NWASNEWS

Volume27 Issue 7

March 2022

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

Shorter Warmer nights are coming

Summer triangle was in the pre dawn sky on Sunday, so with spring equinox and clocks moving forward for summer time (remember to reset the hand paddles for daylight saving, A|ND be careful most controllers for astronomical equipment use the American month and day notation….

But night time observing is all about the galaxies with Orion and the outer Milky Way moving to the west, the star clusters move too.

The three main clusters of galaxies in the Northern hemisphere are to the fore. But large apertures or imaging are needed to get many galaxies as they tend to be 10th to 15th magnitude with a few notable exceptions in the 8-0th magnitude that Messier catalogued. The Leo cluster comes up before the main Virgo cluster, which includes galaxies in Coma Berenices and Canes Venetici. The third group is the cluster in Ursa Major which has around 60 members.

Behind these is the 'wall' of galaxies at 250-400 million light years away, still only 1/30th of the way the edge of the visible universe. Galaxies in every direction, having hidden mass to keep the stars in the galaxies together (Dark Matter) and yet the universe is expanding at an accelerating rate. What is the invisible energy source makes the expansion happen? An unseen force, Dark Energy. Luckily we have Martin Griffiths FRAS speaking this evening on these dark topics…

Hopefully we will be back to physical speaker meeting for May and June and some of our members have missed this, others find the zoom meeting easier, but the banter and coffee conversations are what keep the society together.

The viewing evenings have been blessed with some good weather, even if it is the alternative night, and we are getting very good turn out now at these sessions They are open, and an ideal introduction to astronomy for new comers with or without equipment. I am sorry I had to miss the last viewing session because of hospital treatment, but according to Chris we had 12 newbies come.

I also have a teacher at Westbury Leigh in tough for a meeting/talk session. Still to be arranged around my visits further afield. Not sure about volunteers needed yet.

Join Zoom Meeting

Time: Mar 1, 2022 07:45 PM London

Speaker Martin Griffiths

Subject Dark Energy and Dark Matter

https://us02web.zoom.us/j/89151504770?pwd=VVFUZU1lUXdDcHl3V293Z1o1alpBdz09

Meeting ID: 891 5150 4770

Passcode: 496458

Clear skies Andy

Messer 47 (right) and Messier 46 with a planetary nebula ngc 2438 are low down in Puppis, the poop deck. The planetary nebula is slightly closer than the main cluster of stars 4500 light years away, but it has the same radial velocity (following studies in 1996) so it may be associated. The cluster is about 500 million years old.
M47 is much nearer 1600LY, and was 'lost' because of Messier error in writing coordinates. Aging has been hard, with estimates between 37 and 100 million years.
Photo Andy Burns, Using Esprit 120mm and Nikon D810a camera, 60 seconds, ISO 1000, 5 exposures stacked in Sequator and processed in Photoshop.

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 Mweetings and these will be at home sessions.

Meet 7.30 for 8.00pm start

SEASON 2021/22

2022

1st Mar Martin Griffiths Dark Energy and Matter (Zoom)

5th Apr Pete Williamson Herschel to Hawkwind, Astronomy & Music & How each other influence each other

3rd May Andrew Lound The Moon at Christmas: The Epic Voyage of Apollo 8

7th Jun Prof Matt Griffin The hazards of Asteroid Impacts on the Earth – Should we worry?

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 (Treasurer)

Philip Proven (Hall coordinator)

??? (Teas and Projector)

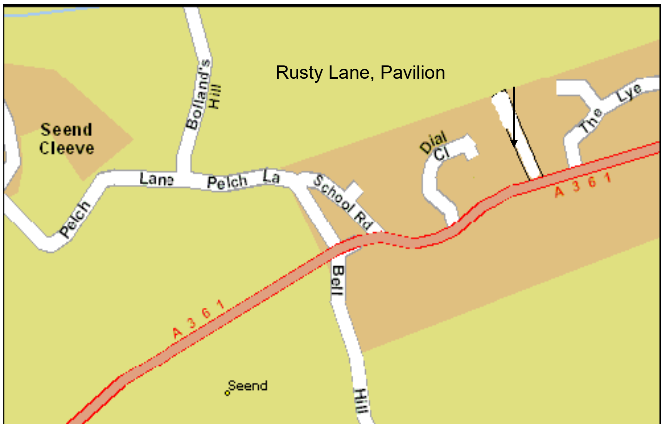
Peter Chappell (Speaker secretary)

Nick Howes (Technical Guru)

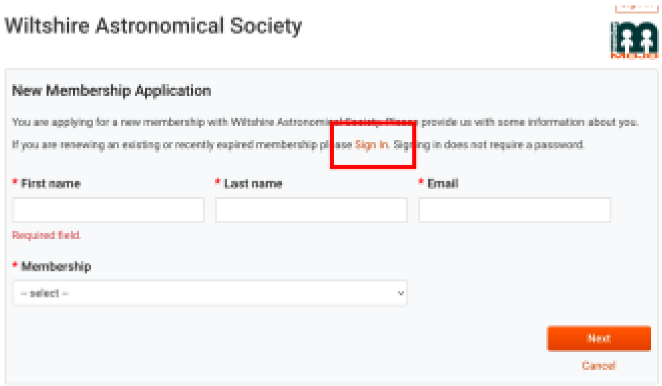
Observing Sessions coordinators: Chris Brooks, Jon Gale,

Web coordinator: Sam Franklin

Contact via the web site details.



Observing Sessions see back page



Martin Griffiths is an astronomer and science presenter with Dark Sky Wales, a former senior lecturer in Astronomy at the University of South Wales, and a founder member of NASA's Astrobiology Science Communication team. He assisted the Brecon Beacon national parks successful campaign to gain International dark sky status and in 2014 became Director of the Brecon Beacon Observatory, a public educational resource at the National Park Visitor Centre. He is the local representative for the BAA campaign for Dark Skies.

Griffiths is a Fellow of the Royal Astronomical Society; a Fellow of the Higher Education Academy; a member of the British Astronomical Association; the Webb Deep-Sky Society; the Society for Popular Astronomy; The Astronomical Society of the Pacific and the Astronomical league. Astrobiology Society of Britain; The European Science Communication Network; The European Society for the History of Science; The Planetary Society and the British Science Association.

Martin is a frequent speaker at Wiltshire AS and has been to the observatory in Spain many times, the Griffon observatory was set up to help the Glamorgan University students connect with the skies, but the astronomy course folded, but he still brings visitors from Dark Skies Wales out to the clearer skies. Hence the picture outside a taverna with live Flamenco music in the background.

Swindon's own astronomy group

Physical meetings continuing!

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

Next meeting: AGM and Owen Brazell

Our next meeting is our AGM, after which Owen will give a presentation on 'Observing Comets' on the 25 March, 2022.

Owen Brazell has been involved in astronomy for over 50 years. His interest in astronomy was sparked by an attempt to see a comet from his native Toronto. From early years, he kept up his interest in astronomy which culminated in a degree in astronomy from St Andrews University.

His main interest is in observing fuzzy objects, both moving and static, as well as solar observing.

Despite this, he spent his working career in the oil and gas industry on the exploration side.

Owen was assistant director to the BAA Deep Sky Section for 25 years and is currently President of the Webb Deep Sky Society, he also writes for various astronomy magazines on deep sky observing. He enjoys visual observing through a range of telescopes from 80mm up to 55cm.

Ad-hoc viewing sessions postponed

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

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

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

Meetings 2022

Friday, 18 Mar 19.30 onwards

Programme: AGM

Friday, 22 April 19.30 onwards

Programme: Jon Gale - The Herschel 400

Friday, 20 May 19.30 onwards

Programme: Hugh Allen - Binary Stars - A history of making waves

Friday, 17 June 19.30 onwards

Programme: Steve Tonkin - Journey Into Space

Website: http://www.swindonstargazers.com

Chairman: Robin Wilkey

Tel No: 07808 775630 Email: robin@wilkey.org.uk
Address: 61 Northern Road Swindon, SN2 1PD

Secretary: Hilary Wilkey

Tel No: 01793 574403 Email: hilary@wilkey.org.uk
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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

GRESHAM ON LINE SESSIONS

MARCH
Planetary Universe by Professor Katherine Blundell
Wednesday, March 30, 2022 6:00 PM gres.hm/planetary-universe
Museum of London / Online Or watch later
How can new worlds be discovered, and how many exoplanets might be out there? What does today's technology in astronomical observatories now enable, and what is it that holds us back from finding what is actually out there? What hinders us from pushing forwards the frontiers of space science?
MAY
The Future of Life on Earth by Professor Roberto Trotta
Monday, May 9, 2022 1:00 PM gres.hm/future-life
Barnard's Inn Hall/ Online Or watch later
Although life is probably widespread in the universe, our pale blue dot, Earth, is the only known place harbouring intelligent life. Even if we manage to stave off extinction by climate change, avoid a nuclear apocalypse and the dangers of runaway AI, biological life on our planet will eventually come to an end in about 5 billion years' time. What are the astrophysical dangers to life on Earth, and the prospects for life's survival into the distant future? JUNE
Life in the Universe by Professor Katherine Blundell
Wednesday, June 1, 2022 6:00 PM gres.hm/life-universe
Museum of London / Online Or watch later
How can life form in the Universe, and what are the necessary ingredients for habitability so that planets can sustain life? Can we expect life elsewhere in the solar system, or on exoplanets? This lecture offers a broader perspective from astrobiology, astrochemistry, and astrophysics on the habitability or otherwise of other planets beyond Planet Earth.
Their website
www.gresham.ac.uk

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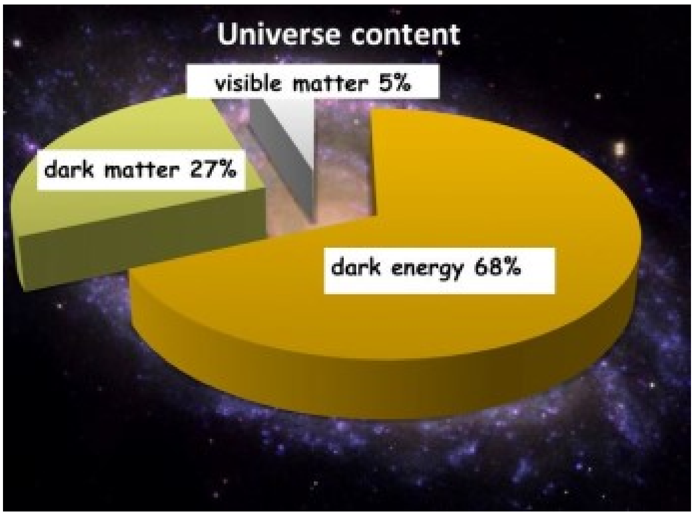
Best wishes for the new Year
Martin
Martin Baker

BACKGROUND BASICS

Dark matter, dark energy



In physical cosmology and astronomy, **dark energy** is an unknown form of energy that affects the universe on the largest scales. The first observational evidence for its existence came from measurements of supernovae, which showed that the universe does not expand at a constant rate; rather, the universe's expansion is accelerating. Understanding the universe's evolution requires knowledge of its starting conditions and composition. Before these observations, scientists thought that all forms of matter and energy in the universe would only cause the expansion to slow down over time. Measurements of the cosmic microwave background (CMB) suggest the universe began in a hot Big Bang, from which general relativity explains its evolution and the subsequent large-scale motion. Without introducing a new form of energy, there was no way to explain how scientists could measure an accelerating universe. Since the 1990s, dark energy has been the most accepted premise to account for the accelerated expansion. As of 2021, there are active areas of cosmology research to understand the fundamental nature of dark energy.

Assuming that the lambda-CDM model of cosmology is correct, the best current measurements indicate that dark energy contributes 68% of the total energy in the present-day observable universe. The mass–energy of dark matter and ordinary (baryonic) matter contributes 26% and 5%, respectively, and other components such as neutrinos and photons contribute a very small amount. Dark energy's density is very low , much less than the density of ordinary matter or dark matter within galaxies. However, it dominates the universe's mass-energy content because it is uniform across space.

Two proposed forms of dark energy are the cosmological constant (representing a constant energy density filling space homogeneously) and scalar fields — such as quintessence or moduli — (dynamic quantities having energy densities that vary in time and space). Contributions from scalar fields that are constant in space are usually also included in the cosmological constant. The cosmological constant can be formulated to be equivalent to the zero-point radiation of space, i.e., the vacuum energy. However, scalar fields that change in space can be difficult to distinguish from a cosmological constant because the change may be prolonged.

Due to the toy model nature of concordance cosmology, some experts believe[15] that a more accurate general relativistic treatment of the structures on all scales[16] in the real universe may do away with the need to invoke dark energy. Inhomogeneous cosmologies, which attempt to account for the back-reaction of structure formation on the metric, generally do not acknowledge any dark energy contribution to the universe's energy density.

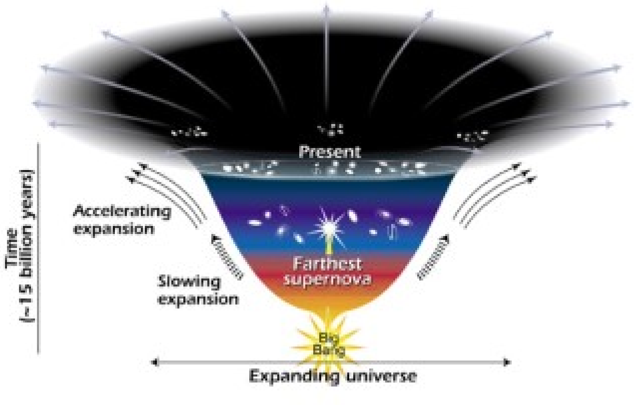
Einstein's cosmological constant

The "cosmological constant" is a constant term that can be added to Einstein's field equation of general relativity. If considered as a "source term" in the field equation, it can be viewed as equivalent to the mass of empty space (which conceptually could be either positive or negative), or "vacuum energy".

