sky objects? Even the Double Cluster (Caldwell 14) was large and loose but not that bright? By now Sirius had cleared the gap between my neighbour's house and my garage roof, so I tried for M48 (often over looked by me), this O C had just cleared their roof, it was also large and loose to look at. Interesting while slewing to this target, the telescope mount went fully right and then decided it would go the other way to reach this target, doing a meridian flip! M50, another O C often over looked was just above the garage roof, this is a small, loose and dim cluster to look at? M47 was very loose but had a couple of bright stars in this cluster. Right next door is M46, this O C is also very loose and hardly noticeable could easy miss it if I was star hopping to this object? Whatever star hopping is! Other direction now and tried for M52, this time it was hiding behind a chimney, on previous visits it was hiding behind a television aerial! Onto a NGC object and 457 better known as the Owl cluster, I could make out the eyes and the wings, was also dim to look at? Nearby is M103, large loose and very dim to view. By now the crescent Moon (17.5 % lit or 4.45 days old about 403,748 kms away and had a diameter of 29.6 arc minutes, all info from Virtual Moon Atlas) had cleared my roof, the terminator line was lovely to look at Mare Crisium and Mare Fecunditatis was on view with Mare Tranquillitatis just starting to see sunlight. Going in the other direction and M81 and M82 in Ursa Major, these galaxies where more like faint fuzzy blobs and easy to miss? Thought for a change I would try some double stars from the handset, started with Castor with the 14mm eye piece and it could not be split, changing to a 10mm one it could just be split? There is a gap of 1.8 arc seconds between these stars, according to the handset info on this item? Tried Cor Caroli, this mag 2.9 star was easy to split being 19 arc minutes apart could not really go wrong here?

By now I noticed cloud had started to roll in, it was 21:55 so I had been out for about two hours and time to pack up and go back indoors. Most of the objects I viewed this evening had to be manually centred to look at but much better than the previous session with the 127mm refractor! Next session will probably be done with the Meade at least that will keep the neighbours up when it slewed to targets, one thing with a big Meade is you know when it is moving!

Temperature had only dropped to 3.5 °C when I finished and with no wind it was a pleasant evening to view.

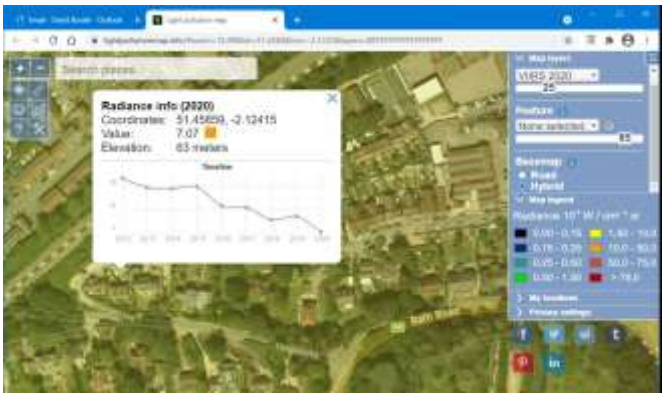
Clear skies.

Peter Chappell



Hi Andy,

I've just noticed that the 2020 results for the Light Pollution Map have been added. Looks like the trend is slowly going in the right direction and the new LED Streetlamps have had some effect on quantity if not quality of local light pollution (i.e. down from previous year).



Dave.

David Buckle

Sat 27/03/2021 09:29

For those of a Mathematical Bent:

https://iopscience.iop.org/article/10.1088/0067-0049/207/2/25

A NOISE ADAPTIVE FUZZY EQUALIZATION METHOD FOR PROCESSING SOLAR EXTREME ULTRAVIOLET IMAGES - IOPscience

The Institute of Physics (IOP) is a leading scientific society promoting physics and bringing physicists together for the benefit of all. It has a worldwide membership of around 50 000 comprising physicists from all sectors, as well as those with an interest in physics.

iopscience.iop.org

Dave.

Hi Andy,

Spotted the attached - thought it might be of interest for the newsletter?

