

Lewes Astronomical Society

Newsletter - April 2024

Astronomy News, Spaceflight News, and Observational Highlights

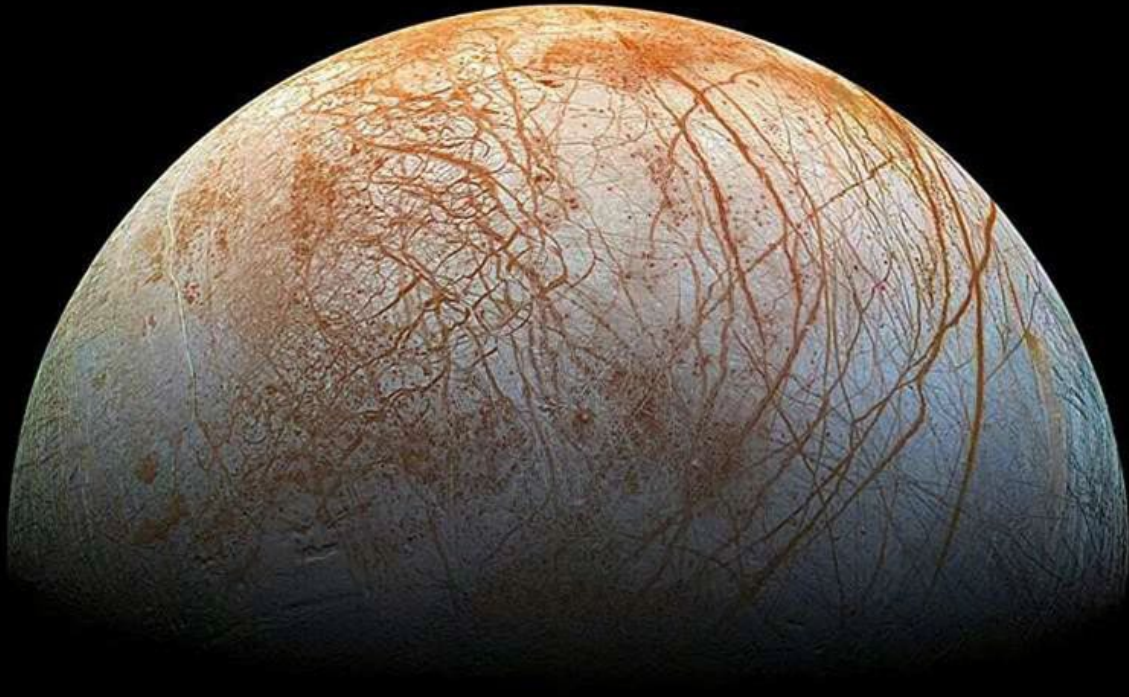
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April 2024

Astronomy News

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Will Clipper Find Life on Europa? (1)



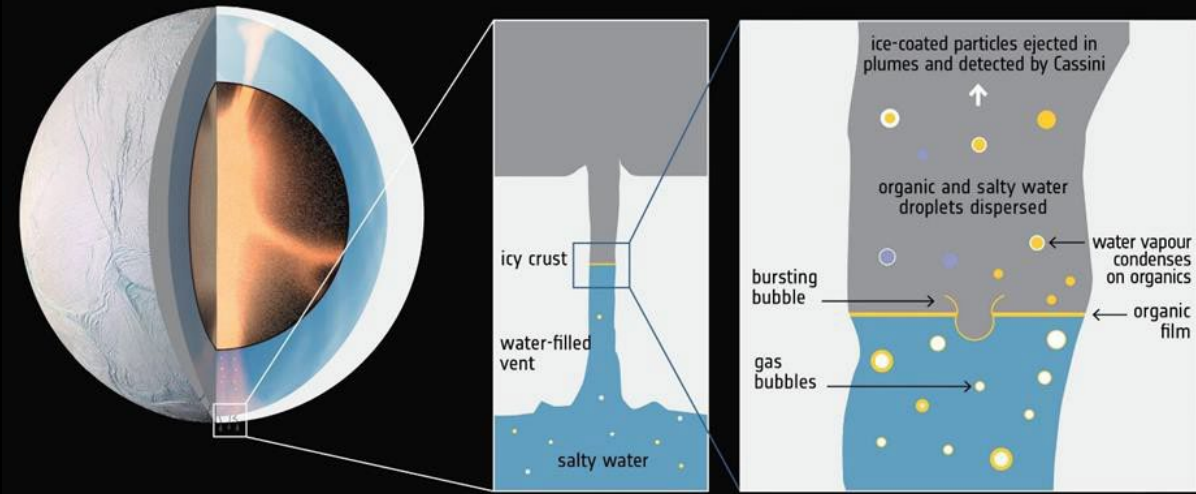
Red streaks across the surface of Europa, the smallest of Jupiter's four large moons. Credit: NASA/JPL/Galileo

- **NASA's Europa Clipper mission is due to be launched in October 2024 and will be well equipped to explore Jupiter's smallest Galilean moon, Europa, upon its arrival in 2030.**
- **With water, phosphate, other salts and carbon-based organic material having already been detected on Europa, and heat energy created by a tug and pull effect under Jupiter's strong gravity, Europa has all the building blocks for Earth-similar lifeforms to exist beneath its thick icy crust.**

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Will Clipper Find Life on Europa? (2)

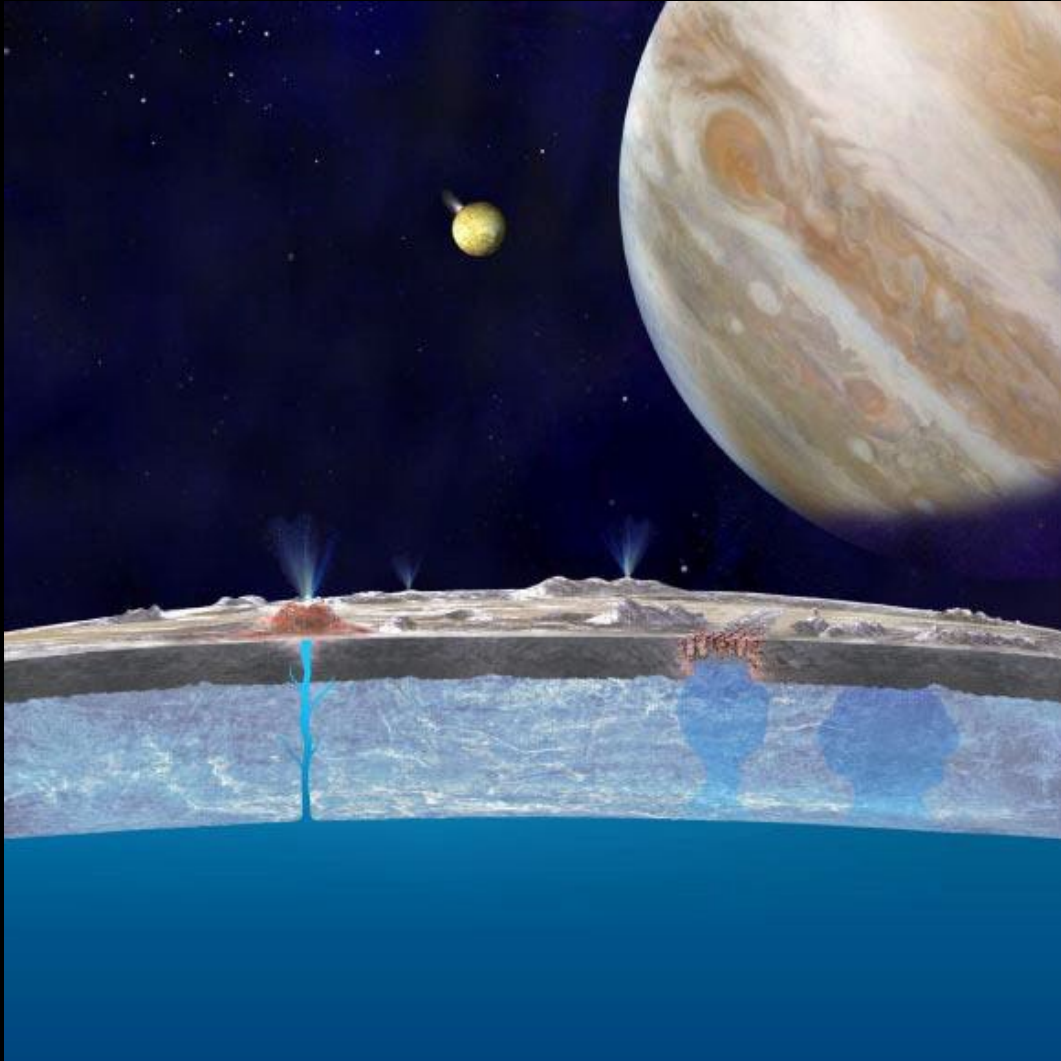
- Whilst in orbit, the Cassini satellite discovered parallel cracks near the south pole of Saturn's sixth biggest moon, Enceladus.
- The vacuum of space causes the subsurface ocean to boil. As gas bubbles rise and erupt at the surface, cellular material becomes incorporated into ice grains and ejected into space in the form of plumes.
- Faint water plumes, or their chemical components, have been detected at Europa suggesting that, like Enceladus, Europa may vent water from its surface.



