

Newsletter for the
Wiltshire, Swindon,
Beckington Astronomical
Societies

Experimenting in Odd Times

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We are all placed in funny times by the virus lock down. I just hope you all keep as healthy as you can.

But we have had to adapt the best we can. I am lucky and have set up an observatory area in my back garden, and the recent night sensitive lighting changes in Chippenham and due to spread county wide has made viewing from home very much better, but the replacement work is another thing put on hold while we get through the social isolation period.

Our April speaker has been rebooked, perhaps as well, he has been taken to his sick bed but not with the virus.

To try keep the society going I have been keeping the newsletter going. But more experimentally I have been trying software to enable us to have a virtual meeting so you the members can log into a meeting and we have a focus speaker in the time, and it must be accessible to as many members as possible.

Skype, House Party and Zoom have been tried out (with my grandchildren as guinea pigs) and the most universally available across platforms and media types has been Zoom. Even with this the rules

changed on Sunday following hackers getting into Zoom (and other communication software suffered hacks and false hacks). But to enable us to have a good hour for our meeting I have subscribed to Zoom, and this allows lots of members at the meeting AND unlimited time with control to reject people slurping their tea to loudly!

Our first speaker in the trial will be our member Gavin James, talking about astrophotography. (How he must regret me bumping into his mother at Savernake Forest a few years ago.

Please try and join us, I have had interest from members who have moved away, so some old faces may be seen.

Meeting ID number and password (numerical) have been e-mailed to members and on the Facebook Members Page.

Keep good health...

Clear skies Andy Burns.

The end of March and first couple of evenings in April gave us some great passes for the International Space Station. Here imaged using an all sky fish eye lens 8mm Sigma on Nikon DSLR. The Moon and Venus are in the far right, or the West and the ISS starts in the west and travels east, and this was a very full pass. 25 pictures of 20 seconds stacked using the free Startrails software for PC.

We are due one more pass in April.. The 29th! But early mornings in May until the 15th May, when we get a late evening pass and morning passes on the same day.

Andy

It would be nice to do a webinar on the website to show the processes, from where to find out about the fly over, decisions that gives us for lens choice and exposures, followed by processing.



Wiltshire Society Page



Wiltshire Astronomical Society
Web site: www.wasnet.org.uk
Facebook members page: <https://www.facebook.com/groups/wiltshire.astro.society/>
Meetings 2018/2019Season.
NEW VENUE the Pavilion, Rusty Lane, Seend
Meet 7.30 for 8.00pm start

NEW SEASON 2019/2020

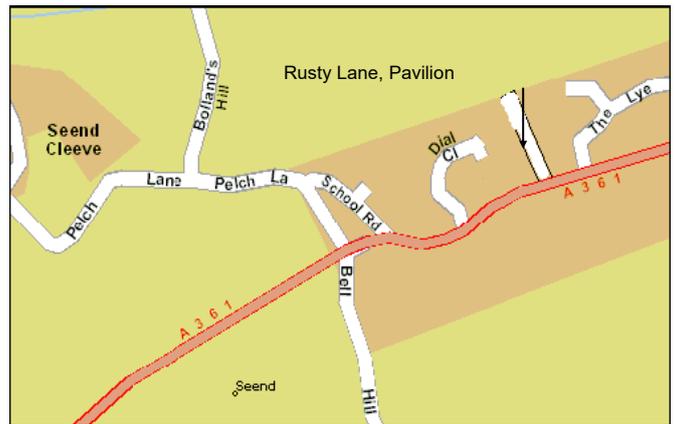
2020
 7th Apr GOONG LIVE ZOOM SESSION. Gavin James will discuss his approach to Astrophotography.
 5th May Martin Griffiths 'The Habitable Zone – What is it and How is it determined'.
 2nd Jun Paul Money 'Triumphs of Voyager (part 2) – Where no probe has gone before'.

Gavin James

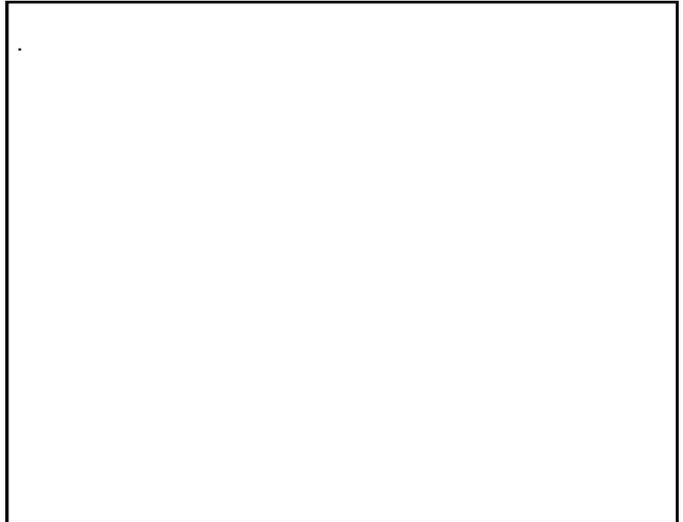
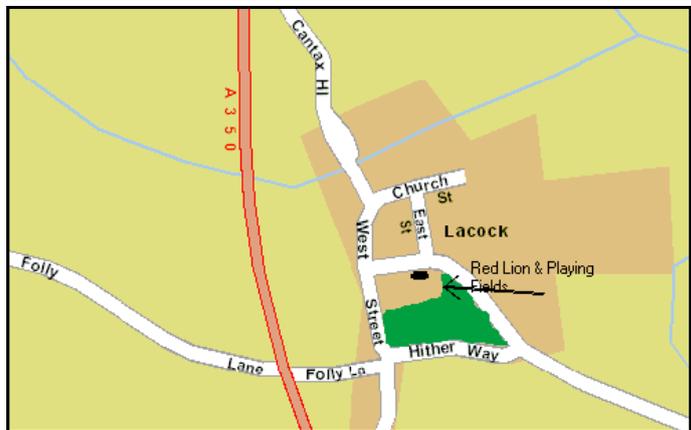
Membership Meeting nights £1.00 for members £3 for visitors

Wiltshire AS Contacts

Andy Burns Chair, anglesburns@hotmail.com
 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





Swindon Stargazers

Swindon's own astronomy group

Meetings cancelled

Due to the current crisis our meetings, like many others have been cancelled at least until the summer break. We hope to reconvene again in September when the postponed AGM will be held.

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>

Meeting Dates for 2020

Friday 17 April

Programme: Cancelled

Friday 15 May

Programme: Cancelled

Friday 19 June

Programme: Cancelled

-----Summer Break-----

Friday 18 September

Programme: AGM if restrictions lifted.

Friday 16 October

Programme: Dr James Fradgley MSc, FRAS: The Universe - 'A brief overview of what we know, or think we know'

Friday 20 November

Programme: Dave Eagle FRAS PGCE BSc (Hons): 'Comets, Enigmatic and Beautiful Visitors'

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

Date	Title	Speaker
17 th April	<i>Cancelled</i>	
15 th May	<i>To be informed</i>	
19 th June	To Be Informed	

This young astronomy club meets at the Sutton Veny Village Hall.

STAR QUEST ASTRONOMY CLUB

Second Thursday of the Month.

SPACE NEWS FOR APRIL 2020

Our Facebook page carries a lot of these news items throughout the month.

SpaceX loses third Starship prototype in cryogenic ground test

April 3, 2020 Stephen Clark

A prototype for SpaceX's Starship space vehicle collapsed during pressure testing early Friday at the company's facility in South Texas — the program's third failure during such testing since November — but assembly of a new version is already underway.

The stainless steel cylinder appeared to rupture near its top after filling with super-cold liquid nitrogen overnight at SpaceX's launch site at Boca Chica, Texas. Elon Musk, SpaceX's founder and CEO, tweeted early Friday that the accident may have been the result of a "test configuration mistake."

The Starship the upper stage of of SpaceX's next-generation launch and space transportation system. Coupled with a massive booster named the Super Heavy, the Starship could haul more than 100 metric tons, or 220,000 pounds, of cargo to low Earth orbit, according to SpaceX.

The fully reusable Super Heavy and Starship vehicles, which will also be able to carry people, will eventually replace the partially reusable Falcon rocket family, SpaceX says.