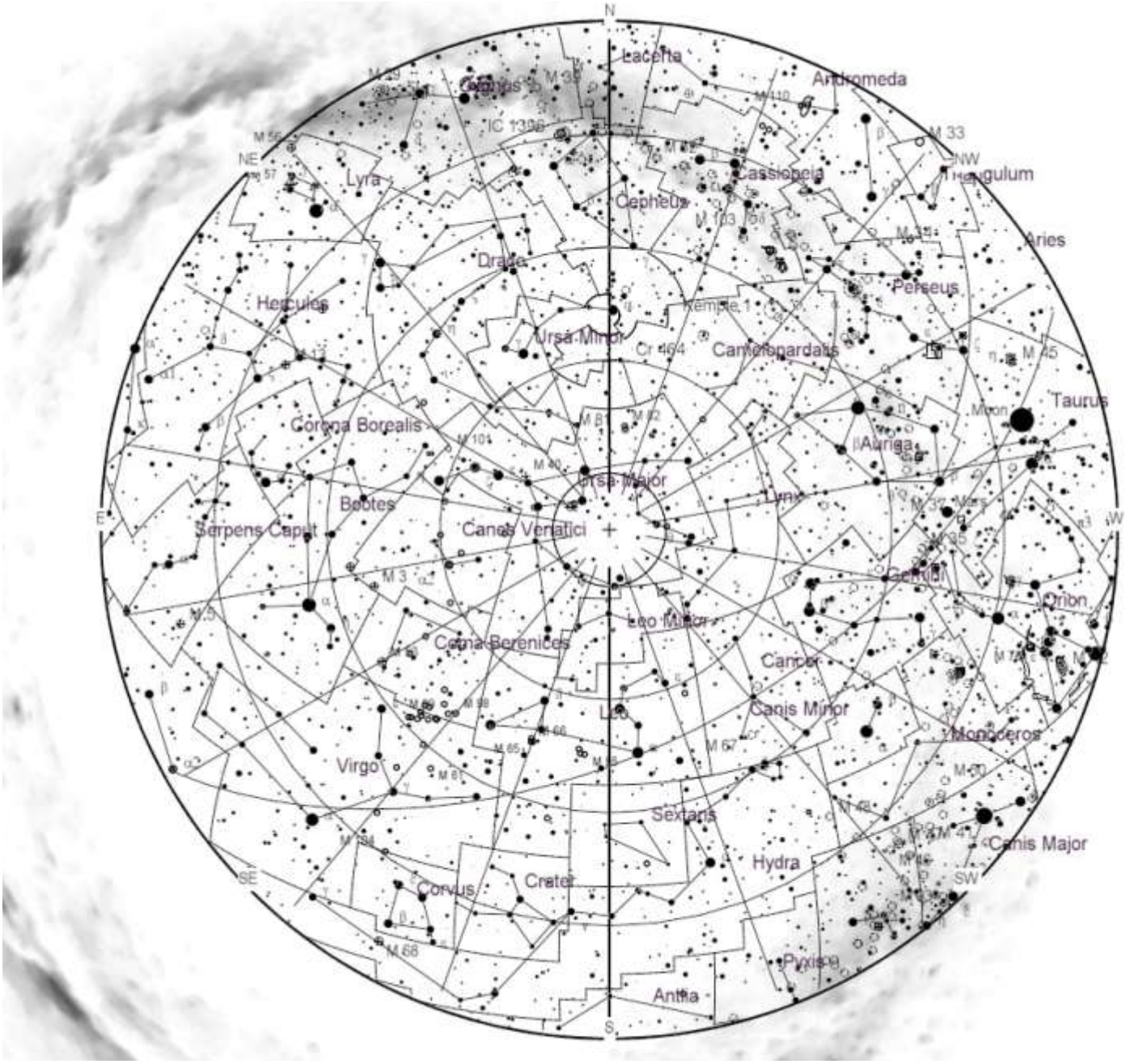
Dave. Buckle

The Peak of Eternal Light on the Moon, Andy Burns, Nikon P1000 Coolpix camera zoom.

Beehive Cluster (M44) with the galaxies laying behind the stars marked. These galaxies are around 170 to 200 MILLION light years away.

Andy Burns Nikon D810a , 60 second exposures through 125 Esprit telescope.

WHATS UP, APRIL 2021



•**April 12** - **New Moon.** The Moon will located on the same side of the Earth as the Sun and will not be visible in the night sky. This phase occurs at 02:32 UTC. This is the best time of the month to observe faint objects such as galaxies and star clusters because there is no moonlight to interfere.

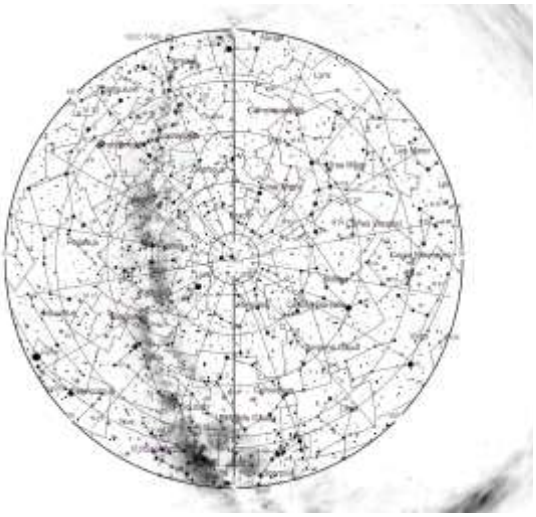
•

•**April 22, 23** - **Lyrids Meteor Shower.** The Lyrids is an average shower, usually producing about 20 meteors per hour at its peak. It is produced by dust particles left behind by comet C/1861 G1 Thatcher, which was discovered in 1861. The shower runs annually from April 16-25. It peaks this year on the night of the night of the 22nd and morning of the 23rd. These meteors can sometimes produce bright dust trails that last for several seconds. The nearly full moon will be a problem this year. Its glare will block out all but the brightest meteors. But if you are patient you may still be able to catch a few good ones. Best viewing will be from a dark location after midnight. Meteors will radiate from the constellation Lyra, but can appear anywhere in the sky.

•

•**April 27** - **Full Moon, Supermoon.** The Moon will be located on the opposite side of the Earth as the Sun and its face will be will be fully illuminated. This phase occurs at 03:33 UTC. This full moon was known by early Native American tribes as the Pink Moon because it marked the appearance of the moss pink, or wild ground phlox, which is one of the first spring flowers. This moon has also been known as the Sprouting Grass Moon, the Growing Moon, and the Egg Moon. Many coastal tribes called it the Fish Moo

Here is the 5am zodiac for the early risers.



Observing Notes - April 2021

Grappling with the Bear!

For most of us, March through April heralds the return of Spring with better weather and life returning outside, but for astronomers this period marks the return of those constellations peppered with galaxies to observe. Our nearest neighbouring galaxy, Messier 31 in the constellation of Andromeda, is not best placed for observation in Spring, but the galaxies in the Great Bear (Ursa Major) are! The Great Bear is probably the constellation most people find first and is also known as the Big Dipper, the Plough, or King Charles's Wain (a type of carriage). The Great Bear takes her name from the Greek story of a wood nymph turned into a bear, with her son being the Little Bear. To find the Great Bear, look North-North East and the familiar tail of the Bear is vertical, with the square of the body above this. Remember though that the constellation covers a lot more of the sky than just the Plough shape.

No matter what you call it, the Great Bear has many sights that can be picked up in binoculars. The tail of the Bear has one of the finest, and easiest to spot, double stars with Mizar and Alcor, each of which is itself a multiple star. The unaided eye can split the two into a pair, with binoculars making it a simple task.