Drawing depicting Enceladus and its ice-covered ocean with cracks near south pole believe to penetrate through icy crust. Middle panel shows where life could thrive on surface of water. Right panel shows how bacterial cells could be lofted into space.
Credit: European Space Agency

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Will Clipper Find Life on Europa? (3)



- An international research team, led by the University of Washington, Seattle, and the Freie Universität, Berlin, have set up study to determine how the new generation of instruments might analyse these ejected plumes.
- To test the capabilities of new instruments aboard Europa Clipper, the team focused on mimicking conditions and lifeform types which may be encountered by the satellite.

Water vapour plumes on Europa's surface. Credit:
NASA/JPL-Caltech

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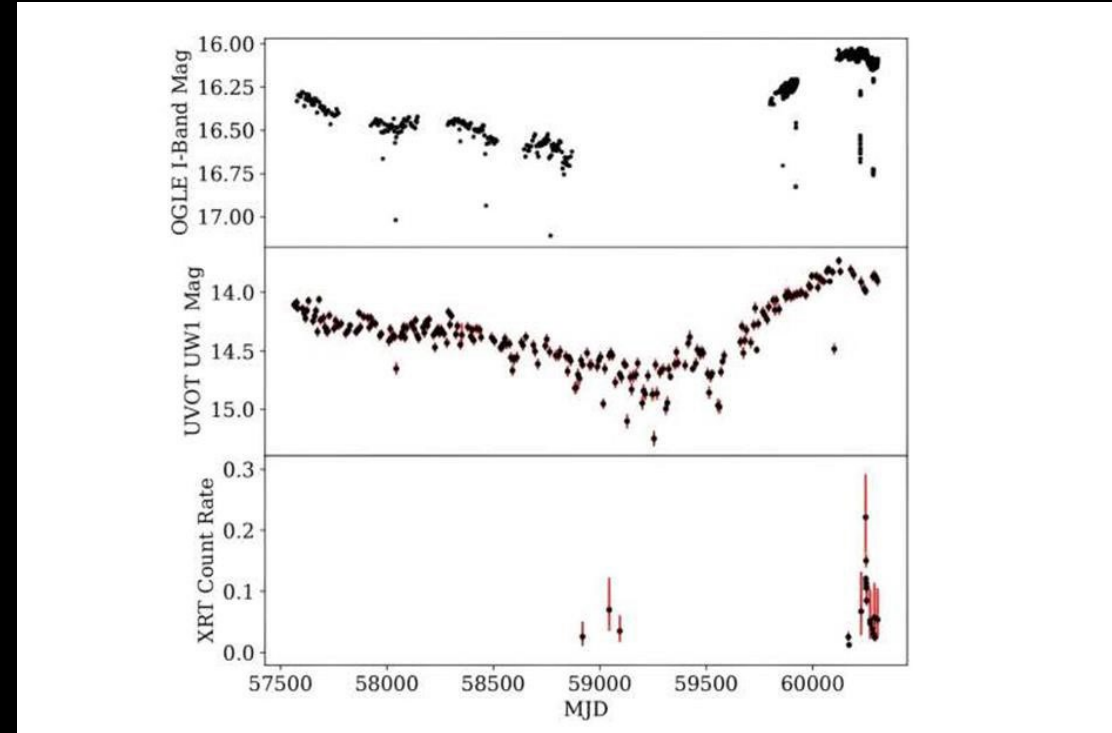
Will Clipper Find Life on Europa? (4)

- By focusing on *Sphingopyxis alaskensis*, a common bacterium found in Alaskan waters which is capable of living in cold environments, can survive on few nutrients, and is smaller than other model organisms such as *E. coli*, researchers hoped to closely simulate the type of lifeform most likely to be found within Europa's oceans.
- Results showed that even a tiny fraction of cellular material could be identified by a mass spectrometer, and the SURface Dust Analyzer (SUDA) onboard Europa Clipper can detect cellular material in one out of hundreds of thousands of ice grains.
- SUDA will be higher-powered than past instruments and will, for the first time, be able to detect ions with negative charges, meaning that it will be easier to detect fatty acids and lipids. Researchers believe that it may now be easier than expected to find traces of life on icy moons.

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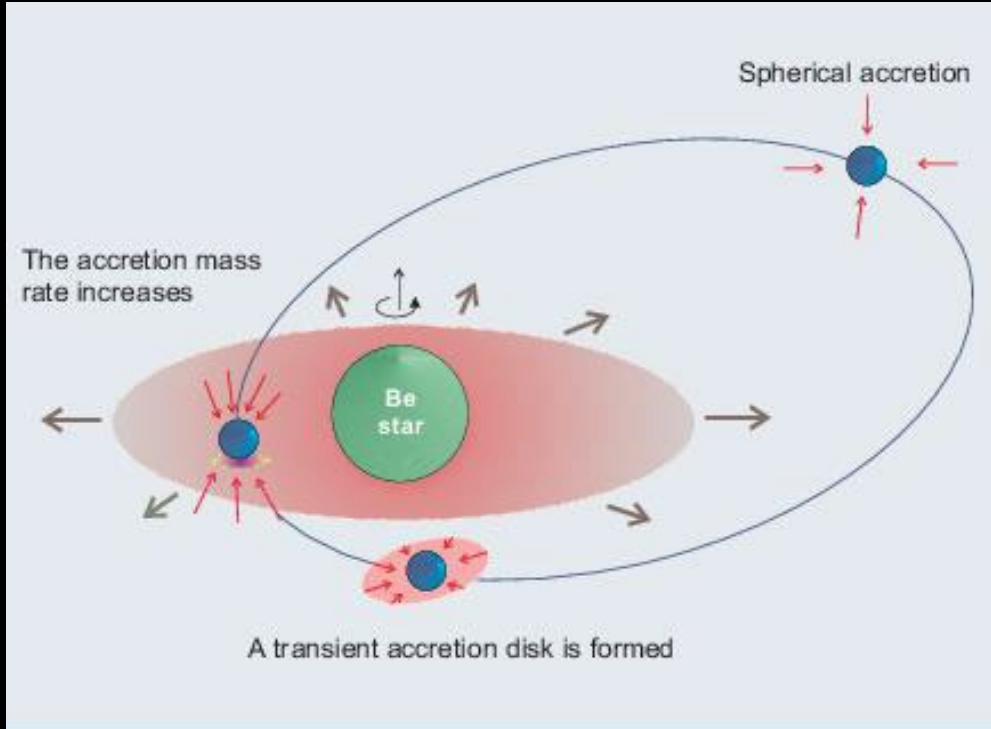
Rare Eclipsing X-Ray Binary Discovered (1)

- Astronomers at Pennsylvania State University (PSU) have discovered new properties belonging to a Be/X-ray binary system, named Swift J010902.6-723710 (SWJ).
- The discovery was made whilst the team were carrying out the Swift Small Magellanic Cloud (SMC) Survey (S-CUBED).
- Be stars (B-emission stars) typically rotate rapidly and are surrounded by a circumstellar disk of gas and dust. They're known for emission line strengths and variability in their brightness, which can change over relatively short timescales.



Ogle IV, Swift UVO, and Swift XRT light curves for Swift J010902.6-723710. Credit: Gaudin et al, 2024

Rare Eclipsing X-Ray Binary Discovered (2)



- X-ray binaries are systems where a normal star or white dwarf orbits and transfers mass onto a compact neutron star or a black hole.
- BeX-ray binaries (BeXrBS) usually consist of Be stars and neutron stars, including pulsars.
- Astronomers divide X-ray binaries into low-mass X-ray binaries (LMXBs) and high-mass binaries (HMXBS).

