NWASNEWS

Volume28 Issue 2

October 2022

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

Tonight an experiment… and call for Speaker Secretary

At this evening's meeting with Paul Money talking about Voyager missions we are experimenting with setting up a remote WIFI and connecting on Zoom with Paul who is remote and also has issues that keep him close to home. I am also letting Mike Alexander join in from La Palma provided the linking all works.

I am trying to keep the hall meetings viable, rather than zoom except for exceptional circumstances. I had several members who could ONLY attend hall meetings. But the last two meetings I have only seen one of those attend. Frustrating.

We need around 20 attendees to make the hall costs work, our subscription pays for speakers. If numbers attending drop too far we may look at pay for Zoom attendance. But I do like to meet face to face under lights rather than just the well attended observing evenings where everyone is covered up and in shadows.

Something to watch out for.

If the link doesn't work then I have a talk ready on Lunar Samples, Meteorites and how they help giving the story of the Moon.

I am also begging to get enquiries for outreach in the winter months.

Now for the the plea for volunteers. At the last meeting Peter Chappell asked to stand down as speaker secretary at the end of this season, however, the next speaker secretary needs to be in place and asking for the next seasons speakers before next January. Volunteers please.

Having the option for Zoom speakers may help speakers be in touch with us without incurring huge travelling expenses.

Another extremely valuable position to fill is the tea and coffee person. We could do it on rota but this rarely works. Again volunteers please.

The hand over of treasurer is going well (as well as the bank verifications of signatures and formalities allow. Thankyou Sam for taking this on.

Also note that we have some members posting fantastic images on our Facebook pages. Be sure to visit these and also our website.

Clear Skies

Andy

Space Station fly over to eclipse by Earth's shadow on 23rd September.
October we don't have many passes until the end of the month then those are early morning views until second week of November.
Don't forget time goes back to GMT at the end of the month, so remember to adjust controllers for standard time. And that horrible Month, Day, Year convention they have.
Andy Burns.

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.

HALL VENUE the Pavilion, Rusty Lane, Seend

Some Speakers have requested Zoom Meetings we will try to hold these at the hall

Meet 7.30 for 8.00pm start

SEASON 2022/23

4 Oct Paul Money The Trials & Tribulations of Voyager (zoom meeting in hall.
1 Nov Chris Hooker The planet Mercury
6 Dec Martin Griffiths How the Moon was formed
2023
3 Jan Mike Alexander Heaven's on Earth (zoom meeting)
7 Feb Prof. David Southwood JUICE
7 Mar Mary McIntyre Shadows in Space & the stories they tell
4 Apr Chris Starr Heavy Metal World
2 May Dr Paul A Daniels The Mega-constellation threat
6 Jun Andrew Lound Venus, Paradise Lost

Paul Money FRAS FBIS.

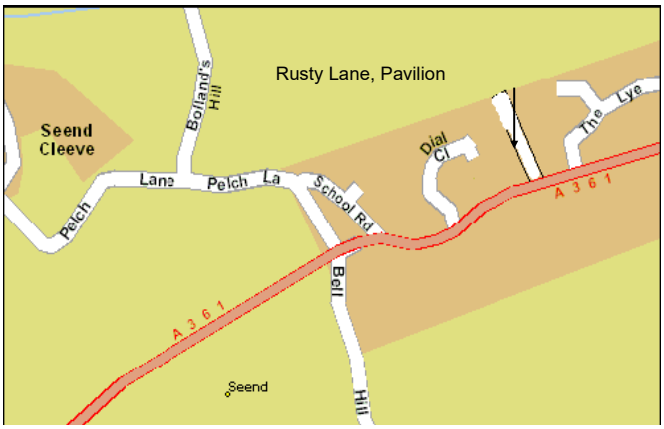
He is well known for his extensive talks and is the reviews editor of the BBC Sky at Night magazine. He broadcasts occasionally on BBC Radio Lincolnshire and Lincoln City Radio. He was awarded the 'Eric Zucker' award for 2002/2003 for contributions to Astronomy by the Federation of Astronomical Societies. 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.

Membership Meeting nights £1.00 for members £3 for visitors

Members can renew or new members sign up online via https://wasnet.org.uk/membership/ and also remind them they can pay in cash too on the door.

Wiltshire AS Contacts

Andy Burns Chair, anglesburns@hotmail.com
Andy Burns Outreach and newsletter editor.
Bob Johnston, Sam Franklin (Treasurer)
Rebecca Rowan (Hall coordinator)
??? (Teas and Projector)
Peter Chappell (Speaker secretary) Retiring
Nick Howes (Technical Guru)
Observing Sessions coordinators: Chris Brooks, Jon Gale,
Web coordinator: Sam Franklin
Contact via the web site details.

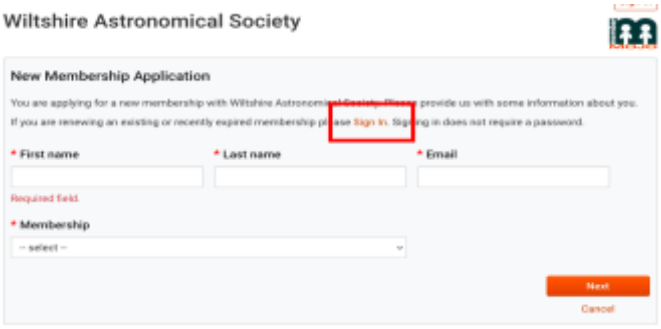


Observing Sessions see back page

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.



Swindon Stargazers

Swindon's own astronomy group

Physical meetings continuing!

Following the relaxation of the Covid rules we are continuing physical meetings.

Friday, 21 October 19.30 onwards

Programme: Mark Radice - Deep Sky Observing

Mark Radice

Mark has been associated with the club since its beginnings and is also a key member of the Salisbury Plain Observing Group (SPOG).

His main interests are in planetary photography and the deep sky.

He has recently been observing rare star clusters in the Andromeda Galaxy (M31).

His exploits are often filmed and published on his YouTube channel ' Refreshing Views'.

Ad-hoc viewing sessions
Regular stargazing evenings are organised near Swindon. The club runs a WhatsApp group to notify members in advance of viewing sessions, usually at short notice. Anyone can call a meeting. To join these events please visit our website on the link below.

Membership of Swindon Stargazers is required for insurance purposes (PLI)

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

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

Friday, 21 October 19.30 onwards

Programme: Mark Radice - Deep Sky Observing

Friday, 18 November 19.30 onwards

Programme: Richard Fleet - The Winchcombe Meteorite

Friday, 9 December 19.30 onwards

Programme: Christmas Social

Website:

http://www.swindonstargazers.com

Chairman: Robin Wilkey

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Address: 61 Northern Road
Swindon, SN2 1PD

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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 No hall meetings.

STAR QUEST ASTRONOMY CLUB

This young astronomy club meets at the
Sutton Veny Village Hall.
Second Thursday of the Month.
Meet at Sutton Veny near Warminster.

BATH ASTRONOMERS

FEDERATION OF ASTRONOMICAL SOCIETIES

FAS CONVENTION: Women in Astronomy
Saturday 12th November 2022

Following our convention at the National Space Centre, and our online events, here is a chance to get together in-person with other astronomy enthusiasts.

We are delighted to announce our Keynote Speaker:
Dame Jocelyn Bell Burnell
Discoverer of Pulsars in the 1960s. She is founder of the Bell Burnell Graduate Scholarship Fund.

Lectures:
Jocelyn Bell Burnell:
Professor of Astrophysics
"Discovering Pulsars" and "The Bell Burnell Graduate Scholarship Fund"
Grace Burthom
A secondary school student
"A Young Person's Guide to the Universe"
Mary McIntyre
Amateur Astronomer and Astrophotographer:
"A History of Women in Astronomy — Part 1"
Becky Smethurst
Astrophysicist, Science Communicator and Author:
"A History of Women in Astronomy — Part 2"

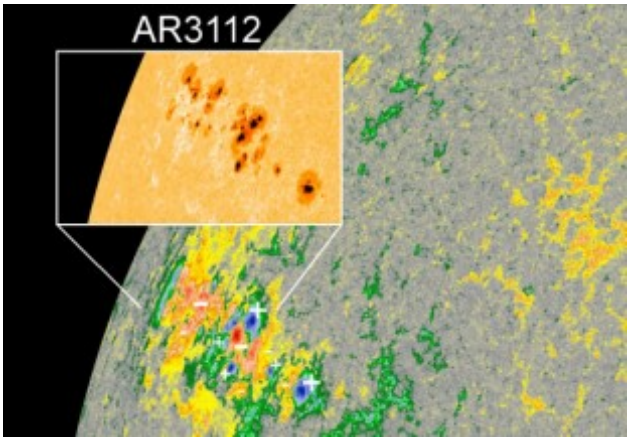
Venue: the Martin Wood Lecture Theatre, Clarendon Laboratory,
Parks Road, Oxford OX1 3PU.

Doors open to attendees at 9:15am, with the programme running from 10am to 5pm.
During the lunch break there will be time to visit the Museum of the History of Science or the Natural History Museum.

SPACE NEWS TO OCTOBER 22

A BIG DANGEROUS SUNSPOT:

One of the biggest sunspots in years has just rotated over the sun's northeastern limb. Introducing, AR3112:



AR3112 has more than a dozen dark cores scattered across 130,000 km of solar terrain, making it an easy target for backyard solar telescopes. Don't have a solar filter? Use the projection method, instead.

The image above is a magnetic map of the sun's surface with a white light photo of AR3112 inset. It shows what makes this sunspot group so dangerous. Positive and negative magnetic polarities are bumping together--an explosive mixture that could produce an X-class solar flare.

The emergence of AR3112 already fully formed and unstable could herald two weeks of high solar activity as the sunspot group transits the solar disk, facing Earth the whole time. Stay tuned.

India loses contact with Mars orbiter: reports

By Robert Lea

An illustration of the Mars Orbiter Mission in orbit around Mars. (Image credit: NASA/ISRO/Robert Lea)

India's Mars Orbiter Mission (MOM) may have finally reached the end of its operations after eight years spent orbiting the Red Planet.

Ground stations operated by the Indian Space Research Organisation (ISRO) have lost communication with the spacecraft. The precise cause isn't yet clear; the orbiter may have run out of propellant, MOM's battery may drained beyond the safe operating limit, or an automated maneuver may have cut communications, according to media reports.

Having operated at Mars for eight years, MOM — also called Mangalyaan — has far exceeded its expected mission life of just six to 10 months. The craft was launched in November 2013 and entered orbit around Mars in September 2014.**AY SOUND**

Although ISRO has not yet released an official statement, a source with the agency told local newspaper The Hindu that "the satellite battery" has drained and "the link has been lost" with MOM.

MOM carries a 4.6 x 6-foot (1.4 x 1.8-meter) solar array wing consisting of three panels mounted on one side of the spacecraft. The array can generate 800 watts power at Mars and charges a lithium-ion battery, but the spacecraft has recently encountered a series of eclipses that could have impacted its ability to recharge.

"Recently there were back-to-back eclipses including one that lasted seven-and-half hours," an unnamed ISRO source told The Hindu.

"As the satellite battery is designed to handle eclipse duration of only about one hour and 40 minutes, a longer eclipse would drain the battery beyond the safe limit," another unnamed official told the paper.

MOM had come out of a long eclipse in April, but as it recovered, the spacecraft may have exhausted its remaining fuel. Upon launch, MOM carried around 1,880 pounds (852 kilograms) of fuel to power its main thruster and eight smaller thrusters used for altitude control.

There's also a chance that the communications breakdown could be a result of MOM's automated system bringing it out of another eclipse, according to an unnamed official's comments in the Times of India. The system may have had the orbiter perform a roll-spin to change direction, resulting in MOM's Earth-facing antenna pointing away from our planet and the spacecraft falling silent.

MOM had previously survived blackouts during its first and second years around Mars, recovering completely autonomously without assistance from the ground. Initial indications suggest that this new blackout is permanent, however, and multiple sources told the Times of India that whatever the cause, the spacecraft won't be able to recover.

"Now, we are trying to ascertain the exact reason — whether it is the exhaustion of fuel or antenna being unable to communicate," an unnamed senior scientist told the Times of India. "But one thing is for certain, we won't be able to recover the spacecraft anymore."

MOM was India's first interplanetary mission and made the ISRO only the fourth space agency to achieve an orbit around the Red Planet. The spacecraft arrived at Mars just in time for it to catch the passage of Comet Siding Spring on Oct. 19, 2014.

The mission's primary goal was to test the technology needed for interplanetary exploration and to use its instruments to study both the Martian surface and atmosphere from orbit.

The instruments on board included a color camera, a thermal infrared sensor, an ultraviolet spectrometer used to study deuterium and hydrogen in Mars's upper atmosphere, and a mass spectrometer to study neutral particles in the outermost layers of the Martian atmosphere.

MOM also carried a sensor designed to search for methane, a molecule that, if present, could imply that life had once existed on the Red Planet. ISRO has not yet revealed that instrument's findings.

Major solar flare disrupts Hurricane Ian disaster response

By Tereza Pultarova

published about 20 hours ago

And there may be more to come because a large active sunspot

has just come into Earth's view.**PLAY SOUND**

Emergency responders dealing with the tragic aftermath of Hurricane Ian in Florida and the Carolinas may have suffered extra setbacks on Sunday (Oct. 2) as a major solar flare disrupted radio communications.

The solar flare, a powerful X1 (the mildest form of the strongest category of flares) erupted from the sun on Sunday at 3:53 p.m.

EDT (1953 GMT) and peaked about 30 minutes later. Since solar flares travel at the speed of light, the burst of electromagnetic radiation caused an immediate radio blackout up to an hour long on the sun-facing side of the planet. The affected region included the whole of the U.S., according to the SpaceWeatherWatch(opens in new tab).

The radio blackout, classed by the U.S. National Oceanic and Atmospheric Administration (NOAA) as a strong R3 category, likely affected rescue workers using 25 MHz radios to communicate in areas where the rampage of Hurricane Ian knocked down cell phone networks. The disruption in the upper layers of Earth's atmosphere caused by the flare may also have made GPS positioning unavailable or less accurate, space weather physicist Tamitha Skov said on Twitter(opens in new tab).

Both flares originated from sunspot (a darkened area of intense magnetic activity on the sun's surface) called AR3110 in the northwestern part of the sun's visible disk and each was accompanied by a coronal mass ejection (CME), which is a burst of magnetized particles from the sun's upper atmosphere, the corona. The two plasma clouds may now be heading to Earth, following a couple of earlier CMEs that exploded from the sun on Saturday (Oct. 1).

Simultaneously, a stronger-than-usual solar wind, a stream of charged particles constantly emanating from the sun, is currently blowing toward our planet from a coronal hole (an opening in the magnetic field of the sun). The combination means that the CMEs may trigger a noticeable geomagnetic storm on Earth in the coming days. NOAA predicts(opens in new tab) that a moderate (G2) geomagnetic storm might hit the planet on Tuesday (Oct. 4), possibly causing minor power grid issues at high latitudes and affecting satellites in low Earth orbit.