But testing of Starship prototypes in South Texas has not gone as quickly as Musk hoped. Last September, Musk said he wanted the Starship to reach orbit within six months. That timeframe passed last week, and no full-size Starship test craft has flown yet.

Pressure testing of the third Starship prototype, designated SN3, was completed earlier this week at ambient temperatures. The next step was to load cryogenic liquid nitrogen into the vehicle, a test that ended with Friday morning's

If the pressure testing this week had completed without incident, SpaceX teams aimed to perform a test-firing of the Starship SN3 vehicle's propulsion system as soon as next week. That would have been followed by a short hop of the Starship.

Last August, SpaceX performed a nearly 500-foot (150-meter) hop of an earlier iteration of the Starship called the Hopper.

Friday's test incident was the third time a Starship prototype has ruptured during pressure testing.

The first Starship test vehicle, dubbed the Starship Mk1, blew up during a pressure test in South Texas on Nov. 20. That vehicle was originally supposed to perform a test flight to an altitude of 65,000 feet (20 kilometers), but SpaceX said they had changed those plans and repurposed the Starship Mk1 to a ground test unit before the Nov. 20 mishap.

A modified Starship prototype named SN1 collapsed during a Feb. 28 pressure test. Musk said engineers believed that failure was with a "thrust puck" at the

bottom of the vehicle that transfers loads from the vehicle's Raptor engines.

SpaceX stripped down the next Starship prototype, named SN2, to test the weld connecting the thrust puck to the vehicle. That testing was successful.

Like SN1, the SN3 prototype was built without aerodynamic fins or a nose cone, which would be included in a full-size flight vehicle.

Construction of the next Starship vehicle, named SN4, has already started in South Texas. The work is continuing amid the coronavirus pandemic, and many aerospace companies like SpaceX are continuing their work under exemptions to local and state stay-at-home orders.

Aerospace parts are considered part of the nation's critical manufacturing sector, and SpaceX is considered part of the U.S. military's industrial base. The Starship could eventually launch national security payloads.

SpaceX is also planning a Starship production facility in Los Angeles, and could launch future Starships from the Kennedy Space Center in Florida. For now, production and testing is centered in South Texas.

The company recently published its first Starship payload user's guide.

In the user's guide, SpaceX officials wrote that the Starship and Super Heavy could deliver more than 100 metric tons to low Earth orbit, and 21 metric tons (more than 46,000 pounds) to geostationary transfer orbit, the drop-off point for many commercial and military communications satellites.

With in-orbit refueling, a capability still in the nascent stages of development, the Starship could deliver more than 100 metric tons of payload to the surface of the moon or Mars, according to SpaceX.

A crew-capable configuration of the Starship could ferry up to 100 people from Earth to low Earth orbit, the moon, or Mars, SpaceX says.

"The crew configuration of Starship includes private cabins, large common areas, centralized storage, solar storm shelters and a viewing gallery," SpaceX wrote in the Starship user's guide.

Pandemic prompts few changes to busy month on space station

April 2, 2020 Stephen Clark



The International Space Station's robotic arm and Dextre, a two-handed robotic aide, extract the European Bartolomeo platform from the trunk of SpaceX's Dragon cargo craft in this March 25 photo. Credit: NASA

U.S. and Russian vehicles ferrying crews and cargo will continue traveling to and from the International Space Station this month, sustaining the orbiting lab in its 20th year of continuous human occupation amid an escalating pandemic on Earth.

A new European platform was also robotically installed outside the space station early Thursday, giving the international research lab a new outdoor deck to host a range of materials science, Earth observation and space science instruments.

NASA has deemed the space station's continued operations a top priority as other agency programs are shut down or slowed during the coronavirus pandemic.

Under the command of controllers on the ground, the station's Canadian-built robotic arm and the two-armed robotic aide Dextre installed the Bartolomeo platform outside the space station's European Columbus science module.

The process to install the platform occurred over two days, NASA said, after the robotic arm pulled the Bartolomeo science deck from the unpressurized trunk of a SpaceX Dragon cargo capsule. The Dragon cargo freighter delivered Bartolomeo and an array of other hardware and science experiments to the space station March 9 following a launch from Cape Canaveral.

But a spacewalk to route wiring and bring the Bartolomeo facility into use has been postponed. The excursion was originally planned in mid-April, when the space station is temporarily back at a full staffing level of six crew members.

Gary Jordan, a NASA spokesperson, said Wednesday that station managers are no longer pursuing a spacewalk during the crew handover later this month, the period between the arrival of a fresh three-man crew and the departure of the station's outgoing Expedition 62 crew.

"The decision was made after an evaluation of crew time during the eight-day handover period," Jordan said.

Once the final wiring harnesses are configured on a future spacewalk, Bartolomeo will be ready to host experiments, expanding the station's research capability.



The Bartolomeo platform is transferred from the Dragon cargo ship to the International Space Station. Credit: NASA

The **Bartolomeo platform** features 12 different mounting sites to accommodate science payloads, experiments, and technology demonstration packages. Developed by Airbus Defense and Space in partnership with the European Space Agency, the new facility is aimed at offering accommodations for commercial experiments outside the orbiting complex.

The Dragon supply ship is scheduled to be released from the space station's robotic arm at 9:52 a.m. EDT (1352 GMT) Monday, heading for re-entry and a parachute-assisted splashdown in the Pacific Ocean southwest of Los Angeles.

Before Monday's release, the Dragon will be unberthed from the station's Harmony module using the robot arm and maneuvered to a position around 30 feet, or 10 meters, below the research complex.

Closing out a nearly 31-day mission, the unpowered cargo capsule will move a safe distance from the station before firing its Draco thrusters in a braking burn to slow down and re-enter the atmosphere. After jettisoning its disposable trunk, the pressurized capsule will plunge into the atmosphere, protected by a high-temperature heat shield, then deploy three main parachutes for a relatively gentle splashdown in the Pacific Ocean around 3:40 p.m. EDT (1940 GMT).

A SpaceX recovery team will be on station to pull the reusable spacecraft from the sea and haul it to the Port of Los Angeles, where teams will begin handing over time-sensitive experiment specimens and more than 4,000 pounds of cargo to NASA.

The Dragon capsule's return to Earth on Monday will mark the final flight of SpaceX's first-generation cargo vehicle after 20 trips to the space station. The specific spacecraft currently at the station is on its third mission in space.

SpaceX's future resupply missions will use the upgraded Dragon 2 spaceship, which comes in crew and cargo variants.



Russian cosmonaut Ivan Vagner, commander Anatoly Ivanishin and NASA astronaut Chris Cassidy pose outside their Soyuz MS-16 crew capsule at the Baikonur Cosmodrome in Kazakhstan. Credit: Andrey Shelpein/Gagarin Cosmonaut Training Center

At the Baikonur Cosmodrome in Kazakhstan, the members of the next space station crew are readying for launch April 9 to begin a six-month expedition in orbit.

NASA astronaut Chris Cassidy will join Russian commander Anatoly Ivanishin and flight engineer Ivan Vagner on the Soyuz MS-16 spacecraft for a six-hour trek to the space station. Liftoff from the Site 31 launch complex at Baikonur is scheduled at 4:05 a.m. EDT (0805 GMT; 1:05 p.m. Baikonur time) on April 9.

Because of concerns about the coronavirus pandemic, the families of the Soyuz crew members and media representatives will not be allowed to attend the launch at Baikonur.

The Soyuz MS-16 crew arrived at Baikonur aboard a Russian space agency jet March 24 after leaving their training site in Star City, Russia, near Moscow.

Cassidy and his crewmates are scheduled to dock with the space station's Poise module at 10:15 a.m. EDT (1415 GMT), joining station commander Oleg Skripochka and NASA flight engineers Jessica Meir and Drew Morgan.

The space station will be restored to its normal crew size of six for nearly eight days before Skripochka's crew floats into a different Soyuz spaceship April 16 for return to Earth.

NASA says station operations have not been impacted by the COVID-19 pandemic, which has restricted travel and triggered stay-at-home orders in many states across the country, limiting in-person work to essential businesses.

The space station flight control team is currently staffed at normal levels at the Johnson Space Center in Houston, according to NASA.