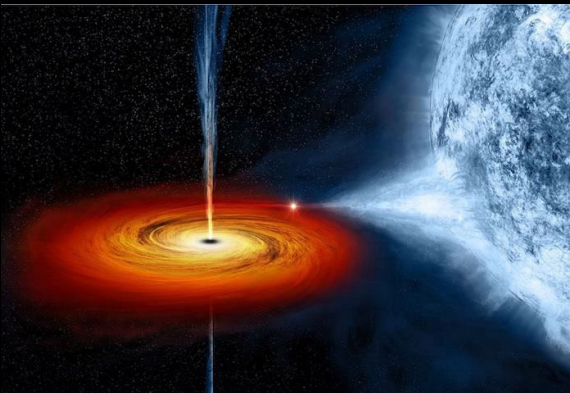
Be star in eccentric orbit with neutron star. Strong equatorial winds occasionally form circumstellar disk. When neutron star intersects disk, accretion rate dramatically increases.

Credit: Orellana, Maristela & Romero, Gustavo. (2004). Gamma-Ray Emission from Be/X-ray Binaries. *Astrophysics and Space Science*. 297. 10.1007/s10509-005-7618-6.

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Rare Eclipsing X-Ray Binary Discovered (3)

- SWJ showcased characteristics of Type I and II outbursts on 10th October 2023.
- Type I outbursts display sudden and short-lived increases in X-ray emission from binary systems, lasting between a few hours and a few days, and are believed to be caused by accretion events: when material from the circumstellar disk surrounding the Be star falls onto the neutron star.



Above: Artist's impression of Be X-ray Binary System. Credit: Mark Garlick

Left: Impression of High Mass X-ray Binary. Credit: NASA/CXC/M.Weiss

- Type II outbursts are more prolonged and less intense, lasting for several weeks or even months with a slower increase of luminosity and a more gradual decline. These are thought to result from interactions between the neutron star and the circumstellar disk.

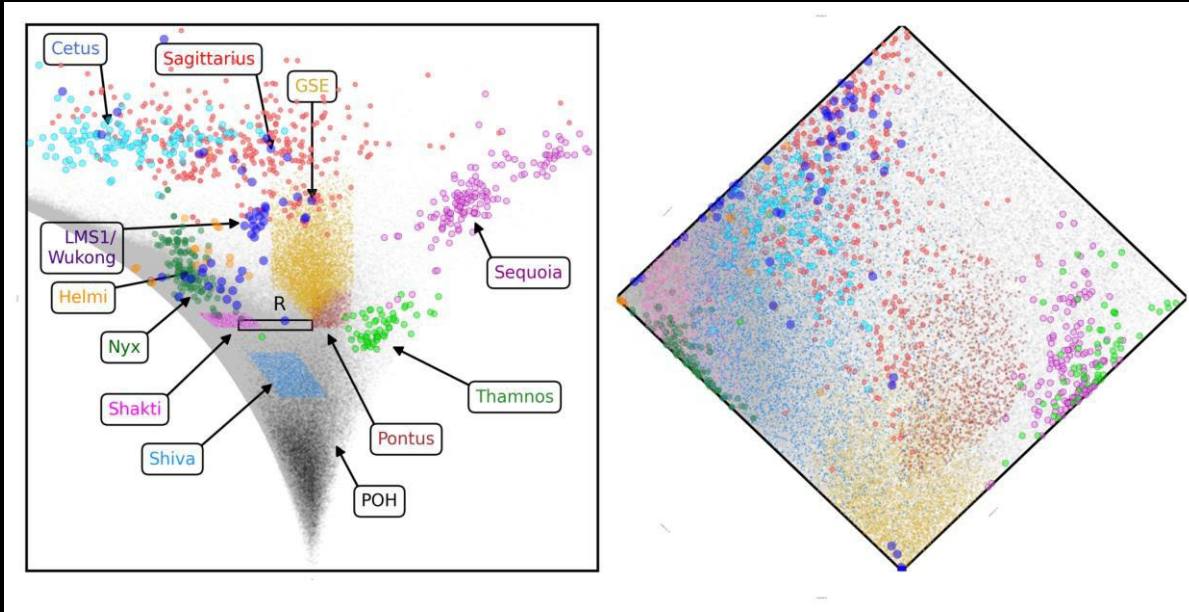
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Rare Eclipsing X-Ray Binary Discovered (4)

- Deep follow-up X-ray observations suggest that the neutron star within SWJ fully rotates every 182 seconds, with a proposed system orbital period of approximately 60.623 days.
- By analysing the light curve of both ultraviolet and infrared emissions, astronomers detected strong eclipse-like features which reappear in line with the orbital period. This would make SWJ the third eclipsing BeXRB identified to date.
- The neutron star is confirmed to be surrounded by a large accretion disk, as was predicted after previous observations. Detected eclipsing behaviour is caused by this disk, which has a radius of approximately 3.3 solar radii.
- “We note that this rare behaviour provides an important opportunity to constrain the physical parameters of a Be/X-ray binary with greater accuracy than is possible in non-eclipsing systems,” the scientists said.

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Gaia Looks Into 'Poor Old Heart' of Milky Way (1)



Starry streams making up the Milky Way
Credit: ESA/Gaia/D PAC/K. Malhan et al. (2024)

- A team of researchers at the Max Planck Institute for Astronomy (MPIA) in Heidelberg, Germany, have been using ESA's Gaia Space Telescope to study the orbits, content, and composition of individual stars in the Milky Way.

- During observations they spotted two new star stream structures, both with certain chemical compositions, lying towards the heart of the galaxy.
- Using data collected by Gaia, researchers determined that each stream contains the mass of around 10 million suns, with stars of 12 to 13 billion years in age moving in very similar orbits, with similar compositions.

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Gaia Looks Into 'Poor Old Heart' of Milky Way (2)

- The streams are named Shakti and Shiva, after the divine couple who unite to create the universe in Hindu philosophy.
- Since these star streams formed and wove together over 12 billion years ago and likely merged with the young Milky Way, helping to shape its spiral arms and disk, these names fit rather well.
- The two streams are very alike, but not identical: Shakti stars have more circular orbits and are slightly further out from the centre of the galaxy than Shiva.

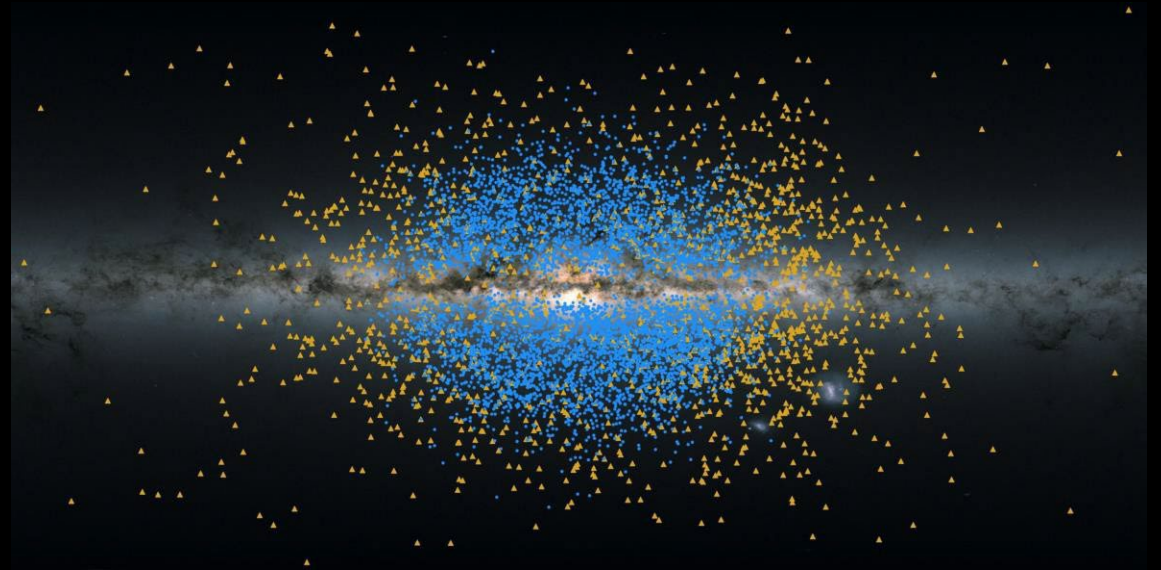


Image of location and distribution of Shakti (yellow) and Shiva (blue) stars throughout the Milky Way. Credit: ESA/GAIA/DPAC/K. Malhan

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Gaia Looks Into 'Poor Old Heart' of Milky Way (3)