Deep Sky objects

M81 and M82

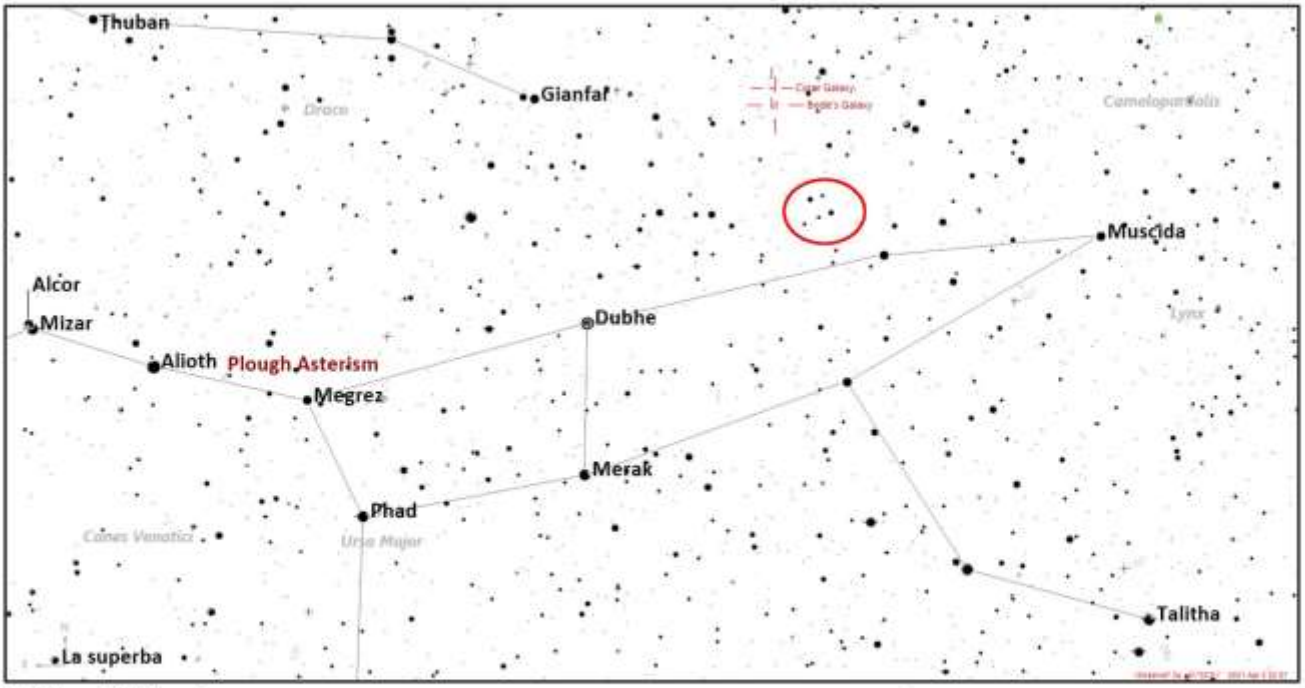
If you want a challenge, why not have a look for a pair of galaxies, Messiers 81 and 82, lying some 12 million light years away? M81 was first discovered by Johann Bode in 1774 hence it is also known as Bode's Nebula. Messier spotted it in 1779 along with Pierre Méchain. M81 is part of the M81 group of 34 galaxies within the constellation.

M82 is also known as the Cigar Galaxy, which is a very apt name which I saw when I had my best ever view of this through a 20" reflector some 10 years ago. M82 is also a member of the M81 group. M82 is also prone to frequent supernova.

To spot them, you will need a dark site, but they can be found in 10 x 50 binoculars. To find them, locate the stars Phad (aka Phecda) and Dubhe and imagine a line connecting them together. Now extend this from Dubhe for the same distance as from Phad. Slowly scan around the area and you may be able to spot 2 small faint patches of light! I also use the square of stars circled to locate the galaxies. In a small telescope, M81 shows up as the

◂ Looking North East to the Great Bear

▴ Detail of Star names in the Bear



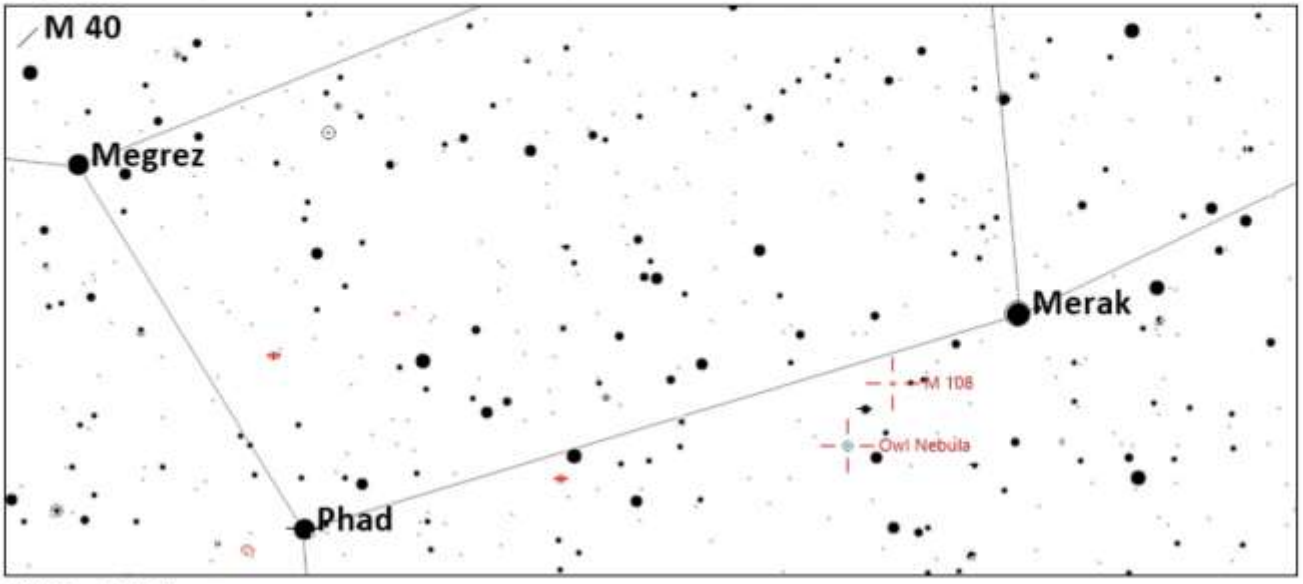
▲ M81 and M82 locations

larger fuzzy patch, with M82 appearing thinner as we are looking at it along its edge!