There are approximately 25 flight control positions at the space station control center in Houston during normal day-to-day operations. Another 10 or so flight control positions are needed during certain events, such as spacewalks or rendezvous operations. During crew nights or weekends, when the station crew is largely off duty, around 10 flight controllers are required in the control center, said Gary Jordan, a NASA spokesperson.



File photo inside NASA's Mission Control Center at the Johnson Space Center in Houston. Credit: NASA

Skripochka, Meir and Morgan are scheduled to undock from the space station in their Soyuz MS-15 spaceship at 9:53 p.m. EDT on April 16 (0153 GMT on April 17). A few hours later, the Soyuz will fire braking rockets to fall back into the atmosphere, targeting a landing on the steppe of

Kazakhstan at 1:17 a.m. EDT (0517 GMT; 11:17 a.m. local time in Kazakhstan).

That will leave Cassidy in command of the space station's Expedition 63 crew, which will have the station to themselves until the planned arrival of NASA astronauts Doug Hurley and Bob Behnken on the first piloted test flight of SpaceX's Crew Dragon capsule.

Hurley and Behnken are scheduled for launch in mid-to-late May from the Kennedy Space Center atop a SpaceX Falcon 9 rocket. The duration of their stay on the space station was originally expected to last just a week or two, but could be extended to several months to provide the station with extra manpower during a time when the orbiting lab's U.S. segment would otherwise be staffed with just a single NASA astronaut.

Cassidy is flying in the final Soyuz seat NASA has purchased from Roscosmos, the Russian space agency. NASA is expected to soon announce the purchase of at least one additional Soyuz seat on an October launch from Baikonur, easing pressure on NASA's commercial crew providers — SpaceX and Boeing — as they prepare their U.S.-made human-rated crew capsules for launch.

The busy month of comings and goings at the International Space Station will wrap up in late April with the arrival of a Russian Progress refueling and resupply freighter.

The Progress spaceship is set to launch atop a Soyuz booster April 25 and will dock with the space station around three-and-a-half hours later with a load of propellant, water and cargo.

Astronomers are hoping to see the very first stars and galaxies in the Universe

Sometimes it's easy being an astronomer. When your celestial target is something simple and bright, the game can be pretty straightforward: point your telescope at the thing and just wait for all the juicy photons to pour on in.

But sometimes being an astronomer is tough, like when you're trying to study the first stars to appear in the universe. They're much too far away and too faint to see directly with telescopes (even the much-hyped James Webb Space Telescope will only be able to see the first galaxies, an accumulation of light from hundreds of billions of stars). To date, we don't have any observations of the first stars, which is a major bummer.

So, astronomers engage in a little bit of cosmic peek-a-boo.

Before the first stars formed (the exact date is uncertain, because we haven't observed it yet, but we suspect it happened about thirteen billion years ago), the universe was composed almost entirely of pure, undiluted neutral hydrogen: single electrons bound to single protons in perfect harmony.

But then the first stars appeared, and poured their high-energy radiation throughout the cosmos, flooding the universe with copious X-rays and gamma rays. That intense radiation ripped apart the neutral hydrogen, converting it into the thin but hot plasma that we see in the present-day universe. This process, known as the Epoch of Reionization, started in little patches that

eventually grew to engulf the cosmos, like a bunch of weird bubbles.

All this is fascinating, but how can astronomers actually detect this process? They can do it through a little trick of neutral hydrogen: it emits radiation at a very specific frequent, 1420 MHz, which corresponds to a wavelength of 21 centimeters. Before the first stars came online, the neutral gas pumped out this 21cm radiation by the bucketload, with the signal gradually diminishing as the universe became a plasma.

Sounds like a plan, except a) this signal is incredibly weak, and b) a bajillion other things in the universe emit radiation at similar frequencies, including our radios on Earth.



A visualization of what the first stars in the universe looked like. Credit: NASA

Disentangling the annoying noise from the juicy cosmological signal requires taking mountains of data and sifting through the astronomical haystack for the 21cm needle. We currently don't have the capabilities to make the detection – that will have to wait for next-generation radio telescopes like the Square Kilometer Array – but current observatories like the Murchison Widefield Array in Western Australia are laying all the necessary groundwork.

Including delivering 200 TB of data in its first pass, which is currently under analysis by some of the most powerful supercomputers in the world.

New Find Shows Uranus Loses Atmosphere to its Magnetic Field

You may never look at Uranus the same way again. It's always worth combing through data from old space missions for new finds.

NASA's researchers at the Goddard Space Flight Center recently did just that, looking at Voyager 2's lone encounter with the planet Uranus to uncover an amazing find, as the planet seems to be losing its atmosphere to its lop-sided magnetic field at a high rate. The finding was published in a recent edition of *Geophysical Research: Letters*.

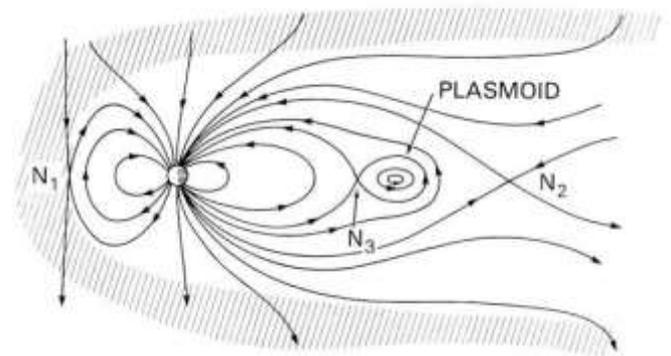
Voyager 2 flew just 50,600 miles (81,400 kilometers) past the cloudtops of Uranus on January 24, 1986. The outer ice giants were secondary targets for the Grand Flyby exploration of the outer solar system and to date, Voyager 2 is the only mission to visit Uranus and Neptune up close.

Voyager 2 meticulously studied Uranus during the key two hours of closest approach, and data collected during the encounter later revealed two new ring systems and 11 new moons. But it was a blip in the magnetometer readings relayed by Voyager 2 that recently gave researchers pause.

The anomaly is thought to have been a plasmoid — a giant plasma bubble clipped off by the planet's magnetic field and hurled into space. Voyager 2 happened to pass briefly through this bubble, though it took researchers over three decades to realize it.

We see other worlds shedding atmosphere throughout the solar system. Such plasmoids are common around the giant planets of Jupiter and Saturn. In the inner solar system, Venus and Mars are both devoid of protective magnetic fields, and are at the mercy of losing upper atmosphere directly to the solar wind. In the case of Earth, this effect is tiny: but Mars missions such as the Mars Atmosphere and Volatile Evolution (MAVEN) and the European Space Agency's Trace Gas Orbiter highlight just how extreme this loss can be.

"Mars used to be a wet planet with a thick atmosphere," says Gina DiBraccio (NASA-GSFC) in a recent press release. "It evolved over time to become the dry planet we see today."



A diagram of a plasmoid disconnection event. Credit: Public Domain/Wikimedia Commons.

And when it comes to the wacky world of Uranus, rotational orientation matters. Orbiting the Sun once every 84 years, Uranus spins on its side: a 'season' is 21 years long on Uranus, with either pole aiming at the Sun 19 Astronomical Units (AU) distant once every 42 years. The oddball of the solar system, Uranus's magnetosphere and the space it carves out wobbles 60 degrees out of sync with its rotational axis.

Though Voyager only made a brief 60 second transit through the plasmoid bubble, the implied dimensions were stunning: with a cylindrical volume of 127,000 miles (204,000 kilometers) wide by 250,000 miles (400,000 kilometers) long, the bubble would stretch from Earth to the Moon.

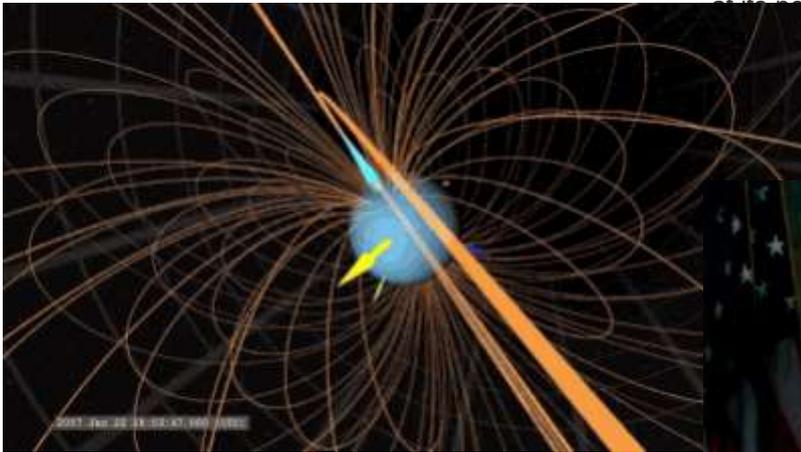
Attack of the Plasmoids

Another unique feature of the Uranus plasmoid was the clean closed loops observed by Voyager 2, in sharp contrast to the twisted magnetic field typical of plasmoids around Jupiter or Saturn.