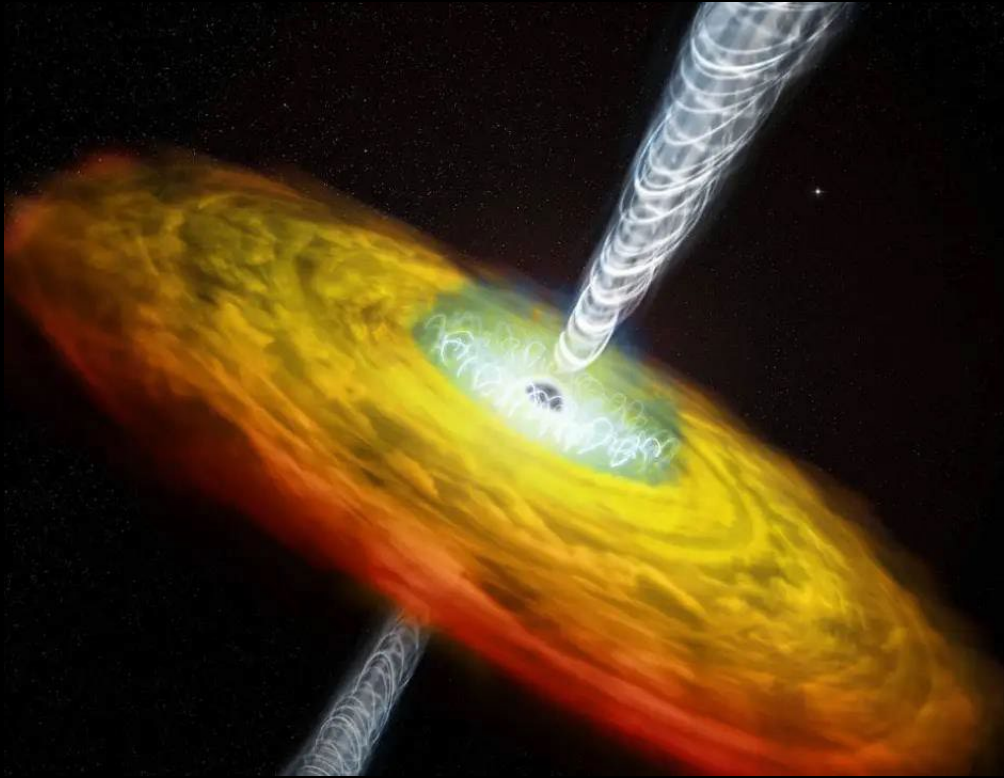
- Stars within these regions are the oldest in the entire galaxy and are so ancient that they are lacking in many of the heavier metal elements, such as gold and platinum; produced via nucleosynthesis in younger stars which formed within enriched environments later in the universe's lifetime.
- Because of its age and metal-poor environment, researchers have dubbed this ancient region of our galaxy 'poor old heart'.
- "What's truly amazing is that we can detect these ancient structures at all...The Milky Way has changed so significantly since these stars were born, that we wouldn't expect to recognise them so clearly as a group – but the unprecedented data we're getting from Gaia made it possible," said Khyati Malhan, lead researcher.
- Future data from Gaia will hopefully reveal more about the formation of the Milky Way and its development.
- See video simulation from the ESA website of the formation of the Milky Way over billions of years in the next slide.

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Simulation of a Milky Way-like galaxy forming at: <https://youtu.be/FoyzBXRoYVw>

Underachieving Black Hole Identified (1)



Some supermassive black holes launch powerful beams of material, or jets, away from them.

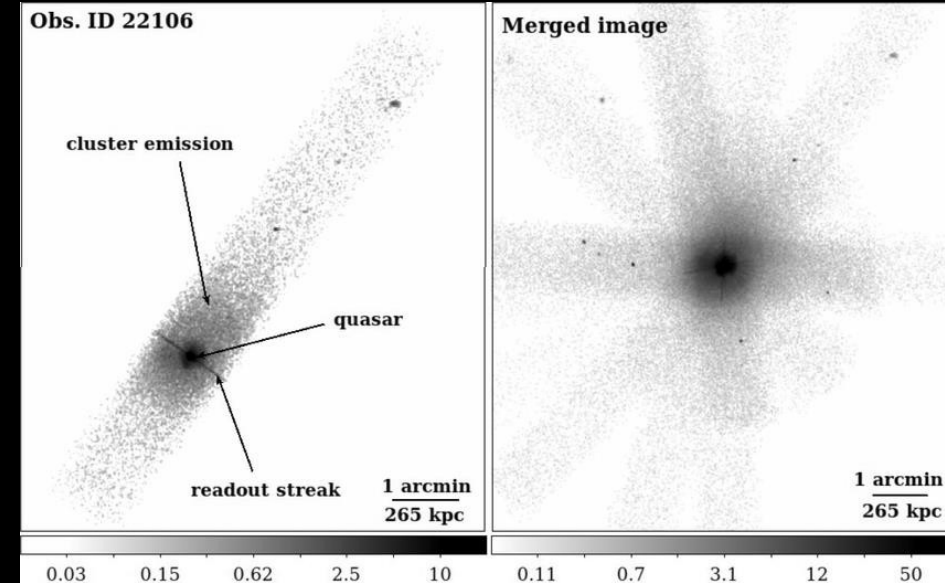
Credit: NASA

- Using NASA's Chandra X-ray Observatory, astronomers at the University of Nottingham have found that quasar H1821+643, located in the constellation of Draco, is underperforming as a supermassive black hole (SMBH).
- Quasars are found at the centres of some galaxies and are a rare subclass of SMBH. As gas spirals at high velocity into the black hole, intense radiation and, sometimes, powerful jets are produced.
- H1821+643 shows the same high levels of radiation and powerful jets but has been found not to be as influential as many of its counterparts.

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Underachieving Black Hole Identified (2)

- Gas density near this black hole is much higher, but with a much lower temperature, meaning that the quasar is generating a lot less heat than usual, allowing hot gas to rapidly cool down and form new stars.
- It is also possible that radiation from the quasar is directly causing hot gas to cool: photons of light from the quasar collide with electrons in the hot gas resulting in energy transference with photons becoming more energetic and electrons cooling from loss of energy. However, a larger amount of gas cooling is occurring than can be explained by this process.

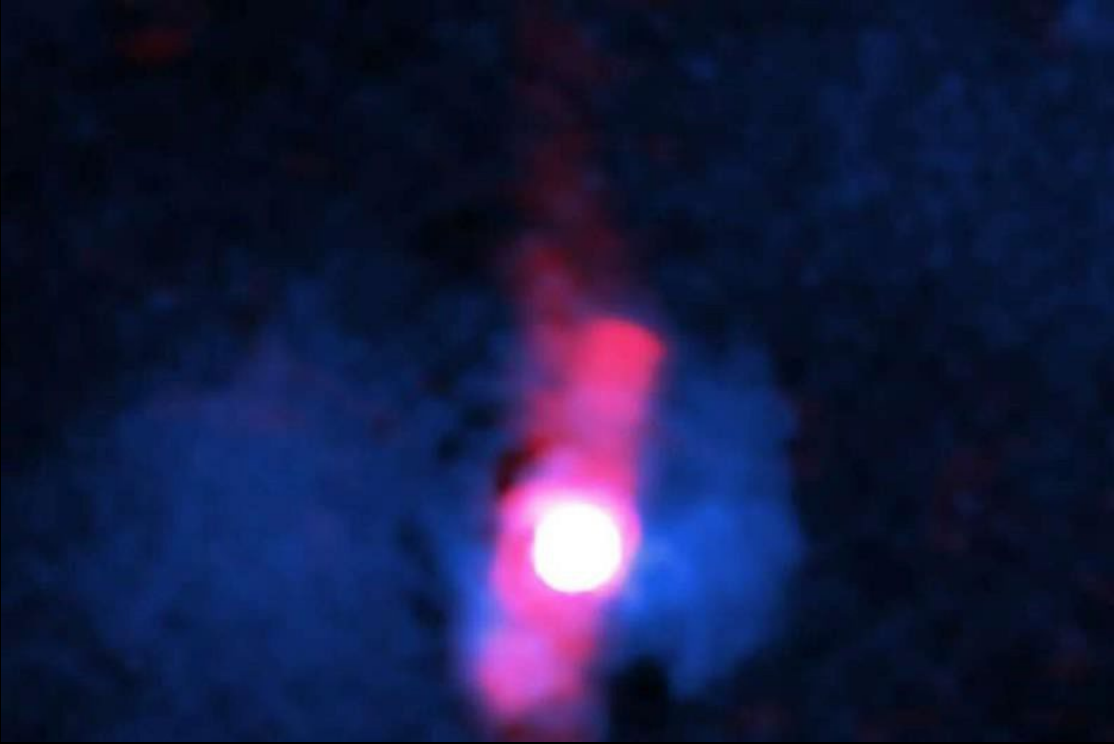


Left panel: Image for single Chandra observation of H1821+643 showing 1/8 subarray and readout streak from bright quasar (obs. ID 22106).

Right panel: Image showing all data sets merged. The range of roll angles for the separate observations changes the orientation of the CCD and readout streak.