Space weather forecasters expect more flares and CMEs in the coming days. A new, large and "complex" sunspot, AR3112, has emerged in the northeast and will traverse the sun's visible disk during the next two weeks, according to the U.K. space weather forecaster Met Office. According to SpaceWeather.com(opens in new tab), AR3112 is "one of the biggest sunspots in years," stretching across 80,000 miles (130,000 kilometers). The Met Office said that AR3112 has a potential to become more active, which means a likelihood of more flares and CMEs.

"Solar activity is forecast to be moderate to high, with flares likely from the large region in the northeast and the region in the northwest," the Met Office said in a statement(opens in new tab).

For aurora chasers, the geomagnetic storms mean a good chance of spotting polar lights away from their usual confines around the poles. The displays might be visible as far south as the north of Scotland in the U.K. and the northern U.S.

SpaceX still on track to launch Crew-5 astronaut mission for NASA Wednesday

By Mike Wall

published about 9 hours ago

But three minor issues must be resolved first.

The SpaceX Falcon 9 rocket and Dragon capsule that will fly the Crew-5 mission for NASA stand on the launch pad at Kennedy Space Center ahead of a planned Oct. 5, 2022 launch. (Image credit: SpaceX via Twitter)

SpaceX's Crew-5 astronaut mission is still on target to launch Wednesday (Oct. 5), though there are a few caveats.

NASA and SpaceX teams held a launch readiness review (LRR) today for Crew-5, which is scheduled to lift off from Pad 39A at Florida's Kennedy Space Center (KSC) on Wednesday at noon EDT (1600 GMT).

That remains the plan, for today's review identified no serious issues with Crew-5's Falcon 9 rocket, Dragon capsule or any other aspect of the mission. Teams are still working on three open issues, but both SpaceX and NASA expressed confidence that all of them will be cleared up relatively quickly.

"We had a good LRR," Steve Stich, manager of NASA's Commercial Crew Program, said during a press conference this evening. "We are proceeding toward launch on

One of the open issues involves a thrust vector control actuator for one of the nine Merlin engines that power the Falcon 9's first stage. The actuator, which helps control the direction of the engine's thrust, behaved abnormally during a static fire engine test that SpaceX performed over the weekend, Stich and others said during this evening's briefing.

The second issue is a communications problem that affects the station-keeping ability of Just Read the Instructions, the autonomous SpaceX droneship on which the Falcon 9's first stage will land shortly after Crew-5's liftoff. The third issue is a leak with the Dragon capsule's portable fire extinguisher.

Teams are troubleshooting all three of these problems and are optimistic they'll be in the rear-view mirror soon.

"I don't see any showstoppers here," Benji Reed, senior director of human spaceflight programs at SpaceX, said in the briefing.

SpaceX plans to replace the misbehaving actuator on the Falcon 9 tonight, Reed said, stressing that the company has done such work before. Teams are trying to resolve the droneship communications issue remotely at the moment, he added, though SpaceX may end up sending people aboard the vehicle as early as Tuesday (Oct. 4) to work on it if need be.

The fire extinguisher leak, meanwhile, will be addressed by replacing a variety of components, followed by testing to see if the fix held.

"We actually expect we will have all of that done by tomorrow morning — again, well in advance of Crew-5 [liftoff]," Reed said of the fire extinguisher work.**PLAY SOUND**

NASA and SpaceX identified two minor issues during the Crew-5 flight readiness review, which was held last Monday (Sept. 26).

One involved bonds on a portion of the Dragon's perimeter, and the other concerned potentially non-standard welds in composite overwrapped pressure vessels (COPVs), bottle-like structures that are part of the Falcon 9's propulsion sys-

tem.

Team members said at the time that they expected to clear both of those issues after further vetting and analysis. And that apparently came to pass, for neither problem was mentioned during tonight's post-LRR briefing.

Crew-5 will send four astronauts — NASA's Nicole Mann and Josh Cassada, Japanese spaceflyer Koichi Wakata and cosmonaut Anna Kikina — to the International Space Station for a roughly five-month stay. As its name suggests, the mission is the fifth contracted crewed flight to the orbiting lab that SpaceX will fly for NASA.
Crew-5 will make history in multiple ways. Mann will become the first Native American woman to reach space, for example, and Kikina will become the first Russian to fly with SpaceX. Crew-5 was supposed get off the ground today, but Hurricane Ian pushed the liftoff back by two days.

The storm had a much more significant effect on the timeline for NASA's highly anticipated Artemis 1 moon mission. NASA had been aiming to launch the uncrewed Artemis 1 on Sept. 27, but Ian forced the team to roll the huge rocket off KSC's Pad 39B and back to the facility's Vehicle Assembly Building.

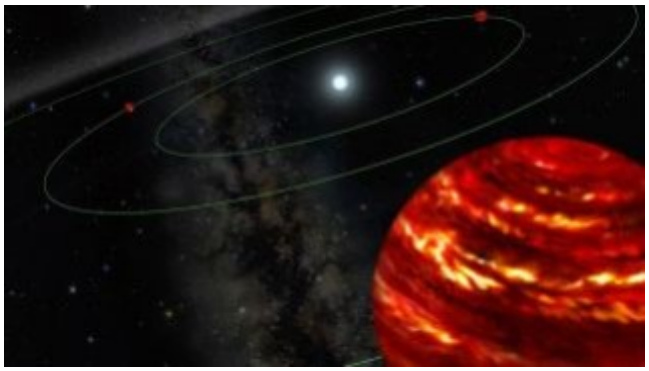
NASA is now targeting Nov. 12 to Nov. 27 for the Artemis 1 liftoff. (Crew-5's Falcon 9 and Dragon didn't need to flee the pad to wait out Ian; they didn't roll out to Pad 39A until Saturday, Oct. 1.)

Scientists need your help to confirm Jupiter-like exoplanets

By Stefanie Waldek

published 1 day ago

Here's your chance to help identify "exo-Jupiters."



An artist's rendering of the multiplanet system TOI 1812. (Image credit: Gemini Observatory. Artwork by Lynette Cook.)

If you've ever dreamed of discovering a new planet, now is your chance.

Telescope manufacturer Unistellar and the SETI Institute have launched the Unistellar Exoplanet Campaign, a citizen science program in which amateur astronomers can help confirm exoplanet candidates spotted by NASA's Transiting Exoplanet Survey Satellite (TESS).

TESS uses the so-called transit method to spot potential exoplanets: It monitors the brightness of stars, and if a star dims temporarily, it's possibly due to an exoplanet passing in front of it — a movement called a transit. To date, nearly 4,000 exoplanets have been discovered using this method.**P**

Because stars might dim for a number of reasons — including the transits of other celestial bodies, such as low-mass stars — follow-up observations are necessary to confirm the existence of an exoplanet. That's where citizen scientists come in.

According to some estimates, TESS has the potential to discover some 10,000 new exoplanets, each of which would require additional observations for confirmation. For the new program, amateur astronomers will use ground-based telescopes to observe targets identified by TESS as exoplanet candidates, thereby contributing to the data pool that will help determine whether the target is indeed an exoplanet. This particular campaign will focus on "exo-Jupiters," or alien worlds with similar characteristics to the gas giant.

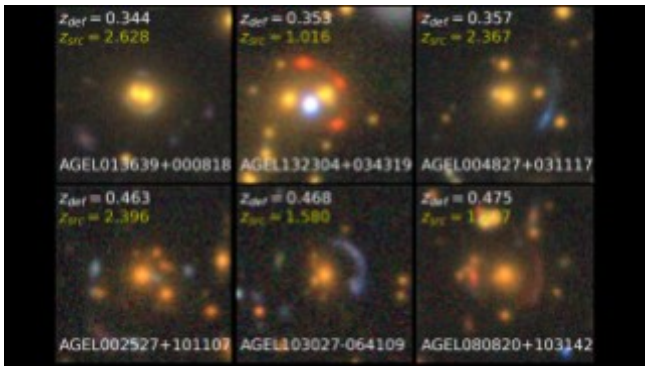
Citizen scientists have already proved helpful in identifying exoplanets. For example, in the case of TOI 1812 — a three-planet system 563 light-years from Earth — 27 data sets contributed by 20 astronomers in seven countries were crucial to determining the orbital period of one of its planets, SETI Institute representatives said in a statement. That information was presented Sept. 20 at the International Astronautical Congress in Paris and is currently being prepared for publication.

"This early success shows the power of putting science directly into people's hands — a core principle of this SETI Institute, Unistellar, and NASA partnership," Tom Esposito, a research assistant at the SETI Institute and space science principal at Unistellar, said in the statement. "Citizen astronomers worldwide uniting to teach humanity about new planets discovered so many trillions of miles away is, simply put, amazing."

Advanced AI discovers a treasure trove of gravitational lenses

By Keith Cooper

published 4 days ago



This image shows a selection of the gravitational lenses identified in DECam images by a machine-learning algorithm. The lenses are faint and appear as arcs of light around a lensing object. (Image credit: AGEL Survey)

Advanced artificial intelligence has identified thousands of possible "gravitational lenses" — warps in space-time predicted by Albert Einstein — promising to enhance our understanding of dark matter and the evolution of galaxies.

Einstein realized that mass warps space, and massive galaxies and galaxy clusters can distort space around them to such a degree that they form a cosmic lens, bending and magnifying the path of light from more distant galaxies through that warped space.

Gravitational lenses are important tools for cosmologists. They can magnify the light of distant galaxies that are too faint to be otherwise seen in detail, or reveal where invisible dark matter is warping space. However, astronomers had only about a hundred good gravitational lenses to use.

Now, a team led by Kim-Vy Tran, an astronomer at ASTRO 3D (the ARC Centre of Excellence for All Sky Astrophysics in 3 Dimensions) and the University of New South Wales in Australia, employed a machine-learning algorithm called a

convolutional neural network to search for gravitational lenses in images taken by the Dark Energy Camera (DECam) on the Victor M. Blanco 4-meter telescope at the Cerro Tololo Inter-American Observatory in Chile.

The algorithm, developed by Colin Jacobs of the Swinburne University of Technology in Australia, sifted through tens of millions of galaxy images to select a sample of 5,000 candidate gravitational lenses that are not immediately obvious to the human eye. 'These lenses are very small, so if you have fuzzy images, you're not going to really be able to detect them," Tran said in a statement(opens in new tab).
Tran and her team used the telescopes at the W. M. Keck Observatory in Hawaii and the Very Large Telescope in Chile to follow up on 77 of the 5,000 candidate lenses. They found 68 of these lenses to be real, and spectroscopically confirmed the redshifts of both the lens and the object being lensed for 53 of them. The lenses are typically at higher redshifts than most previously known lenses, meaning that astronomers can see deeper into the universe with them.

The algorithm's 88% success rate in finding new lenses means there are now potentially thousands of new lenses for astronomers to choose from, though Tran said the team's aim was more modest.
"Our goal … is to spectroscopically confirm around 100 strong gravitational lenses that can be observed from both the Northern and Southern hemispheres throughout the year," she said.

The average redshift of the lenses is 0.58, which corresponds to a distance of about 5 billion light-years, whereas the faraway objects that are being magnified by the lenses are typically at redshifts of about 1.92, meaning their light set out about 10 billion years ago.

"With these lenses at different distances, we can look at different points in the cosmic timeline to track how things change over time, between the very first galaxies and now," Tran said.

"Normally these galaxies look like small, fuzzy blobs, but the lensing magnification allows us to see their structure with much better resolution," Tucker Jones, an associate professor in the Department of Physics and Astronomy at the University of California, Davis, and a member of the research team, said in the statement.

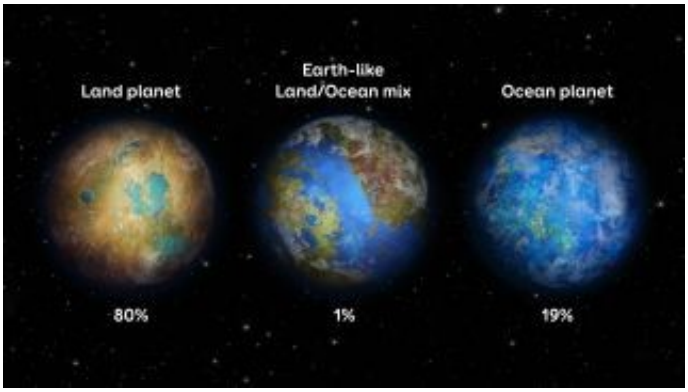
The lenses therefore provide promising targets for follow-up with observatories such as the Hubble Space Telescope and the James Webb Space Telescope.

The research was published Sept. 26 in The Astronomical Journal.

'Pale blue dot' planets like Earth may make up only 1% of potentially habitable worlds

By Keith Cooper

We may need to look for "pale yellow dots" instead.



An artist's impression of three kinds of habitable planets: a planet with mostly land; a planet with a good mix of land and sea, like Earth; and an ocean planet with barely any land. (Image credit: Europlanet 2024 RI/T. Roger.)

Earth-like worlds with similar land-to-ocean ratios to our planet's may be exceedingly rare.

According to a new study, Earth-like planets with about 30% of their surface covered by exposed continental land may make up only 1% of rocky worlds in stars' habitable zones, the areas around stars where liquid water can exist on a planet's surface. Instead, roughly 80% of potentially habitable worlds are completely dominated by land, and about 20% are purely ocean worlds, the study found.

The researchers came to this conclusion by modeling the relationship between water in a planet's mantle and a planet's recycling of continental land via plate tectonics.

"We Earthlings enjoy the balance between land areas and oceans on our home planet," Tilman Spohn, executive director of the International Space Science Institute in Switzerland and a member of the research team, said in a statement (opens in new tab). "It is tempting to assume that a second Earth would be just like ours, but our modeling results suggest that this is not likely to be the case."

The results indicate that Earth's ratio of land to sea (1:3) is finely balanced and that for most planets, this ratio can easily tip over into mostly land or mostly sea. Spohn and his collaborator, Dennis Höning, a postdoctoral researcher at the Potsdam Institute for Climate Impact Research in Germany, concluded that the most likely time for this tipping point to occur is when a planet's interior has cooled close to the temperature of Earth's mantle, which is 2,570 degrees Fahrenheit (1,410 degrees Celsius) near the crust and as hot as 6,700 F (3,700 C) at greater depths. How well subduction zones at the boundaries between tectonic plates can cycle water over land at this mantle temperature dictates whether a planet will be dominated by land or ocean.

Earth reached these conditions about 2.5 billion years ago, at the end of the Archean, and our planet found the delicate balance we live in today. However, over billions of years, even Earth's fine balance is unstable, although we don't notice it because the rates of change are small, Spohn said. Other planets could have reached this tipping point much sooner.

"In the engine of Earth's plate tectonics, internal heat drives geologic activity, such as earthquakes, volcanoes and mountain building, and results in the growth of continents," Spohn said. On the other hand, "The land's erosion is part of a series of cycles that exchange water between the atmosphere and the interior. Our numerical models of how these cycles interact show that present-day Earth may be an exceptional planet."

Spohn and Höning also considered other factors, such as how the outgassing of carbon dioxide (a greenhouse gas) contributes to the carbon-silicate cycle that acts as a planet's long-term thermostat controlling the climate over millions of years. They found that, while both land- and ocean-dominated planets could still be habitable, with similar temperatures if all else were equal, their life-forms and climates might not be quite unlike Earth's.