"Imagine if one spacecraft just flew through this room and tried to characterize the entire Earth," says DiBraccio.

cio in the recent press release. "Obviously, it's not going to show you anything about what the Sahara or Antarctica is like."

Though this is indeed only a tantalizing statistical sample of one, such an event, if typical, could account for 15 to 55% of the atmospheric mass loss for Uranus... more than the proportion seen at any other world in the solar system.



The rotational pole of Uranus versus its magnetic field. Credit: NASA/Scientific Visualization Studio/ Tom Bridgman

Return to the Ice Giants

There are missions on the drawing board to send dedicated Icy World orbiters to both Uranus and Neptune, though these are still a long ways off, in the 2030 or 2040 time frame.

It's great to see new discoveries still coming out of old data... if nothing else, this highlights the need to go back.

Following Comet Y1 ATLAS: the 'Lost Comet' of Spring



Got clear skies? If you're like us, you've been putting the recent pandemic-induced exile to productive use, and got out under the nighttime sky. And though 2020 has yet to offer up a good bright 'Comet of the Century' to keep us entertained, there have been a steady stream of good binocular comets for northern hemisphere viewers, including C/2017 T2 PanSTARRS and C/2019 Y4 ATLAS. This week, I'd like to turn your attention to another good binocular comet that is currently at its peak: the 'other' comet ATLAS, C/2019 Y1 AT-

ED ON MARCH 24, 2020 BY MATT
AMS



Apollo 15 Astronaut Al Worden has Passed Away

Last Wednesday (March 18th), the world was saddened to hear of the death of Apollo astronaut Alfred "Al" Worden, who passed away after suffering a stroke at an assisted living facility in Texas. A former Colonel in the US Marine Corps who obtained his Bachelor of Science from West Point Academy in 1955 and his Master of Science at the University of Michigan in 1963, Worden went on to join NASA.

In 1966, Worden became one of the 19 astronauts selected by NASA to participate in the Apollo Program. After serving as part of the astronaut support crew Worden for *Apollo 9* and as the backup pilot for the Command Module for *Apollo 12*, he had the distinction of serving as the pilot of the Command Module *Endeavour* during the *Apollo 15* mission, which flew from July 26th to August 7th, 1971.

During the missions' return to Earth, he also conducted an extra-vehicular activity (EVA) to retrieve film cassettes from the Command Service Module (CSM). This was the first EVA to happen in "deep space," since it took place about 315,400 km (196,000 mi) from Earth and 69,000 km (42,850 mi). As of 2020, it remains one of only three such EVAs to ever be conducted.

For his accomplishments, Worden awarded the NASA Distinguished Service Medal in 1971. He was inducted into the International Space Hall of Fame in 1983, the United States Astronaut Hall of Fame in 1997, and the International Air & Space Hall of Fame at the San Diego Air & Space Museum in 2016. As an Apollo astronaut, he was also honored with a NASA Ambassador of Exploration Award in 2009.

In an interview with Smithsonian Magazine in 2011, Worden spoke about his time in space and what his favorite activity was as the CM pilot:

"The thing that was most interesting to me was taking photographs of very faint objects with a special camera that I had on board. These objects reflect sunlight, but it's very, very weak and you can't see it from [Earth]. There are several places between the Earth and the moon that are stable equilibrium points. And if that's the case, there has to be a dust cloud there. I got pictures of that."

After retiring from active duty in 1975, Worden joined the private sector and worked to advance the science of space flight. In addition to becoming the president of Maris Worden Aerospace, Inc., he served as vice-president of BF Goodrich Aerospace Brecksville, Ohio, and held various positions with a number of other aerospace and aviation companies.



The crew of Apollo 15, lunar module pilot James B. Irwin (left), commander David Scott (right) and command module pilot Alfred M. Worden (rear). Credit: NASA

Worden was also an education and literacy advocate who wrote several books. These included his collection of poetry, titled "Hello Earth: Greetings from Endeavour", and a children's book, "I Want to Know About a Flight to the Moon", both of which were released in 1974. He also released a memoir in 2011 titled "Falling to Earth" and even appeared on an episode of "Mr. Rogers' Neighborhood".

These accomplishments and were highlighted by NASA Administrator Jim Bridenstine in a statement released on March 18th:

"NASA sends its condolences to the family and loved ones of Apollo astronaut Al Worden, an astronaut whose achievements in space and on Earth will not be forgotten."

"A Colonel in the U.S. Air Force, Worden was a test pilot and instructor before joining NASA as an astronaut in 1966. He flew to the Moon as command module pilot aboard Apollo 15. During this time he earned a world record as "most isolated human being" while his crew mates roamed the lunar surface, and he was 2,235 miles away from anyone else."

"Later in his career, Worden became Senior Aerospace Scientist at NASA's Ames Research Center in California. His multiple appearances on the children's show Mr. Rogers' Neighborhood surely fueled the desire of many children to pursue careers along the lines of his and become future exploration leaders."

"Of his mission Worden said, 'Now I know why I'm here. Not for a closer look at the Moon, but to look back at our home, the Earth.'

"We remember this pioneer whose work expanded our horizons."

Worden is survived by his three daughters, Tamara Christians, Merrill Bohanning, and Alison Penczak, who also announced their father's passing on his website on March 18th:

"It is with great sadness that the family of Colonel Al Worden, (USAF Ret.) CMP Apollo 15 share the news that "Al" died in his sleep last night. The family thank you all for your kindness, thoughts, and prayers."

"He was a much admired man of great personality and energy, and an engaging storyteller who touched the souls of many."

"We have lost another voice from that great Apollo generation. Our heartfelt condolences go to his family, friends and colleagues."

"Rest in Peace, Colonel."

It is always sad to witness the passing of a person, but it takes on special significance when those people represent the greatest accomplishment of a generation. However, like his peers, Worden encouraged students to study the STEM fields and become astronauts. He also advocated that in the new era of space exploration (Space Race 2.0) humanity should explore beyond Mars and even settle in space.

Of the 24 astronauts who would serve in the Apollo program, 11 are still with us today – which includes the second man to walk on the Moon, Buzz Aldrin. Worden now joins his 12 fellow astronauts who have been laid to rest, which includes Neil Armstrong and Alan Shepherd – the first man to walk on the Moon and the first US astronaut to go to space, respectively.

Elon Musk says that SpaceX Has no Plans to Spin Off Starlink



Last week, the Satellite 2020 Conference & Exhibition wrapped up after four days of presentations and addresses from some of the leading experts in the telecommunications industry. As advertised, SpaceX founder Elon Musk was on hand to deliver a keynote speech in which he announced that (contrary to earlier statements) Starlink will not be spun off and become its own business enterprise.

New Study Shows the Earth and Moon are not so Similar After All

According to the most widely-accepted theory, the Moon formed roughly 4.5 billion years ago when a Mars-sized object named Theia collided with Earth (aka. the **Giant Impact Hypothesis**). This impact threw up considerable amounts of debris which gradually coalesced to form Earth's only natural satellite. One of the most compelling proofs for this theory is the fact that the Earth and the Moon are remarkably similar in terms of composition.

However, previous studies involving computer simulations have shown that if the Moon were created by a giant impact, it should have retained more material from the impactor itself. But according to a **new study** conducted by a team from the University of New Mexico, it is possible that the Earth and the Moon are not as similar as previously thought.

The study that describes their findings, titled "Distinct oxygen isotope compositions of the Earth and Moon", recently appeared in the journal *Nature Geoscience*. The study was conducted by Erick J. Cano and Zachary D. Sharp of UNM's Department of Earth and Planetary Sciences, and Charles K. Shearer of UNM's Institute of Meteoritics.