The cosmological constant was first proposed by Einstein as a mechanism to obtain a solution of the gravitational field equation that would lead to a static universe, effectively using dark energy to balance gravity.] Einstein gave the cosmological constant the symbol Λ (capital lambda). Einstein stated that the cosmological constant required that 'empty space takes the role of gravitating negative masses which are distributed all over the interstellar space'.

The mechanism was an example of fine-tuning, and it was later realized that Einstein's static universe would not be stable: local inhomogeneities would ultimately lead to either the runaway expansion or contraction of the universe.
The equilibrium is unstable: if the universe expands slightly, then the expansion releases vacuum energy, which causes yet more expansion. Likewise, a universe which contracts slightly will continue contracting. These sorts of disturbances are inevitable, due to the uneven distribution of matter throughout the universe. Further, observations made by Edwin Hubble in 1929 showed that the universe appears to be expanding and not static at all. Einstein reportedly referred to his failure to predict the idea of a dynamic universe, in contrast to a static universe, as his greatest blunder.

Inflationary dark energy

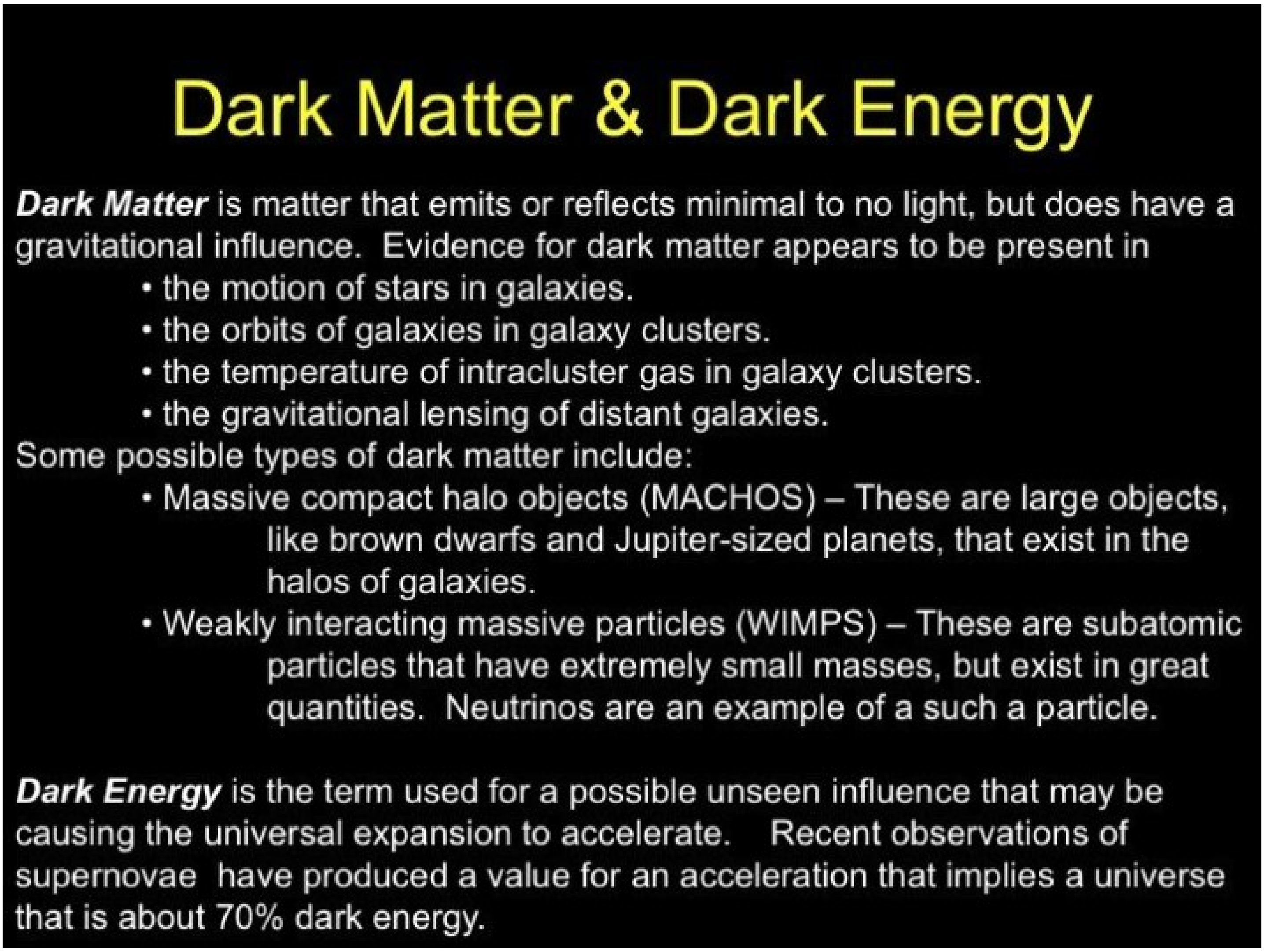


This diagram reveals changes in the rate of expansion since the universe's birth 15 billion years ago. The more shallow the curve, the faster the rate of expansion. The curve changes noticeably about 7.5 billion years ago, when objects in the universe began flying apart at a faster rate. Astronomers theorize that the faster expansion rate is due to a mysterious, dark force that is pushing galaxies apart.

Alan Guth and Alexei Starobinsky proposed in 1980 that a negative pressure field, similar in concept to dark energy, could drive cosmic inflation in the very early universe. Inflation postulates that some repulsive force, qualitatively similar to dark energy, resulted in an enormous and exponential expansion of the universe slightly after the Big Bang. Such expansion is an essential feature of most current models of the Big Bang. However, inflation must have occurred at a much higher energy density than the dark energy we observe today and is thought to have completely ended when the universe was just a fraction of a second old. It is unclear what relation, if any, exists between dark energy and inflation. Even after inflationary models became accepted, the cosmological constant was thought to be irrelevant to the current universe.

Nearly all inflation models predict that the total (matter+energy) density of the universe should be very close to the critical density. During the 1980s, most cosmological research focused on models with critical density in matter only, usually 95% cold dark matter (CDM) and 5% ordinary matter (baryons). These models were found to be successful at forming realistic galaxies and clusters, but some problems appeared in the late 1980s: in particular, the model required a value for the Hubble constant lower than preferred by observations, and the model under-predicted observations of large-scale galaxy clustering. These difficulties became stronger after the discovery of anisotropy in the CMB by the COBE spacecraft in 1992, and several modified CDM models came under active study through the mid-1990s: these included the Lambda-CDM model and a mixed cold/hot dark matter model. The first direct evidence for dark energy came from supernova observations in 1998 of accelerated expansion in Riess *et al.*[21] and in Perlmutter *et al.*,[22] and the Lambda-CDM model then became the leading model. Soon after, dark energy was supported by independent observations: in 2000, the BOOMERanG and Maxima CMB experiments observed the first acoustic peak in the CMB, showing that the total (matter+energy) density is close to 100% of critical density. Then in 2001, the 2dF Galaxy Redshift Survey gave strong evidence that the matter density is around 30% of critical. The large difference between these two supports a smooth component of dark energy making up the difference. Much more precise measurements from WMAP in 2003–2010 have continued to support the standard model and give more accurate measurements of the key parameters.

The term "dark energy", echoing Fritz Zwicky's "dark matter" from the 1930s, was coined by Michael Turner in 1998.



SPACE NEWS TO FEBRUARY 22

Curiosity Finds a Bizarre Rock on Mars that Looks Like a Flower

The Curiosity rover took a picture of something pretty enticing this week on the surface of Mars. While the object in question looks like a tiny little flower or maybe even some type of organic feature, the rover team confirmed this object is a mineral formation, with delicate structures that formed by mineral precipitating from water.

Curiosity has actually seen these types of features before, which are called diagenetic crystal clusters. Diagenetic means the recombination or rearrangement of minerals, and these features consist of three-dimensional crystal clusters, likely made of a combination of minerals. Curiosity deputy project scientist Abigail Fraeman said on Twitter that these features that were seen previously were made of salts called sulfates. From studies of previous features like this found on Mars (you can read a paper on them here), originally the feature was embedded within a rock, which eroded away over time. These mineral clusters, however, appear to be resistant to erosion. Another name for these features is concretion, which you may remember from the Opportunity rover, who saw features that were nicknamed 'blueberries,' since they were small and round. You can see round concretions next to the flower-like feature in this image.

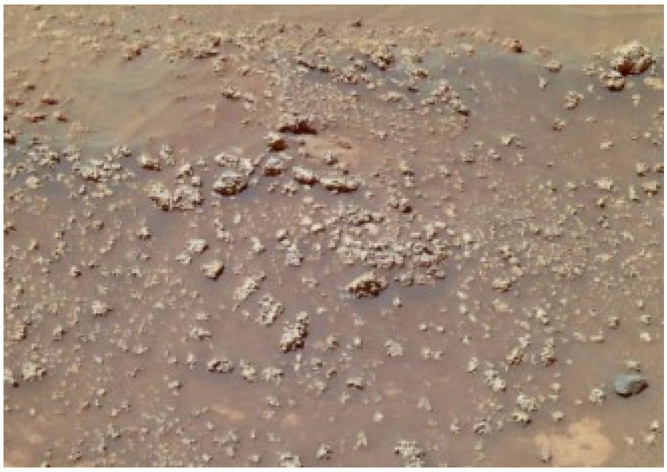
The rover science team saw this feature earlier this week and named it 'Blackthorn Salt'. They used the rover's Mars Hand Lens Imager, called MAHLI, to take these close-up images. This camera is the rover's version of the magnifying hand lens that geologists usually carry with them into the field. MAHLI's close-up images reveal the minerals and textures in rock surfaces.

Curiosity rover obtained this 'Hand Lens' extreme close-up of one of the very small and rather unusual concretion features. This one has been called 'Blackthorn Salt'. Credit: NASA/JPL-Caltech/MSSS/Kevin M. Gill

Here you can see a 3-D model of the object, thanks to Simeon Schmauss:

Mineral formation | Mars Curiosity Sol 3396 by semeion on Sketchfab

Curiosity found another flower-like feature back in 2013, and the Spirit rover found similar-looking rocks that were nicknamed 'cauliflower' features because of their knobby protuberances.



"Cauliflower" shaped silica-rich rocks photographed by the Spirit Rover near the Home Plate rock formation in Gusev Crater in 2008. Credit: NASA/JPL-Caltech

Our thanks to Kevin Gill who processed the images, taken on Sol 33

Webb turns those 18 separate star images into a single unified star. Next comes even better focus.

It's coming together! Engineers for the James Webb Space Telescope have now completed two more phases of the seven-step, three-month-long mirror alignment process. This week, the team made more adjustments to the mirror segments along with updating the alignment of its secondary mirror. These refinements allowed for all 18 mirror segments to work together — for the first time — to produce one unified image.

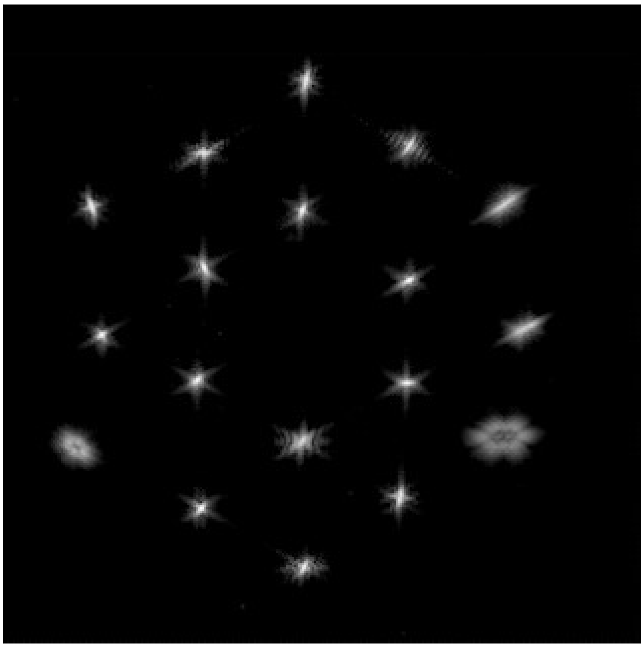
As you can see in the image above, this view of the a star shows one image instead of the 18 views – one from each segment – that we saw earlier this week. NASA engineers say that after future alignment steps, the image will be even sharper.

"We still have work to do, but we are increasingly pleased with the results we're seeing," said Lee Feinberg, optical telescope element manager for Webb, in a blog post. "Years of planning and testing are paying dividends, and the team could not be more excited to see what the next few weeks and months bring."

The star in this image is different from the one that was used earlier (HD 84406).