"Their fauna and flora may be quite different," Spohn said. The models indicated that ocean-dominated planets with less than 10% land would likely be warm, with moist atmospheres and tropical climates, whereas land-dominated worlds with less than 30% of their surfaces covered in ocean would be colder, drier and harsher than their ocean-dominated counterparts. On these land-dominated planets, cold deserts would stretch across the landmasses, and vast glaciers and ice sheets would be common.
Spohn and Höning's results differ slightly from those of other

research teams, however. For example, a study by Evelyn MacDonald of the University of Toronto found that for tidally locked worlds, the more land there is, the greater the average surface temperatures in general, Space.com previously reported. And perhaps the most famous study of land planets, led by Yutaka Abe of the University of Tokyo in 2011, found that land planets can remain habitable across much wider distances from their star than water worlds can and that they don't freeze over as fast because there is less water for ice and snow. However, Abe's study, along with others, agrees with Spohn and Höning's conclusion that land-dominated planets would be far more common than Earth-like or water-rich planets.

Consequently, instead of looking for Carl Sagan's quintessential "pale blue dot," astronomers should be searching habitable zones for "pale yellow dots."

The results were presented at the European Science Congress, which took place in Granada, Spain, from Sept. 18 to 23, and the findings are described in the team's conference abstract.

Contact with ET: How would humanity react?

By Leonard David

published 7 days ago

It's unclear what the effects would be.

The Allen Telescope Array in Northern California is dedicated to astronomical observations and a simultaneous search for extraterrestrial intelligence (SETI). (Image credit: Seth Shostak/SETI Institute)

The announcement that we have discovered alien life, if indeed it ever comes, would be one of the biggest moments in human history. And the ripple effects would be huge as well.

Unidentified flying object (UFO) organizations and specialists have been calling for "full disclosure" that alien contact has already occurred and could even be underway now, given highly publicized recent reports of UFOs — or unidentified aerial phenomena (UAP), as they've been rebranded — spotted by U.S. military pilots.

Meanwhile, powerful observatories like NASA's new James Webb Space Telescope are giving us highly detailed looks at the universe. Eventually, such data could tell us that Earth is not the only inhabited planet — perhaps, even, that life is common throughout the cosmos.

That knowledge would likely have far-reaching effects on our view of ourselves and our place in the universe. Researchers are looking into the potential psychological impacts of such an announcement, which some people might have a hard time accepting.**LAY SOUND**

Wanted: pertinent technical info

Carol Cleland is a professor in the Department of Philosophy at the University of Colorado, Boulder. She is also director of the university's Center for the Study of Origins and a SETI (Search for Extraterrestrial Intelligence) Institute affiliate.

Cleland thinks it is very premature to say that Earthlings have had contact with E.T., especially since we don't have the unredacted technical information about the behavior of UAPs supposedly buzzing about in our airspace.

"All we have are some subjective summaries that have been sensationalized," Cleland said. "Harvard's Galileo Project is a secular attempt to acquire the pertinent technical information to address this question scientifically."**PLAY SOUND**

Immediate future

Heading that Galileo Project initiative is astrophysicist Avi Loeb of Harvard University.

Loeb said that previous protocols for possible contact with extraterrestrial intelligence were mostly inspired by the possibility of detecting radio signals from planetary systems around distant stars.

"Given that the nearest star system, Alpha Centauri, is 4.4 light-years away, such signals would require a decade or more for a round trip conversation. As a result, they do not bear consequences to our immediate future," he told Space.com.

But a different type of contact could deliver a prompt impact, Loeb said. "It concerns physical objects from another civilization that are already within the solar system. The arriving hardware need not be brainless but could possess artificial intelligence (AI) — seeking information about the habitable region around the sun, our backyard."**PLAY SOUND**

Contact protocol

The stated goal of the Galileo Project is to bring the hunt for possible signatures of alien technological civilizations from "accidental or anecdotal observations and legends" to the mainstream of "transparent, validated and systematic scientific research," according to its website(opens in new tab).

As part of that work, the Galileo Project aims to identify the nature of UAP.

The Galileo Project is designing and employing high-tech gear in a search for possible extraterrestrial equipment near Earth. An encounter with such objects would enable instant contact without a significant delay in communication time, Loeb said.

"The potential for an immediate engagement changes the response protocol relative to a delayed radio signal, just as it does for an in-person meeting compared to a letter which is delayed by surface mail," he said.

Loeb pointed out that there is no current international agreement on how humanity should engage with a visiting object of extraterrestrial origin. It would be prudent to formulate such guidelines before they are needed, he added. **PLAY SOUND**

Decision tree

"Any engagement could have implications for the future of humanity and should not be left to the spontaneous whims of a small team of researchers," Loeb said. "Since this is an international matter, the United Nations has the responsibility for formulating the contact protocol."

The safest course of action would be to use passive instrumentation to collect as much data as possible about any objects of interest, Loeb advised. This would include monitoring their response to unrelated human activities.

"Given this information, we should weigh the risks and benefits that will result from different engagements," he said. "The

decision tree on how to proceed will have branches that depend on the objects' properties and behavior. Since it is difficult to forecast these unknowns in advance, decisions will have to be reached in real time."

Cultural boundaries

"What do we know about alien life today? Nothing," said Linda Billings, a consultant to NASA's Astrobiology Program and Planetary Defense Coordination Office.

"Some scientists believe that single-celled life must exist, or must have existed, somewhere else in our solar system," Billings said.

"Some believe that life must have evolved elsewhere in the universe. Some believe life must be common throughout the universe," she added. "Some believe intelligent life must have evolved elsewhere. Some believe in, hope for, a universe teeming with intelligent life. Believe is the correct word here, not knowing."

Public opinion research provides at best a faint indicator of what everybody else thinks, believes and hopes for with regard to extraterrestrial intelligent (ETI) life, Billings said, and barely begins to probe differences in thinking and belief across cultural boundaries.

"Our thinking about ETI to date has been largely anthropocentric, ethnocentric, Western-centric," she said.**P**

Pile of assumptions

Billings said that SETI currently rests on a pile of assumptions, most notably that extraterrestrial life will have evolved the same way that life has evolved here on Earth. Also, it generally assumes that "advanced" alien life will have developed intelligence similar to human intelligence.

In addition, Billings continued, SETI scientists assume that intelligent extraterrestrial beings will have developed the same kinds of technologies that humans have, and that these beings will be as curious about the possibility of intelligent life beyond their star system as we are.

"These are assumptions, not facts," said Billings.

"As to the consequences of human contact with extraterrestrial intelligence — and, again, the assumption here is that humans would be able to recognize and communicate with it — I am not at all convinced that such an event would be world-changing," she said. "It's a common claim, with no evidence to back it up. In addition, it's not possible to predict how, when and where contact might be made … The cultural conditions under which such an event might occur are, and will remain, unknown."

Code cracking

Loeb sees things differently.

First of all, in order to avoid catastrophic misinterpretations as in the "Trojan Horse" story from ancient Greek mythology, Loeb said that data must be analyzed carefully within the broadest possible mindset.

Deciphering the intent of intelligent extraterrestrial equipment may resemble the challenge of breaking the code of an encryption device, Loeb said, pointing to the film "Arrival" as an example. In that 2016 sci-fi drama, a linguist works with the U.S. military to communicate with alien lifeforms.

What would be required is a team of linguists and computer scientists, doing work resembling that led by Alan Turing in breaking the Nazis' Enigma code during World War II, said Loeb.

"We might need to rely on our AI systems in figuring out the intent of extraterrestrial AI systems," Loeb said.

Out of Africa, out of Earth?

A proper interpretation of prompt contact with extraterrestrial technologies, Loeb said, could bring about "the most significant advance in our understanding of the reality around us in the entire history of humans."

What is more, Loeb senses, this new understanding could have major consequences for our future aspirations in space.

"Our historic migration out of Africa started about 100,000 years ago," said Loeb, "but our future migration out of Earth may be triggered by a dialogue with a messenger from afar that does not resemble anything we had seen before."

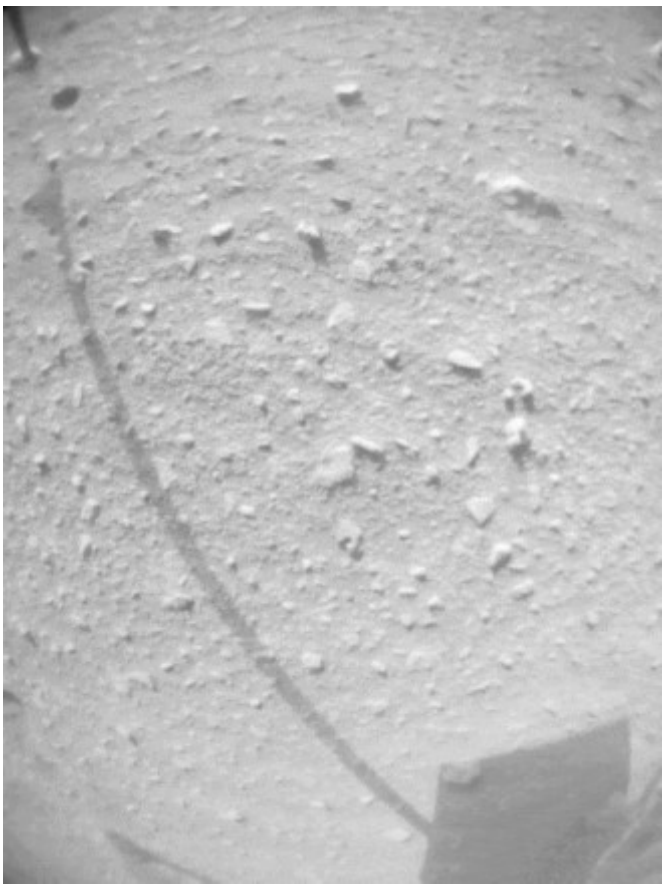
Editor's note: *This story was updated at 7:45 p.m. EDT on Sept. 27 to clarify Carol Cleland's affiliation. She — not the University of Colorado, Boulder's Center for the Study of Origins — is a SETI Institute affiliate.*

Leonard David is author of the book "Moon Rush: The New Space Race," published by National Geographic in May 2019. A longtime writer for Space.com, David has been reporting on the space industry for more than five decades. Follow us on Twitter @Spacedotcom(opens in new tab) *or on Facebook* (opens in new tab).

Join our Space Forums to keep talking space on the latest missions, night sky and more! And if you have a news tip, correction or comment, let us know at: community@space.com.

A Small Piece of “Foreign Object Debris” Fell off Ingenuity’s Leg During its 33rd Flight

We hope this is just as inconsequential as having a piece of toilet paper stuck to your shoe, but images from the Ingenuity helicopter show it had a piece of debris fluttering from its leg during its most recent flight. A blog post from NASA said a small piece of foreign object debris (FOD) was seen in footage from the Mars helicopter’s navigation camera (Navcam) for a portion of its 33rd flight on September 24, 2022.



A small piece of foreign object debris (FOD) is seen in footage from the navigation camera of NASA's Ingenuity Mars Helicopter during its 33rd flight on Mars on Sept 24, 2022. The FOD is seen attached to one of the rotorcraft's landing legs, then drifting away. Credits: NASA/JPL-Caltech.

This piece of debris was not visible in Navcam footage from the previous flight, number 32. The FOD can be seen during Flight 33 Navcam from most of the earliest frames to approximately halfway through the video, when it fell from the leg and drifted back to the Mars surface.

The Ingenuity team wrote that "all telemetry from the flight and a post-flight search and transfer are nominal and show no indication of vehicle damage. The Ingenuity and Perseverance Mars 2020 teams are working to discern the source of the debris."

A picture of the Ingenuity helicopter on the surface of Mars, taken by the Perseverance rover. Credit: NASA/JPL/Caltech

Mostly Likely Explanation

The most likely explanation is that the piece of fabric is something left over from Perseverance's parachute, or descent stage or even the backshell, which all worked in tandem to bring the rover and helicopter safely to the surface of Mars back in February of 2021. In July of this year, the rover found a weird string-like piece of debris, which also was likely from the landing system. Ingenuity snapped some amazing pictures of the backshell and parachute in April 2022.

This image of the Perseverance rover's parachute and backshell was taken by the Ingenuity helicopter during its 26th flight on April 22, 2022. Credit: NASA/JPL/Caltech

During Ingenuity's 33rd flight, the rotocraft was in in the air for just under a minute, reaching an altitude of 10 meters (33 feet) and traveled about 111 meters (365 feet).

Ingenuity's stats:

Ingenuity stands about a half a meter (1.6 feet) tall and weighs about 1.8 kilograms (4 lbs) on Earth, and about 0.68 kilograms (1.5 lbs) on Mars. It's rotor system is made from four specially made carbon fiber blades arranged into two 1.2 -meter (4-foot)-long counter-rotating rotors that spin at roughly 2,400 rpm. Ingenuity has two cameras and is powered by a solar array on top of the rotor system that charges six lithium-ion batteries. Originally, the team was hoping for about 5 flights from the tiny helicopter, but now its up to 33 and still going strong … and hopefully only just a little embarrassed about that white stuff hanging from its leg.

China's Zhurong Rover Looks Deep Underground and Sees Layers From Multiple Floods on Mars

Mars exploration has been ongoing for decades at this point, and some regions of the planet have become more interesting than others. Of particular interest is a basin known as Utopia Planitia. It was the site of the Viking-2 landing, one of the first-ever successful missions to Mars. From data collected during that mission, scientists developed a theory that the crater that formed Utopia might have been the site of an ancient ocean. New results from China's Zhurong rover point to an even more exciting past – repeated flooding.

Zhurong has been exploring the red planet for a little over a year and has primarily been moving around Utopia Planitia. One of its instruments, a ground penetrating radar, is providing the world with the first data on the subsurface structure of Utopia since Viking-2 was shut down in 1980.

The picture that radar is painting is an interesting one. It appears that there are several layers beneath the surface of Utopia Planitia. The regolith, which is most commonly thought of as Martian dirt, only extends to about 10 meters below the surface.

UT discusses the China vs NASA Mars race.

Below that is where things get interesting – a paper just published in Nature by researchers at the Chinese Academy of Sciences points to several different sub-layers beneath the regolith. They also point to a potential cause – flooding.

That's not to say that there is any active flooding going on. In fact, Zhurong found no evidence of liquid water anywhere

within the basin's top 80 meters of material. However, the layered structure the rover noticed could easily have been caused by repeated flooding events.

The research team thought those events might have occurred in the Late Hesperian or Amazonian period, which followed the Late Heavy Bombardment that formed many of Mars' modern craters, and ended about 3 billion years ago. Back then, liquid water was thought to be extant on Mars' surface, though it also signaled the beginning of the end of that liquid water on the surface.

An image from China's Zhurong rover shows spacecraft hardware in the foreground and Martian terrain in the background.
Credit: CNSA

Some of that liquid water might have ended up sloshing around in Utopia Planitia, though. And the best way to detect it would be to find layers such as those found by Zhurong. Though the CAS research team quickly points out that there could be other possible explanations and invites public comment on their work.

If assisted by Occam's razor, that work points to a pattern of flooding in the Utopia basin billions of years ago. But new evidence could always overturn those assumptions. If the recent history of Mars exploration is any indication, Zhurong will sure not be the last visitor to this particularly interesting basin.

Should Low Earth Orbit be a protected environmental ecosystem?