The theory that the Earth and the Moon were once a single body has existed since the 19th century. But it was not until rock samples were brought back by the Apollo astronauts that scientists had definitive evidence that Earth and the Moon formed together. These samples showed that like Earth, the Moon was composed of silicate minerals and metals differentiated between a metal core and a silicate mantle and crust.

While the Moon has less iron and less in the way of lighter elements, the Giant Impact Hypothesis explains this quite well. Iron, a particularly heavy element, would have been retained by Earth while the heat and explosive force of the impact caused the lighter elements to boil off and be ejected into space. The rest of the material from Earth and Theia would have then cooled and then mixed to form the Earth and Moon as we know them today.

This theory also explains the speed and nature with which the Moon orbits the Earth; in particular, how it is tidally-locked with our planet. However, previous studies involving computer simulations have shown that in this scenario, roughly 80% of the Moon should consist of material that originated from Theia.

This presents a serious quandary for astronomers and geologists, and various theories have been advanced to explain this. In one scenario, Theia was similar in composition to Earth, which would explain why Earth and the Moon seem so similar. In another, the mixing of materials was very thorough, to the point that both the Earth and the Moon retain elements of Theia.



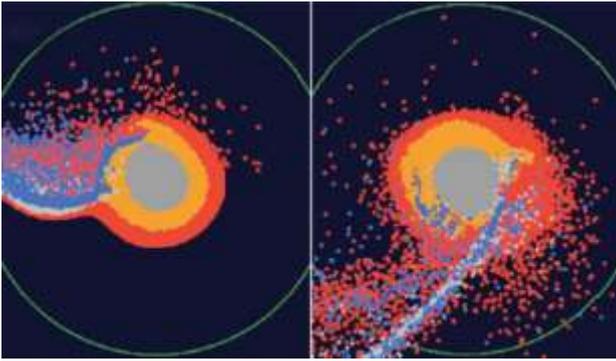
The chemicals that made life possible on Earth may have come from another planet that collided with Earth, forming the Moon. Image Credit: Rice University

Unfortunately, these explanations are either inconsistent with what we know about the Solar System or present theoretical problems of their own. To shed light on this, Cano and his colleagues considered a key inconsistency with the Giant Impact Hypothesis. Basically, when scientists examined the Apollo lunar rock samples, they noted that the oxygen isotope values were virtually identical to those found in rocks here on Earth.

If the Giant Impact Hypothesis is correct, then the precursors to the Earth and Moon either had identical values to begin with, or extensive homogenization took place after the impact event. To address this, Cano and his colleagues conducted a high-precision oxygen isotope analysis of a range of different lunar rocks. What they found was that lunar rocks showed higher concentrations of lighter oxygen isotopes than Earth.

In addition, the differences increase the deeper one probes from the crust into the mantle. They attribute this to the fact that the crust is where debris from Earth and Theia would have mixed, whereas the interior is where material from Theia would be more concentrated. As they summarize in their study:

"Oxygen isotope values of lunar samples correlate with lithology, and we propose that the differences can be explained by mixing between isotopically light vapour, generated by the impact, and the outermost portion of the early lunar magma ocean. Our data suggest that samples derived from the deep lunar mantle, which are isotopically heavy compared to Earth, have isotopic compositions that are most representative of the proto-lunar impactor 'Theia'."



Snapshots a simulation of the Giant Impact that created the Earth-Moon system. Credit: Yale News/Natsuki Hosono (et al.) 2019

In summary, the team's research findings show that Earth and Theia were not similar in composition, which provides the first definitive evidence that Theia likely formed farther from the Sun than Earth did. Similarly, their work shows that the distinct oxygen isotope compositions of Theia and Earth were not completely homogenized by the Moon-forming impact.

This study calls to mind research that was recently conducted by a team from Yale and the Tokyo Institute of Technology. According to their work, the Earth was still a hot ball of magma when the Moon-forming impact took place. This is what would have allowed for material from Theia to be lost to space while material from Earth quickly coalesced to form the Moon.

Whether material from Theia was lost to space or retained as part of the Moon's interior is a question that scientists will be able to examine more fully thanks to the many sample-return missions that will be happening in the coming years. These include NASA send astronauts back to the lunar surface (*Project Artemis*) and multiple rovers sent by China (*Chang'e 5* and *Chang'e 6* missions).

These and other mysteries about Earth's only satellite stand a good chance of being answered soon!

Five Space and Astronomy Activities to do at Home During the Coronavirus Outbreak

We're in uncharted territory as the world faces the Coronavirus (COVID-19) pandemic. While the medical community is on the front lines of dealing with this, as well as others who provide critical services in our communities, the best thing many of us can do is to stay home (and wash our hands).

If you're looking for ways to keep occupied, keep your kids in learning-mode while school is canceled, and expand your horizons — all at the same time — luckily there are lots of space and astronomy-related activities you can do at home and online. We've compiled a few of our favorites, including this first one, one that just became available yesterday.

Re-live Apollo 13 in Real Time

If you're feeling like you want to take a break from the current timeline in our planet's history, here's a great alternative. To celebrate the anniversary of NASA's historic Apollo 13 mission, a new website just went live that allows you to live through the mission, as it happened 50 years ago.

Apollo 13 in Real Time puts together audio recordings, video footage, transcripts, photographs and incredible details

of this nail-biting mission, all available in one place. You can hear all the transmissions between the astronauts and Mission Control, as well as behind the scenes discussions and even some phone calls.

The website is the brainchild of Ben Feist, a contractor at NASA's Johnson Space Center in Houston. Feist did the same thing for the Apollo 11 anniversary last summer. His initial project was a real-time site for Apollo 17's 45th anniversary in 2017.



The crew of Apollo 13 after landing safely. Credit: NASA.

For the Apollo 13 recreation, Feist and a group of volunteers took historical material that were in bits and pieces across many different institutions and organizations and by "brute force" put them together in a cohesive, easy-to-view website.

"The formats don't lend themselves to be easily retimed to mission time," Feist told Universe Today in an email. "The tapes are all analog, the video is all on film at different frame rates, and almost nothing was timecoded. The only way to assemble this was through brute force research and perseverance.

If you saw the Apollo 11 IMAX film that was released in 2019, you may recall seeing some footage shot in Mission Control during the Apollo 11 flight. What many don't realize is that footage originally had no sound. It had to be paired "by hand" with NASA recordings of the audio conversations in Mission Control. The film was 16 mm, while the audio recordings from Mission Control were a completely different format. You'll see the same type of paired footage for Apollo 13 in Real Time (as well as the Apollo 11 site.) None of this had ever been done before.

Feist worked with Apollo 11 Archive Producer Stephen Slater on the IMAX film, and the two worked together for the Real Time Apollo mission compilations.



Apollo astronauts at Mission Control during Apollo 13. Credit: NASA.

“Stephen has provided all of the historical footage for this project,” Feist said, “and has synchronized the silent mission control footage from Apollo 13 with the restored mission control audio recordings, bringing the footage to life with sound for the first time ever. We then placed every clip of footage within the mission timeline at the precise moments they were shot. The result feels like a visual window into history opening and closing as the mission progresses.”

Feist said the mission control recordings have sat unheard in the national archives in Maryland since 1970, and that there is only one machine that can play back these tapes and it’s housed in Houston at Johnson Space Center.

“The last five of these tapes were only recently found and were just digitized at JSC this past month specifically for the Apollo 13 in Real Time project,” Feist said. “These last tapes contain the period of the mission surrounding the onboard explosion that disabled the mission and were used as part of the accident investigation in 1970.”

A member of the volunteer team, Jeremy Cooper, wrote a “brilliant piece of software” that allowed for distortions in the tapes to be corrected, resulting in stunningly clear audio that is perfectly synced to the original mission time. There are 7,200 hours of this material on the website.

On the site right now, you can join the mission at launchtime, or “in progress.” But starting April 10, you’ll be able to join in “right now” exactly 50 years later. As I found during using the Apollo 11 in Real Time Site during the Apollo 11 anniversary, it’s quite emotional to be connected to what was unfolding exactly 50 years ago. It really transported me through time, and I expect the same thing to happen for Apollo 13.