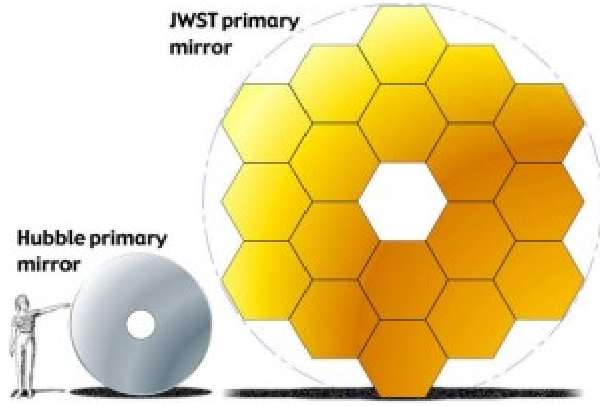
"We need fainter stars for later steps," said Marshall Perrin, deputy project scientist for JWST, on Twitter. "We've used a bunch of different stars so far and will use many more. This one happens to be 2MASS J05042687-5438018, a K=8.8

mag star."
Perrin added that the snowflake pattern in the single image is diffraction from the hexagonal shape of each segment.
"This pattern's going to be a signature of JWST images, instead of the plus-shaped diffraction spikes Hubble and many other telescopes have," Perrin added. "As we continue to phase the mirrors, and the central peak gets five time sharper and 25 times brighter, the diffraction spikes will narrow and get fainter. … After a decade plus of simulating these [images], it's a delight to see them for real!"
JWST's Near Infrared Camera (NIRCam) instrument took the images of this star, which are being used to align the mirrors and calibrate the telescope.
The two steps that were taken this week are called Segment Alignment and Image Stacking. Segment Alignment corrects most of the large positioning errors for the segments. A process called Phase Retrieval uses mathematical analysis to determine the precise positioning errors of the segments. At this phase, the segments still don't work together as a single mirror.



Before and after Segment alignment. Credit: NASA/STScI

This animated gif shows the "before" and "after" images from Segment Alignment, when the team corrected large positioning errors of its primary mirror segments and updated the alignment of the secondary mirror.
In Image Stacking, the images from each segment image are stacked on top of one another. Then the individual segment images are moved so that they fall precisely at the center of the field of view to produce one unified image. This puts all the light in one place on the detector.
"We still have to ensure the light arrives at the detector in perfect unison, which will make the resolution 5 times better than what you see here," said JWST project scientist Klaus Pontoppidan on Twitter.
Next, the team will now begin making even smaller adjustments to the positions of Webb's mirrors.
Although Image Stacking put all the light from a star in one place on NIRCam's detector, the mirror segments are still acting as 18 small telescopes rather than one big one. The segments now need to be lined up to each other with an accuracy smaller than the wavelength of the light.

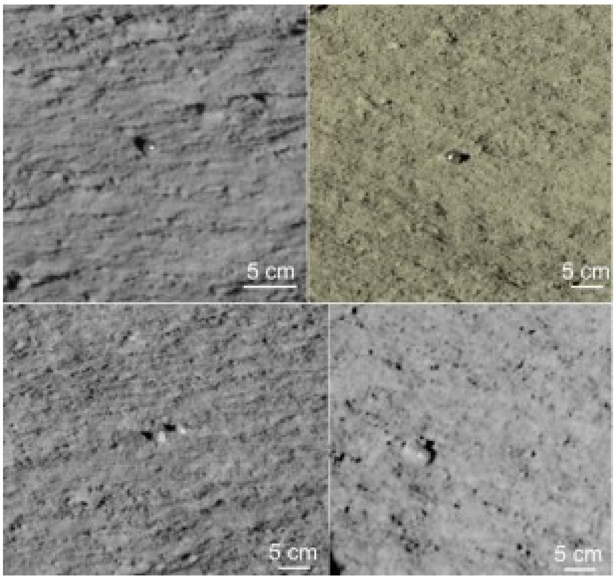


JWST primary mirror size compared to the Hubble Space Telescope. Credit: NASA

The team is now working on that, beginning the fourth phase of mirror alignment, called Coarse Phasing, where NIRCam is used to capture light spectra from 20 separate pairings of mirror segments. This helps the team identify and correct vertical displacement between the mirror segments, or small differences in their heights. This will make the single dot of starlight progressively sharper and more focused in the coming weeks.
But from here on, the process will be iterative, where once a certain level of alignment and focus is achieved, the engineers may have to go back and re-do certain steps to achieve perfect alignment.
"You align the mirrors, then check them, and then you need to go back a few steps and adjust and recenter, and then go back through the entire process again," Feinberg told me last month, "which is why the process will take approximately three months."
Team members continue to share their experiences and provide more info on the alignment process at the JWST blog.

Chinese Rover Finds Translucent Glass Globules on the Moon

Scientists say China's Yutu-2 rover, part of the Chang'E-4 mission, has found several small glass globules on the Moon's far side. While tiny glass beads have been found previously in lunar samples brought back by the Apollo astronauts, the ones found by Yutu-2 are much bigger and translucent.
The discovery was made by Dr. Zhiyong Xiao, one of the lead scientific team members of the Chang'E-4 mission. They beads were found by looking at panoramic images taken by the rover. Since the rover doesn't have sampling capabilities and is not a sample return mission like it's older sibling, the Chang-E-5 mission, there is no compositional data on the glass beads, only observational evidence.
In the paper published in the Science Bulletin, Xiao said taking into account the location where the glass was found – in the South Pole Atkien basin at the lunar farside – and the local context of what is known about that region, they believe the beads are like most likely the result of large impacts to the Moon.
The paper details the discovery of several translucent spherical and dumbbell-shaped glassy globules that range in size, but are as large as 4 centimeters (1.5 inches). They were found on the surface of the Moon, and are transparent to translucent, with some exhibiting a light brownish color.



Two confirmed (upper row) and two possible (bottom row) glass globules found along the route of Yutu-2 (Image taken by the Yutu-2 rover; courtesy of China National Space Administration).

As you can see from the images, the glass beads are quite compelling.

“Transparent and translucent glasses on the Moon are less than 1 mm in diameters, and larger ones are dark and opaque,” the team wrote in their paper. “Hitherto discovered macro-sized glass globules on the Moon (up to 4 cm in diameter) are opaque impact glass.”

In the Apollo samples, tiny glass beads were found across several of the missions, but they were incredibly small, less than 1 millimeter. Studies of those beads indicated they were volcanic in origin, and they have different colors, depending on their chemical makeup. For example, scientists found green beads in lunar soil collected by astronauts on the Apollo 15 mission in 1971, and the famous “orange soil” of Apollo 17 in 1972 was colored by glass beads.

Both volcanic and impact glasses on the Moon are formed by cooling of regolith that has experienced extreme heat. Glass spherules can record important information about the mantle composition and the history of both lunar volcanism and impact cratering.

Orange soil (from volcanic glass beads) is clearly visible in this image from Apollo 17. Credit: NASA

In the case of the Apollo 17 orange glass, analysis back on Earth revealed volcanic glass formed when molten lava from the interior of the Moon erupted, some 3 to 4 billion years ago, spewing up above the airless surface and into the vacuum of space. As the lava became exposed to the vacuum, it separated out into tiny fragments and froze, forming tiny beads of volcanic glass in orange and black colors. Later analysis revealed measurable water content in the beads.

But the glass found by Yutu-2 is different, say the researchers and they conclude that from “their unique morphology and local context suggest they are most likely impact glasses — quenched anorthositic impact melts produced during cratering events — rather than being of volcanic origin or delivered from other planetary bodies.” , the researchers said.

Xiao and his team predict that the glass globules would be abundant across the lunar highlands, providing promising sampling targets for future missions that could reveal the early impact history of the Moon.

Chang’e-4 launched on Dec. 8, 2018, and made a soft landing in the Von Karman Crater in the South Pole-Aitken Basin on the far side of the moon on Jan. 3, 2019. So far, Yutu-2 has traveled more than 1,000 meters.

New Photos Show a Black Hole Blasting out Powerful Winds

Pictures of galaxies never cease to amaze, and astronomers are consistently coming up with new ones that provide a different viewpoint on the universe and maybe some exciting science along with it. A recent picture of the galaxy NGC 7582, taken with the Very Large Telescope (VLT), shows an active supermassive black hole at the galaxy’s core. However, something appears to be redirecting its “wind” away from the rest of the spiral galaxy.

Black holes are notorious for gobbling up matter and, as a byproduct, producing massive streams of energy that can obliterate their surroundings. A study from Stéphanie Juneau of NOIRLab showed that in NGC 7582 at least, those energy streams are being redirected away from the rest of the galaxy by a “wind.”

That isn’t a “wind” in a traditional sense, but one that can be seen in a particular wavelength of light. Utilizing the Multi Unit Spectroscopic Explorer (MUSE) of VLT, Dr. Juneau and her colleagues looked at the ionized particles that were present in the galaxy. The color-corrected image shows oxygen (blue), nitrogen (green), and hydrogen (red), respectively. The ionized heavier elements can be seen in a cone shape around the supermassive black hole at NGC 7582’s center, depicting the expected energy flow nicely. By contrast, the red coloration of the image shows where the star-forming regions of the galaxy are. Conveniently, the wind seems isolated from those delicate regions, allowing stars to form unmolested.

No matter what might be protecting those star-forming systems, the image that shows it is astounding. And it happens to have some novel science behind it too.

Learn More:

ESO – A black hole caught blowing a gust

Juneau et al – The Black Hole-Galaxy Connection: Interplay between Feedback, Obscuration, and Host Galaxy Substructure

Sci News – Galaxy Substructure Plays Important Role in How Active Black Holes Affect Their Galaxies: Study

Lead Image:

An image of NGC 7582, on the left showing it in traditional light, while on the right is a detailed view of the massive wind coming of the galaxy’s central black hole.

A Colossal Flare Erupted From the Far Side of the Sun

Earlier this week the Sun erupted with a huge explosion, blasting solar particles millions of kilometers into space. The team for the ESA/NASA Solar Orbiter spacecraft says the blast is the largest solar prominence eruption ever observed

in a single image together with the full solar disc.
Luckily for us here on Earth, the eruption on February 15, 2022 occurred on the farside of the Sun, the side facing away from our planet. But ESA and NASA predict geomagnetic storms are possible in the next few days as the active region on the Sun responsible for the blast turns toward us.
The event was captured by several spacecraft, including Solar Orbiter and STEREO A.
A solar prominence consists of red-glowing loops of plasma, structured by tangled magnetic field lines generated by the Sun's internal dynamo. An erupting prominence occurs when such a structure becomes unstable and bursts outward, releasing the plasma. They are often associated with outbursts of charged particles called coronal mass ejections (CMEs), which if directed towards Earth, can wreak havoc with our space-based technology.
Evidence of that came last week when SpaceX lost up to 40 of their recently launched 49 Starlink internet satellites after several CMEs erupted. The solar particles affected Earth's atmosphere — 'puffing' it up, so to speak — making it difficult for the satellites to maintain their orbits. In a statement on February 8, SpaceX said "the escalation speed and severity of the storm caused atmospheric drag to increase up to 50 percent higher than during previous launches."
The Sun has definitely increased in activity the past few months, and this latest event on February 15 zapped two "sungrazer' comets that came close to the Sun.

One of Life's Building Blocks can Form in Space

Peptides are one of the smallest biomolecules and are one of life's critical building blocks. New research shows that they could form on the surfaces of icy grains in space. This discovery lends credence to the idea that meteoroids, asteroids, or comets could have given life on Earth a kick start by crashing into the planet and delivering biological building blocks.
Peptides are short chains of amino acids, and amino acids are the building blocks of proteins. When peptides join together in a chain, they're called polypeptides. A chain of polypeptides longer than about 50 is a protein. Sometimes peptides are called the "shorter cousins of proteins." Proteins are larger biomolecules that play many critical biological roles, so there would be no proteins and no life without peptides. Every cell and all tissue in the body contains peptides.
According to most, Emil Fischer discovered peptides and the peptide bond in the early 20th century. He won the 1902 Nobel Prize in chemistry. Fischer thought the day would come when scientists could use peptide science to synthesize proteins. Now we live in an age of constant peptide discovery and synthesis, leading to more than 80 new therapeutics that treat a wide range of diseases. Peptides are critical, and their use is widespread. Their discovery helped usher in an age marked by a burst in our understanding of biological processes.
Their discovery in space might do the same for the understanding of the origins of life.

The sequence where amino acids and peptides come together to form organic cells. Credit: peptidesciences.com
Peptides had to originate somewhere. Researchers have discovered other building blocks like amino acids in space in recent years. Astronomers found amino acids in meteorites that fell to Earth, and they've discovered glycine in a comet along with ammonium salts and aliphatic compounds. Now it looks like we can add peptides to the list of organic building blocks that occur naturally in space.
"It is an amazing fact that complex organic molecules exist in denser regions between the stars, in protoplanetary disks, primitive meteorites and comets."
Thomas Henning, study co-author, MPIA.
If this new research is accurate, natural processes in space can produce basic pre-biological building blocks. This suggests that the possibility of life's emergence could be widespread and that any fertile planet or moon has likely been seeded with these building blocks.
The research comes from scientists at the University of Jena and the Max Planck Institute for Astronomy. The paper is "A pathway to peptides in space through the condensation of atomic carbon." The lead author is Serge Krasnokutski, and the paper is published in the journal Nature Astronomy.
"It is an amazing fact that complex organic molecules exist in denser regions between the stars, in protoplanetary disks, primitive meteorites and comets," said Thomas Henning, co-author of the new study and director at the Max Planck Institute for Astronomy. "They can be formed by a variety of processes from processes in the gas phase, on icy grain surfaces and wet chemistry on the parent bodies of meteorites."
In their paper, the researchers point out that complex molecules are present in the interstellar medium (ISM). Previous researchers have simulated ISM conditions in labs and produced the same complex molecules. But there's a limit to that type of research. "Until now, however, only relatively small molecules of biological interest have been demonstrated to form experimentally under typical space conditions," they explain.