An article published in Nature Astronomy makes a strong case to declare the orbital space around earth an ecologically protected environment. It was part of a submission to the US Court of Appeals in August last year and was filed by several organisations in response to license amendments granted by the FAA to SpaceX for Starlink satellites. To understand why this is so important, it may help to remember that orbital space is a "common" area, like "International Waters" in our oceans, so it is not currently protected by a single country or organization.

In 1833, William Forster Lloyd described the economic principle of "The tragedy of the commons". It states that any common area or resource that is "public" and belongs to everybody will be mercilessly exploited and ultimately depleted. We've seen this for thousands of years in the depletion of minerals and the extinction of whole species. And now, the most recent example is the rapidly growing number of artificial objects in orbit around Earth, including mega-constellations of satellites owned by companies like Starlink.

The article, titled "The case for space environmentalism," draws a stark comparison between environmental threats on the planet's surface and the unrestricted exploitation of orbital space. The threat is incremental, and comes from multiple contributors, so the question is whether orbital space should continue to be classified as a "global commons," commercially exploited and treated as "free".

NASA image of a satellite in Low Earth Orbit

But what counts as "orbital space?" Back in the 1960's, the Fédération Aéronautique Internationale (FAI) attempted to define where the atmosphere ends and space begins. They settled on an altitude of 100 kilometers above sea-level and called it the Kármán line (after Theodore Von Kármán, the engineer and physicist who first proposed it.) Although there are competing standards for where space begins, most regulatory bodies have accepted the Kármán line, or something very close to it, as an international standard.

Most space activity happens in a 36 000 km thick shell around the earth, starting at the Kármán line. This "near orbital space" is broken up into 3 distinct sections: Low Earth Orbit (LEO), Medium Earth Orbit (MEO) and Geosynchronous orbit (GSO). Low earth orbit represents altitudes between 100 km and 2000 km. This is the area where most artificial objects can be found, including active satellites and space debris. It is a busy "space highway" for communications, military, and scientific traffic. At this altitude, a full orbit takes approximately 90 – 120 minutes. There are enough large objects in this zone that anybody looking up from earth will likely see something crossing over every minute or so. Because there is still a thin wisp of atmosphere at such a low orbit, atmospheric drag limits the lifespan of any object in LEO, meaning that things break up faster. But its proximity to earth means that there is very little delay in communications. This is important to understand, because satellites can be sent higher up into MEO (20 000 km) and GSO (35 786 km) regions. At these altitudes, there is better coverage of the earth's surface, and the hardware contends with less drag, so it lasts longer and requires fewer satellites. The downside is that signal delays are inevitable at these altitudes. So newer broadband services have taken advantage of plummeting launch costs to deliver thousands of smaller satellites into LEO, where propagation delays are measured in milliseconds and signal strengths are stronger.

With so many satellites in such low, unstable orbits, we can expect a steady rain of objects falling back to earth and burning up in the atmosphere, dumping thousands of tonnes of exotic minerals and chemicals into the upper atmosphere. The long-term effects of this are yet to be discovered, but environmentalists are starting to worry.

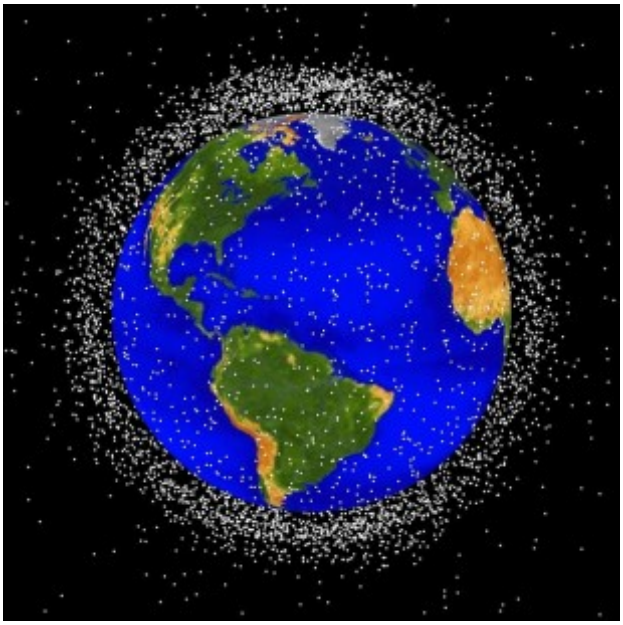


Illustration of space junk in orbit around Earth

Their main concerns cover the physical threat of space debris in our atmosphere, as well as more complex issues, such as public access to the stars in the form of amateur and professional optical astronomy. With so many constellations of satellites obscuring our view and increasing an already rampant light pollution problem, technical and observational exploration also becomes problematic. Compounding the issue is the threat to long-term scientific research including the impacts on wide-field survey instrumentation and radio astronomy.

With all these factors combined, it is not an exaggeration to say that we are making a terrible trade-off. We're trading our ability to study the universe and all its wonders for cheaper, faster communication on earth's surface, and risking physical harm to our planet.

But is this a problem we should be worrying about in our lifetime? Well, in 2008 there were only 2000 active satellites, but recent launches by various companies have more than doubled that number. If all goes to plan, the population is expected to have reached 100 000 by 2030. And although environmentalists are proposing that we urgently regulate the region and establish a "Traffic Footprint", like the Carbon Footprint, these warnings and recommendations are not being taken seriously enough.

Companies Will Have Five Years to Dispose of Their Dead Satellites

Kessler syndrome seems to be a growing fear for those interested in space exploration. The condition where numerous non-functional pieces of junk block access to orbit appears to be inching closer to reality, spurred on by weekly news reports of dozens of more satellites launching that will eventually become precisely that kind of obsolete space junk. But that won't happen if the US's Federal Communications Commission (FCC) has anything to do with it – a new rule the commission adopted will require companies to deorbit their unused satellites in less than five years after decommissioning.

By some arcane feature of the American bureaucracy, the FCC, which typically is thought of more as a regulator for cell phone wireless spectra and making sure that pacemakers aren't interrupted by welding machines, is somehow responsible for the country's satellite policies. Previously, the commission had ruled that satellites could stay in orbit for up to 25 years, and some had been grandfathered in. Some pieces of debris were still in orbit after being launched in the 1950s.

That will not stand with the dozens of new satellites being launched consistently. Superconstellations, such as Starlink's planned potential 42,000 satellites, could pose an actual threat to human access to space, especially if some of them fail, as a non-insignificant number of Starlink satellites have. Worse yet, they could suffer an "unplanned catastrophic failure" that results in myriad smaller pieces of debris strewn through the satellite's orbit.

To put a stop to such a scenario, the FCC instituted a new rule that requires all companies that launch satellites to be able to deorbit them within five years of their decommissioning. There is a two-year grace period for this rule to take effect, most likely to allow companies time to integrate the new requirements into their existing projects and not burden any imminently launchable missions. In addition, there are some possible exceptions for particular science missions that might not be able to meet that requirement.

Those requirements are not without controversy – some point to additional government red tape that could put some handcuffs on the rapidly expanding satellite industry. The FCC even hopes they are unnecessary, with one Commissioner stating that he hoped the rule would be "a largely unused backstop for best-in-class commercial practice."

However, that might be wishful thinking. The FCC only has jurisdiction over American companies, and they are certainly not the only ones launching satellites into orbit. It remains unclear what would be necessary to bring other space-faring nations on board with the requirements, but most likely, some kind of international cooperation would be required.

UT video on the threat satellite super constellations pose in terms of space junk.

At the time of writing, that was not immediately forthcoming. But a clear stance from a regulatory agency of the world's most powerful space-faring nation is certainly an excellent place to start. Anyone concerned about the future of human spaceflight will hope this is only the beginning of a reasonable regulatory regime for keeping one of the most essential space-based resources, a clear path to space, clear for the indefinite future.

Mars Rocks Have the Right raw Ingredients to 3D Print Everything From Tools to Rocket Parts

3D printing will be an absolutely critical technology as space exploration starts to take off. Initially, it will be impossible to individually manufacture every tool needed to create and sustain infrastructure in space. The only option will be to build some of those tools in space itself, in no small part, because it could potentially take months or even years to get to any area where the tools are manufactured. So any tool that can be created in situ is the best option available for early space explorers. Using materials like Martian regolith to 3D print those tools has long been an area of ongoing research. Now a team from Washington State University has successfully printed some tools using simulated Martian regolith, and they seem to work – up to a point.

The team, led by Professor Amit Bandyopadhyay of WSU's Mechanical and Materials Engineering Department, used a powder-based 3D printing method to combine simulated Martian regolith. Martian regolith is a black, powdery substance designed to mimic materials found on the surface of the red planet with a powdered titanium alloy.

Combinations of materials ranging from only 5% regolith up to 100% regolith were tested. They were subjected to a sintering process that saw them heated to 2,000 degrees C and then allowed to cool while forming different shapes and sizes of solid material.

Showcasing 3D printing using Martian regolith.
Credit – Washington State University YouTube Channel

Testing the resultant ceramics was a mixed bag. Samples made of the 100% Martian regolith were brittle and developed cracks in their structure as part of the printing process. While those cracks would prove a deal-breaking for tool manufacturing, such cracks are relatively inconsequential for other use cases on the Martian surface, such as adding a layer of radiational protection to human habitats, which Dr. Bandyopadhyay and his team are quick to point out.

Lower concentrations of regolith (and consequently higher concentrations of titanium) performed better in terms of the material properties necessary for tool-making. In fact, the mixture of 5% regolith with 95% titanium actually resulted in superior physical properties to tools that were made with simply 100% titanium.

The press release from WSU doesn't explain why that might be the case, but it points to a potential use case for Martian regolith as a significant component of tools used by future Martian explorers. And as the press release does make clear, every saved kilogram of material that doesn't have to be launched is potentially hundreds of thousands of dollars saved.

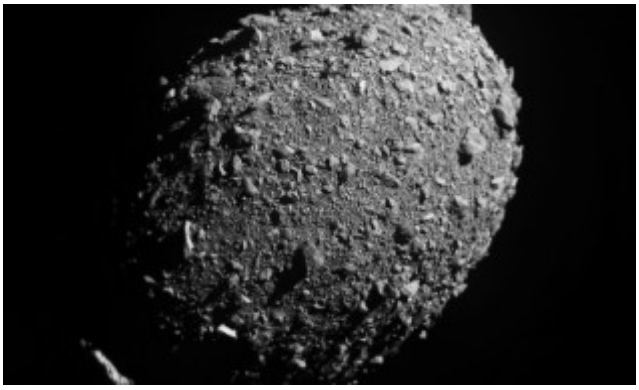
Mars isn't the only place 3D printing with regolith could prove useful. Artist's impression of a lunar base created with 3D printing techniques.
Credits: ESA/Foster + Partners

We've reported numerous times that printing using regolith isn't a novel idea. We've also reported how in-situ resource utilization can get messy sometimes. This isn't even the first time Dr. Bandyopadhyay's team has 3D printed something with regolith – they were part of a NASA study ten years ago that looked at using crushed lunar regolith as a feed material for a 3D printing process.

There's still lots of work to be done before any tool is used to fix anything on Mars, but proving it could be made even partially with materials native to the Red planet is a step towards making it a reality. And the team at WSU is undoubtedly not the last group that will look at making even better tools out of those materials.

A Single High-Resolution Image of Dimorphos Stacked From DART's Final Images

Here's a sharper view of Dimorphos, the small asteroid moonlet that the DART (Double Asteroid Redirection Test) spacecraft intentionally crashed into. Eydeet on Imgur created a higher resolution image of Dimorphos by stacking the last few images received from the spacecraft before impact.



First impressions? It's an egg-shaped rubble pile.

Dimorphos is about 160 meters (525 feet) in diameter and it orbits a larger, 2,560-foot (780-meter) asteroid called Didymos. This asteroid duo makes the perfect target for this demonstration test, as NASA says the impact should change the way Dimorphos orbits Didymos. DART crashed into the asteroid at roughly 22,530 km/hr (14,000 mph), which is expected to have slightly slowed the asteroid's orbital speed. One NASA scientist explained, the impact was "like ramming a golf cart into the Great Pyramid."

Scientists are now poring over the data to determine how much the orbit was changed. This will show if DART's 570 kilograms (1,260-pounds) of impact is a viable mitigation technique for protecting the planet from an Earth-bound asteroid or comet, if one were discovered.

The orbit of Didymos and Dimorphos ranges from just outside the orbit of Earth (about 1 AU) to a bit beyond the orbit of Mars (about 2.27 AU. It takes 2.11 years for the pair to make a trip around the Sun.

The following tweets provide some info about the scale of what we see up close on Dimorphos:

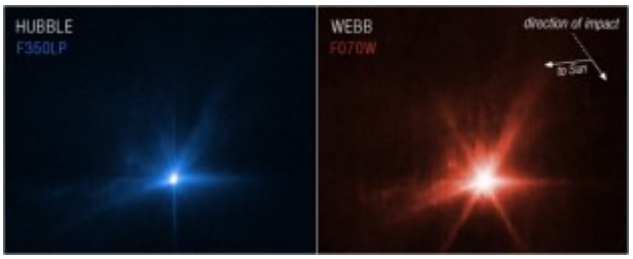
Didymos is classified as a member of the Amor group of asteroids, which are near-Earth asteroids with orbits outside the orbit of Earth and inside of Mars' orbit.

Didymos spins rapidly – rotating about once every 2.26 hours. The moonlet revolves around the larger body about once every 11.9 hours. The main asteroid and its moonlet orbit each other about 1 kilometer (0.62 miles) apart.

DART launched on November 24, 2021, and after 10 months of flying about 11 million kilometers (7 million miles) through space, it caught up with Dimorphos.

The DART team has said they expect the impact to shorten Dimorphos' orbit by about 1 per cent, or roughly 10 minutes; precisely measuring how much the asteroid was deflected is one of the primary purposes of the full-scale test. Some of the early indications from images taken by both ground-based and space telescopes are that the

impact appeared to be larger than expected. More details from the telescopes will be coming out in the coming weeks and months, so it may be some time before we know precisely how much DART's impact altered Dimorphos' the asteroid's orbit around Didymos.



For the first time, the NASA/ESA/CSA James Webb Space Telescope and the NASA/ESA Hubble Space Telescope took simultaneous observations of the same target. These images, Hubble on left and Webb on the right, show observations of Dimorphos several hours after NASA's Double Asteroid Redirection Test (DART) intentionally impacted the moonlet asteroid. Courtesy NASA, ESA, CSA, and STScI

DART Impact Seen by Hubble and Webb

What happens when you whack a little asteroid with an even littler spacecraft? People around the world watched on the 26th of September when the DART mission smashed into the side of Dimorphos. This tiny worldlet is a companion asteroid to Didymos. It was the world's first test of the kinetic impact technique, using a spacecraft to deflect an asteroid by modifying its orbit. Amateur observer networks and professional observatories tracked the meetup from the ground. In a first, both Hubble Space Telescope (HST) and the James Webb Space Telescope (JWST) took simultaneous images and data.

Together, they managed to track the asteroid before the event. Then, they got images and data about the ejecta (the material that got flung away from it) afterward. Each set of images showed streaks of ejecta stretching out away from the little asteroid. Scientists could even tell exactly where the spacecraft hit the asteroid. The data should tell them about the asteroid's composition and structure. Eventually, they should find out how much the impact affected Dimorphosis's orbit.