Credit: Russell, H & Nulsen, P & Fabian, A & Braben, T & Brandt, W & Clews, L & McDonald, M & Reynolds, Christopher & Sanders, J & Veilleux, Sylvain. (2024).

Underachieving Black Hole Identified (3)



Quasar H1821+643.

Credit: X-ray: NASA/CXC/Univ. of Nottingham/H.

Russell et al.; Radio: NSF/NRAO/VLA

Image Processing: NASA/CXC/SAO/N.

- The rapid cooling of approximately 3,000 solar masses of hot gas each year provides material for star formation, and around 120 solar masses of new stars are observed to form in the host galaxy every year, with another 40 solar masses consumed by the SMBH.
- This rapid fuel intake should, at some point, increase the power of the quasar's jets, strongly heating the gas and drastically slowing down the growth of both the galaxy and the black hole.

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Condor Telescope Reveals New World (1)

- The Condor Array Telescope was conceived, built, and operated by a team of faculty and students at the Department of Physics and Astronomy at Stony Brook University, New York, in collaboration with the American Museum of Natural History.
- It is located at the Dark Sky New Mexico observatory, situated under some of the darkest skies in the United States.
- Condor's purpose is to study low-surface-brightness within nearby and distant galaxies; transiting planets and stars at a very rapid cadence; and the faint and extended ejecta of explosive and massive stars.



The Condor Array Telescope has introduced a new era in astronomy, enabling the study of extremely faint cosmic phenomena.

It is made up of six 180mm-diameter refracting telescopes, each of which are equipped with a focal-reducing field corrector, large-format CMOS camera, motorized filter wheel, and motorized focuser, attached to a common remote-controlled mount. Credit: Condor Team

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Condor Telescope Reveals New World (2)



A view created by Condor and computer technologies of extremely faint shells of ionized gas surrounding the dwarf nova Z Camelopardalis.

Image credit: Condor Team

- According to lead researchers from Stony Brook and the Department of Astrophysics at the AMNH, Condor is now fully operational.
- Four new research papers published in the Monthly Notices of the Royal Astronomical Society this month have presented the first scientific findings based on observations.

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Condor Telescope Reveals New World (3)

- The first paper details study of extremely faint “stellar streams” surrounding the nearby spiral galaxy NGC 5907, known as the Knife Edge galaxy, located 50 million light years from Earth.
- These streams are threads of stars, disrupted and pulled out from primary dwarf galaxies by the tidal gravitational force of a larger companion galaxy.
- Images taken in 2010 through another telescope show a stellar stream forming two complete loops of a helix surrounding the galaxy.
- The “Dragonfly Telephoto Array” also observed this galaxy in 2019, but these images showed no trace of the helix.
- To test Condor, the team captured a deep image in 2022 of NGC 5907 and found no trace of the helix, but a single stellar stream stretching 220 kiloparsecs (KPC) from east to west. This led to the conclusion that the helix of 2010 was likely an artifact related to the image processing.

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Condor Telescope Reveals New World (4)



Left: This image, captured by an amateur telescope in 2006, appears to show a second loop around the Knife Edge Galaxy.

D. Martínez-Delgado et al. / The Astrophysical Journal 2008

Below: Dragonfly telephoto array viewed only a single loop in 2019

Van Dokkum et al. / Astrophysical Journal Letters 2019



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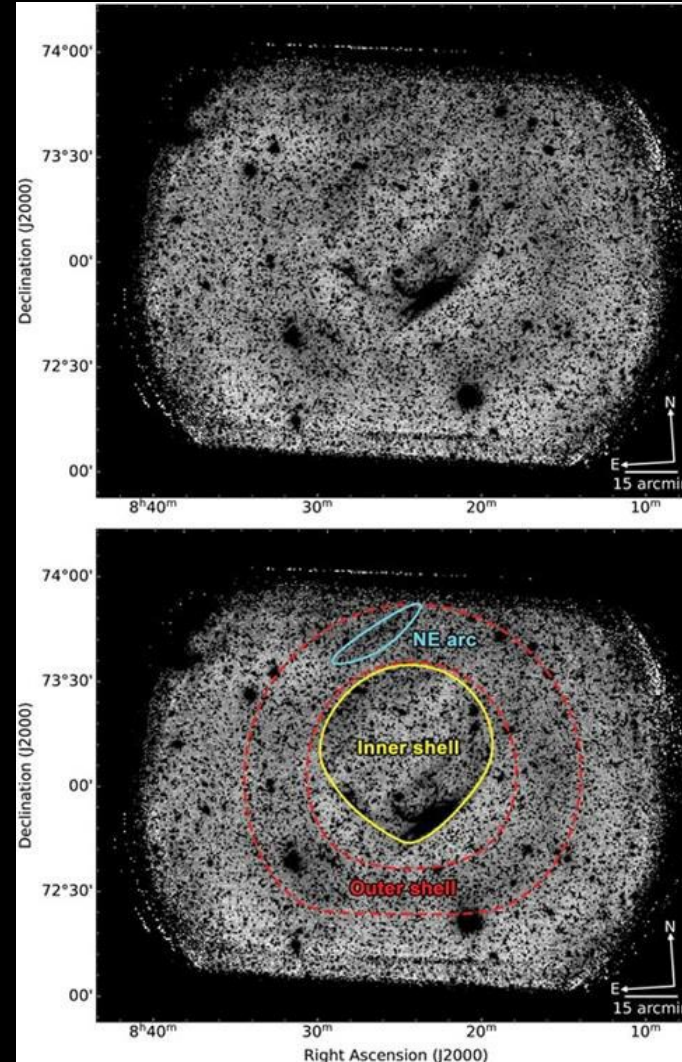
Condor Telescope Reveals New World (5)

- The second paper details a study that used Condor to reassess an image of the dwarf nova Z Camelopardalis, or “Z Cam”, which was shown to be surrounded by a partial shell of gas.
- This image was obtained by the Kitt Peak National Observatory 4-meter telescope in January 2007 and the gas shell was speculated to have been emitted by a “new star” that was recorded by Chinese Imperial Astrologers in the year 77 BCE.
- By comparing the positions of the shell in earlier and later images, the team measured its expansion rate and found that it was consistent with an explosion more than 2,000 years ago.
- Surprisingly, a complete shell of gas was revealed to be surrounding Z Cam, not just a partial shell, as was shown by the 4-meter telescope, with another even larger shell surrounding the first.

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Condor Telescope Reveals New World (6)

- The Condor images confirm a long-standing hypothesis that concentric shells must surround frequently erupting novae of relatively massive white dwarfs and are the first ever examples found of the phenomenon. This demonstrates how sensitive Condor is and how it is able to pick up images that are too faint for conventional telescopes.



Clear 'inner' shell encircling Z Cam ('inner shell', solid yellow outline) is surrounded by an outer, roughly circular nebulosity which is approximately 1.5 degrees in diameter ('outer shell', between dashed red rings)

Credit: Michael M Shara, Kenneth M Lanzetta, James T Garland, Stefan Gromoll, David Valls-Gabaud, Frederick M Walter, John F Webb, David R Zurek, Noah Brosch, R Michael Rich, Introducing the Condor Array Telescope – III. The expansion and age of the shell of the dwarf nova Z Camelopardalis, and detection of a second, larger shell, Monthly Notices of the Royal Astronomical Society, Volume 529, Issue 1, March 2024, Pages 212–223

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Condor Telescope Reveals New World (7)

- Both other papers also describe extremely faint shells of gas surrounding another nova. This is the product of multiple nova shells crashing into each other over tens of thousands of years, creating a shell 50 times larger than previously known nova shells. The shell was previously predicted to exist but couldn't be detected by conventional telescopes.
- The possibilities provided by Condor's ability to spot the faintest lights far away in the night sky will give us new eyes to unravel the cosmos, and to reveal the stories of stars and galaxies that have been hiding behind their own dim glow.