M97 – Owl Nebula

Messier 97 is one of 4 planetary nebulae catalogued by Messier and Méchain and observed by them in 1781. Méchain noted in his log "Nebula in the Great Bear, it is difficult to see". William Parsons of Birr Castle observed the nebula in 1848 and it was his sketch which seems to have spawned the Owl nickname. He recorded it as "Two stars considerably apart in the central region, dark penumbra round each spiral arrangement, with stars as apparent centres of attraction. Stars sparkling in it; resolvable". In fairness to him, he was using the 72" reflector for his observation, thus gaining an advantage!

I do not have of my own observing notes for this object, but have seen it many times, first of all in my 6" reflector I think in 2007 or 2008. It can be a little devil to track down but add a UHC or OIII filter to your armoury and you should be able to spot it. I normally aim my finder a third down a line drawn from Merak to Phad and have a little scan around at say 40X and it normally pops into view.



▲ M97 and M108 locations

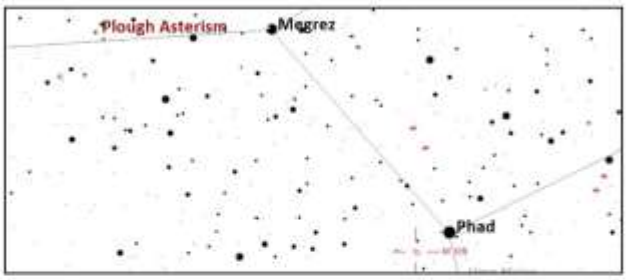
M108

Lying close to the Owl Nebula is M108, a lovely edge on galaxy lying some 46 million light years away. M108 was discovered by Méchain in 1781, following his discovery of the Owl Nebula. Messier observed it in 1781 as well, but never noted an accurate position or added it to his catalogue; in 1953 it was added by the noted American astronomer and historian Owen Gingerich.

M108 is one of the largest and brightest members of the cluster and can be spotted in a small telescope. Again, I observed it with my 6" reflector and always check it out when I observe the Owl. Location instruction are as per the owl, but if you scan around a little for the Owl you will find M108

M109

Lying near to Phad, the bottom left star of the Bear's square, M109 has the distinction of being the furthers object in Messier's catalogue at 83 million light years away. It is a barred spiral galaxy and can be seen in larger binoculars, although I have not tried to observe it through mine; note to self for April to do so. As before, it was one of my early observations with my 6" reflector. Reading other's observing logs, opinion seems to be that a



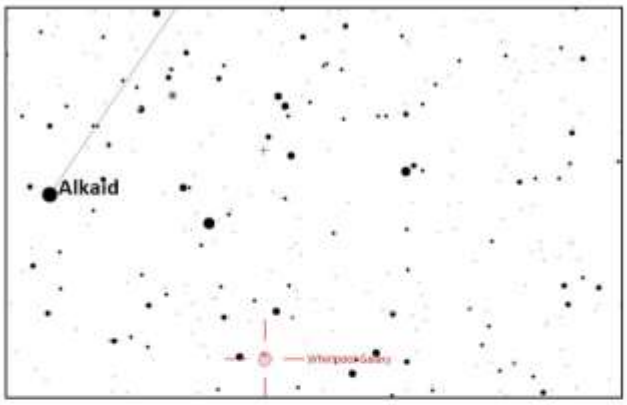
▲ M109 location

4" telescope shows a hazy streak of light, with a 6" showing the galaxy's nucleus and nebulosity.

To locate M109, centre your finder on Phad, then drop a little below it and you should spot M109.

M51 - the Whirlpool

M51, also known as the Whirlpool, does belong to the constellation of Canes Venatici, but it lies close to the Bear so I always consider it part of my ursine tour. M51 is composed of 2 galaxies,



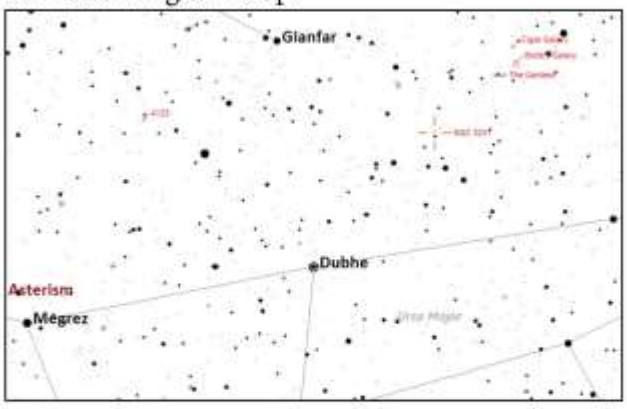
▲ M51 - The Whirlpool

M51 A and B which are an interacting pair; essentially their gravitational fields are disturbing each other which in the case of this pair is triggering star formation.

It is an easy galaxy to spot in binoculars (10 x 50 are adequate); simply point your binoculars at Alkaid, then drop away to a small triangle of stars and M51 pops into view.

NGC 3231

When deciding which objects to include this month, this little open cluster popped up in my search list. I have not observed it and have found little about it when searching. My observing software states it as "Challenging" in 15 x 70 binoculars and "Apparent" in a 6". Let's see what our observing turns up!

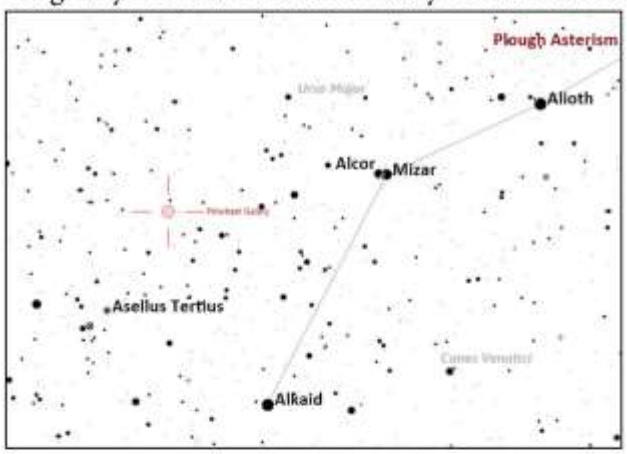


▲ NGC 3231

M101

Finally, we have a large faint galaxy M101, the Pinwheel, a galaxy comprising several hundred billion suns, nearly twice the size of our own Milky Way and glowing at a distance of 22 billion light years. I first spotted M101 in my 10 x 50s one

Spring following a Messier Marathon held on the Ridgeway. I had seen it there easily and then tried



▲ M101 - The Pinwheel

from just south of Devizes; it was not as easy to find as it is sensitive to light pollution. First spotted by Méchain in 1781, images show spiral arms sprinkled with star forming nebulosity, along with hot, blue young clusters of newborn stars tracing out the spiral arms.