Doin' it with DART

The collision of spacecraft and an asteroid posed a challenge for observers. That's because Dimorphos and its companion Didymos move fairly quickly in their orbits. Ground-based observers were able to track the faint objects fairly well, and networks of smaller telescopes caught a view of the collision and its aftermath.

For JWST, tracking that action isn't exactly what the telescope was built for, but the teams managed. Flight operations, planning, and science teams for JWST had to come up with a method to track the asteroids. They actually move faster than JWST was originally programmed for, so that had to be taken into account. JWST watched the event using its Near-Infrared Camera (NIRCam). Webb observed the impact over five hours total and captured 10 images.

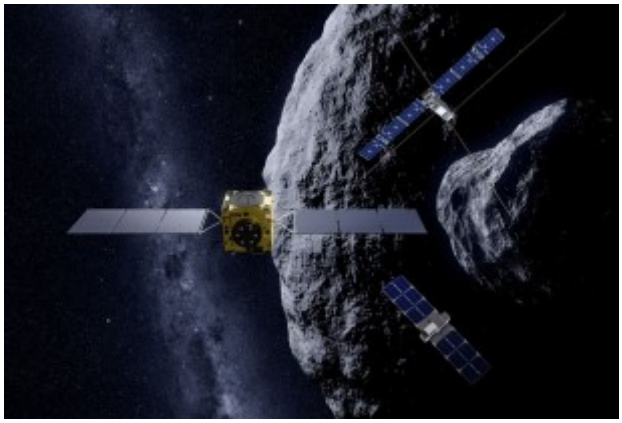
HST had a little easier time of it since it successfully tracked comets, asteroids, and planets throughout its history. The telescope captured 45 images in the time immediately before and following DART's impact with Dimorphos.

The Work Continues

In the coming months, scientists will also use Webb's Mid-Infrared Instrument (MIRI) and Near-Infrared Spectrograph (NIRSpec) to make more observations of Dimorphos. Hubble will monitor Dimorphos ten more times over the next three weeks to monitor how the ejecta cloud from the collisions expands and fades over time.

The DART mission isn't the first spacecraft to encounter a small solar system body. Recall, for example, the Rosetta mission, which crash landed on Comet 67P/Churyumov-Gerasimenko. More recently, the OSIRIS-REx mission touched down briefly on asteroid Bennu to capture samples for future study. Hayabusa2 returned samples after a brief encounter with asteroid Ryugu and is on its way to study other asteroids within this decade.

Hera Follows Dart



ESA's Hera mission will head to Dimorphos in 2024 to see what DART did to this little world. Courtesy ESA/ Science Office

The European Space Agency is sending its Hera mission to Dimorphos in 2024 to do a post-impact study. It will be the first probe to rendezvous with a binary asteroid system and examine the aftermath of DART's kinetic impact test. The idea is to see how well an asteroid deflection mission could work, in the event that one is headed directly for Earth.

The DART and Hera missions are in the vanguard of asteroid deflection studies. The threat of asteroid collisions on our planet is very real, and both NASA and ESA have worked together to develop asteroid monitoring networks. The next steps, which began with DART and will continue with HERA, will find ways to avert the threat of impact.

Artist's impression of the DART mission impacting the moonlet Dimorphos. Credit: ESA

The First Telescope Images of DART's Impact are Starting to Arrive

On September 26th, at 23:14 UTC (07:14 PM EST; 04:14 PM PST), NASA's Double Asteroid Redirect Test (DART) spacecraft successfully struck the 160-meter (525 ft) moonlet Dimorphos that orbits the larger Didymos asteroid. The event was live-streamed all around the world and showed footage from DART's Didymos Reconnaissance

and Asteroid Camera for Optical navigation (DRACO) as it rapidly approached Dimorphos. In the last few seconds, DART was close enough that individual boulders could be seen on the moonlet's surface.
About 38 seconds after impact, the time it took the signal to reach Earth, the live stream ended, signaling that DART had successfully impacted Dimorphos and was destroyed in the process. Meanwhile, teams of astronomers stretching from the Indian Ocean to the Arabian Peninsula watched the impact with their telescopes. One, in particular – the Les Makes Observatory on the island of Le Reunion in the Indian Ocean – captured multiple images of the impact. These were used to create a real-time video and show the asteroid brightening as it was pushed away, followed by material ejected from the surface.
The observation campaign was organized by the ESA's Planetary Defence Office (PDO) and coordinated by the Agency's Near-Earth Object Coordination Centre (NEOCC). This campaign was one of several worldwide that coincided with DART's successful test of the kinetic impact method. While not all observation stations were successful due to cloud cover, technical problems, and other issues, the ESA campaign acquired several stunning images showing the kinetic impactor hitting its target and what immediately followed.

"Something like this has never been done before, and we weren't entirely sure what to expect," said Marco Micheli, an Astronomer at the NEOCC. "It was an emotional moment for us as the footage came in."

As you can see from the video (posted above), the asteroid immediately started brightening upon impact and was many times brighter within seconds. This indicated that the moonlet's trajectory was altered, causing more sunlight to be reflected from its surface. Less than a minute after impact, a cloud of ejected material became visible as it drifted into the path of direct sunlight and began reflecting it. The time-lapse video shows (in thirteen seconds) what took place over roughly half an hour. As Dora Föhring, another NEOCC astronomer, adds:

"This was the conclusion of weeks of discussions, meetings, accurate planning and observational design by our team, together with local observers and scientists at all our collaborating stations. This fantastic campaign has produced data that our astronomers, together with the whole DART collaboration, will now begin to analyse to extract valuable scientific information on the effects of the impact."

To determine how much the moonlet's orbit has been altered, astronomers will measure its light curve over time using ground-based telescopes. Observations will also be made using space-based telescopes, including the venerable *Hubble* and the *James Webb*. This data will be used to calculate any changes in Dimorphos' period as it continues to orbit Didymos, which will confirm that the kinetic impact method is an effective means of altering the trajectory of asteroids and preventing them from impacting Earth.

The ESA also plans to mount a follow-up mission with the Hera mission, which will launch in October of 2024 and rendezvous with the double-asteroid system in December 2026. Once it arrives, Hera will be the first spacecraft to rendezvous with a double-asteroid system and perform a detailed post-impact survey. Ian Carnelli, the *Hera* Mission Manager, said:

"The results from DART will prepare us for Hera's visit to the Didymos binary system to examine the aftermath of this impact a few years from now. Hera will help us understand what happened to Dimorphos, the first celestial body to be measurably moved by humankind, and ultimately to protect ourselves from space rocks that could one day do the same."

The last complete image of asteroid moonlet Dimorphos, taken by the DRACO imager on NASA's DART mission from ~7 miles (12 kilometers) from the asteroid and 2 seconds before impact. The image shows a patch of the asteroid that is 100 feet (31 meters) across. Dimorphos' north is toward the top of the image. Credits: NASA/Johns Hopkins APL

POSTED ONSEPTEMBER 27, 2022 BY NANCY ATKINSON

This is the Last Thing DART saw as it Smashed Into its Asteroid Target

The first-ever planetary defense technology demonstration mission successfully conducted its mission, slamming into the surface of a distant asteroid and going out in a blaze of glory. NASA's Double Asteroid Redirection Test (DART) spacecraft acted as a kinetic impactor, colliding with the small and harmless asteroid Dimorphos on September 26 at 7:14PM ET, with the hope of deflecting it.

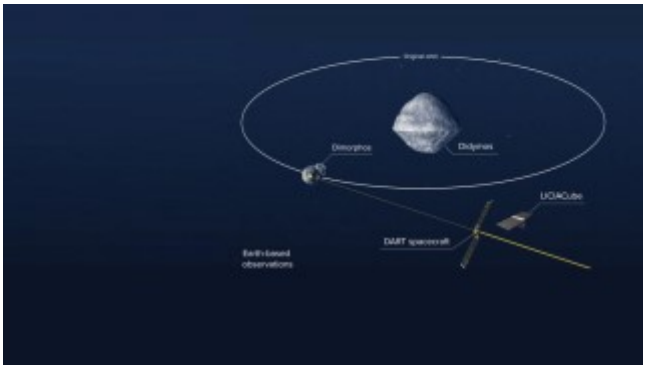
"DART's success provides a significant addition to the essential toolbox we must have to protect Earth from a devastating impact by an asteroid," said Lindley Johnson, NASA's Planetary Defense Officer. "This demonstrates we are no longer powerless to prevent this type of natural disaster. Coupled with enhanced capabilities to accelerate finding the remaining hazardous asteroid population by our next Planetary Defense mission, the Near-Earth Object (NEO) Surveyor, a DART successor could provide what we need to save the day."

The last minutes of the spacecraft's mission can be seen in this video:

Dimorphos is a small asteroid moonlet, just 530 feet (160 meters) in diameter. It orbits a larger, 2,560-foot (780-meter) asteroid called Didymos. Neither asteroid poses a threat to Earth, and the impact should change the way Dimorphos orbits Didymos, making the duo the perfect target for this test. NASA says that DART's impact demonstrates a viable mitigation technique for protecting the planet from an Earth-bound asteroid or comet, if one were discovered.

DART launched on November 24, 2021, and after 10 months of flying about 7 million miles (11 million kilometers through space, caught up with Dimorphos. DART weighed 1,260-pounds (570-kilograms) and crashed into the asteroid at roughly 14,000 miles (22,530 kilometers) per hour, which is expected to have slightly slowed the

asteroid's orbital speed.



A graphic showing all the objects necessary in DART's planetary defense test. Credit: NASA, APL.

Our lead image shows what DART's camera saw 2 seconds and 12 km away before impact, showing the asteroid to be a rubble pile, with enormous boulders. Astronomer Will Gater put a human figure next to the intended crash site for reference of the size of the boulders on Dimorphos.

There was actually one more image that the spacecraft's sole instrument captured. DRACO, (Didymos Reconnaissance and Asteroid Camera for Optical navigation, was in the process of sending back the image data to Earth when the transmission was rudely interrupted by the impact:

DART's final look at the asteroid moonlet Dimorphos before impact. The spacecraft's on board DRACO imager took this final image ~4 miles (~6 kilometers) from the asteroid and only 1 second before impact. DART's impact occurred during transmission of the image to Earth, resulting in a partial picture. The image shows a patch of the asteroid that is 51 feet 16 meters) across. Dimorphos' north is toward the top of the image. Credits: NASA/Johns Hopkins APL

Overnight and today in the morning after, images from ground-based telescopes have been coming in, confirming that DART made impact. Researchers will be able to measure precisely show much the impact changed Dimorphos' orbit, but they expect the impact to have shortened its orbit by about 1%, or roughly 10 minutes. Being able to precisely measuring how much the asteroid was deflected is one of the primary purposes of the full-scale test.

View from Les Makes Observatory in Le Reunion

Additionally, space telescopes like the James Webb Space Telescope were also monitoring the impact. Here's the initial data from JWST:

Before impact, the DART spacecraft released a smaller satellite, the Italian-built LICIACube. This tiny spacecraft followed DART on its way to its doom, taking pictures of the immediate aftermath. Those images were just released this morning in a press conference from the Italian team:

"Planetary Defense is a globally unifying effort that affects everyone living on Earth," said Thomas Zurbuchen, associate administrator for the Science Mission Directorate at NASA Headquarters in Washington. "Now we know we can aim a spacecraft with the precision needed to impact even a small body in space. Just a small change in its speed is all we need to make a significant difference in the path an asteroid travels."

More details about DART's test will be coming out in the next few weeks as researchers study the data coming in from all the telescopes around the world, so stay tuned. You can keep track of any news here on Universe Today, as well as on NASA's Planetary Defense website.

In the meantime, know that Bruce Willis and the dinosaurs would be proud.

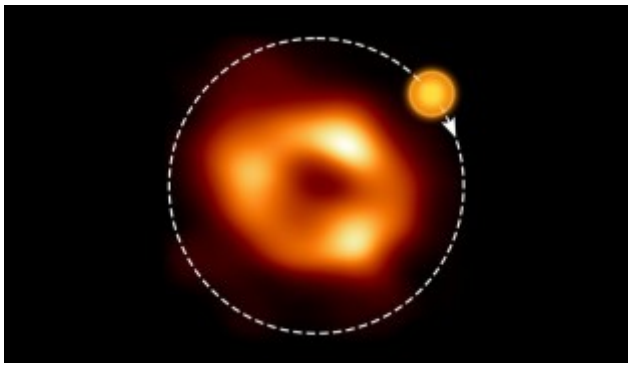
There's a Blob of Gas Orbiting Around the Milky Way's Supermassive Black Hole

Sagittarius A* (Sag A*)* is usually a pretty quiet object, as supermassive black holes go. It's not wildly active, like the object at the heart of M87, for example. But, every once in a while, there's a little action in its neighborhood. Right now, there appears to be a hot blob of gas running rapidly in circles around the black hole. Astronomers detected it using the Atacama Large Millimeter Array (ALMA) in Chile. The data from that radio astronomy facility tells them more about the environment around Sag A*.

What's the hot spot made of? And, how fast is it moving? "We think we're looking at a hot bubble of gas zipping around Sagittarius A* on an orbit similar in size to that of the planet Mercury," said Maciek Wielgus of the Max Planck Institute for Radio Astronomy in Bonn, Germany, who led the study of the bright region, "but it's making a full loop in just around 70 minutes. This requires a mind-blowing velocity of about 30% of the speed of light!"

Astronomers suspected the flares from the gas blob were caused by magnetic interactions in the superheated gas surrounding Sag A*. The ALMA observations support this idea. In addition, the data provide clues about the geometry of the black hole's magnetic field.

Tracking the Blob of Gas



This shows a still image of the supermassive black hole Sagittarius A*, as seen by the Event Horizon Collaboration (EHT), with an artist's illustration indicating where the modeling of the ALMA data predicts the superheated blob of gas to be and its orbit around the black hole. Credit: EHT Collaboration, ESO/M. Kornmesser (Acknowledgment: M. Wielgus)

The superheated gas blob is moving clockwise around the black hole, with the orbit face-on to Earth. ALMA observed it not long after the Chandra Space Telescope measured a burst of x-ray energy coming from the same region. ALMA observations actually focused on polarized radio emission from Sagittarius A. That is used to track the extent of the black hole's magnetic field. The data, coupled with theoretical models, will give clues to how the hot spot formed and what kind of conditions it experiences as it orbits. The results help astronomers understand more about the shape of the local magnetic field. That, in turn, gives some insight into the nature of Sag A and its surroundings.

The ALMA and Chandra observations weren't the first

telescopes have spotted the blob. The GRAVITY instrument at the Very Large Telescope also measured this same region, but in infrared light. The data from GRAVITY and ALMA both confirm that the flare originates in a clump of gas swirling around the black hole.

The Value of a Multi-Messenger View

Spotting the same region in a range of frequencies is actually very useful. This is because each “regime” of the electromagnetic spectrum focuses on a specific set of temperatures, motions, and events at a specific object. X-rays measure hotter and more energetic activities, while infrared ‘sees’ things as they cool down. Radio frequencies allow scientists to use polarized light to measure the magnetic field that the flaring blob of gas encounters.