Scientists detected glycine in Comet 67P/Churyumov-Gerasimenko' coma in 2020. In this image, Rosetta's scientific camera OSIRIS shows the sudden onset of a well-defined jet-like feature emerging from the side of the comet's neck, in the Anuket region. Image Credit: ESA/Rosetta/OSIRIS
This research focuses on the icy surfaces of dust grains—particularly carbon or silicate atoms—that exist in giant molecular clouds (GMCs.) If we subtract the dominant amounts of hydrogen and helium in GMCs, these atoms make up half of the remaining mass in GMCs. The carbon and silicate atoms are clumped together in conglomerates less than one-millionth of a meter in diameter. Their location inside GMCs is vital because stars, and eventually planets, form from material

in GMCs. This is the beginning of the potential link between peptides and life on Earth or elsewhere.

This work is different than previous work that produced small biologically important molecules. Peptides are chains of amino acids, so they're larger than things like formaldehyde produced previously. This new research focuses on the icy layers of the carbon and silicate atom conglomerates. These layers provide a natural laboratory where materials adhere to the ice and come into close contact with each other. That proximity allows chemical reactions to form more complex molecules.

"Here we prove experimentally that the condensation of carbon atoms on the surface of cold solid particles (cosmic dust) leads to the formation of isomeric polyglycine monomers (aminoketene molecules). Following encounters between aminoketene molecules, they polymerize to produce peptides of different lengths," the authors write.

This discovery strongly rests on the scientific efforts of lead author Serge Krasnokutski. He's interested in the chemistry of carbon atoms, particularly cold carbon atoms found in space. Krasnokutski developed and then patented a method to produce cold carbon atoms that allows laboratory experiments to duplicate conditions in space. Labs around the world now use this method.

In 2020 Krasnokutski published results showing that glycine, which is the simplest amino acid, could form on the surface of dust grains with the help of cold carbon atoms. He showed that these chemical reactions didn't need ultraviolet photons for an energy source.

Molecular clouds are vast star-forming regions. This image shows the Orion Molecular Cloud Complex, an active star-forming region 1,000 and 1,400 light-years away. New research shows that peptides, one of life's building blocks, can get their start in these frigid regions. Image Credit: By Rogelio Bernal Andreo – http://deepskycolors.com/astro/JPEG/RBA_Orion_HeadToToes.jpg, CC BY-SA 3.0, https://commons.wikimedia.org/w/index.php?curid=20793252

"Single carbon atoms are surprisingly reactive, even at the lowest temperatures," Krasnokutski said. "They act as 'molecular glue' that joins molecules together, and turns inorganic substances into organic ones."

Once simple amino acids like glycine form, the next question almost asks itself. Can these acids form into longer chains of peptides or proteins in space?

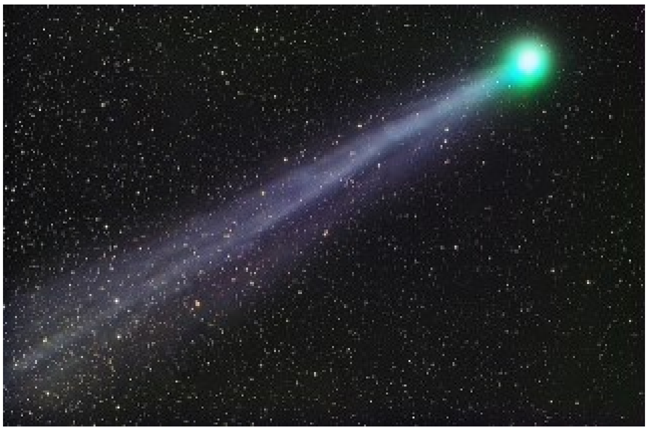
The only way to find out was to devise and conduct the right experiments. The team of researchers needed to replicate the key conditions of cold carbon atoms in space. They used a method previously developed at MPIA's Laboratory Astrophysics Group at the University of Jena. The method centers on an Ultra-High Vacuum (UHV) chamber, which creates the vacuum found in molecular clouds in the ISM.

Inside the UHV, the researchers simulated the surface of icy dust grains and deposited atoms and molecules onto their surfaces. They found that aminoketene formed on the cold surface. Aminoketene is the precursor to glycine, the simplest of the amino acids. They also found evidence of peptide bands, a type of chemical bond that bonds amino acids together in short chains of peptides, as well as in longer chains of proteins.

Those peptide bands only showed up when the team warmed their samples up above the temperature inside molecular clouds. So they may occur naturally when a new star forms, or when the dust grains are deposited on a planet's surface in a star's habitable zone. "Together, the low-temperature chemistry forming aminoketene and the warming-up letting the aminoketene molecules bond to form peptide could create peptides on interstellar dust grains," the press release says in summary.

The team has discovered a new pathway to the formation of peptides. And it requires less energy than other pathways, meaning it could happen naturally in the cold of outer space. Also, it requires C atoms, carbon monoxide, and ammonia, which are the most abundant molecule species in the ISM.

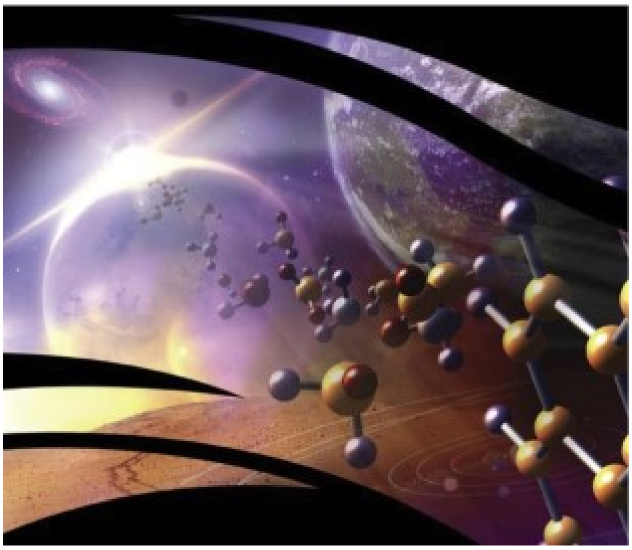
Carbon is at the center of this, just as it is in all life. "The single carbon atoms initiate a rich and diverse chemistry. Even under the conditions found in outer space, that chemistry goes much further towards what is needed for the emergence of life than previously thought," said Krasnokutski.



Carbon is necessary for life and is the fourth most abundant element in the Universe by mass. In this image of comet C/2014 Q2 (Lovejoy), the carbon helps create the green glow around the comet called the coma. Image Credit: By John Vermette – www.johnsastrophotos.com, CC BY-SA 4.0, https://commons.wikimedia.org/w/index.php?curid=38688394

Scientists are finding that the ingredients for life are more widespread than they thought. With this study, we're finding that some of these ingredients can combine into biological building blocks in an unlikely spot: the freezing vacuum inside molecular clouds in the ISM. The complexity of those building blocks increases when conditions warm up.

These results strengthen the idea of molecular panspermia. That idea says that while life is rare, the building blocks are widespread. These building blocks have likely spread to every planet and moon, though life is impossible on the majority of worlds. If this is true, then life has likely arisen on multitudes of moons and planets throughout the Universe.

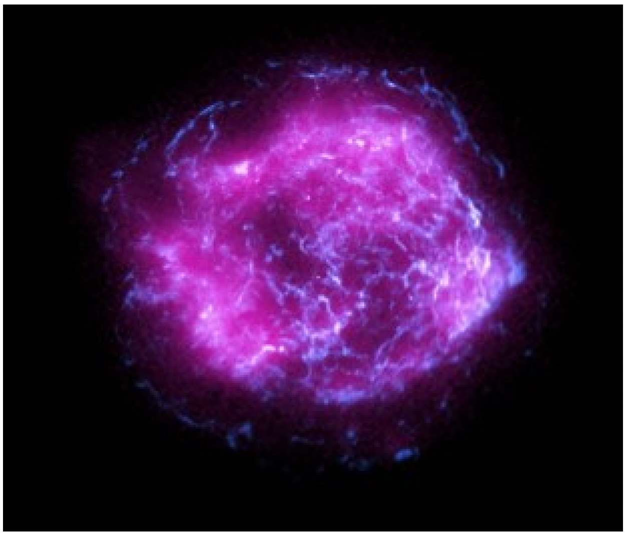


The molecular panspermia says that the building blocks of life are widespread in the Universe, even if life itself is not. Credit: NASA

But research shows that many worlds, though they may have experienced a period of habitability, never remained habitable for long. That means Earth is still a rarity, possibly even unique.

It's the only place that we know of where tiny building blocks forged in the freezing vacuum of outer space eventually evolved into complex life smart enough to study its own origins.

The First Image From NASA's new X-ray Observatory



It's first light for one of the newest space observatories! The Imaging X-Ray Polarimetry Explorer team has released their first image, taken after a month-long commissioning phase for the spacecraft. And it's a beauty.

IXPE looked at a favorite target among space observatories, the supernova remnant Cassiopeia A. While x-rays are invisible to human eyes, the amount of magenta color in this image corresponds to the intensity of X-ray light observed. Needless to say, it's intense with high energy x-rays.

Satellites can now see Exactly Where Methane is Being Dumped Into the Atmosphere

Methane is one of the most important greenhouse gases, despite the overwhelming interest in carbon dioxide emissions as the primary source of climate change. It is hard to track, though, as its sources can range from leaking chemical and gas pipelines to literal farm fields. Now an energy analytics company has a system they believe can track otherwise undocumented methane emissions in a way that could prove helpful in eliminating them altogether.

The company, known as Kayrros, recently published the results of their survey in Science. They used ESA's Sentinel-5P satellite to monitor the entire world for methane emissions. Monitoring was completed using the TROPOspheric Monitoring Instrument (TROPOMI). Doing so required combing through thousands of daily pictures the satellite captured every day. What they found wasn't particularly surprising, but it was important.

Not convinced methane is a problems? Here's a good argument for why it is.

Credit – Bloomberg Markets & Finance YouTube Channel

Over the course of two years, 1,800 unplanned methane emissions that released more than 25 tons per hour occurred. Of those, 1,200 events came from oil and gas facilities. If these unexpected leaks could be mitigated, it would be the equivalent of removing 20 million cars from the road.

The study mainly focused on six major fossil fuel producers as its research subjects. These included countries on three continents – Russia, Turkmenistan, the USA, Iran, Kazakhstan, and Algeria. Each of these countries would stand to gain economically if they could eliminate these unexpected leaks – with Turkmenistan benefiting the most by saving $6 billion in lost revenues from gas leaks. That is a pretty significant figure for a country whose total GDP is around $45 billion.

NASA video showing some of methane's sources.

Credit – NASA Scientific Visualization Studio YouTube Page

Such monitoring and economic analysis could only have taken place using satellites. Any in-situ or aerial sensor is much less likely to detect the types of emissions the Kayrros data captured. But it does have a defect – satellite data has a very high minimum threshold, meaning that they cannot detect any emissions that release less than 25 tons per house. Those can still be pretty significant, especially as there are likely many more of them than those events detected by TROPOMI. Even the large events it caught made up approximately 10% of the overall methane emissions from oil and gas production.

Knowing there's a problem is the first step to solving it, and this new satellite analysis method very clearly shows that there is a problem. Whether or not the countries that would most benefit from solving the problem will take it upon themselves to do so is another matter entirely. But if they do, the world will be better off for it.

Learn More:

Kayrros – Groundbreaking study in Science provides first statistical characterization of methane ultra-emitters from oil and gas

Science – Global Assessment of Oil and Gas Methane Ultra-Emitters

ESA – Mapping high-resolution methane emissions from space

Astronomy Jargon 101: Hydrostatic Equilibrium

In this series we are exploring the weird and wonderful world of astronomy jargon! You'll feel balanced with today's topic: hydrostatic equilibrium!

Hydrostatic equilibrium is a state of balance between gravity, which wants to pull things together, and pressure, which wants to blow it apart. It appears a lot in astrophysics, from the Earth's own atmosphere to gigantic clusters of galaxies.

The word "hydro" appears because the concept was first studied in the context of fluids, but it can apply to concepts like the composition of rocky planets. The word "static" implies that once this state is achieved, it's going to hang out like that for a long time.

The Earth's atmosphere is in a state of hydrostatic equilibrium. The gravity of the Earth is constantly pulling the atmosphere down. If nothing could resist it, all the air around the

Earth would compress down into a thin shell. On the other hand, the atmosphere is warm, and that warmth has a pressure associated with it. With only the pressure, our atmosphere would blow off into space.
The inward pull of gravity balances the outward pressure, and the two are locked. In the end, the atmosphere stays nice and thick…and exactly where it is.
The same thing happens to clouds of interstellar gas and dust. These nebulae can maintain hydrostatic equilibrium for millions of years, but if they become disturbed or acquire too much mass, gravity can win and they begin to collapse, forming stars in the process.
On the very largest scales, entire galaxy clusters maintain hydrostatic equilibrium. The plasma that fills the space between galaxies, called the intracluster medium, is incredibly hot. It would all collapse into the center of the cluster if it wasn't able to support itself from its own pressure.
The concept of hydrostatic equilibrium figures prominently in the definition of a planet. Objects that are too small don't have enough gravity to pull themselves into a spherical shape. However, larger objects, like the Earth, can achieve it.
Lastly, stars themselves are in hydrostatic equilibrium, which allows them to shine for billions of years or longer. The outward pressure generated by the energy of the fusion reactions balances the pull of gravity. If the star were to begin fusing too much hydrogen, the extra energy would puff the star out, reducing the amount of fuel and lowering the fusion rate, returning the star to equilibrium.