Aim your optics along the handle of the plough, tracing a line between Alkaid and Mizar/ Alcor and a right angle of stars takes you to M101.

Planets

Mercury is poorly positioned at the start of the month, but from 19th April its superior conjunction takes it to an evening planet. On the 25th April though, Mercury sits just over 1˚ north northwest of Venus, with both planets remaining close for the rest of the month.

Venus

During April, Venus slowly re-emerges into its "Evening Star" incarnation and on 12th April lies close to the less than 1% lit Moon. As the month progresses its increasing brightness helps the planet stand out.

Mars

Mars remains visible, sinking into the west, setting by 22:30

Jupiter

Jupiter is a morning planet, but is poorly placed, rising just 70 minutes before the Sun, and not reaching much of an altitude.

Saturn

Saturn is also a morning object, distancing itself from the Sun. On the morning of 6th April a 31% lit waning moon sits beneath it, with Jupiter 12˚ to the east-north east.

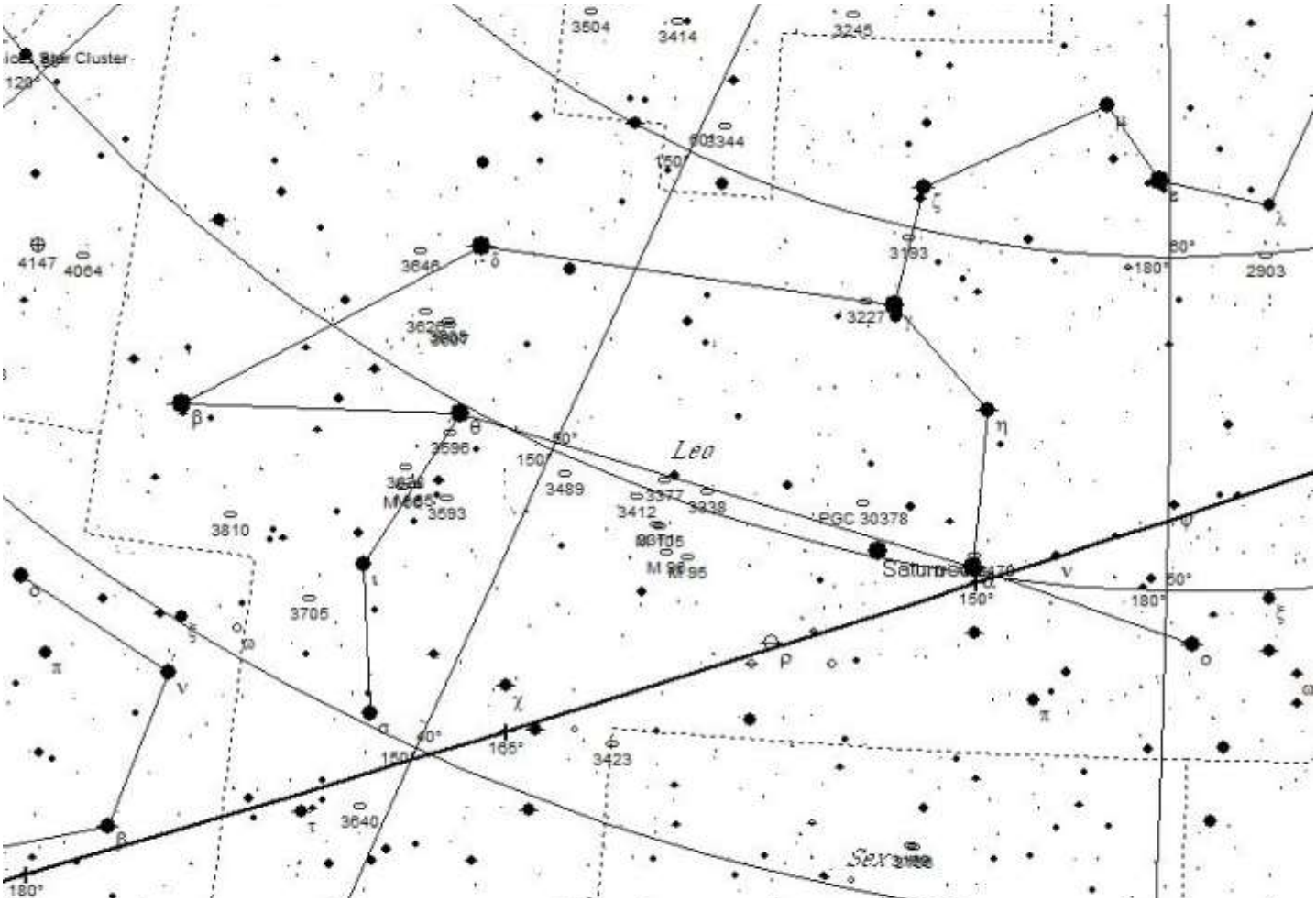
Neither Uranus nor Neptune are easily visible this month.

Sky events

The Lyrids meteor shower peaks on the 22nd to 23rd April with the radiant near Vega. The rates vary but typical values are 10 to 15 per hour. The moon is waxing gibbous so will hinder observing all but the brightest meteors.

Chris Brooks
Jonathan Gale
WAS Observing Team

CONSTELLATIONS OF THE MONTH: LEO



Leo

Positioned directly on the ecliptic plane, Leo is a constellation of the zodiac preceded by Cancer to the west and followed by Virgo to the east. It is an ancient constellation, originally charted by Ptolemy and recognized by the International Astronomical Union as one of the 88 modern constellations. Leo spans 947 square degrees of sky and is the twelfth largest of all. It contains 3 bright stars and around 15 stars in its asterism, with 92 Bayer/ Flamsteed designated stars within its confines. It is bordered by the constellations of Ursa Major, Leo Minor, Lynx, Cancer, Hydra, Sextans, Crater, Virgo and Coma Berenices. Leo is visible to all observers located at latitudes between +90° and ?65° and is best seen at culmination during the month of April.