“What is really new and interesting is that such flares were so far only clearly present in x-ray and infrared observations of Sagittarius A*. Here we see for the first time a very strong indication that orbiting hot spots are also present in radio observations,” said Wiegus. Other team members also pointed out further advantages of multi-wavelength observations of the flare.

“Perhaps these hot spots detected at infrared wavelengths are a manifestation of the same physical phenomenon: as infrared-emitting hot spots cool down, they become visible at longer wavelengths, like the ones observed by ALMA and the EHT,” said Jesse Vos, a Ph.D. student at Radboud University, the Netherlands, who was also involved in this study.

The Webb Image you’ve Been Waiting For: the Orion Nebula

This is it, folks. Feast your eyes! It’s what we’ve been training for—seeing the James Webb Space Telescope’s first detailed view of the Orion Nebula! JWST’s NIRCam gazed at this starbirth nursery and revealed incredible details hidden from view by gas and dust clouds.

The images of the nebula come from a research project called the **P**hoto**d**issociation **R**egions for **All**. It’s part of the telescope’s Early Release science program. A number of astronomers around the world are part of the PDRs4All group, and they’ve planned these observations for a long time. “We are blown away by the breathtaking images of the Orion Nebula. We started this project in 2017, so we have been waiting more than five years to get these data,” said Western astrophysicist Els Peeters, who is part of the group.

Diving into the Orion Nebula

This composite image of the Kleinmann-Low Nebula, part of the Orion Nebula complex, is composed of several pointings of the NASA/ESA Hubble Space Telescope. The Trapezium is above the center, and the Orion Bar is at the lower left, next to two bright stars. By ESA/Hubble, CC BY 4.0, https://commons.wikimedia.org/w/index.php?curid=57169218

So, where exactly did JWST point and what did it search out? The Orion Nebula we all know and love exists within a larger object called the Orion Molecular Cloud. The central section lies in the middle of the Orion constellation, just below the three stars that form its belt. JWST zeroed in on a smaller, innermost region right near a grouping of stars called The Trapezium. Its observation was planned in order to capture what happens in star birth regions.

Light from the Trapezium stars (not seen in the JWST image below) lights up the view. The Trapezium and other young stars in the region give off strong ultraviolet (UV) radiation. It eats away at the clouds of gas and dust in a process called “photodissociation”. In particular, the UV light is eroding a feature called the “Orion Bar”, which we see edge-on. It’s a wall of thick dust and gas that’s running diagonally across the image. The bright star near its heart is ?2 Orionis A, which is actually a triple star system.

Diving into JWST’s view of Orion Nebula, we see a young star with a disk inside its cocoon. The disk is being dissipated or “photo-evaporated” due to the strong radiation field of the nearby stars of the Trapezium. The orbit of Neptune is shown for comparison. There are also filaments; the inset shows thin, meandering filaments that are especially rich in hydrocarbon molecules and molecular hydrogen. They are believed to be created by turbulent motions of the gas within the nebula. The bright star is ?2 Orionis A. Finally, a young star can be seen inside a globule of gas and dust where it is forming. Credit: NASA, ESA, CSA, PDRs4All ERS Team; image processing Salomé Fuenmayor

Learning from JWST’s View of Orion

Astronomers have long known that UV emissions from hot, young stars play a role in sculpting gas and dust clouds. With the NIRCam’s ability to pierce through clouds of gas and dust, more details emerge about how UV light and other activities transform the clouds. “These new observations allow us to better understand how massive stars transform the gas and dust cloud where they’re born,” said Peeters, who is a professor of astronomy at Western University in Canada. “Massive young stars emit large quantities of ultraviolet radiation directly into the native cloud that still surrounds them, and this changes the physical shape of the cloud as well as its chemical makeup. How precisely this works, and how it affects further star and planet formation is not yet well known.”

A compare-and-contrast of Hubble's view of the same Orion Nebula region (left) that JWST looked at (right). *Credit: NASA, ESA, CSA, PDRs4All ERS Team; image processing Olivier Berné. Credit for the HST image: NASA/STScI/Rice Univ./C.O'Dell et al.*

Although this nebula lies some 1,500 light-years away from us, its details offer new insight into what conditions were like in the nebula where our own Sun and planets were born. Thick clouds of gas and dust obscure the view in the Orion Nebula. This also happens in other star birth regions. Hubble and other telescopes were largely unable to "see through" the dust in these regions. JWST detects infrared light from objects hidden by the dust and "lifts the veil" on a star birth nursery to show amazing details.

"Seeing these first images of the Orion Nebula is just the beginning. The PDRs4All team is working hard to analyze the Orion data and we expect new discoveries about these early phases of the formation of stellar systems," said team member Emilie Habart. "We are excited to be part of Webb's journey of discoveries."

BIRTH OF STARS START AT THE MIDDLE

This is an image of the center of the Milky Way. The bright white area right of center is home to the supermassive black hole Sagittarius A star. Credit: By NASA/JPL-Caltech/ESA/ CXC/STScI

While astronomers use our galaxy to learn about the properties of galaxies in general, there are notable differences between the Milky Way and others. For starters, our galaxy has a relatively low rate of stellar formation (only a few solar masses a year), whereas "starburst" galaxies experience episodes that last a few million years where they produce tens or even hundreds of solar masses per year. Interestingly, that high formation rate was the norm among galaxies ten billion years ago, with tens of solar masses produced every year.

But in the Milky Way's central region, about 1,300 light-years around our galaxy's supermassive black hole (SMBH), star formation rates over the past 100 million years have been observed to be ten times higher than on average. In short, our galaxy's core is as productive as a starburst galaxy or as productive as galaxies were ten billion years ago. Astronomers have been hoping to study this region to learn more about the factors influencing star formation in galaxies. Unfortunately, this has been far more difficult than studying other galaxies because of how our Solar System is embedded in the Milky Way's disk.

Our observatories must contend with the massive amounts of light-obscuring dust between Earth and the Galactic Center. To circumvent this problem, astronomers rely on instruments that observe the Universe in the infrared, millimeter-wave, or radio wavelengths. These can image the radiation absorbed by the dust, or passes through it, thus revealing objects that are otherwise obscured in visible light. Another issue (already mentioned) is how the Galactic Center is so crowded, making it difficult to discern individual stars (except for the very bright ones that stand out from the rest).

Astronomers know that stars continue to form in the Galactic Center, as indicated by ionized radiation and x-ray emissions. But it has been extremely difficult to spot young stars, those that formed in the past few million years. Prior to this analysis, astronomers could only account for two massive star clusters and a few isolated young stars at the center of our galaxy – about 10% of the expected stellar mass. This has left many questions unanswered about the locations of all the other young stars and their properties.

The central region of the Milky Way in infrared light, acquired by NASA's Spitzer Space Telescope. Credit: NASA/ JPL-Caltech/S. Stolovy (Spitzer Science Center/Caltech)

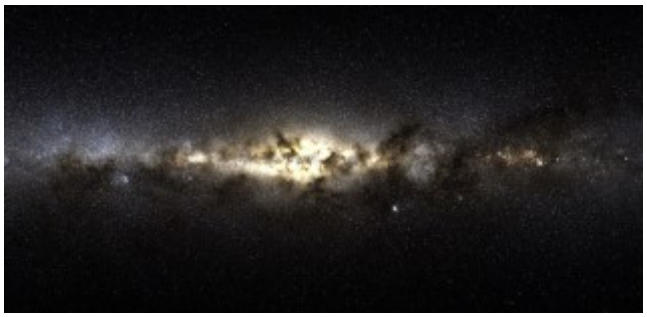
To address this question, Nogueras-Lara, Neumayer, and Schödel consulted data from the GALACTICNUCLEUS campaign, a survey that uses the HAWK-I infrared camera – part of the Very Large Telescope (VLT) at the Paranal Observatory in Chile. Together they took nearly 150 short-exposure pictures of the Milky Way's central region in the J, H, and K_s infrared bands and examined an area totaling 64,000 square light-years around the Galactic Center. These pictures were then combined via holographic imaging to correct for atmospheric distortion and map the region in much finer detail than ever before.

Whereas only a few tens of stars had been previously mapped, the GALACTICNUCLEUS survey provided individual data for 3 million stars in the Galactic Center. Moreover, the team noticed that the area known as Sagittarius B1 contains considerably more young stars than other regions, made evident by the way they ionize surrounding gas clouds. With these high-resolution observations, Nogueras-Lara and his colleagues were able to study the region's stars in detail for the first time – including the statistical distribution of stellar luminosity.

This is particularly important because luminosity distribution changes gradually (and in a predictable fashion) for stars that formed around the same time. Given such a distribution, it is possible to reconstruct a history of star formation based on those that formed more than 7 billion years ago, between 2 and 7 billion years ago (the "intermediate bracket"), and within the last 2 billion years. Upon analyzing their data, the team found that Sag B1 had an older "intermediate bracket" population and a large population of stars that were 10 million years old or younger. As Nogueras-Lara said in an

MPIA press release:

“Our study represents a big step forward in finding the young stars in the Galactic Center. The young stars we found have a total mass of more than 400,000 solar masses. That is nearly ten times higher than the combined mass of the two massive star clusters that were previously known in the central region.”



The all-sky view that the Gaia survey would have of a simulated Milky-Way-like galaxy. Credit: Sanderson et al.

Interestingly, the stars were also found to be dispersed and not part of a massive cluster, which suggests they were born in one or more looser stellar associations that rapidly dissolved as they orbited the Galactic Center over several million years. While these results pertain specifically to Sag B1, they could mean that young stars in the Galactic Center were generally born in loose associations that have since dispersed into separate stars. This would explain why the young populations are so much harder to resolve and require high-resolution surveys in multiple wavelengths.

Another interesting finding was that there is also an older population of stars in Sag B1. In the innermost regions of the Galactic Center, there are stars more than 7 billion years old but virtually no stars in the intermediate range. This could mean that star formation began in the innermost part of the Galactic Center and then spread to the “nuclear disk,” the small disk of stars surrounding the center. Indications of this inside-out mechanism of star formation have already been observed in other galaxies, and these latest results suggest this is also true of the Milky Way.

Looking ahead, the team hopes to conduct follow-up observations using the K-band Multi-Object Spectrograph (KMOS) instrument on the VLT. By adding spectral observations to the overall luminosity distribution they observed, they hope to identify some of the very young stars in the Galactic Center directly. In addition, there are plans to track the proper motions of the newly-discovered stars based on data obtained by missions like the ESA’s *Gaia Observatory*. While stars that formed in the same association get dispersed over time, their motion is still likely to be very similar, indicating a common origin.

Ergo, tracking the proper motion of stars in Sag B1 will allow astronomers to deduce if the young stars observed there were indeed born in one or more loose associations. As Nadine Neumayer summarized:

“Both kinds of measurements will serve to hopefully confirm, but definitely refine, the results of the now-published work. At the same time, we and our colleagues will start exploring what the new insights into star formation in the Galactic Center can tell us about high-productivity star formation in other galaxies.”

E Mails Viewings Logs and Images from Members.

Viewing Log for 14th September

After doing a sunset session at Hackpen Hill, I went off to my usual viewing place near Uffcott off of the A4361. I had to wait for about 30 minutes while the skies got dark enough so I could do the telescope set ups, during this time I noticed five aircraft contrails in the sky. By 20:17 I finally found Polaris and could carry on with my set ups, with a temperature of 15 °C and some wind the conditions for evening would not be too bad? I would be using my usual set up of the Meade LX90 GOTO telescope but with the Televue Delos 17.3 mm eye piece instead of the 14 mm I normally use.

First target for the evening was Saturn in the southern sky, I could make out Titan clearly and what I thought was another moon, might be Rhea but not certain? Tried to get the Cassini division with the 6 mm eye piece but could not find it, maybe the rings are too close for them to be seen clearly? The last time I was out here (29th of August), I managed to see 14 of the 15 Messier (M) objects in the constellation of Sagittarius, the one I missed was M 28. So this was my first deep sky object before it got behind the hedge, as it was it was just above the said hedge! M 28 was a fuzzy blob (F B), hazy, globular cluster (G C), and being so low would not help either. Constellation for the evening was going to be Ophiuchus which is just above Sagittarius, I would be using my Sky & Telescope Pocket Sky Atlas for reference. First target was M 9, a large dim G C to look at. The first of three cars (for the evening) went by me while I was viewing M 9. On to another G C in M107, this faint fuzzy blob (F F B) was easy to miss? M 16, the Eagle nebula was next, a very large and loose open cluster (O C) but I could not make out any nebula which goes with the O C. M 14, a large G C was dim to view, high thin cloud did not help me here! M 10 which is nearby was a large G C which had a bright centre. The G C, M 12 turned out to be an F B to look at, easy to miss. The other two cars now went past me. By now (21:45) the Moon was up but still hiding behind a hedge and tree, so I still had some time before deep sky objects would start to disappear. Back to the planets and starting with Neptune, could not locate it, now that is quite normal with this set up! On to Jupiter instead, once centred the planet was quite bright for my eye. To the west of the planet was Europa and Ganymede with Io and Calisto to the east. I thought I could make out the Great Red Spot, checking the programme Jupiter 2 once home it was on the edge of the planet, so I probably saw it? Now on to the Moon as it had cleared the hedge, the waning (18.52 day old or 78.2 % lit) gibbous phase had a good terminator could make out quite a few craters and the shadows to go with them. The crater Copernicus (93 kms) in diameter stood out well, it was very white and probably the first thing somebody would see if just generally looking at the Moon with the eye? The skies did not very promising now, went to M 13 which I could hardly see, so I decided it was time to pack up at 22:07. With little dew and now no wind the conditions were very good, final temperature was 12 °C.

Clear skies.

Peter Chappell

PS. While I was out viewing, the planet Uranus was in conjunction with the Moon, unfortunately I had forgotten about this event and did miss it, I did take a couple of pictures of the Moon while I out but did not see Uranus unfortunately.

Viewing Log for 16th of September (WAS viewing evening)

This viewing session clashed with the monthly meeting of Swindon Stargazers, so I would be arriving much later than THE planned start time of 20:00? After the main speaker (Mark Radice who we have in October) had finished I headed off down the M 4 to Lacock, when I arrived it was nice to see quite a few people at the scopes, downside was only Andy and Chris were on hand to help people out. I had my Meade LX90 set up and ready by 21:34, this time I would be using my 14 mm Pentax WX eye piece, with no wind and a temperature of 12 °C, conditions should be good.

First object was Saturn, could make out Titan fairly clearly and thought I could make out two other moons (checking the programme Stellarium later) I might have seen Dione or Rhea and a 9.0 magnitude star? Now off to Neptune and this time I actually found the planet not far off of the main eye piece, well in the view if the finderscope, just a hint of blue was showing? On to Jupiter, could make out the two main weather belts clearly with Ganymede to the west and Io (closest) followed by Europa and Calisto to the east. Tonight I was going to follow the suggestions in September's Astronomy Now magazine starting with NGC 7009, the Saturn nebula AKA Caldwell 55, this planetary nebula looked like Saturn but out of focus? Slewing to the next target I had a power failure, what! Turns out the plug jack (which is a bit loose) for the power cable came loose. Securing the jack to the hand controller plug I carried on and re did my set ups! By now some people had come over to my scope, so I decided not to carry on with my planned list but asked what they would like to see. Started with Messier (M) 13, the best globular cluster (G C) in the northern sky? This was good to look at and could make out the odd star around the edges of this cluster. Staying with G C's, M 12 and M 10 where too low to look at but managed to see M 2, which would give M 13 a run for its money. On to NGC 457, the Owl cluster a good open cluster (O C) to look at, has two bright stars within the cluster. M 29 is another O C I like to show people, a six star rectangle with the two central stars pushed in a bit. A good planetary nebula is M 57 to look at. There was a request for Neptune to be look at, manage to find this planet again. While slewing to Uranus, I heard the motors in the telescope making a strange noise, a couple of seconds later the scope had died again. Turns out, the battery was flat and no more viewing was possible! I did turn the scope manually and managed to find Uranus for the folks which were left to look at.