Wow. Parker Solar Probe Took a Picture of the Surface of Venus

The Parker Solar Probe's mission is to study the Sun. But the spacecraft's instruments have nabbed some pretty impressive data on Venus, as it uses the planet for gravity assists in its ever-shrinking solar orbit.
Now, the spacecraft has captured visible light images of Venus' surface, somehow able to peer through the shroud of clouds in the planet's atmosphere.
This is complete bonus data that wasn't ever expected.
"The images and video just blew me away," said Brian Wood, a physicist at the Naval Research Laboratory in Washington, DC. Wood is the lead author of a new study detailing the images, published in Geophysical Research Letters.
On it's fourth flyby of Venus in February of 2021, Parker's visible light camera, the Wide-field Imager for Parker Solar Probe, or WISPR, captured views of the planet's nightside. WISPR was designed to see faint features in the solar wind flowing out from the Sun.
The mission scientists thought they could use the cameras to see Venus' clouds during flybys of the planet, and you may recall we reported last year how WISRP somehow captured Venus' surface in infrared light, during flyby number three.
Now, they've captured visible light images – the light that humans can see – where light and dark surface features are visible through the planet's clouds.

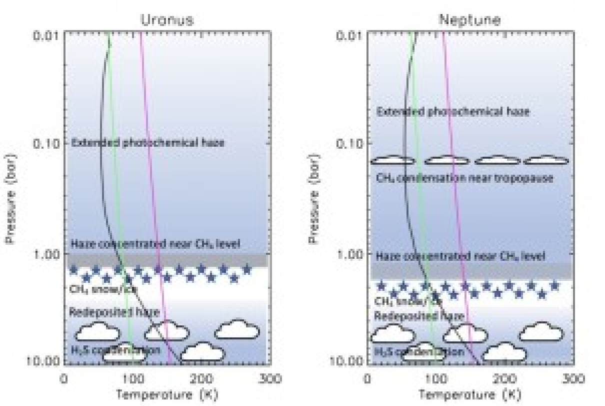
As Parker Solar Probe flew by Venus on its fourth flyby, its WISPR instrument captured these images, strung into a video, showing the nightside surface of the planet. Credits: NASA/APL/NRL

While the Soviet Venera spacecraft took images during their short life on the surface, this is the first time visible light from the Venusian surface has been captured from space.
Mission scientists said they expected WISPR to capture Venus' thick, carbon dioxide clouds, which normally block views of the surface. But instead, the camera was able see through the clouds, revealing the dark-tinted shape of Aphrodite Terra, a highland area near Venus' equator. The feature appears dark because of its lower temperature, about 85 degrees Fahrenheit (30 degrees Celsius) cooler than its surroundings.
"WISPR is tailored and tested for visible light observations," said Angelos Vourlidas, the WISPR project scientist. "We expected to see clouds, but the camera peered right through to the surface."
The images, combined into this video, reveal a faint glow from the surface that shows distinctive features like continental regions, plains, and plateaus. A luminescent halo of oxygen in the atmosphere can also be seen surrounding the planet.
The WISPR images show features on the Venusian surface, such as the continental region Aphrodite Terra, the Tellus Regio plateau, and the Aino Planitia plains. Since higher altitude regions are about 85 degrees Fahrenheit cooler than lower areas, they show up as dark patches amidst the brighter lowlands. These features can also be seen in previous radar images, such as those taken by Magellan.
Beyond looking at surface features, scientists said the new WISPR images will help to better understand the geology and mineral make-up of Venus, as well provide clues to the planet's evolution. The new images will also be helpful for the two upcoming missions planned for Venus.
"By studying the surface and atmosphere of Venus, we hope the upcoming missions will help scientists understand the evolution of Venus and what was responsible for making Venus inhospitable today," said Lori Glaze, director of the Planetary Science Division at NASA Headquarters. "While both DAVINCI and VERITAS will use primarily near-infrared imaging, Parker's results have shown the value of imaging a wide range of wavelengths."

Why are Neptune and Uranus Different Colours?

Uranus and Neptune are similar planets in many ways. Both are ice giant worlds, both have atmospheres rich in methane, and both have a bluish colour. But while Uranus has a pale blue-green hue, Neptune has a deep blue colour. But why? Why would two planets so similar in size and composition appear so different? According to a recent study, the answer lies in their aerosols.
Aerosols are small dust particles or droplets of liquid that are suspended within a gas. On Earth, we often think of aerosols as a form of pollution, since smoke and smog are aerosols. But aerosols can also be less harmful things such as the mist of a fog, or a cloud of tiny ice crystals on a cold winter's night. If you have an atmosphere, you are bound to have aerosols.
Aerosol particles can be so small that their diameters are roughly the same as the wavelengths of visible light. Because of this, the way light scatters off them can depend on the light's wavelength. Through a process known as Mie scattering, long red wavelengths usually scatter more than shorter blue wavelengths. Mie scattering is why Mars often has a tan sky rather than a blue one, and why sunsets on Mars are often blue. As this latest study shows, aerosols play a significant role in the colouring of Uranus and Neptune, but the connection is not a simple one.
The atmospheres of Uranus and Neptune are mostly hydrogen and helium, but they are also rich in methane (CH_4). Methane absorbs red light and reflects blue, which

is why both planets have a generally blue colour. There are traces of other elements in their atmospheres, and the chemical reactions between various molecules can create a haze of aerosols that can taint their basic blue hue.



How aerosol layers color Uranus and Neptune. Credit: Irwin, et al

Based on spectral observations of Uranus and Neptune, the team devised a model where there are three main types of aerosols, numbered by how deep they are located within the planet's atmosphere. The deepest layer is Aerosol-1, which seems to be a combination of molecular smog and ice particles of hydrogen sulfide (H_2S). Hydrogen sulfide reflects green light while absorbing red and blue, which helps give Uranus its greenish tinge. The middle layer of aerosol-2 doesn't reflect much visible light but does reflect ultraviolet and infrared. The highest layer is aerosol-3. It is composed of particles smaller than a micron and tends to reflect visible light about the same at all colors. The aerosol-3 layer is thicker on Uranus, making it appear paler than Neptune. Neptune also has an upper layer of methane ice clouds, helping it maintain its deep blue.

This layering of aerosols could also help explain storms on the two planets, such as the great blue spot seen on Neptune as it was visited by Voyager II. As the upper layers are cleared by a storm, the deeper, bluer layer is more easily seen.

While this unified model of aerosol layers can explain the appearance of both worlds, alternatives can't be ruled out. The team also came up with different models that would explain Uranus and Neptune separately. But the unified model works well and could help us explain the atmospheres of icy gas worlds around other stars.

Reference: Irwin, Patrick GJ, et al. "Hazy blue worlds: A holistic aerosol model for Uranus and Neptune, including Dark Spots." *arXiv preprint* arXiv:2201.04516 (2022).

How Dark Matter Could Be Measured in the Solar System

Dark matter has long been a mystery to astronomers, in no small part because it is so hard to measure directly. Its influence is plain when looking at its gravitational effects on objects such as far away galaxies, but measuring that influence directly has proved much trickier. But now, a team of scientists thinks they have a way to measure the influence of dark matter directly – all it would require is a specialized probe that sits really far away from Earth for a while.

Gravity is a very predictable force – its strength diminishes with distance. While standing on the Earth, its influence is the strongest source of gravity. Similarly, if an object is floating around the solar system, the sun is likely its strongest source of gravity. But even in the solar system itself, dark matter influences the gravity felt by objects orbiting the sun.

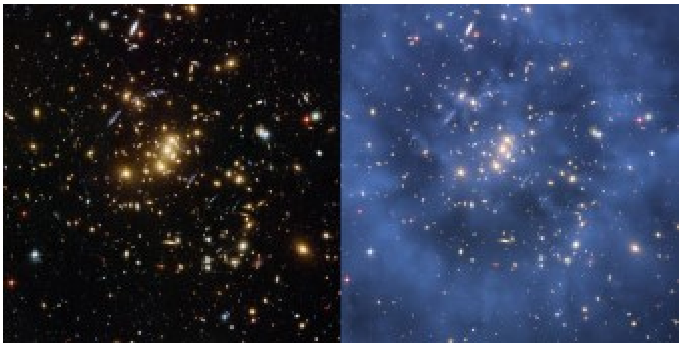
UT video discussing what we know about dark matter.

That's because matter (both "dark" and "baryonic" – i.e., normal) outside of the solar system also pulls on objects within the solar system. However, that pull is weaker because of the huge distances between objects. Dr. Edward Belbruno calls this pull the "galactic force," which sounds more like a TV superhero team from the 90s rather than a measure of gravitational influence. Nevertheless, he and his colleagues calculated that approximately 45% of this galactic force was caused by regular matter, while the other 45% was caused by dark matter.

Dark matter's lesser influence doesn't seem to make sense, given that it accounts for up to 95% of the galaxy's gravitational pull. However, that disparity seems to be due to the distance between objects in the solar system and the vast majority of dark matter in the galaxy. Dark matter is clustered in a halo around the outside of the galaxy. Since our solar system isn't very near the edge, dark matter's impact on objects within the solar system is minimized even more.

That doesn't mean it's completely undetectable. Calculates put forward in the paper suggest that the influence of dark matter might have moved the probe Pioneer 10 by as much as 1.5 m (5 ft). Admittedly that is a minimal distance compared to the billions of kilometers it has traveled over its 50-year lifespan. But with the right instruments, a similar effect could be measured on a different spacecraft.

The paper suggests that a probe set up with an experiment specifically designed to monitor gravitational influences could detect the effects of dark matter by simply traveling to 100 AU and dropping a ball into space. This ball would have to be reflective, but it would be subject only to the galactic force. In contrast, the spacecraft, which would also have to have a commonly used power source called a radioisotope thermal generator (RTG), would also be subjected to the thermal force caused by that RTG.



The left image shows galaxy cluster Cl 0024+1 from a Hubble image in visible light. The right image shows blue shading representing dark matter according to the gravitational lensing it causes.

Credit – NASA, ESA, M.J. Jee and H. Ford (John Hopkins University)

By subtracting the acceleration (or deceleration) caused by the thermal force from the overall acceleration difference of the probe, scientists could figure out what gravitational acceleration is caused by the galactic force itself. Currently, no mission is on the docket that is designed for such an experiment, but one called Interstellar Probe has been put forward as a concept. It would pause at 500 AU to look at conditions there, and with the right equipment could be the probe source needed to directly study the effects of dark matter for the first time.

Learn More:

NASA – How Dark Matter Could Be Measured in the Solar System

Belbruno et al – When leaving the Solar system: Dark matter makes a difference

Futurism – NASA Proposes Sending Spacecraft to Measure Mysterious Dark Matter

UT – By Measuring Light From Individual Stars Between Galaxy Clusters, Astronomers Find Clues About Dark Matter

The First Rogue Black Hole has Been Discovered, and it's Only 5,000 Light-Years Away

Microlensing strikes again. Astronomers have been using the technique to detect everything from rogue planets to the most distant star ever seen. Now, astronomers have officially found another elusive object that has long been theorized and that we first reported on back in 2009 but has never directly detected – a rogue black hole.

That detection comes at the end of a 6-year observational campaign, with dozens of authors collaborating on a paper recently published in arXiv (meaning it has not yet been peer-reviewed). Those six years of painstakingly gathered data all started back in 2011, when a star about 20,000 light-years away brightened suddenly. Scientists were looking for just such an event and had found several before but needed more data to be sure of what they were actually seeing.

UT video discussing the black hole formation process.

Microlensing leaves two tell-tale signs. The object in the background of a microlensing event would grow significantly bright, as was seen with this star in 2011. In addition, and if the positioning were lucky enough, telescopes would see the star shift ever so slightly as the massive lensing object passed in front of it.

Past observations have shown plenty of brightening events that microlenses might have caused, but astronomers have never before seen the positional shift that would confirm that theory. Kailash Sahu and his colleagues turned Hubble, which is still one of the most functional observation platforms in humanity's arsenal, toward the star a few weeks after its original brightening. They then checked back in with it periodically over the course of the next six years. In that time frame, they also collected positional data, hoping to use a technique called astrometry to detect slight movements that would indicate the star was subject to a microlensing object between itself and Hubble.

Finding black holes is hard – here we discuss the nearest one.

A combination of warping and amplification of the star's light is exactly what Hubble saw. But even that wasn't conclusive enough to prove that the heavy object in front of the star was a black hole – just that it was heavy enough to cause a microlensing effect. To rule out other potential sources of the microlens, Sahu and his colleagues checked the light level of the lens itself. They did not find any, which would have been the case if another object, such as a brown dwarf, was the cause of the lens. Also, the duration of the lensing effect must last long enough to suggest a particularly deep gravity well. The original event in 2011 lasted 300 days, enough to point to a black hole that weighs approximately 7.1 times that of the sun.

With that weight estimate, scientists were also able to estimate how fast the black hole was moving and came up with around 45 kilometers per second – much faster than the stars surrounding it in that area of the Milky Way. Such a speed differential also points to a potential source of the black hole itself – an explosion from a supermassive star probably both created the black hole and kicked it on its way. Sahu estimates the event happened around 100 million years ago, but it is hard to tell as there is no clear, traceable path to where the black hole came from.