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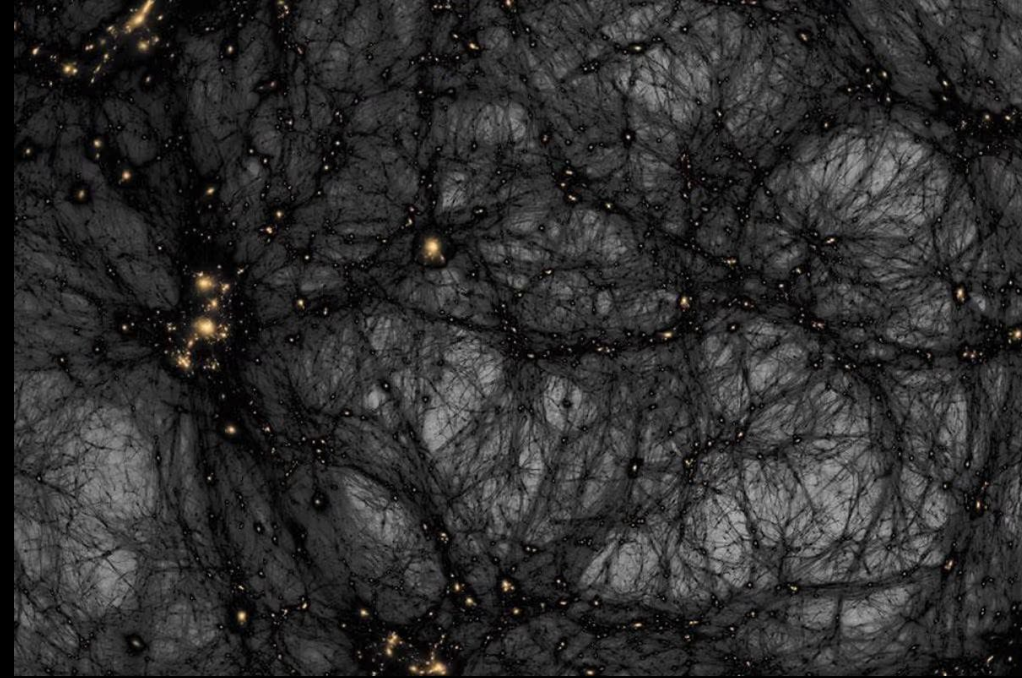
Aging Brown Dwarfs Wander Alone

- Researchers at the Trottier Institute for Research on Exoplanets, Université de Montréal, Canada, have published results from a study of brown dwarf formation and binary systems.
- Brown dwarfs are interstellar objects that are larger and hotter than Jupiter, but smaller than the lowest-mass stars. They form in the same way as stars, out of the gravitational collapse of a cloud of molecular hydrogen, but do not have enough mass to sustain nuclear fusion like a normal star.
- Using NASA's Hubble Space Telescope, which can detect binaries passing within 300 million miles of each other (the approximate distance between our Sun and the asteroid belt), researchers were able to determine that the relationship in brown dwarf binaries is generally short-lived.
- The implications are that star-forming mechanisms do produce binary pairs, but that the brown dwarfs are so weakly linked by gravity that they drift apart over time, with the result that the oldest, lowest-mass and coldest brown dwarfs are extremely unlikely to be found with a companion.

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No Room for Dark Matter (1)

- The current theoretical model for the composition of the universe states that it's made of less than 5% ordinary matter and roughly 27% dark matter, with the rest made of dark energy.
- Researchers at the university of Ottawa have published a study challenging this model by showing that the universe has no room for dark matter.
- “Dark matter” describes all that appears not to interact with light or the electromagnetic field, or that can only be explained through gravitational force. We can't see it and we don't know what it's made of, but it helps us to understand how galaxies, planets and stars behave.



Credit: Tom Abel and Ralf Kaehler (KIPAC, SLAC) AMNH

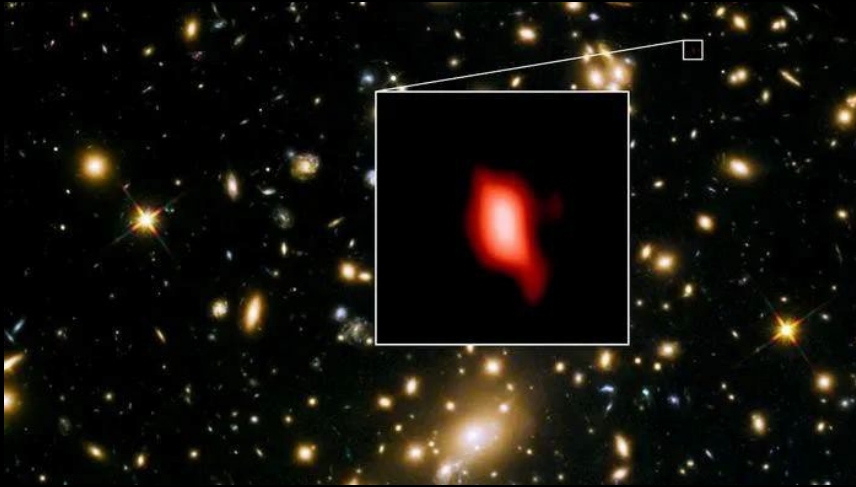
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No Room for Dark Matter (2)

- Rajendra Gupta, physics professor at Faculty of Science, used combination of the Covarying Coupling Constants (CCC), first described by Paul Dirac, and Fritz Zwicky's "tired light" (TL) theories (the CCC+TL Model).
- Covarying Coupling Constants (CCC) looks at how physical constants, such as the strength of gravity or the speed of light, within our universe may change over time; increasing or decreasing depending on certain conditions; meaning that they change together in certain patterns rather than remaining fixed.
- The Tired Light Model theorises that light loses energy as it travels through space.
- Together, these ideas suggest there may be alternative explanations for cosmological phenomena such as cosmic redshift.

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No Room for Dark Matter (3)



Redshift of distant galaxy MACS1149-JD1
Credit: ALMA (ESO/NAOJ/NRAO), NASA/ESA
Hubble Space Telescope, W. Zheng (JHU), M.
Postman (STSCI), The Clash Team, Hashimoto
et al

- JWST early universe observations helped cosmologists to age the universe by measuring the cosmic redshift of the earliest known galaxies, confirming the model's predictions.
- Redshifts refer to light being shifted toward the red part of the spectrum due to the wavelengths being stretched out as they travel through expanding space. Therefore, the higher the redshift in observed galaxies, the further light has travelled and the more it's been stretched, meaning there is a greater distance between us and the galaxy, and their formation during the early universe.

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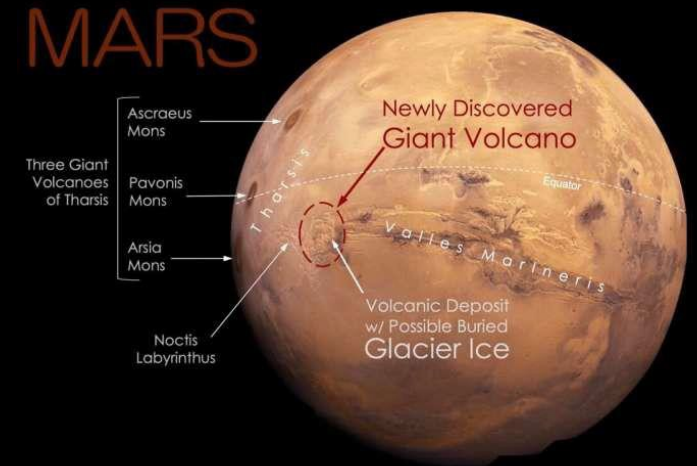
No Room for Dark Matter (4)

- Rajendra Gupta analysed data from recent papers on the distribution of galaxies at low redshifts and the angular size of the sound horizon at high redshift. By using the CCC+TL Model in his analysis of the data, he was able to come to the following conclusion:
- “In standard cosmology, the accelerated expansion of the universe is said to be caused by dark energy but is in fact due to the weakening forces of nature as it expands, not due to dark energy...this eliminates (dark matter’s) cosmological existence while being consistent with key cosmological observations that we have had time to confirm.”
- If correct, this groundbreaking new discovery will herald a shift in our understanding of the universe and upend many research projects that have been working to discover the properties of dark matter.

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Giant Martian Volcano Discovered (1)

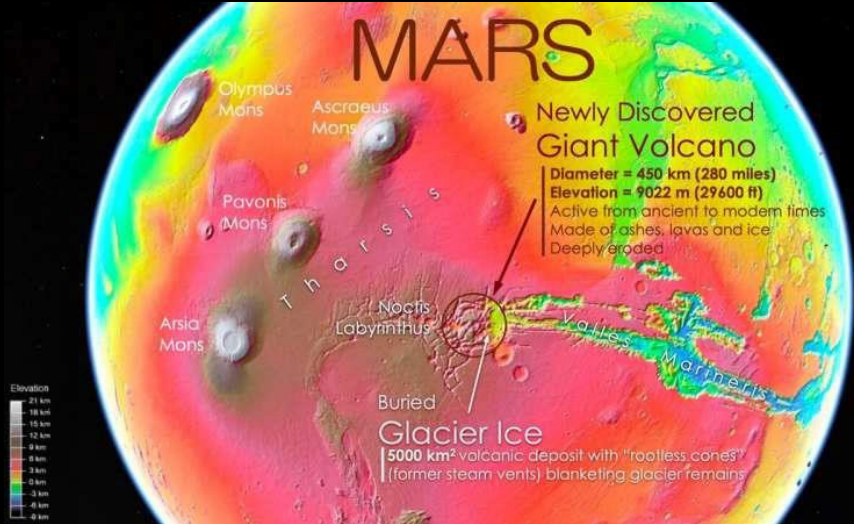
- In a groundbreaking announcement at the 55th Lunar and Planetary Science Conference, Texas, scientists announced the discovery of a giant volcano hiding in plain sight in the eastern part of Mars' Tharsis volcanic province, near the planet's equator.
- The volcano has been called "Noctis Volcano" while it waits for an official name.
- The area has been continuously imaged by orbiting spacecraft since Mariner 9 in 1971, but the volcano is too deeply eroded to be recognisable, even though it stands at 29,000 feet in elevation (similar height to Everest) and spans 450km in width.