Feist said it was an “insane” amount of effort to pull this together. “But the material is so rich and rewarding to work with, it didn’t feel like work when we were doing it,” he said. “It feels absolutely wonderful to have brought Apollo 13 back to life for everyone to explore.”

Citizen Science

Want to help find a new exoplanet, search for gravitational waves or identify incoming meteors? You can help scientists around the world by becoming a Citizen Scientist and doing real scientific activities. A great place to find astrono-

my related Citizen Science activities is at the Zooniverse.



Originally started in 2007 as a website to classify galaxies, Zooniverse has blossomed to encompass the power of crowd sourcing in all sorts of areas. Specifically for space and astronomy, you can help locate and identify supermassive black holes with Radio Galaxy Zoo: LOFAR, help transcribe early groundbreaking work of women astronomers with Star Notes, and search for undiscovered worlds with Planet Hunters TESS. There are tons more of online citizen science you can do at Zooniverse, in areas as varied as literature, medicine, the arts and biology.

Another citizen science site near and dear to our heart is Cosmoquest , but they are currently under site maintenance. They hope to be back up and running soon, however their Twitch channel is open with several educational programs.

Crowdfight COVID-19 is looking for experts (in multiple fields) to help with research in fighting the virus.

SciStarter has a great searchable list of citizen science project

Another site is CitizenScience.gov, and most of these are geographic-specific to the US.



Rigs to view the Sun in both hydrogen-alpha and visible light. Credit: David Dickinson

Astronomy Outdoors

Medical experts say that even if you are practicing social distancing, you should try to get outside to exercise, get some fresh air and avoid cabin fever. Going to a park, nature reserve or other open areas is a great way to accomplish that. Take a look at nature all around you. It’s springtime in the northern hemisphere, so birds are returning, other animals are moving about more, early flowers may be popping up or blooming in your area, and trees may be budding out.

This might also be a great time to do some astronomy. If you have a telescope, take this opportunity to use it!

Maybe the kids' (or your own) bedtime is relaxed a bit now if school is closed. Take a look at the Moon and its changing phases over the next few nights. Right now, Venus is visible at sunset. If you're an early riser, Mars, Jupiter and Saturn are visible before sunrise.

Even if you don't have a telescope, you can still take advantage of seeing the night sky. All the objects listed in the previous paragraph are naked-eye objects. Track their movements, keep a chart if you'd like to make a science project out of it. Go to the Heavens Above website to find out when the International Space Station is flying over your backyard, as well as other visible satellites like the Hubble Space Telescope. Plus more Starlink satellites are scheduled to be launched on March 15.

Our favorite guide to easy viewing of the night sky is Bob King's "Night Sky With the Naked Eye." For a more advanced observing guide, of course, "The Universe Today Ultimate Guide to Viewing the Cosmos" by our very own David Dickinson and Fraser Cain comes highly recommended!



Read and Listen

While you might be finding it hard to concentrate with everything that's going on in the world, if you're waiting this out at home, now might be the time to try to catch up on some reading or find a new podcast. If you found the Apollo 13 in Real Time site a wonderful look back, you may enjoy some of the recent Apollo books, such as Rod Pyle's "First On The Moon," James Donovan's "Shoot For the Moon," or the classic and comprehensive "A Man on the Moon" by Andrew Chaikin. Or may I humbly suggest my book, "Eight Years to the Moon" that shares behind the scenes stories of Apollo through the eyes and experiences of 60 engineers and scientists in the 1960s.

More book ideas:

Audible started a free version for kids and families called Audible Stories during this time of quarantine.

A list of 50 books that are set in space.

Space.com put together a list of the best space and sci-fi books for 2020

Joanne Manaster put together a list of books by women science writers.

For children's books, Emily Lakdawalla puts together a wonderful list every year.

Podcasts:

Of course, we highly recommend Astronomy Cast with Dr.

Pamela Gay and Fraser Cain, as well as Fraser's Guide to Space, Questions and Answers and Open Space.

At the Cosmoquest site, you can find The Daily Space & 365 Days of Astronomy podcasts; also Cosmoquest is on Twitch with several programs, and they've got a March Planetary Madness schedule of online events you can watch.

Here's a comprehensive list of some of the best space and astronomy podcasts.

Ideas/Projects for Kids and Families

With the recent closures of schools, people are mobilizing online resources and providing other great ideas for parents. So many are popping up, but here are a few:

One idea I just saw today would be great for kids AND parents, to keep a journal about this very unusual period in our lifetimes. Writing and discussing how this is affecting lives and making kids feel is important:

I'm getting involved with a YouTube channel called Authors Everywhere, which includes authors sharing stories, reading aloud, offering writing prompts or prompts for artistic projects.

Skype A Scientist, which pairs scientists with classrooms, is expanding their reach and will be offering LIVE classes online, see the link above. The founder of this website, Dr. Sarah McNulty, is also organizing a Virtual Book Tour, which I'll also be participating in. Links here will be updated when available.

NASA's Learning Space has several activities for various age groups, plus a Family FAQ for learning from home.

Read, Wonder, and Learn! Favorite Authors & Illustrators Share Resources for Learning Anywhere – Spring 2020 was just started by author Kate Messner, and includes videos and ideas for home learning.

Storyline Online has participatory reading online

Emily Calandrelli (@TheSpaceGal) has started a video series on various science projects to do at home

Geoff Notkin of the "Meteorite Men" television series on the Discovery Channel has made the entire series available on You Tube, as well as his STEM Journals show.

ViewSpace has interactive activities and videos on Earth and space science.

Scholastic Learn at Home has tons of home-based projects.

Open Culture has a list to Take a Virtual Tour of 30 World-Class Museums & Safely Visit 2 Million Works of Fine Art as well as other learning links

National Public Radio (NPR) reporter Ari Shapiro has started a video series for 5th graders on current events.

Arecibo Observatory has a downloadable coloring book.

Stan Draws Spaceships has created a Space Explorer Coloring Book to download.

We'll keep adding to the list as we find them and feel free to add your own ideas in the comments.

E Mails Viewings Logs and Images from Members.

Hi Andy,

One viewing log (probably last for a while?) and a few pictures of Lunar X and V (first time I have witness this ?) and ISS transits I saw recently.

Viewing Log for 6th March

Late in the afternoon I noticed a message from Chris Brooks on the Wiltshire AS members Facebook page asking if anyone would be interested in an adhoc viewing session that evening? Being a Friday and I was not doing anything that night, I replied saying I would be interested subject to the clouds going away? I said I would make a decision around 19:15 and get back to Chris. At the time the sky above my house was fairly clear, so I said to Chris I would meet him at my usual viewing place of Uffcott around 20:00? The Uffcott site would be new to Chris, he gave me a post code which was up the lane a bit, and so he would be in the right area. When I arrive at my usual lay-by he was not there but soon found me as he had actually gone past the place and turned around and found me on the return trip!

With the possibility of clouds in the area I only took my Porta Mount II tripod and William's Optic 98 mm Apo refractor with me, I would be using the 10 mm Pentax XW eye piece (later on I used the 20 mm version). When I was setting up the waxing gibbous Moon was high in the sky (at 21:47 it would be highest in the sky that evening) and 88.4 % lit or 12.2 days old, normally after half Moon I do not do viewing session as the Moon washes the sky out? I had the telescope set up and ready by 20:13 and that was as far as I went as cloud had now covered most of the sky, the Moon could barely be seen so it was a case of wait and see what happens. Mean time Chris was setting up his GOTO telescope, he was using a William's Optic GT81 mm refractor the blue/white colour on the scope looked very good!

After waiting about 45 minutes we could see Venus starting to put on a show, so we knew cloud cover would start to break up? Venus was starting to get low in the western sky, I could make out a gibbous phase of the second planet in the Solar System, must be getting close half phase? With only having an f6 refractor I could not make much detail of planets as this scope is really for Deep Sky objects? After another 30 minute wait, the sky finally started to clear and I could make my shadow out on the road! After Venus I headed off to M42 and M43, with the Moon in Leo I could hardly make anything out of this great nebula, the dust lanes could hardly been seen, the trapezium stars could be made out but not much else? M45, the Pleiades were wonderful and bright in the telescope, probably one of the better times I had seen this massive open cluster (O C)? I should have been able to find M41 as it is about four degrees directly below Sirius but I think the Moon stopped this O C coming to my eyes? M1, the only Supernova remnant in Messier's list could not be found so I was not having much luck. For most of the evening's session my kit would not be used BUT a first for me was finding M36 in Auriga, I knew I had got one of the three O C's in this constellation but which one? Chris used his kit to confirm I had found M36, a bonus for someone who very rarely does not use GOTO equipment!