At this point a women with a bright white light who was walking her dogs in the field started to affect our night vision, so we decided to pack up then, seems like she had been around earlier in the evening when I was not there?

The time was now 22:28 and the temperature had dropped to 10 °C. While on the way home on the M 4 I noticed the Moon was rising and about 3 ° away was Mars. So in the next few weeks we will have all five outer planets well up on view before midnight.

Clear skies.

Peter Chappell

Some Images from the Society Viewing Night

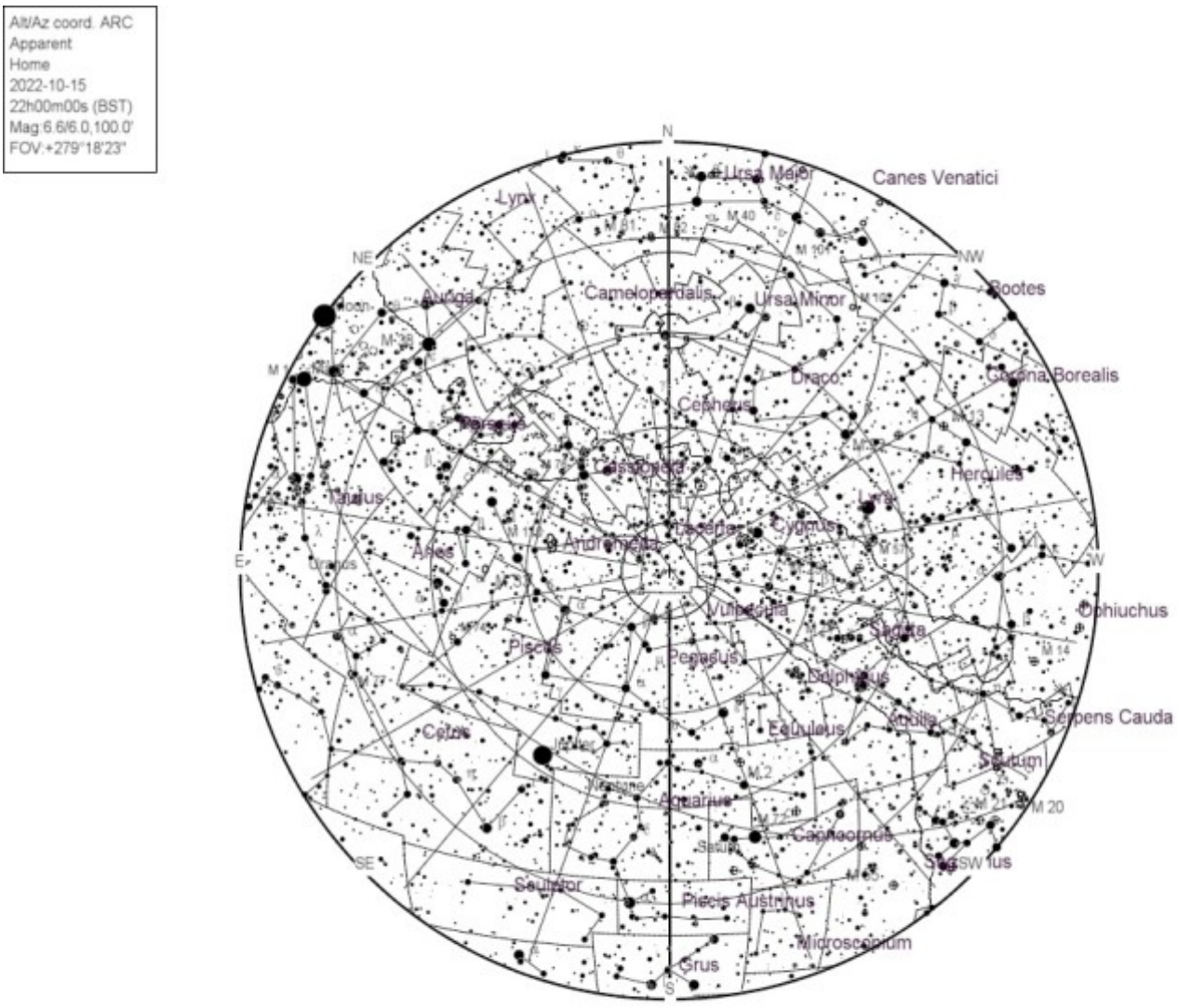
Andy Burns

Nikon D810A 20mm Sigma art lens

300mm lens Lagoon nebula M20 and Triffid M20 very close to the horizon. 25 seconds exposures.

Full harvest Moon rising, so subject to Ryleigh shifted orange colouration. Nikon P1000 using zoom at around 1600mm.

WHATS UP, OCTOBER 2022



October 7 - **Draconids Meteor Shower.** The Draconids is a minor meteor shower producing only about 10 meteors per hour. It is produced by dust grains left behind by comet 21P Giacobini-Zinner, which was first discovered in 1900. The Draconids is an unusual shower in that the best viewing is in the early evening instead of early morning like most other showers. The shower runs annually from October 6-10 and peaks this year on the the night of the 7th. The first quarter moon will block out all but the brightest meteors this year. If you are patient, you may still be able to catch a few good ones. Best viewing will be in the early evening from a dark location far away from city lights. Meteors will radiate from the constellation Draco, but can appear anywhere in the sky.

October 8 - **Mercury at Greatest Western Elongation.** The planet Mercury reaches greatest western elongation of 18 degrees from the Sun. This is the best time to view Mercury since it will be at its highest point above the horizon in the morning sky. Look for the planet low in the eastern sky just before sunrise.

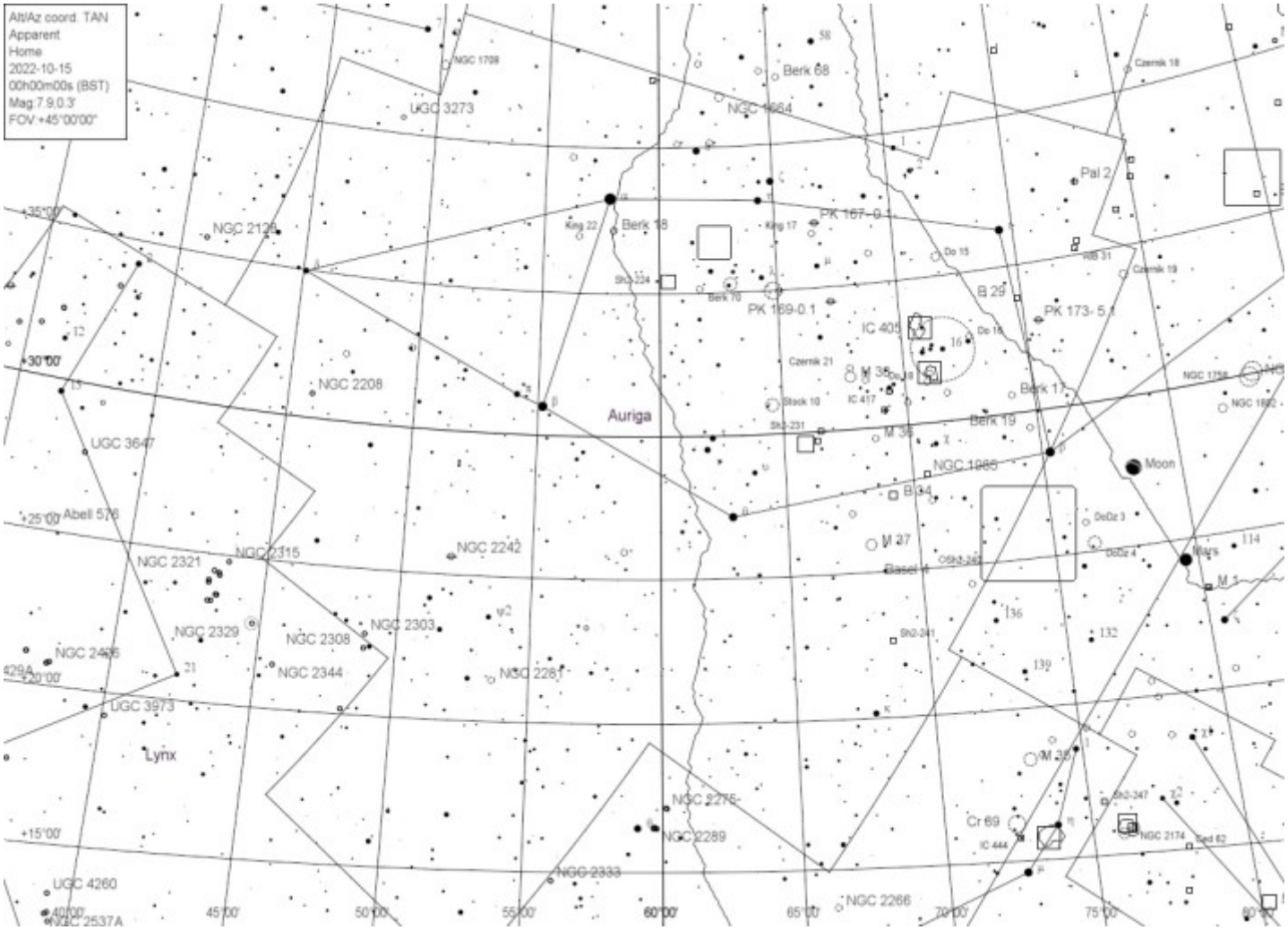
October 9 - **Full Moon.** The Moon will be located on the opposite side of the Earth as the Sun and its face will be will be fully illuminated. This phase occurs at 20:55 UTC. This full moon was known by early Native American tribes as the Hunters Moon because at this time of year the leaves are falling and the game is fat and ready to hunt. This moon has also been known as the Travel Moon and the Blood Moon.

October 21, 22 - **Orionids Meteor Shower.** The Orionids is an average shower producing up to 20 meteors per hour at its peak. It is produced by dust grains left behind by comet Halley, which has been known and observed since ancient times. The shower runs annually from October 2 to November 7. It peaks this year on the night of October 21 and the morning of October 22. The thin, crescent moon will leave mostly dark skies for what should be a good show. Best viewing will be from a dark location after midnight. Meteors will radiate from the constellation Orion, but can appear anywhere in the sky.

October 25 - **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 10:49 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.

October 25 - **Partial Solar Eclipse.** A partial solar eclipse occurs when the Moon covers only a part of the Sun, sometimes resembling a bite taken out of a cookie. A partial solar eclipse can only be safely observed with a special solar filter or by looking at the Sun's reflection. This partial eclipse will be best seen in parts of western Russia and Kazakhstan. It will be best seen from central Russia with over 80% coverage.

CONSTELLATIONS OF THE MONTH: AURIGA



·Briefly part of the constellation was attributed by Father Maximillian Hell to the constellation of Tubus Herschelii Major which combined with Tubus H. Minor was placed either side of 8 Geminorium, where William Herschel discovered the planet Uranus on the 13th March 1781.

·The star beta Taurii (Elnath) has interchanged between Taurus and Auriga as required.

a alpha Capella, the Goat Star also Alhajoth. This is the nearest of all 1st Magnitude stars (0.06) to the North Pole and is circumpolar from the UK. Currently the star is around 45 light years distant; the proper motion of Capella appears to match the Hyades cluster in Taurus.

According to Burnham Capella is a 4 star binary system though visually only 2 components can be detected. Other stars in the zone are not associated, so the 3rd star in the system is designated Capella H, and is a Red Dwarf at around magnitude 10, 0.7 times Sol, this star has also been updated to be a binary star..

Double/multiple stars: AP 0.6 G5III, 1.1 G0III, sep. 0.04", 0.285y, a = 0.054", masses 2.67 and 2.55 solar. Capella is first star for which an orbit was determined from interferometer measures, by Anderson at Mt. Wilson in 1920.

Speckle sep. 0.040" 1981.24 and 1981.68; 0.055" 1982.16.

Component H, a close binary, 10.0 dM1, 13.7 dM5 sep. 2" at 723" from A, probably physical with A. Other components all faint and distant from A.

b beta Menkalina. Also a short period binary, discovered by A Maury in 1889. Other components discovered by W Herschel in 1783 and by E Barnard in 1901.

Spectroscopic binary: ADS 4556A, 3.9600d, K 107.5k/s, V0 -17.1k/s, msin3i 2.20, asini 5.85. Masses 2.33, 2.25 solar. Rotational velocities both components <30k/s. Second SB ever discovered, by Antonia Maury, 1889.

The star is linked to the Sirius and Ursa Major star group, and lies around 90 light years away (82ly Hipparchus).

g gamma Al Nath is now beta Taurii!

d delta. This star is the brightest star at the northern point of Auriga. A 3.7 magnitude star at 140ly, K0III class star. Around 50 times Sol luminosity. Possibly 4 components.

e epsilon. Almaaz. The next three stars are known as the kids of the goat. Epsilon is an unusual eclipsing binary. According to Burnham there are three theories to explain the peculiar light curve that include low density super giant or even dust rings around the secondary star.

[8]One of the strangest and least understood stars in the sky: a binary system, located in the constellation Auriga, in which an enormous yellow-white supergiant is periodically eclipsed by an object that is vastly larger. Its occasionally-used Arabic name, Almaaz, means “the he-goat.”
The bright component of Epsilon Aurigae is a hot-end supergiant F star, slightly more than 1 AU in diameter. Large though this is, every 27.1 years the bright star is eclipsed for two years by something of truly colossal proportions. The prevailing idea is that the mysterious dark component is a star surrounded by a thick ring of obscuring dust set nearly edge on. The supergiant we see and the mystery star are perhaps 30 AU apart, the dust ring about the secondary star is some 20 AU in diameter. The ring has some sort of gap in the middle, as Epsilon Aur brightens a bit at mid-eclipse. We have little idea what lies at the centre the dusty ring. One theoretical model predicts an object with a mass of 4 solar masses, another with a mass 15 solar masses. It could be one star that has generated a disk through a fierce out-flowing wind or, as more commonly believed, a pair of class B stars that are themselves in tight orbit. The last eclipse took place in 1982-1984. The next will be in 2009-2011, when a new generation of telescopes will be trained on this stellar enigma in an effort to unlock its mysteries.

z zeta Sadatoni or Hoedus I. 3.76 magnitude, 788ly. Binary system, K4II and B7V, Orbiting period 2.66 years, eccentricity 0.4.