Map displaying location of new volcano
In relation to previously known volcanoes.
Credit: Background image: NASA/USGS
Mars globe. Geologic interpretation and
annotations by Pascal Lee and Sourabh
Shubham 2024

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Giant Martian Volcano Discovered (2)



Topographic map showing the iconic location of The Noctis Volcano between the largest volcano And canyon provinces on Mars. Credit: Background Image: NASA Mars Global Surveyor (MGS) Mars Orbiter Laser Altimeter (MOLA) digital elevation model.

Geologic interpretation & annotations by Pascal Lee and Sourabh Shubham 2024

- The clues which led to the volcano's identification may be found in a jumble of layered mesas and canyons, located in the eastern part, as well as several elevated mesas forming an arc in its central summit area.
- The remains of a collapsed volcanic crater which would have hosted a lava lake, called a caldera remnant, is also visible near to the centre.
- Its size and complex modification history indicate that it had been active for a long time, and glacier ice is likely to still be present beneath a recent volcanic deposit in its southeastern part.

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Giant Martian Volcano Discovered (3)

- It had been long suspected that there was a volcano in the region, due to the presence of a wide variety of minerals spanning a long stretch of Martian history and has been described as a 'smoking gun'.
- A 5,000 square km area of volcanic deposits within the volcano's perimeter presents many low, rounded, blister-like mounds; produced by explosive steam venting or steam swelling when a thin blanket of hot volcanic minerals rests on water or ice-rich surface.
- Further research is required to unravel the volcano's long and complex history, presenting exciting opportunities for future missions and, eventually, perhaps even human exploration.

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Total Solar Eclipse Excites America (1)

- On Monday 8th April 2024, a total solar eclipse will cross North America beginning over the South Pacific Ocean and passing over Mexico at around 11:07 a.m. PDT (Pacific Daylight Time, 7 hours behind UTC), the United States, and finally Canada at 5:16 p.m. NDT (Newfoundland Daylight Time, 2 hours behind).
- Total solar eclipses occur when the Moon passes between the Earth and the Sun, casting a shadow that blocks the sun's light from view for just a few minutes. They are not uncommon, but the shadow forms a narrow band a few miles wide over the surface of the Earth, so relatively few people will see a total solar eclipse.
- NASA is encouraging "citizen scientists" to photograph the Sun's corona so that as much data may be collected as possible. For up to 4 minutes and 28 seconds of this total solar eclipse as its shadow speeds across the Earth, scientists will observe animal reactions and gauge communication disruptions.

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Total Solar Eclipse Excites America (2)

- NASA's high-altitude jets will chase the Moon's shadow to study the Sun's corona with improved telescopes, studying the surrounding dust which was left over from when the Solar System was forming.
- Rockets will also be blasting off into the ionosphere, approximately 400 miles outside of the totality zone, but with 81% of the Sun obscured in a partial eclipse.
- On its journey, the eclipse will cover many American states, with many businesses offering souvenirs, hotel packages, parties, eclipse-themed doughnuts, and a potentially panic-buy-inspiring "eclipse survival kit", which is made up of four mini versions of Moon Pie and two pairs of eclipse glasses.
- An eclipse explorer and full list of every location in the U.S., along with the exact timing of each partial, totality and maximum, may be found on NASA's website via the following link: <https://science.nasa.gov/eclipses/future-eclipses/eclipse-2024/where-when/>

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Astronomy News in Brief (1)

- **Heat to blame for space pebble demise: “zodiacal light” is the faint glow in the night sky caused by the scattered dust of broken comets. Debris ejected by comets in our atmosphere is observed here on Earth as meteors and may be as large as a grain of sand or a pebble. Dust in the zodiacal cloud is made up of particles the size of tobacco smoke. New research by “CAMS” – a NASA-sponsored global network that watches the night sky for meteors, has “developed software that detects meteors in videos recorded from different locations and then triangulates their trajectory in the atmosphere.” They conclude that thermal stresses may cause larger meteoroids near Earth to break up, while particles inside Mercury’s orbit fall apart from loss of material in the heat.**

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Astronomy News in Brief (2)

- Trojan asteroid shares orbit with Mars: Observations made using the Gran Telescopio Canarias (GTC) has confirmed that the asteroid 2023 FW14, discovered last year, is in the same orbit as Mars, and slightly ahead. It is estimated to have joined Mars around 1 million years ago and may leave within the next 10 million. This increases the number of Trojans (small bodies in the solar system that share the orbit of a planet) accompanying Mars to 17.
- At least one in a dozen stars show evidence of planetary ingestion: An international research team studying twin stars (born of the same molecular clouds) have discovered that, in about 8% of the 91 pairs looked at, the composition differs. This difference is due to one of the twins devouring either planets or planetary material.

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Astronomy News in Brief (3)

- Asteroid's orbit and shape changed after DART impact: NASA's Double Asteroid Redirection Test (DART) smashed into a 560-foot asteroid, Dimorphos, on September 26th, 2022, proving that a kinetic impactor could deflect life-threatening asteroids. Further information about the impact has come to light. Dimorphos had a roughly symmetrical shape, like a squashed ball, with a well-defined circular orbit. After impact, the shape has changed to more of an oblong watermelon and the no longer circular orbit is now 33 minutes and 15 seconds shorter.
- Spring is officially here! The Vernal Equinox arrived on March 19th, heralding the start of the spring season for the Northern Hemisphere. The equinox and solstice due to the angle at which Earth faces the Sun. At an equinox, the Earth's axis and its orbit line up, so that both hemispheres get an equal amount of sunlight. At a solstice, Earth is at its most extreme tilt towards or away from the Sun.

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Astronomy News in Brief (4)

- **Life's building blocks are surprisingly stable in Venus-like conditions: Life could be found in the clouds of Venus, which extends from 30 to 40 miles above the surface and hosts milder temperatures than the blistering lands below. It was previously thought that life would look very different due to the highly toxic chemical composition of the clouds, but this is now being challenged. A new study by MIT researchers states that 19 amino acids essential for life on Earth remain stable for up to four weeks when placed in similar conditions. Results say that building blocks of life are stable in sulphuric acid, meaning that Venus' clouds could, theoretically, support complex chemicals needed for life.**

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April 2024

Spaceflight News

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SpaceX's Rocket Soars for an Hour (1)

- SpaceX's mega rocket Starship, the largest rocket ever built at 122m high, saw two test flights end in "rapid unscheduled disassembly" just minutes after liftoff in 2023.
- During its inaugural launch on 18th April last year, Starship cleared its launch platform, but the failure of several of the booster's 33 methane-fuelled engines and the failed proper detachment of the booster from the rocket resulted in an explosion four minutes after liftoff.



Explosion of the first test flight in April 2023
Credit: Joe Skipper/Reuters

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SpaceX's Rocket Soars for an Hour (2)



Successful liftoff of second Starship test flight in November 2023. The rocket reached an altitude of nearly 150 km before it exploded.

Credit: Timothy A. Clary/AFP via Getty

- Elon Musk recently announced that the second flight of the Starship prototype on 18th November could have reached orbit if it had been carrying a payload. The ship exploded 8 minutes into the flight due to venting excess liquid oxygen, which would otherwise have been used to fuel the engines if the ship had been carrying a payload.
- The U.S. Federal Aviation Administration (FAA) awarded a launch licence for a 3rd mission to take place during March, and Starship launched from Starbase in Boca Chica, Texas at dawn on Thursday 14th March.

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SpaceX's Rocket Soars for an Hour (3)

- A few minutes after liftoff, the first-stage booster successfully separated from the ship but, instead of entering the Gulf of Mexico intact as was planned, it broke apart 1,500 feet in the air.
- Starship continued upwards, reaching an altitude of about 145 miles (233km) as it passed over the Atlantic in the direction of the Indian Ocean, its final destination. With only 15 minutes remaining, at around 49 minutes into the flight, SpaceX lost all contact with Starship as it prepared to make its descent. At this point, the ship was travelling at around 16,000mph, at an altitude of 40 miles (65km), and is presumed to have broken apart.
- “The ship has been lost, so no splashdown today” said SpaceX’s Dan Huot. “But again, it’s incredible to see how much further we got this time around.”