Even without that clear, traceable path, scientists have now definitively found something they have long sought, and they won't be alone in doing so. Several all-sky surveys are popping up soon that will help scientists consistently scan the skies for events like that in June 2011, and they will most likely find plenty more. That isn't to say that any of these hard-to-see masses of gravity will prove a threat to Earth, but the more we leverage new techniques like microlensing, the more likely we are to find any that eventually might be.

Learn More:

arXiv (Sahu et al.) – An Isolated Stellar-Mass Black Hole Detected Through Astrometric Microlensing

Scientific American – Astronomers Find First Ever Rogue Black Hole Adrift in the Milky Way

Syfy – ASTRONOMERS FIND THE FIRST ROGUE BLACK HOLE WANDERING THE MILKY WAY!

Futurism – Astronomers Just Found A Rogue Black Hole Careening Through Its Galaxy

Ice Cores Tell the Tale of an Incredibly Powerful Solar Storm That Hit the Earth 9,200 Years Ago

For decades, climate researchers and Earth scientists have used cores from ice sheets in the Arctic and Antarctic to better understand Earth's climate history. Given how sensitive our atmosphere and climate are to the Sun, these ice cores are also a record of Solar activity. In a recent analysis of ice cores from Greenland and Antarctica, a research team led by Lund University in Sweden found evidence of an extreme solar storm that occurred about 9,200 years ago – when solar activity was believed to be one of the Sun's more "quiet" phases.

The team consisted of researchers from Lund's Department of Geology & Quaternary Sciences, the Alfred Wegener Institute (AWI) for Polar and Marine Research, the Laboratory of Ion Beam Physics at ETH Zürich, and the Ice Dynamics and Paleoclimate team (part of the British Antarctic Survey) at Cambridge University. Their results appeared in a paper that was recently published by *Nature Communications.*

The Sun is absolutely essential for most life on Earth and the processes that ensure continued habitability. However, there is a flip side to this relationship, which comes in the form of the "Sunspot Cycle," an 11-year period where the number and location of sunspots on the surface rises and falls. During periods of peak sunspot activity (a "solar maximum"), the Sun's surface becomes more energetic, resulting in increased solar wind and the occasional solar flare.

When these reach Earth's atmosphere, it can lead to geomagnetic storms (or solar storms) that seriously impact Earth's infrastructure – like power outages and communication disturbances. By developing predictive models that could anticipate solar activity (and solar storms), advanced warning systems could be created that would let us prepare for the ensuing disruption. But predicting solar storms is not an easy task.

It is currently believed that solar storms are more likely during an active phase of the Sun (solar maximum). However, according to the study led by Lund University researchers, this may not always be the case for particularly large storms. While analyzing ice cores from Greenland and Antarctica, the team found peaks of radioactive isotopes – beryllium-10 and chlorine-36 – produced by high-energy cosmic particles associated with solar storms.

This was a surprising find since the event that created these isotopes occurred roughly 9125 years before the present day (ca. 7176 BCE). This coincides with the "Neolithic Period," a historic era where humanity was making the transition from hunting and gathering to agriculture and sedentary living. At this time, it is believed that Earth was less exposed to such energetic events. As co-author Raimund Muscheler, a geology researcher at Lund University, said:

"We have studied drill cores from Greenland and Antarctica, and discovered traces of a massive solar storm that hit Earth during one of the sun's passive phases about 9,200 years ago. This is time-consuming and expensive analytical work. Therefore, we were pleasantly surprised when we found such a peak, indicating a hitherto unknown giant solar storm in connection with low solar activity."

Analysing ice cores led the researchers to their surprising results. Credit: Raimund Muscheler

The implications of this find could be immensely significant when it comes to mitigating the danger posed by solar storms. If a storm of the same magnitude were to happen today, it would have devastating consequences for Earth and space exploration efforts. In addition to triggering power outages all over the planet, disabling communications, and endangering air traffic control, it would damage satellites and make it very difficult to communicate with astronauts or long-range missions.

Knowing how and when they can occur (regardless of the solar spot cycle) is essential to ensuring that people and infrastructure (whether it's here on Earth or in space) remain safe and sound. "These enormous storms are currently not sufficiently included in risk assessments," Muscheler added. "It is of the utmost importance to analyse what these events could mean for today's technology and how we can protect ourselves."

Comprehensive Sky Survey Finds Over a Million New Objects

In perfect viewing conditions, with good eyesight and clear, dark skies, the average person can see between 2,500 and 5,000 stars in the night sky. Add a telescope to the mix, and the number of visible objects in the sky explodes exponentially. For example, in 1995, the Hubble Space Telescope famously pointed its mirrors at a tiny piece of empty space – about 1/12th the size of the Moon – and revealed three thousand new objects crammed into that little area, most of them distant galaxies, offering a glimpse of the past stretching back to the early Universe. The astounding implication of the Hubble Deep Field image was that there are still billions of objects out there yet unseen by human eyes (or telescopes). Since then, the process of surveying deep space has been a massive ongoing undertaking, using all the tools available to us, from visible light telescopes like Hubble to infrared and radio telescopes. In a new data dump last week, a major radio sky survey, LOFAR, has revealed over a million new, never before seen objects in the night sky.

The LOFAR Two-Meter Sky Survey (LOFAR stands for 'International Low-Frequency Array'), is a network of interconnected radio telescopes across Europe. LOFAR began as a national project in the Netherlands in 2010, but has since expanded to include multiple countries. There are currently 48 sensor stations connected to the network, with more expected to come online in the near future. LOFAR's unique capabilities allow it to survey an impressively wide portion of the night sky, capturing low-frequency radio signals from distant objects. At these frequencies, the objects that LOFAR finds tend to be highly energetic distant objects like black holes, galaxies bursting with star formation, and explosive galactic mergers, though it does occasionally catch bright objects closer to home, like nearby flaring stars.

The 1995 Hubble Deep Field, which revealed thousands of distant galaxies in a seemingly empty patch of sky. Image Credit: Robert Williams (NASA, ESA, STScI)

Perhaps the most impressive part of the LOFAR survey is its width. This release covers a whopping 27 percent of the northern sky, offering researchers a wealth of information on high-energy objects across a vast swath of space.

According to Durham University, "the research team found about a million objects that have never been seen before with any telescope and almost four million objects that are new discoveries at radio wavelengths."

In total, the catalog shows 4,396,228 radio sources coming from the region. It's an impressive resource for astronomers to dig into, and it's just the beginning. As Timothy Shimwell (ASTRON and Leiden University) explains, "this release is only 27% of the entire survey and we anticipate it will lead to many more scientific breakthroughs in the future, including examining how the largest structures in the Universe grow, how black holes form and evolve, the physics governing the formation of stars in distant galaxies and even detailing the most spectacular phases in the life of stars in our own Galaxy."

The survey will continue to expand its catalog across the northern skies in the coming months. According to the team, "our aim is now to secure the observing time required to complete [the survey] whilst ensuring we are able to process the data in a way that maximises the scientific opportunities. To this end we have secured observations that will extend our coverage…to 85% of the northern hemisphere by May 2023."

In the meantime, the data for this 27% is publicly available for researchers to peruse, and is bound to offer some exciting new discoveries. A previous LOFAR release revealed many previously unknown phenomena, including signals that might represent orbiting exoplanets; a slow-spinning pulsar "that challenges the current theories describing such objects," "jellyfish galaxies" that shed material while traveling through space, and black holes eruptions.

The LOFAR 'superterp'. Part of the core of the extended telescope, near Exloo, Netherlands. Image Credit: LOFAR / ASTRON.

E Mails Viewings Logs and Images from Members.

Viewing Log for 4th of February (WAS Viewing Evening)

(IMAGES ANDY BURNS)

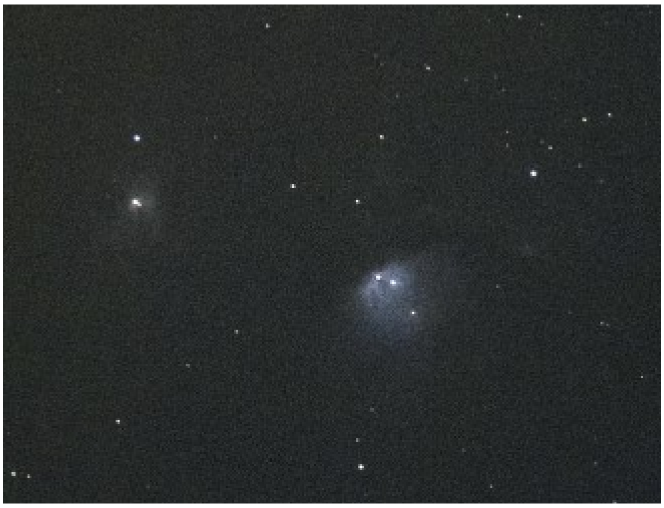
For the second month of the trot, the monthly WAS viewing session at Lacock had to be put back by a week due to the poor weather on the planned day!

Did not have a great start to the planned session, while washing up I managed to slice open my middle two fingers on the new chopping machine blade we had, a few weeks earlier this same blade cut open third finger on my right hand! So we had to do some first aid to stop the blood coming out of my fingers, this put me back by at least 40 minutes. Lucky for me I could operate most of the equipment I was using this evening with my right hand, just need to remember to keep the left one out of the way, if possible.

I arrived at Lacock at 20:10 and had my Meade LX90 set up and ready to go, tonight I would be using my 17.3 mm Delos eye piece. I had also brought along a small step ladder, this was used to cover the security light sensor in the car park, at least for some of the evening we would not have white light around us. The temperature was 5 °C and little wind for company, there was seven of us for the session, Chris, Andy and myself plus a few newbies having a look thru the different equipment we had there. Throughout the night I had several people coming up and viewing what I was looking at and asking some interesting questions at times? First object for me was the moon as it was now setting in the western horizon, as usual the terminator (day/night line on the surface of the moon) had some interesting features to look at, the crater Janssen had just cleared the terminator in the southern part of the moon. At the time the moon was 4.61 days old or 24.4 % lit with an apparent diameter of 30.90' and 386,686 kms away (all info from Virtual Moon Atlas). Staying with the solar system I slewed to Uranus, as usual this planet was not in the eye piece but in the finderscope, so I had to do some manual adjusting to locate the planet. It looked a bluey white colour to me? Onto the deep sky objects now, these are in a mixed up order as various people we had with us would like to look at different objects, hence no real order in viewing them. First object was

Messier (M) 42, the great Orion nebula, as usual this object was brilliant to look at, could make out the dust lanes very clearly.

On to M 37, an open cluster (O C) in Auriga, this is a large and loose object to look at. Tried to look at a globular cluster (G C) next, the only one I know in the winter sky is M 79 in Lepus but unfortunately was blocked out by trees at the moment. On to spiral galaxies (S G) and M 82 in Ursa Major, this was good to look at, one of the better S G's in Messier's list? Not far away is M 81, this had a bright core. Looking at M 45, the Pleiades and M 44, the Beehive clusters is better with the finderscope as using the main scope you are looking thru these O C's, too much magnification! Leo had now cleared the horizon, so I had a look at M 66, one of the triplets along with M 65 and NGC 3628. As usual this S G was a faint fuzzy blob to view. Four degrees below Sirius (brightest star in the night sky) is M 41, another large and loose O C. On to a Planetary nebula and M 97, the Owl Cluster in Ursa Major, for a change this looked good to see? Yet a few years ago it was my nemesis in that I could never see it! Back to Orion and M 78, the closet Emission and



Reflection nebula to us, I could make out the two main stars and a hint of some nebula?

By now M 79 had cleared the trees, so I slewed down to this G C, it had a bright core and little else to tell, and being so low it does not help viewing this object? Going east and M 48 in Hydra, this is a very large and loose O C, an object I often do not view? Not far above Sirius is another O C in M 50, this is large and loose with not many stars in the centre. By now Leo was much higher, so I went back to M 66, this time I could also include M 65 in the same field of view, both objects were fuzzy blobs to look at.

The Whirlpool galaxy (M 51) in Canes Venatici is another object I rarely view but tonight it was good to look at and could even make out NGC 5195, the galaxy it is interacting with.

Final object for the evening was M 3, one of the better G C's to look at, could even make out the odd star in this cluster?

By now it was 22:31 and only Chris was left with me, so we decided to call it an evening.

Clear skies.

Peter Chappell

Viewing Log for 22nd of February

After finishing a game of golf during the afternoon which was mainly sunny, I decided I would have a viewing session after having some tea.

When I turned into the lane in which I do the viewing session, I noticed two people setting up telescopes. I asked them whether they were doing astrophotography or viewing, turns out one was doing viewing while the other was doing astro! I asked them if they wished to come to my usual place as it was a bit further away from the farm buildings. Turns out it was Mike and Mark, both members of Swindon Stargazers.

I had my Meade LX90 set up and ready to start by 19:55, I would be using a Delos 17.3 mm eye piece with the telescope. With a temperature of 6 °C and little wind the session should be quite pleasant and I would have company for the first time in a very long time here?

As usual, the first target was Uranus and it was not in the eye piece but viewable in the finderscope, so after some manual adjusting I could see the seventh planet from the sun, all I could make out was a blueish surface with no details. As we are starting to come into Messier (M) marathon season I thought I would go thru the list and see the delights of his list. First object was M 74, a spiral galaxy (S G) which was a faint fuzzy blob (F F B) to look at, nearby is M 77, another S G but only a faint blob (F B) but did have a small bright centre which I could just make out. Around to the north western part of the sky was M 33, the Pinwheel galaxy another S G. I could only make this galaxy out by adverted vision even though it is large at 60 arc minutes in size. Finally a car went past us and there would only be one other for the whole night, very rare, normally I could expect up to eight in a session? Back to the viewing once the car had gone by and M 31, the Andromeda galaxy coming in at 160 arc minutes, this is the largest S G (as viewed) in the whole sky?