There are five annual meteor showers associated with constellation Leo. The first is the Delta Leonid meteor stream which begins becoming active between February 5 through March 19 every year. The activity peaks in late February with no exact date, and the maximum amount of activity averages around 5 meteor per hour. The next date is April 17 and the Sigma Leonid meteor shower. Look for this rare occurrence to happen near the Leo/ Virgo border. It is a very weak shower and activity rates no higher than 1 to 2 meteors per hour. The next is the most dependable shower of all – the November Leonids. The peak date is November 17th, but activity occurs around 2 days on either side of the date. The radiant is near Regulus and this is the most spectacular of modern showers. The year 1966 saw 500,000 per hour a rate of up 140 per second! Just a few years ago, in 2005 the rates were equally impressive. Why? Comet Temple-Tuttle is the answer. Whenever it nears perihelion, it adds fresh material to the stream and gives us a spectacular show. On the average, you can expect around 20 per hour between 33 year shows, but they are the fastest known at 71 kps. The last is the Leo Minorids which peak on or about December 14. This meteor shower was discovered by amateurs in 1971 and hasn't really been confirmed yet, but do look for around 10 faint meteors per hour.

In Greek mythology, Leo was identified as the Nemean Lion, which may have been the source of the "tail" of the lion that killed Hercules during one of his twelve labours. While many constellations are difficult to visualize, Leo's backwards question-mark is relatively easily to picture as a majestic lion set in stars. One of the reasons for its placement in the zodiac is possibly due to the fact that lions left their place in the desert for the banks of the Nile when the Sun was positioned in these stars. It is also possible that the Nile's rise at this time and the lion's migration is also the reason for the Sphinx to appear as it does – a leonine figure. The Persians called it Ser or Shir; the Turks, Artan; the Syrians, Aryo; the Jewish, Arye; the Indians, "Sher"; and the Babylonians, Aru — all meaning a lion. Early Hindu astronomers recognized it by regal names, as did other cultures. All befitting of the "King of Beasts"!

Let's begin our tour by taking a look at the brightest star – Alpha Leonis – the "a" symbol on our map. Its name is Regulus and it is one hot customer when it comes to

spin rate. Revolving completely on its axis in a little less than 16 hours, oblate Regulus would fly apart if it were moving any faster. Ranking as the twenty-first brightest star in the night sky, Alpha Leonis is a helium type star about 5 times larger and 160 times brighter than our own Sun. Speeding away from us at 3.7 kilometres per second, Regulus isn't alone, either. The "Little King" is a multiple star system composed of a hot, bright, bluish-white star with a pair of small, faint companions easily seen in small telescopes. The companion is itself a double at around magnitude 13 and is a dwarf of an uncertain type. There is also a 13th magnitude fourth star in this grouping, but it is believed that it is not associated with Regulus since the "Little King" is moving toward it and will be about 14″ away in 785 years. Not bad for a star that's been reigning the skies for around for a few million years!

Let's fade east now, and take a look at Beta Leonis – the "B" symbol on our map. Its name is Denebola which means the "Lion's tail" in Arabic. Located about 36 light years from Earth, this white class A dwarf star is more luminous than the Sun, emitting 12 times the solar energy and a Delta-Scuti type variable star. While that in itself isn't particularly rare, what makes Denebola unusual is that it belongs to the Vega-class stars – ones that have a shroud of infra-red emitting dust around them. This could mean a possibility of planet forming capabilities! In binoculars, look for an optical double star companion to Beta. It's not gravitationally, or physically related, but it's a pleasing pairing.

Now, return to Regulus and hop up for Eta Leonis, the "n" symbol on our map. Eta is very special because of its huge distance – about 2100 light years from our solar system – and that's only a guess. It is a supergiant star, and one that is losing its stellar mass at a huge rate. Compared to Sol, Eta loses 100,000 times more mass each year! Because of its position near the ecliptic plane, Eta is also frequently occulted by the Moon. Thanks to alert observers, that's how we learned that Eta is also a very close binary star, too – with a companion only about 40% dimmer than the primary. Some time over the next 17 million years, the pair of red supergiant stars will probably merge to become a pair of massive white dwarf stars… or they may just blow up. Only time will tell…

Hop north for Gamma Leonis – the "Y" symbol on our map. Its name is Algeiba and it is a very fine double visual star for binoculars and true binary star small telescopes. Just take a look at this magnificent orange red and yellow pair under magnification and you'll return again and again. The brighter primary star is a giant K type and orbiting out about four times the distance of Pluto is its giant G type companion. Further north you'll find another excellent visual double star for binoculars – Zeta Leonis. It's name is Aldhafera and this stellar spectral class F star is about 260 light years away.

Are you ready to try your hand at locating a pair of galaxies with binoculars? Then let's try the "Leo Trio" – M65, M66 and NGC 3623. Return towards Beta and look for the triangular area that marks the asterism of Leo's "hips". If the night is suitable for binocular galaxy hunting, you will clearly see fifth magnitude Iota Leonis south of Theta. Aim your binoculars between them. Depending on the field of view size of your binoculars, a trio of galaxies will be visible in about one third to

one fourth of the area you see. Don't expect them to walk right out, but don't sell your binoculars short, either. The M65 and M66 pair have higher surface brightness and sufficient size to be noticed as two opposing faint smudges. NGC 3623 is spot on the same magnitude, but is edge on in presentation instead of face-on. This makes it a lot harder to spot, but chances are very good your averted vision will pick it up while studying the M65/66 pair. The "Leo Trio" makes for a fine challenge!