As I said before we used Chris's kit, his 81 mm refractor gave crisp and bright views of the sky, even with a very bright Moon close by (if ever I got another small refractor, this is one I might get? Just do not inform the wife about it!) some of the objects we looked at included M81 and M82 in Ursa Major, M52, M103 and NGC457 (Owl Cluster) in Cassiopeia, M31 and M32 in Andromeda (close to northern horizon so not very clear), we tried M95 and M96 in

Leo but these galaxies were washed out? So the final object for the evening was the Moon, I did not bring one of my eye piece cases out with me which contained the Moon filter, so the first time I looked at the Moon I had spots in front of my eye! Along the terminator in the south I could see the craters Zucchi, Bettinus, Kircher and Wilson clearly and to the north I could make out the craters Carpenter, Anaximander just clearing the terminator. The ejector rays from the crater Tycho were clearly seen on the surface of the Moon.

At 22:51, we decided to call it an evening, for a lot of the time we actually did not do astronomy but talked about some astronomy items or other subjects? Pewsey car park was chosen as the place for the Messier marathon later in the month (possible report about the session might be in the magazine?) we had about six cars go past us in the nearly three hours we were out, closing our eyes to keep the night vision was not really needed as the Moon destroyed any night vision we had?

Clear skies.

Peter Chappell

PS I could not make the planned Messier marathon night as I was working that evening, I had planned to meet up with Chris on the following Wednesday evening and probably do an all-nighter? Unfortunately the government decided we should have a lockdown due to Covid-19 which cancelled our planned meeting. I suspect this will be my last viewing log for a few months? I cannot really view from my garden as I have a street light right beside the drive way in the front and the back has houses overlooking it which can give off more light at times!

Some images from Peter.





Peters first sighting of Lunar X and Y

Hi Andy,
Here are my submissions for the WAS April 2020 Newsletter.

Serif for Affinity Photo software review

As the topic for Tuesday is astrophotography members may be interested in a good deal that is on offer from Serif for Affinity Photo.

I have been using the Windows version for a while and I think it is an excellent layer based post processing professional photo product. It now has a good following from professional photographers as well. I struggled with GIMP etc for ages but now can get the results I want relatively easily. You will always find reviews giving Photoshop the edge but I think you have to be very picky and be in some really deep areas of Photoshop to notice the difference. As it is a very comprehensive product you have to invest time to learn how to use it but it is usually straightforward to convert Photoshop processes to Affinity Photo since the menus etc are similar.

The real deal maker for me is the cost. Currently you can get a 90 day free trial and/or buy a single licence for Mac OS or Windows for the product for half price which is £24 (Ipad is only £10). This is about two month's subscription to Photoshop, although you do get Lightroom as well from Adobe. Details are on the Serif website <https://affinity.serif.com/en-gb/store/>. NB I am not on commission or anything for the product!

Serif also have an Affinity Photo workbook but that is quite pricey (£38). But if anyone does follow up on the offer there is also a useful intro ebook Essential Affinity Photo (£6) available at

<https://lenscraft.co.uk/lenscraft-store-2/photography-books-courses-guides/>

After the plug here are my submissions:

16/03/2020

Saturn, Jupiter and Mars in the early morning twilight
Canon 1100D, Sigma 17-70mm at 70mm (effective focal length 112mm)
ISO 800, F4.5, 3.2 sec
Post processed in Affinity Photo



23/03/2020
Venus
Canon 1100D, Sigma 17-70mm
Landscape ISO 1600, F2.8, 0.6



31/03/2020
Pleiades, Venus and 19:46 UT ISS UK Pass
Canon 1100D, Sigma 17-70mm



ISS 32 images stacked and a single image overlaid to remove star trails and post processed in Affinity Photo - 17mm (effective focal length 28mm) ISO 1600, F2.8, 10 sec
Stay safe and well.
Clear skies,
John Dartnell

Hi Andy,
Many thanks for your email and reminder about the news-
letter, which I attach.
Your virtual session sounds like fun and hard work too,
good luck with it.
Stay well and keep looking up.
Best wishes and good health.

Robin

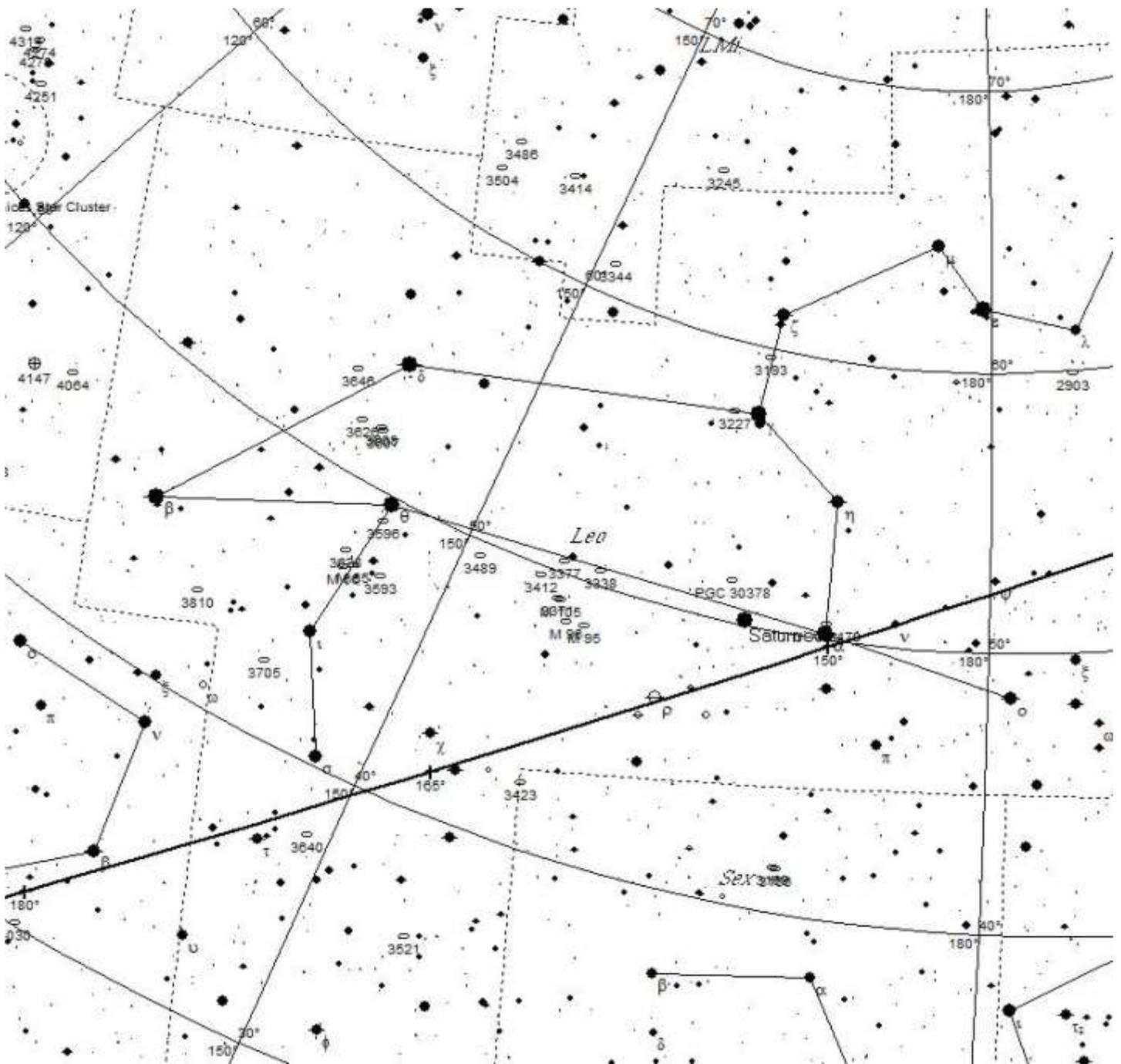
Michael Alexander
Sun 08/03/2020 22:40
https://youtu.be/NI5Nm_T67aQ
Andy,
A short video I thought you might enjoy.