This large galaxy had a bright core which could easy be mistaken for a comet head. Nearby is M 32 a satellite galaxy of M 31, this was an F B to look at which had small bright centre. Also near M 31 is M 110 but I could not make out this S G as it was hiding in a tree! Higher in the sky is Cassiopeia and the first of the open clusters (O C) on the list, M 52, this O C was small, dim and dense to look at. M 103 has three bright stars which make up a triangle around these are a few stars and the O C is small to look at. Next was the first planetary nebula (P

M52:

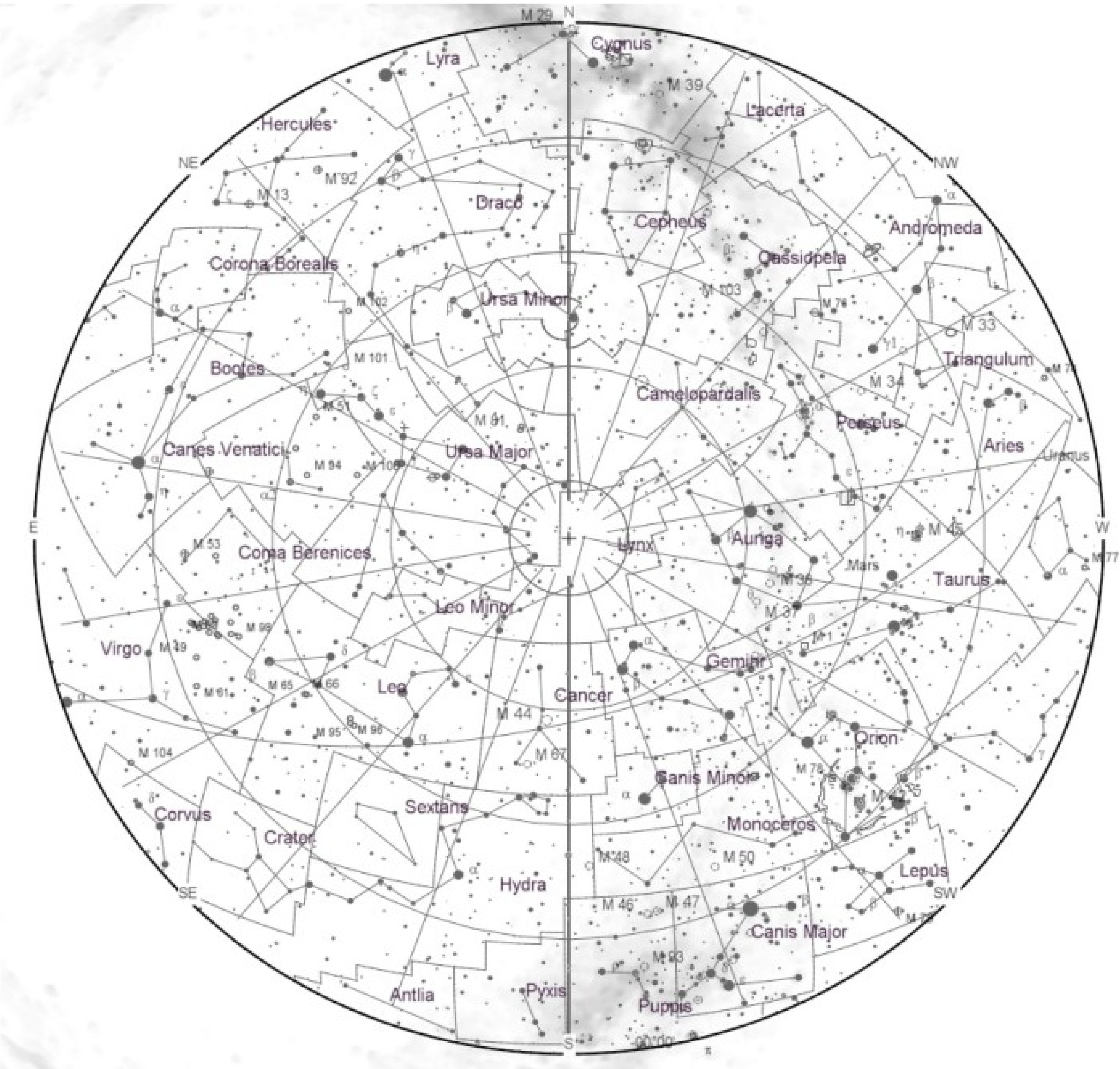
N) on the list and one of the hardest objects to locate in M 76, the Little Dumbbell nebula, it was F F B to look at and I could not make out any detail of the P N. Probably the finest O C and brightest is M 45, the Pleaides, best seen with the finderscope as I was looking thru the object with the eye piece!

On to the first globular cluster on the list and M 79 in Lepus, this was an F F B to look at which did not help looking thru a tree at it! On to the first diffused nebula (D N) and M 42, the great Orion nebula, as usual just brilliant to look at and could make out the dust lanes very clearly. In the same field of view is M 43, another D N which is often over looked. Up to M 78 which is just above the belt stars and hard to see, even the two main stars of this D N? Turns out the eye piece had dewed up! So drying the glass I could make out the two stars and some nebula. Above Orion is Taurus and M 1 which started his famous list, this is the only Super Nova Remnant (SNR) on the whole list. This SNR was a large grey blob to look at which suddenly went dimmer? Turns out the eye piece had dewed up again! On to Auriga and M 37, this is a large dense and dim O C to look at. Why dim, the eye piece had yet again dewed up after drying it, so time to change the eye piece to a Pentax WX 14 mm one. Better viewing finally! Next was M 36, a small and loose O C which is the same for M 38 but a bit dimmer to look at. Going to Sirius and dropping four degree's you come across M 41, a large and loose O C.

By now most of the equipment used for the night was dewing up a lot, so we decided to call it a night, it was now 22:35 and 5 °C. Not much astronomy was done this evening as I was chatting to the other two quite a lot of the time. Hopefully when I am next out I will be able to carry on with the list and M 50. This last weekend had great clear skies for viewing but I was away near Bournemouth with the wife and a couple of friends, at least I did get some games of golf in but did not do very well with the score sheet but that is another story!

Clear skies.

Peter Chappell



March 2 - **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 17:38 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.

March 18 - **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 07:20 UTC. This full moon was known by early Native American tribes as the Worm Moon because this was the time of year when the ground would begin to soften and the earthworms would reappear. This moon has also been known as the Crow Moon, the Crust Moon, the Sap Moon, and the Lenten Moon.

March 20 - **March Equinox.** The March equinox occurs at 15:24 UTC. The Sun will shine directly on the equator and there will be nearly equal amounts of day and night throughout the world. This is also the first day of spring (vernal equinox) in the Northern Hemisphere and the first day of fall (autumnal equinox) in the Southern Hemisphere.

April 1 - **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 06:27 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.

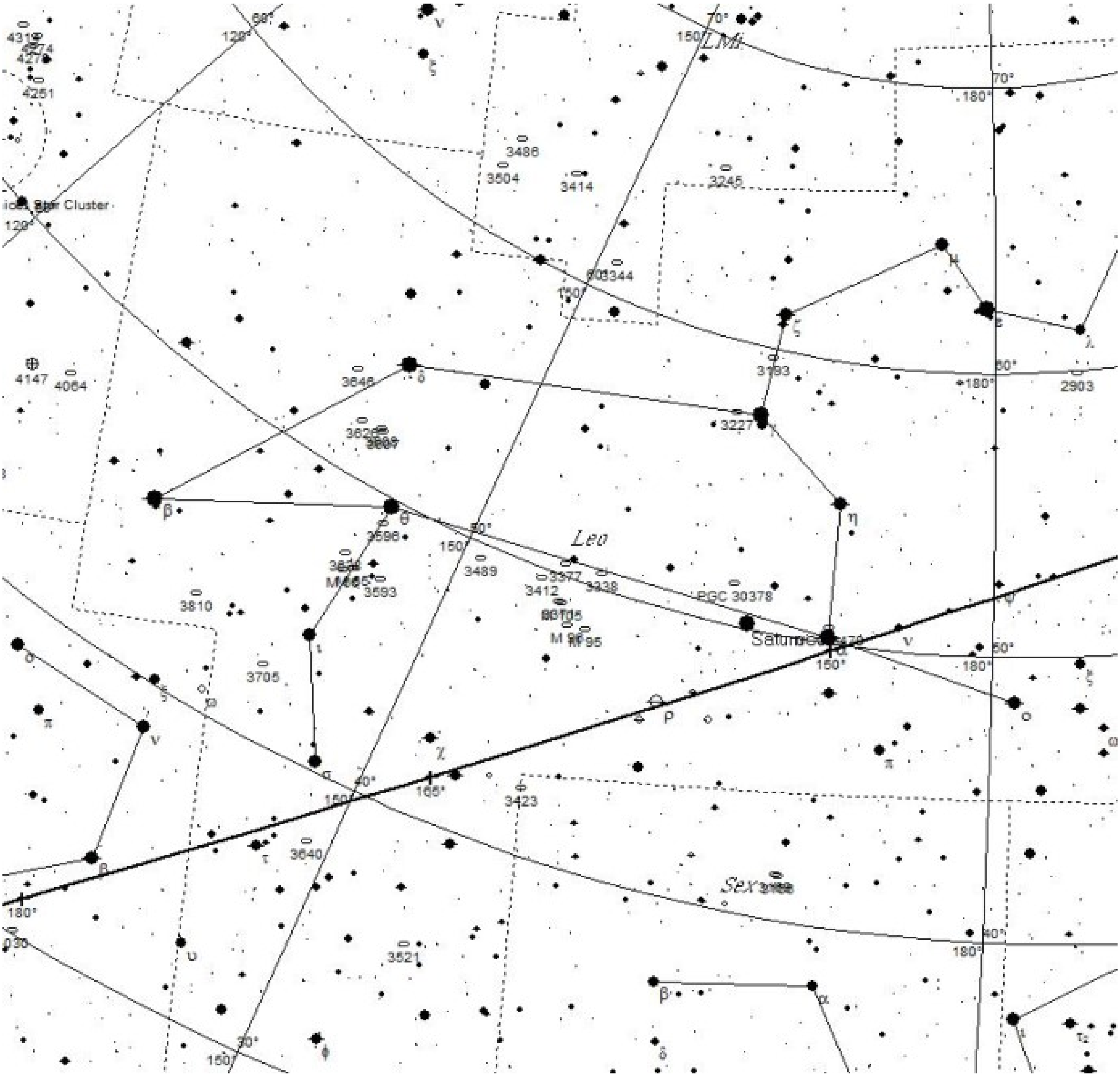
Spring equinox and clocks moving forward for summer time in March (remember to reset the hand paddles for daylight saving, A|ND be careful most controllers for astronomical equipment use the American month and day notation….

But night time observing is all about the galaxies with Orion and the outer Milky Way moving to the west, the star clusters move too.

The three main clusters of galaxies in the Northern hemisphere are to the fore. But large apertures or imaging are needed to get many galaxies as they tend to be 10th to 15th magnitude with a few notable exceptions in the 8-0th magnitude that Messier catalogued. The Leo cluster comes up before the main Virgo cluster, which includes galaxies in Coma Berenices and Canes Venetici. The third group is the cluster in Ursa Major which has around 60 members.

Behind these is the ‘wall’ of galaxies at 250-400 million light years away, still only 1/30th of the way the edge of the visible universe.

CONSTELLATIONS OF THE MONTH: LEO



Leo

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

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

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

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

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

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

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

Are you ready to try your hand at locating a pair of galaxies with binoculars? Then let's try the "Leo Trio" – M65, M66 and NGC 3623. Return towards Beta and look for

the triangular area that marks the asterism of Leo's "hips". If the night is suitable for binocular galaxy hunting, you will clearly see fifth magnitude Iota Leonis south of Theta. Aim your binoculars between them. Depending on the field of view size of your binoculars, a trio of galaxies will be visible in about one third to one fourth of the area you see. Don't expect them to walk right out, but don't sell your binoculars short, either. The M65 and M66 pair have higher surface brightness and sufficient size to be noticed as two opposing faint smudges. NGC 3623 is spot on the same magnitude, but is edge on in presentation instead of face-on. This makes it a lot harder to spot, but chances are very good your averted vision will pick it up while studying the M65/66 pair. The “Leo Trio” makes for a fine challenge!

Now let’s begin working with larger binoculars and small telescopes as we head for M96 galaxy group (RA 10h 46m 45.7s Dec +11 49′ 12″). Messier 96 is the brightest spiral galaxy within the M96 Group which includes Messier 95 and Messier 105 as well as at least nine other galaxies. Located about 38 million light years away, this group of galaxies with the Hubble Space Telescope and 8 Delta Cephei variable stars were found to help determine each individual galaxy’s distance. While you can’t expect to see each member in small optics, larger telescopes can hope to find elliptical galaxies NGC 3489 (11:00.3 +13:54), NGC 3412 (10:50.9 +13:25), NGC 3384 (10:48.3 +12:38) and NGC 3377 (10:47.7 +13:59), as well as barred spiral galaxy NGC 3299 (10:36.4 +12:42),

For an awesome spiral galaxy in a small telescope, don’t overlook NGC 2903 (RA 9:32.2 Dec +21:30). At a bright magnitude 9, you can often see this particular galaxy in binoculars from a dark sky site as well. Discovered by William Herschel in 1784, this beauty is often considered a missing Messier because it just so bright and conspicuous. As a matter of fact, the comet of 1760 passed it on a night Messier was watching and he didn’t even see it! For larger telescopes, look for NGC 2905 – a bright knot which is actually a star forming region in the galaxy itself with its own Herschel designation.