Now let's begin working with larger binoculars and small telescopes as we head for M96 galaxy group (RA 10h 46m 45.7s Dec +11 49′ 12″). Messier 96 is the brightest spiral galaxy within the M96 Group which includes Messier 95 and Messier 105 as well as at least nine other galaxies. Located about 38 million light years away, this group of galaxies with the Hubble Space Telescope and 8 Delta Cephei variable stars were found to help determine each individual galaxy's dis-

tance. While you can't expect to see each member in small optics, larger telescopes can hope to find elliptical

galaxies NGC 3489 (11:00.3 +13:54), NGC 3412 (10:50.9 +13:25), NGC 3384 (10:48.3 +12:38) and NGC 3377 (10:47.7 +13:59), as well as barred spiral galaxy NGC 3299 (10:36.4 +12:42),

For an awesome spiral galaxy in a small telescope, don't overlook NGC 2903 (RA 9:32.2 Dec +21:30). At a bright magnitude 9, you can often see this particular galaxy in binoculars from a dark sky site as well.

Discovered by William Herschel in 1784, this beauty is often considered a missing Messier because it just so bright and conspicuous. As a matter of fact, the comet of 1760 passed it on a night Messier was watching and he didn't even see it! For larger telescopes, look for NGC 2905 – a bright knot which is actually a star forming region in the galaxy itself with its own Herschel designation.

Before we leave, you must stop by NGC 3521 (RA 11:05.8 Dec -00:02). This 35 million light year distant spiral galaxy is often overlooked for no apparent reason – but it shouldn't be. At a very respectable magnitude 9, you can often find this elongated gem with the bright nucleus in larger binoculars from a dark sky site and you can easily study spiral galaxy structure with a larger telescope. Look for an inclined view with patchiness in the structure that indicates great star forming regions at work. Its stellar counter rotation is being studied because it has a bar structure that we are seeing "end on"!

This doesn't even begin to scratch the surface of what you can find on Leo's hide. Be sure to get yourself a good star chart or sky atlas and go lion taming!

Sources: SEDS, Wikipedia Images Andy Burns

ISS PASSES For April and All May 2021 from Heavens Above website maintained by Chris Peat