Best Regards
Mike and Lyla in La Palma

Here is M78 in Orion from early March during a mini
Messier Marathon photo session. Also is the dreaded
streak fro a Satellite of the Starlink series of sky spoiling
communications set up being built up be Elon Musk.



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 Mi-

norids 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 "h" 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



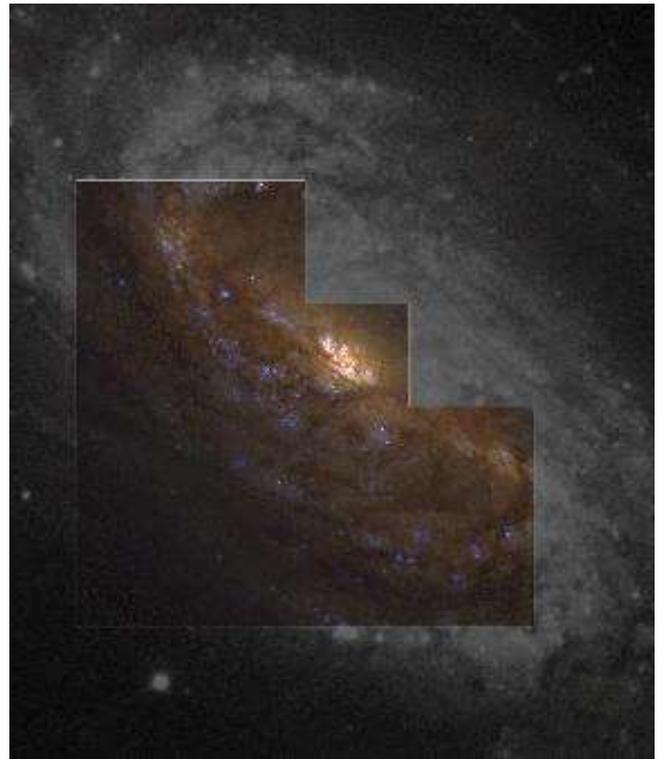
and Messier 105 as well as at least nine other galaxies. Located about 38 million light years away, this group of galaxies with the Hubble Space Telescope and 8 Delta Cephei variable stars

were found to help determine each individual galaxy's distance. 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](#)

By Tammy Plotner via Universe Today.

A Messier Photo hunt.

The last weeks of March were blighted by the fears of the virus and lock ins that stopped group viewing sessions but recent changes to lighting at my end of town have improved my viewing so much it was easy to go on a mini Messier marathon from home. I had also just had my arthritis injections so couldn't move to much, and a cancelled holiday meant I had to restock my larder at the wrong time in the lock down (having given a big rubble sack full of tins and pasta to the local foodbank) and used up fresh. But we were blessed with no or new Moon and clear skies for more than a week.

With testing gear and finding wire faults I ended up with over 70 messier objects imaged in 4 nights.

Here is a selection, from open clusters, globulars, nebula and galaxies so many types were imaged... with a maximum 60 second single exposures on all images. KISS imaging.



Open cluster M52 in Cassiopeia.



M42 and 43 before the were lost behind houses. Star birth nebula



M1 the crab in Taurus, a nova remnant.



Messier 33, the Triangulum galaxy, quite low down in the west.



M13, the great globular cluster in Hercules.

ISS PASSES For April Early May 2020

From Heavens Above website maintained by Chris Peat

Date	Brightness	Start	Highest point	End						
	(mag)	Time	Alt.	Az.	Time	Alt.	Az.	Time	Alt.	Az.
29 Apr	-1.2	04:24:30	10°	SSE	04:25:54	12°	SE	04:27:19	10°	ESE
01 May	-2.2	04:25:14	13°	SSW	04:27:34	25°	SSE	04:30:24	10°	E
02 May	-1.8	03:39:33	16°	SSE	03:40:21	18°	SE	03:42:43	10°	E
03 May	-1.2	02:53:49	12°	SE	02:53:49	12°	SE	02:54:37	10°	ESE
03 May	-3.2	04:26:46	15°	SW	04:29:22	46°	SSE	04:32:37	10°	E
04 May	-2.8	03:40:58	27°	S	03:42:03	34°	SSE	03:45:09	10°	E
05 May	-2.2	02:55:09	24°	SE	02:55:09	24°	SE	02:57:35	10°	E
05 May	-3.8	04:28:05	11°	WSW	04:31:15	75°	SSE	04:34:38	10°	E
06 May	-1.2	02:09:16	13°	ESE	02:09:16	13°	ESE	02:09:51	10°	E
06 May	-3.7	03:42:13	27°	SW	03:43:50	61°	SSE	03:47:11	10°	E
07 May	-3.4	02:56:18	46°	SSE	02:56:27	47°	SSE	02:59:44	10°	E
07 May	-3.7	04:29:47	10°	W	04:33:10	86°	N	04:36:35	10°	E
08 May	-2.2	02:10:20	25°	ESE	02:10:20	25°	ESE	02:12:12	10°	E
08 May	-3.8	03:43:17	18°	W	03:45:43	87°	S	03:49:06	10°	E
09 May	-1.0	01:24:21	11°	E	01:24:21	11°	E	01:24:36	10°	E
09 May	-3.9	02:57:17	43°	WSW	02:58:15	76°	SSE	03:01:39	10°	E
09 May	-3.7	04:31:42	10°	W	04:35:05	88°	N	04:38:29	10°	E
10 May	-3.5	02:11:15	54°	ESE	02:11:15	54°	ESE	02:14:09	10°	E
10 May	-3.7	03:44:12	10°	W	03:47:36	85°	N	03:51:00	10°	E
11 May	-1.9	01:25:11	22°	E	01:25:11	22°	E	01:26:39	10°	E
11 May	-3.8	02:58:07	23°	W	03:00:06	86°	N	03:03:30	10°	E
11 May	-3.8	04:33:33	10°	W	04:36:56	70°	SSW	04:40:17	10°	ESE
12 May	-1.0	00:39:04	10°	E	00:39:04	10°	E	00:39:05	10°	E
12 May	-3.9	02:11:59	57°	WSW	02:12:36	87°	S	02:16:00	10°	E
12 May	-3.8	03:46:02	10°	W	03:49:26	83°	S	03:52:49	10°	ESE
13 May	-3.4	01:25:47	52°	E	01:25:47	52°	E	01:28:29	10°	E
13 May	-3.8	02:58:42	11°	W	03:01:56	88°	NNE	03:05:19	10°	E
13 May	-3.3	04:35:24	10°	W	04:38:37	41°	SSW	04:41:49	10°	SE
14 May	-2.1	00:39:28	24°	E	00:39:28	24°	E	00:40:58	10°	E
14 May	-3.8	02:12:22	22°	W	02:14:24	85°	N	02:17:47	10°	E
14 May	-3.7	03:47:51	10°	W	03:51:10	55°	SSW	03:54:28	10°	ESE
14 May	-1.5	23:52:45	15°	E	23:52:45	15°	E	23:53:25	10°	E
15 May	-3.8	01:25:36	36°	W	01:26:51	86°	N	01:30:15	10°	E
15 May	-3.9	03:00:18	10°	W	03:03:41	70°	SSW	03:07:03	10°	ESE
15 May	-3.2	22:59:34	10°	SW	23:02:41	35°	SSE	23:05:49	10°	E

END IMAGES, OBSERVING AND OUTREACH



NGC 457 The Owl cluster 7,900 light years away, and below the small unrelated cluster ngc438 7,800 light years away.
 Also known as the ET cluster but as the diagram below shows it is easy to see the owl shape, and especially with its target prey beneath its talons it makes a great view through binoculars just below the centre of the 'W' of Casseiopeia
 Nikon D810A using the TMB101.
 Andy



Wiltshire Astronomical Society	Observing Sessions 2019/20	
Date	Moon Phase (%)	Moonrise/Targets
2020		
24th April not dark until 9:30pm	Suspended	Venus high, galaxies of Leo and Virgo clusters
22nd May not dark until 10pm	Await details	Summer triangle rising

OUTREACH

On hold during Isolation/Social Distencing