Before we leave, you must stop by NGC 3521 (RA 11:05.8 Dec -00:02). This 35 million light year distant spiral galaxy is often overlooked for no apparent reason – but it shouldn’t be. At a very respectable magnitude 9, you can often find this elongated gem with the bright nucleus in larger binoculars from a dark sky site and you can easily study spiral galaxy structure with a larger telescope. Look for an inclined view with patchiness in the structure that indicates great star forming regions at work. Its stellar counter rotation is being studied because it has a bar structure that we are seeing “end oThis doesn’t even begin to scratch the surface of what you can find on Leo’s hide. Be sure to get yourself a good star chart or sky atlas and go lion taming!

Sources: SEDS, Wikipedia

CAMPAIGN
CPRE STARCOUNT 2022

There's now just one month to go until Star Count!
A velvety black sky scattered with shining stars is a sight we should all have the opportunity to see. But too often, light pollution obscures our view of stars.
Our analysis of last year's Star Count showed that just 5% of people experienced 'truly dark skies', and 51% of us live in areas with severe light pollution.
That's why we need your help to map the nation's view of the stars, so we can better protect our dark skies in the countryside and our towns and cities.
By counting the number of stars you can see in the constellation of Orion, you'll be helping us build a better picture of our view of the stars. We base the time of Star Count around the new moon, the darkest natural time, and this time it's on 2 March.

Not sure how to take part? Follow our six simple steps below!
1) Find a good spot to do your Star Count which is south-facing.
2) If you're doing your Star Count from home, turn off all the lights in your home so it's as dark as possible and go outside.
3) Look south in the night sky (the way satellite dishes face) and find the constellation of Orion. Look out for Orion's belt (see image below).
4) Let your eyes adjust to the dark – the longer you wait, the better (we recommend at least 20 minutes). Count the number of stars you can see within the rectangle formed by the four corner stars. You count the 'belt', but not the corner stars.
5) Head to our website to submit your count and help us map the nation's view of the night sky.
6) Make a one off or regular donation to our work. Together, we can help our beautiful countryside thrive, for everyone's benefit - now and for generations to come.
Happy stargazing!
Emma
Emma Marrington
Dark skies campaigner

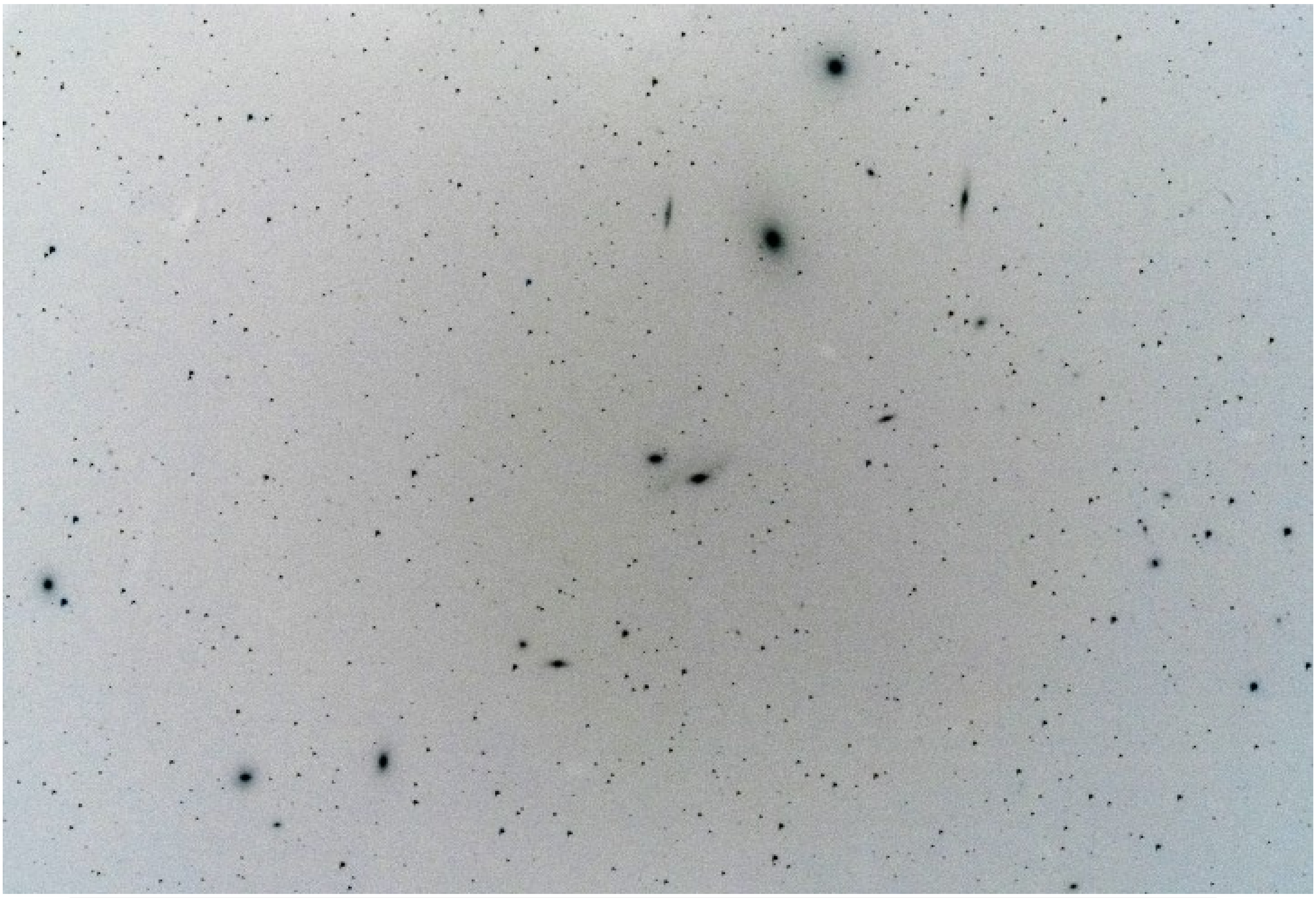
ISS PASSES For Marchand early April 2022

from Heavens Above website maintained by Chris Peat.

Date	Brightness	Start	Highest point	End						
	(mag)	Time	Alt.	Az.	Time	Alt.	Az.	Time	Alt.	Az.
01 Mar	-3.0	04:32:19	51°	E	04:32:19	51°	E	04:34:59	10°	E
01 Mar	-3.7	06:05:15	12°	W	06:08:24	89°	N	06:11:48	10°	E
02 Mar	-0.8	03:46:12	16°	E	03:46:12	16°	E	03:47:03	10°	E
02 Mar	-3.8	05:19:08	34°	W	05:20:28	85°	N	05:23:51	10°	E
03 Mar	-3.3	04:33:00	62°	ENE	04:33:00	62°	ENE	04:35:54	10°	E
03 Mar	-3.7	06:05:55	10°	W	06:09:17	69°	SSW	06:12:38	10°	ESE
04 Mar	-1.0	03:46:52	19°	E	03:46:52	19°	E	03:47:55	10°	E
04 Mar	-3.8	05:19:47	30°	W	05:21:20	83°	SSW	05:24:43	10°	ESE
05 Mar	-3.6	04:33:40	72°	E	04:33:40	72°	E	04:36:45	10°	E
05 Mar	-3.1	06:06:49	10°	W	06:10:01	41°	SSW	06:13:12	10°	SE
06 Mar	-1.2	03:47:34	20°	E	03:47:34	20°	E	03:48:45	10°	E
06 Mar	-3.5	05:20:30	27°	W	05:22:05	55°	SSW	05:25:24	10°	ESE
07 Mar	-3.6	04:34:26	64°	SSE	04:34:26	64°	SSE	04:37:29	10°	ESE
08 Mar	-1.2	03:48:26	19°	ESE	03:48:26	19°	ESE	03:49:30	10°	ESE
08 Mar	-2.8	05:21:23	23°	WSW	05:22:40	31°	SSW	05:25:40	10°	SSE
09 Mar	-2.8	04:35:28	36°	S	04:35:28	36°	S	04:37:56	10°	SE
10 Mar	-0.9	03:49:39	13°	ESE	03:49:39	13°	ESE	03:50:04	10°	ESE
10 Mar	-1.9	05:22:36	16°	SW	05:23:01	16°	SW	05:25:09	10°	S
11 Mar	-1.5	04:36:56	15°	S	04:36:56	15°	S	04:37:51	10°	SSE
17 Mar	-1.7	19:43:24	10°	S	19:44:41	15°	SSE	19:44:41	15°	SSE
18 Mar	-1.5	18:56:39	10°	SSE	18:57:40	11°	SE	18:58:42	10°	ESE
18 Mar	-2.0	20:30:32	10°	SW	20:32:08	24°	SSW	20:32:08	24°	SSW
19 Mar	-2.9	19:42:38	10°	SW	19:45:41	31°	SSE	19:46:26	28°	ESE
19 Mar	-0.9	21:18:50	10°	WSW	21:19:23	14°	WSW	21:19:23	14°	WSW
20 Mar	-2.3	18:54:55	10°	SSW	18:57:37	23°	SE	19:00:20	10°	E
20 Mar	-3.4	20:30:39	10°	WSW	20:33:31	57°	SW	20:33:31	57°	SW
21 Mar	-3.6	19:42:31	10°	WSW	19:45:50	56°	SSE	19:47:30	26°	E
21 Mar	-1.4	21:19:10	10°	W	21:20:26	21°	W	21:20:26	21°	W
22 Mar	-3.2	18:54:28	10°	SW	18:57:40	42°	SSE	19:00:53	10°	E
22 Mar	-3.9	20:30:55	10°	W	20:34:18	88°	NNW	20:34:18	88°	NNW
23 Mar	-3.8	19:42:40	10°	WSW	19:46:03	83°	SSE	19:48:06	22°	E
23 Mar	-1.6	21:19:27	10°	W	21:21:00	25°	W	21:21:00	25°	W
24 Mar	-3.9	20:31:11	10°	W	20:34:34	86°	N	20:34:44	80°	ENE
25 Mar	-3.8	19:42:53	10°	W	19:46:16	85°	N	19:48:24	21°	E
25 Mar	-1.7	21:19:39	10°	W	21:21:19	26°	W	21:21:19	26°	W
26 Mar	-3.9	20:31:21	10°	W	20:34:44	77°	SSW	20:34:57	72°	SSE
27 Mar	-3.8	20:43:02	10°	W	20:46:26	88°	S	20:48:34	21°	E
27 Mar	-1.6	22:19:52	10°	W	22:21:28	23°	WSW	22:21:28	23°	WSW
28 Mar	-3.4	21:31:30	10°	W	21:34:47	49°	SSW	21:35:05	47°	S
29 Mar	-3.6	20:43:07	10°	W	20:46:29	64°	SSW	20:48:42	19°	ESE
29 Mar	-1.3	22:20:19	10°	W	22:21:36	16°	WSW	22:21:36	16°	WSW
30 Mar	-2.3	21:31:42	10°	W	21:34:37	27°	SSW	21:35:14	25°	SSW
31 Mar	-2.7	20:43:13	10°	W	20:46:22	37°	SSW	20:48:53	14°	SE
01 Apr	-1.3	21:32:25	10°	WSW	21:34:15	14°	SW	21:35:29	12°	SSW
02 Apr	-1.6	20:43:30	10°	W	20:46:04	20°	SW	20:48:36	10°	SSE

END IMAGES, OBSERVING AND OUTREACH

Markarian's chain. A tiny part of the Virgo cluster of galaxies, these are in the northern most part of Virgo, with the cluster of galaxies ranging from 45 to 70 Millions light yrs away. The top most blobs (in negative form here to show more distant galaxies) are Messiers 84 and 86 Elliptical or close it get SO class spiral, 58 Mly away, and ngc 4435 and 4438 next down the chain are two interacting spirals known as the 'eyes'. More galaxies than Milky Way stars in the part of the Virgo cluster. Taken Feb 25th.
Nikon D810a, Esprit 120 Pro telescope, 5 exposures of 60 seconds, stacked in Sequator, reversal and small process Photoshop.



Observing Sessions and Covid19 - Update

Proposed Observation Sessions for 2021-2022

Any observing meetings will need to to be safe and follow social distancing recommendations.
A reminder email shall be sent out early on in the week to inform you of the planned event but it should also be noted that like the weather, Government guidelines may change at any time and therefore the usual email will be sent out by 16:00 on the day giving notice of whether observing is 'ON' or 'OFF' that evening, so look out for these. If a session is cancelled we may then possibly plan a new different date.

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:

- **Friday 25 March 2022 (Messier Marathon)**
- **Friday 29 April 2022**
- **Friday 27 May 2022**
- **Friday 03 June 2022 (limited sky darkness)**

The final decision on the planned dates will be advised shortly and published on the website :https://wasnet.org.uk/observing/ but we shall also try to arrange special evenings for events such as meteor showers/ Lunar eclipses etc.
Also if members wish to propose 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.

OUTREACH

Zoom sessions and Google Classroom sessions have kept outreach going to schools

I have been asked to return to Westbury Leigh, again this month.

If any schools or clubs are interested in having talks from WAS please contact Andy Burns.

Dark Skies Wales are starting their live observing sessions, but talks are delayed.