A: K4II; Size 160xSol; Mass 8.6xSol; Temp3200K

B: B7V; Size 4xSol; Mass 6.8xSol; Temp15000K

h eta Hoedus II, mag 3.18, class B3V, 370ly. 580xSol luminosity. Possibly part of the Pleiades group!

q theta. 2.65magnitude, A0p, Si classification, 173ly. Silicon star (A kind of Ap star that shows a particular enhancement of the 4200 Å strontium line. Silicon stars typically lie toward the middle of the Ap star temperature range), 2 associated stars one definite binary companion.
i iota 2.67mag, K3II, 330ly (512ly in latest measurements). About 750xSol luminosity (this upped to 1600xSol because of distance information update from Burnham). This most remarkable feature about this star is that it is the only principle star of the Auriga constellation that has only 1 known component.

Special star: AE Auriga

This is the star of the Flaming Star Nebular. The star shows up in unfiltered photographs long before the nebular and can be seen on the star constellation shot above.

Magnitude does vary, from around 5.76 to 6.08, but this is probably a factor of the nebula it is passing through and lighting up. At around 1500ly distance it is a bright O class star about 900x the luminosity of the Sun.

It is likely that this star was ejected (along with mu Columbae) from the Orion nebula star forming region when two pairs of big binary stars come too close to one another and the principle stars swapped partners, with the lesser stars being ejected onto opposing paths. AE Auriga is not associated with the nebula it is currently seen with. More about this below.

Messier Objects and Nebula[3, 4]

The string of open clusters through the line of q Auriga and i Auriga spanning down to the toe of Gemini (M35) is one of the binocular wonders of the sky, visible at some stage through the night all year except June and July. The soft grey glows can catch eye as your sky scanning tumbles along the edge of the Milky Way. Turn up the power and the gemstones of stars excite the rods at the back of the eye and all sorts of differences between the globular clusters become apparent. Stopping at around 25 to 50x magnification will give the best views but more detail can be drawn out at higher magnifications. All three were recorded in the Messier list were recorded in the 1640’s by Giovanni Hodierna.

M37

The cluster of M37 is the largest and most tightly packed of the clusters in Auriga. At modest power the density of stars is very distinct. At a distance of 4,400 light years it is the most distant of this group of open clusters. M35 in Gemini is half the distance so may look more exciting but it is less condensed than M37.

The stars are around 200 million years old, and number around 1900 members (500+ in some reports[9]). It must have been a magnificent sight watching the cluster collapsing out of a huge cloud of hydrogen…

Image: Andy Burns

M36

The closest of the 3 clusters at 4,100ly. The cluster is very young, at around 25 million years, and has around 60 members down to around magnitude 13. It also has 15 brighter members at around magnitude 9 to 10 that stand out at quite low powers against the pearly background of stars in the rest of the cluster.

Image: Andy Burns

M38

The top most of the Messier clusters can be found at the end of a chain of stars that come from the 'pointing' finger of the binocular double crescent just below the q/i line. This cluster is 4,200ly away and has about 120 stars but these a quite widely spaced (about half M36 and one fifth of M37 density).

It is around 280 million years old, the oldest of the trio of clusters.

Image: Andy Burns

The low power view of this open cluster promises more than the high power can deliver. There is a distinct cross of brighter stars around the centre. Smaller stars seem to form a double ring which adds to the suggestion of a Celtic cross.

The Flaming Star Nebular C31

While AE star is very visible, and can be imaged easily, I have yet to see this nebular that is lit up by the visiting star. This is a target for after August, when it rises high enough above the horizon.

Mythology

As one of the most recognisable asterisms that make a constellation the myths and legends about the constellation have many links to lore of many lends, and the more recent civilisation have referred back to the ancient stories and updated to their own languages.

The geographical location of these old civilisations, and a certain extent the occupations and lively hoods of these peoples can be reflected in their attitude to the stars of the constellation.

The wagoner or charioteer has been in popular usage right through European language, but special attention has always been given to Capella and the triangle of three stars of the western flank of the constellation. These have been called the goat and her kids. The origin can be traced to Greek mythology when Zeus was on one of his many trips to Earth he was taken ill, but was nurtured and protected by a nanny goat and her kids. For this service he placed them in the skies forever. This obviously shows a farming culture. When the passage of these stars are said to portend weather whilst at sea, they hold a far more ominous feeling amongst fishers and sailors of the Mediterranean. There rising in early October was a signal for the end of navigation. A festival is held for the end of the influence of these stars, Natalis Navigationus. The 'Stormy' rain Goate Starre of Pliny.

In the mid 16th century the animal interpretation of these stars seem to have changed to become the Rein holder or the second arm. A loose group of stars (w) to the east of beta Aurigea form the whip tails of the first hand of the constellation.

Capella has also been linked in ancient Arabic cultures with the Hyades. At this latitude Capella rises with the Pleiades (Al Hadj) and its slight offset gave it the reputation as the 'driver' of these stars. This Pleiades became the camels, and the driver with whip in hand can be seen as the basis for later charioteer interpretations of Auriga. Lockyear links at least 5 ancient temples orientated towards Capella.

In India it is called Brahma Ridaya, the heart of Brahma.

The Chinese have an asterism here, called Woo Chay, the five chariots (or chariot of the five emperors), a striking similarity to the western ideas of Auriga.

In the new world the Peruvians named Capella Colca, and associated it with shepherds, again a coincidence with the Mediterranean peoples. Later English poets have used the term Shepherds Star for Capella.

The Greaco/Babylonians had a constellation in this region of Rukubi, the Chariot.

Translations of ancient Greek put Erechtheus, the genetically lame son of lame Vulcan in this chariot for ease of locomotion.

References

[1] Maps and recent star information from Sky Map Pro 10

[2] Cambridge Guide to the Constellations

[3] Burnham's Celestial Handbook Vol 1

[4] Stephen O'Meara, Deep Sky Companions: The Messier Objects and The Caldwell Objects

[5] Richard Hinckley Allen, Star Names Their Lore and Meaning

[6] Folklore of the Portucelts, Andy Burns, Chippenham Press

[7] Constellation detail maps from Starry Night Pro V6

[8] David Darling Encyclopaedia of Astrobiology and Astronomy (online) www.daviddarling.info/encyclopedia

[9] Seds.org

[10] The Complete Guide to the Constellations: Geoffrey Cornelius

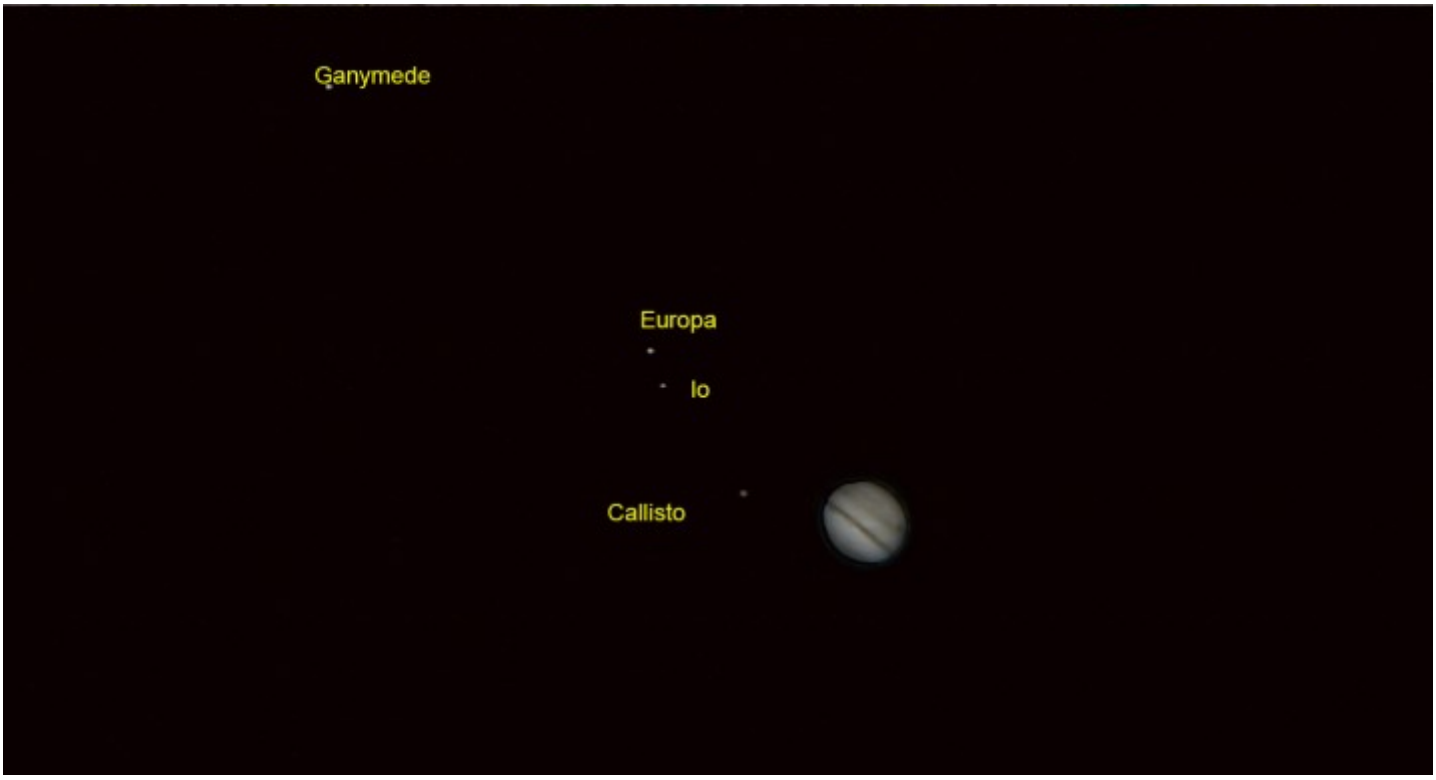
ISS PASSES For OCTOBER 2022

from Heavens Above website maintained by Chris Peat.

Date	Brightn	Start	Highest point	End						
	(mag)	Time	Alt.	Az.	Time	Alt.	Az.	Time	Alt.	Az.
03 Oct	**-1.9**	**19:30:13**	**10°**	**W**	**19:33:09**	**27°**	**SSW**	**19:36:04**	**10°**	**SSE**
05 Oct	-0.9	19:31:27	10°	WSW	19:33:18	14°	SW	19:35:10	10°	S
21 Oct	-0.9	06:38:32	10°	S	06:40:42	16°	SE	06:42:53	10°	E
22 Oct	-0.7	05:51:25	10°	SSE	05:52:22	11°	SE	05:53:17	10°	ESE
23 Oct	-2.1	06:36:55	10°	SSW	06:39:56	31°	SSE	06:42:56	10°	E
24 Oct	-1.6	05:49:51	16°	S	05:51:27	22°	SE	05:54:07	10°	E
25 Oct	-1.0	05:03:31	15°	SE	05:03:31	15°	SE	05:05:02	10°	ESE
25 Oct	-3.2	06:36:26	14°	SW	06:39:12	55°	SSE	06:42:30	10°	E
26 Oct	-2.8	05:49:58	36°	S	05:50:35	40°	SSE	05:53:46	10°	E
27 Oct	-1.3	05:03:24	21°	ESE	05:03:24	21°	ESE	05:04:57	10°	E
27 Oct	-3.8	06:36:18	20°	WSW	06:38:27	82°	S	06:41:50	10°	E
28 Oct	-3.7	05:49:39	67°	S	05:49:44	67°	SSE	05:53:05	10°	E
29 Oct	-1.2	05:02:55	22°	E	05:02:55	22°	E	05:04:18	10°	E
29 Oct	-3.8	06:35:48	24°	W	06:37:41	85°	N	06:41:03	10°	E
30 Oct	-3.8	04:49:02	81°	E	04:49:02	81°	E	04:52:15	10°	E
31 Oct	-1.1	04:02:13	20°	E	04:02:13	20°	E	04:03:26	10°	E
31 Oct	-3.8	05:35:06	27°	W	05:36:49	90°	SSW	05:40:10	10°	E
01 Nov	-3.6	04:48:16	71°	ENE	04:48:16	71°	ENE	04:51:19	10°	E
01 Nov	-3.3	06:21:20	10°	W	06:24:37	52°	SSW	06:27:52	10°	SE
02 Nov	-0.9	04:01:25	18°	E	04:01:25	18°	E	04:02:26	10°	E
02 Nov	-3.7	05:34:17	30°	W	05:35:47	67°	SSW	05:39:06	10°	ESE
03 Nov	-3.3	04:47:26	60°	ESE	04:47:26	60°	ESE	04:50:15	10°	ESE
03 Nov	-2.5	06:20:24	10°	W	06:23:22	29°	SSW	06:26:19	10°	SSE
04 Nov	-0.7	04:00:35	16°	E	04:00:35	16°	E	04:01:20	10°	E
04 Nov	-3.1	05:33:28	30°	WSW	05:34:33	40°	SSW	05:37:43	10°	SE
05 Nov	-2.6	04:46:39	38°	SE	04:46:39	38°	SE	04:48:57	10°	ESE
05 Nov	-1.7	06:19:49	10°	WSW	06:21:52	15°	SW	06:23:54	10°	S
06 Nov	-0.5	03:59:52	11°	ESE	03:59:52	11°	ESE	04:00:04	10°	ESE
06 Nov	-2.3	05:32:44	22°	SW	05:33:05	22°	SW	05:35:45	10°	SSE
07 Nov	-1.6	04:46:00	19°	SSE	04:46:00	19°	SSE	04:47:14	10°	SE
08 Nov	-1.2	05:32:12	10°	SSW	05:32:12	10°	SSW	05:32:24	10°	SSW

END IMAGES, AND OBSERVING

Jupiter and its Moons from 29th September. Grabbed using Celestron 9.25 and Nikon D7200 in video mode. The week of its closest pass in 56 years was marred by cloud and/or poor seeing. The video was stacked in Reqistax (after conversion to AVI file from proprietary Nikon Video. Both these bits of software are available for free. I added moon names in photoshop but got too close to Ganymede...The Celestron optics invert image left-right. Andy Burns.



Observing Sessions

Proposed Observation Sessions for 2022-2023

Planned observing evenings will be on a Friday night in the Lacock playing fields behind the Red Lion pub at 19:00 or an Hour after sunset depending on the time of year.
With the New Moon being around the beginning of the month and the full moon generally around the middle, the following dates for observing are proposed:

a ad-hoc session for other reasons and at other locations, such as astro-photography, solar observing etc, with other like-minded members then they can do so through the Society Members Facebook Page or through the WAS contact page on the website.

Opportunity	Day	Date	Month	Set-up	Observe
First	Friday	21st	October	19:00	19:30
Second	Friday	28th	October	19:00	19:00
First	Friday	18th	November	18:30	19:00
Second	Friday	25th	November	18:30	19:00
First	Friday	16th	December	18:30	19:00
Second	Friday	23rd	December	18:30	19:00
First	Friday	13th	January	18:30	19:00
Second	Friday	20th	January	18:30	19:00
First	Friday	10th	February	18:30	19:00
Second	Friday	17th	February	19:00	19:30
Third	Friday	24th	February	19:00	19:30
First	Friday	17th	March	19:00	19:30
Second	Friday	24th	March	19:30	20:00
First	Friday	14th	April	20:00	20:30
Second	Friday	21st	April	20:30	21:00
First	Friday	12th	May	20:30	21:00
Second	Friday	19th	May	20:30	21:00

OUTREACH: Stanton St Quinton school TBA
STARGAZING for Beginners 2OCT Done.