Date	Brightness	Start	Highest	End						
	(mag)	Time	Alt.	Az.	Time	Alt.	Az.	Time	Alt.	Az.
28 Apr	**-1.6**	**04:49:56**	**10°**	**S**	**04:52:20**	**18°**	**SE**	**04:54:44**	**10°**	**E**
29 Apr	-1.2	04:03:42	10°	SSE	04:05:13	13°	SE	04:06:45	10°	ESE
30 Apr	-2.7	04:51:04	10°	SW	04:54:11	35°	SSE	04:57:19	10°	E
01 May	-2.3	04:05:23	18°	S	04:06:59	25°	SSE	04:09:51	10°	E
02 May	-1.9	03:19:43	18°	SE	03:19:49	18°	SE	03:22:14	10°	E
02 May	-3.5	04:52:50	10°	WSW	04:56:11	62°	SSE	04:59:33	10°	E
03 May	-1.0	02:34:00	11°	ESE	02:34:00	11°	ESE	02:34:16	10°	ESE
03 May	-3.3	04:06:57	21°	SW	04:08:54	47°	SSE	04:12:11	10°	E
04 May	-3.0	03:21:13	34°	S	03:21:39	35°	SSE	03:24:47	10°	E
04 May	-3.7	04:54:54	10°	W	04:58:18	88°	SSE	05:01:42	10°	E
05 May	-2.0	02:35:26	22°	ESE	02:35:26	22°	ESE	02:37:20	10°	E
05 May	-3.8	04:08:23	16°	WSW	04:10:58	77°	SSE	04:14:21	10°	E
06 May	-0.9	01:49:38	10°	E	01:49:38	10°	E	01:49:42	10°	E
06 May	-3.7	03:22:34	38°	SW	03:23:39	62°	SSE	03:27:01	10°	E
07 May	-3.3	02:36:44	45°	SE	02:36:44	45°	SE	02:39:39	10°	E
07 May	-3.7	04:09:42	10°	W	04:13:06	86°	N	04:16:31	10°	E
08 May	-1.8	01:50:52	20°	E	01:50:52	20°	E	01:52:15	10°	E
08 May	-3.8	03:23:49	24°	W	03:25:45	88°	S	03:29:09	10°	E
09 May	-3.9	02:37:56	61°	SW	02:38:25	77°	SSE	02:41:49	10°	E
09 May	-3.7	04:11:51	10°	W	04:15:16	89°	N	04:18:39	10°	E
10 May	-3.0	01:52:01	42°	E	01:52:01	42°	E	01:54:27	10°	E
10 May	-3.7	03:24:57	13°	W	03:27:55	85°	N	03:31:18	10°	E
11 May	-1.6	01:06:05	18°	E	01:06:05	18°	E	01:07:06	10°	E
11 May	-3.8	02:39:01	30°	W	02:40:32	86°	N	02:43:57	10°	E
11 May	-3.8	04:14:00	10°	W	04:17:23	68°	SSW	04:20:45	10°	ESE
12 May	-3.9	01:53:00	79°	WSW	01:53:12	88°	S	01:56:36	10°	E
12 May	-3.9	03:26:39	10°	W	03:30:03	82°	S	03:33:27	10°	ESE
13 May	-2.9	01:06:55	40°	E	01:06:55	40°	E	01:09:14	10°	E
13 May	-3.8	02:39:50	14°	W	02:42:42	89°	N	02:46:06	10°	E
13 May	-3.3	04:16:11	10°	W	04:19:23	40°	SSW	04:22:35	10°	SE
14 May	-1.9	00:20:36	21°	E	00:20:36	21°	E	00:21:53	10°	E
14 May	-3.8	01:53:29	25°	W	01:55:20	85°	N	01:58:44	10°	E
14 May	-3.7	03:28:47	10°	W	03:32:06	53°	SSW	03:35:25	10°	SE
14 May	-1.9	21:53:20	10°	SSE	21:55:01	13°	SE	21:56:41	10°	ESE
14 May	-3.6	23:27:57	10°	SW	23:31:14	49°	SSE	23:34:31	10°	E
15 May	-3.8	01:04:35	10°	W	01:07:59	86°	N	01:11:22	10°	E
15 May	-3.9	02:41:25	10°	W	02:44:48	68°	SSW	02:48:10	10°	ESE
15 May	-2.4	04:18:36	10°	W	04:21:14	21°	SW	04:23:51	10°	SSE
15 May	-3.2	22:40:50	10°	SW	22:43:58	36°	SSE	22:47:07	10°	E
16 May	-3.9	00:17:14	10°	W	00:20:37	89°	S	00:24:01	10°	E
16 May	-3.9	01:54:05	10°	W	01:57:28	81°	SSW	02:00:52	10°	ESE
16 May	-2.9	03:31:03	10°	W	03:34:02	29°	SSW	03:37:01	10°	SSE
16 May	-2.8	21:53:51	10°	SSW	21:56:44	26°	SSE	21:59:38	10°	E
16 May	-3.9	23:29:54	10°	WSW	23:33:16	78°	SSE	23:36:40	10°	E
17 May	-3.9	01:06:44	10°	W	01:10:07	89°	N	01:13:32	10°	E
17 May	-3.4	02:43:36	10°	W	02:46:48	39°	SSW	02:49:59	10°	SE
17 May	-3.8	22:42:36	10°	WSW	22:45:57	64°	SSE	22:49:18	10°	E
18 May	-3.8	00:19:22	10°	W	00:22:45	85°	N	00:25:21	16°	E
18 May	-2.7	01:56:13	10°	W	01:58:15	32°	W	01:58:15	32°	W
18 May	-3.5	21:55:22	10°	SW	21:58:39	49°	SSE	22:01:56	10°	E
18 May	-3.8	23:32:00	10°	W	23:35:23	86°	N	23:38:47	10°	E
19 May	-3.8	01:08:51	10°	W	01:11:57	63°	SW	01:11:57	63°	SW
19 May	-3.8	22:44:38	10°	W	22:48:02	89°	SSE	22:51:25	10°	E
20 May	-3.9	00:21:29	10°	W	00:24:53	81°	SSW	00:25:52	43°	ESE
20 May	-1.3	01:58:28	10°	W	01:58:48	12°	W	01:58:48	12°	W
20 May	-3.8	21:57:18	10°	WSW	22:00:41	78°	SSE	22:04:04	10°	E
20 May	-3.8	23:34:08	10°	W	23:37:32	90°	N	23:39:53	19°	E
21 May	-2.3	01:11:00	10°	W	01:12:49	26°	WSW	01:12:49	26°	WSW
21 May	-3.7	22:46:47	10°	W	22:50:10	85°	N	22:53:34	10°	E
22 May	-3.6	00:23:37	10°	W	00:26:53	52°	SSW	00:26:53	52°	SSW
22 May	-3.7	21:59:24	10°	W	22:02:47	85°	N	22:06:11	10°	E
22 May	-3.8	23:36:15	10°	W	23:39:37	67°	SSW	23:40:59	32°	SE
23 May	-1.3	01:13:26	10°	W	01:13:56	12°	W	01:13:56	12°	W
23 May	-3.8	22:48:53	10°	W	22:52:17	80°	S	22:55:07	14°	ESE
24 May	-2.4	00:25:53	10°	W	00:28:03	25°	WSW	00:28:03	25°	WSW
24 May	-3.7	22:01:32	10°	W	22:04:55	90°	NW	22:08:19	10°	E
24 May	-3.2	23:38:24	10°	W	23:41:35	39°	SSW	23:42:12	35°	S
25 May	-3.5	22:51:00	10°	W	22:54:18	52°	SSW	22:56:23	20°	SE
26 May	-1.3	00:28:41	10°	WSW	00:29:20	12°	WSW	00:29:20	12°	WSW
26 May	-3.7	22:03:38	10°	W	22:07:00	66°	SSW	22:10:21	10°	ESE
26 May	-2.1	23:40:50	10°	W	23:43:24	20°	SW	23:43:33	20°	SSW
27 May	-2.5	22:53:15	10°	W	22:56:12	28°	SSW	22:57:47	19°	SSE
28 May	-3.0	22:05:47	10°	W	22:08:58	38°	SSW	22:12:04	10°	SE
29 May	-1.5	22:56:05	10°	WSW	22:57:56	14°	SW	22:59:20	12°	SSW
30 May	-1.9	22:08:13	10°	W	22:10:46	20°	SW	22:13:18	10°	SSE

END IMAGES, OBSERVING AND OUTREACH

Messier 38 and NGC1907.
The larger open cluster M38 is a very easy binocular object in the constellation of Auriga. They M38, M36 and M37 clusters were found before 1654 by Hodierna, and then the unluckiest astronomer ever, Le Gentil independently found them in 1749.
Admiral Smyth saw the oblique cross of stars and William Herschel saw the different sizes of stars making the cluster and also added the small cluster 1907 to his catalogue.
The main cluster is now put at 3500 light years away with an age of 150 to 200 million light years.
The smaller cluster ngc 1907 is around 1000 light years further away. Though line of sight suggest they are neighbours, ngc1907 is close to M36 and M37. in the spiral arm.

Andy Burns, 4th April, Nikon D810, 5x60second exposures merged in Sequator.

Wiltshire Astronomical Society Observing Suggestions for April 2021 @ 22:00

We have updated some of the observation targets this month for those with binoculars or smaller wide field telescopes to have something to search for.

The WAS Observing Team will provide recommended observing sessions for you to do while under lockdown at home or as part of your social bubble. Please always follow the latest government guidelines if observing away from the home.

These observing recommendations will continue until we can start our group observing again.
This month most target objects can be found around Northern part of the night sky at about 22:00.
Where To Look This Month:
This month we Grappling with the Bear!

Just select 'What's Up' link below to get the PDF file.
What's Up Link:
WAS_April_2021.pdf
Also Wiltshire Astronomical Society will produce the monthly newsletter containing further information, which can be downloaded here: https://wasnet.org.uk/

OUTREACH

Zoom sessions and Google Classroom sessions have kept outreach going to schools. In January I did sessions at Stonar and Westbury Leigh. If anyone else has links to schools who might be interested in 'in the classroom' sessions ask them to get in touch with me via anglesburns@hotmail.com.