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SpaceX's Rocket Soars for an Hour (4)

- Several of Starships key goals were achieved during this most recent test flight, and officials anticipate a point in time when Starship may successfully land on the moon. NASA insists that this mission be completed before the rocket is authorised to carry a human crew.



SpaceX's mega rocket Starship launches at dawn in the haze on it's third test flight from Starbase in Boca Chica, Texas, Thursday, March 14, 2024. Credit: AP Photo/Eric Gay

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NASA Launches BurstCube Mission (1)

- A new satellite, BurstCube - led by NASA's Goddard Space Flight Center in Greenbelt, Maryland - has been sent up to the International Space Station aboard SpaceX's 30th Commercial Resupply Services mission. Liftoff took place at 4:55pm EDT (Eastern Daylight Time) on Thursday 21st March from Cape Canaveral Space Force Station in Florida.
- The shoebox-sized satellite will be deployed from the ISS into Earth's orbit with the mission to improve gamma-ray detector coverage of the night sky. We can currently only view 70% of the sky at any one time due to existing detectors being partially blocked by the Earth.
- BurstCube may be small, but its mission is to unravel the universe's most powerful explosions by detecting, locating, and studying short gamma-ray bursts. These short, high-energy bursts are usually indicative of neutron star collisions.

NASA Launches BurstCube Mission (2)



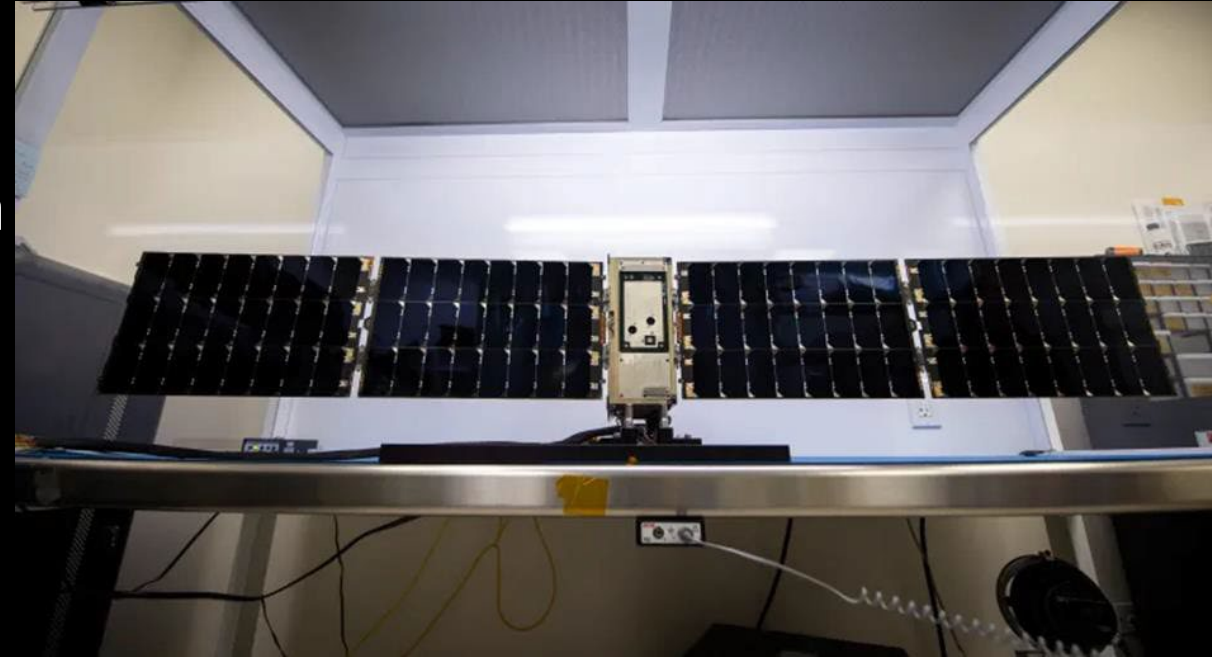
Neutron stars form when a star ends its life in a cosmic explosion
Known as a supernova. Credit: ESO/M. Kornmesser

- Neutron stars are born from the supernovae events of massive stars and are composed of the densest matter in the known universe. A collision event would create both light and gravitational waves, as well as heavy elements such as gold and iodine - an essential ingredient for life.

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NASA Launches BurstCube Mission (3)

- As well as detecting gamma-ray bursts, BurstCube can also detect gravitational waves rippling out from spiralling neutron stars, providing an excellent opportunity for testing new technology and for new astronomers and aerospace engineers to gain experience in multi-messenger astronomy; a relatively new method that coordinates observation and interprets data, such as X-rays and gravitational waves, that emanate from the same source to find answers about our universe.



Gamma rays will enter through one of BurstCube's four detectors and be converted into visible light by a cesium iodine layer called a scintillator. The light will then enter another layer with an array of 166 silicon photomultipliers, and will be converted into a pulse of electrons, which BurstCube will measure. Credit: NASA/Sophia Roberts

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NASA Launches BurstCube Mission (4)

- In 2017, researchers using the Laser Interferometer Gravitational-Wave Observatory (LIGO) managed to observe gravitational waves and light from the same event – GW170817 – in which two neutron stars had collided. By measuring a peak in gravitational wave disturbance and connecting it with a gamma-ray burst which followed, astronomers realised they were experiencing a watershed moment, and that studying both light and gravitational waves could teach them about different aspects of the event.
- Astronomers have been hoping to catch another event of this magnitude since and, with BurstCube's ability to cover a larger portion of the night's sky, their chances are greatly improved.
- Follow this link for a short video on the GW170817 event - <https://www.ligo.org/detections/GW170817.php>

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Thomas P. Stafford Dies Age 93 (1)

- Retired Air Force three-star general, astronaut on four space missions and one of 24 astronauts who flew to the moon, Father of Stealth in charge of “Area 51”, and diplomatist Thomas P. Stafford has died at the age of 93, in hospital near his Space Coast Florida home.
- From a young age, Stafford would watch giant DC-3 airplanes flying over his childhood home in Weatherford, Oklahoma. “I wanted to fly since I was 5 or 6 years old seeing those airplanes,” he told NASA historians.
- Graduating in the top 1% of his class at the U.S. Naval Academy, he volunteered for the Air Force, hoping to fly combat in the Korean War but, by the time he got his wings, the war was over.



This Aug. 23, 1965 photo provided by NASA shows astronaut Thomas P. Stafford, near the NASA Motor Vessel Retriever in the Gulf of Mexico during training. Stafford, who commanded a dress rehearsal flight for the 1969 moon landing and the first U.S.-Soviet space linkup, died Monday, March 18, 2024. He was 93. Credit: NASA via AP

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Thomas P. Stafford Dies Age 93 (2)



Right: Wally Schirra and Tom Stafford on board the USS Wasp (CV-18) celebrate their completion flight. Left: Gemini 7 photographed through hatch Of Gemini 6 spacecraft Credit: NASA



Thomas Stafford (right) and Eugene Cernan wave to Crowd aboard aircraft Carrier USS Wasp. Credit: NASA

- Stafford graduated first in his class at the Air Force's experimental test pilot school and stayed on as an instructor. In 1962, NASA selected him, alongside Neil Armstrong, Frank Borman and Pete Conrad, for its second set of astronauts.
- Before Apollo, Stafford flew on two Gemini flights, including the first rendezvous with two U.S. capsules in orbit.
- On the Apollo 10 mission in May 1969, two months prior to the historic Apollo 11 mission, Stafford and Gene Cernan took "Snoopy" the lunar lander within 9 miles of the Moon's surface.

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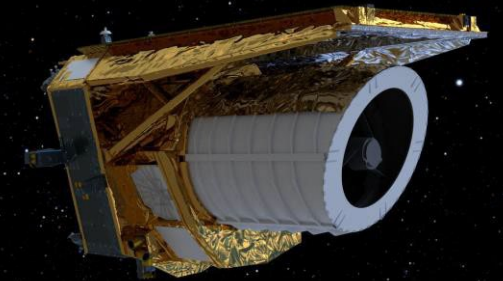
Thomas P. Stafford Dies Age 93 (3)

- After the moon landings, Stafford was chosen to command the American side of the NASA and the Soviet Union joint docking mission, requiring intensive language training, being followed by the KGB, and a less required trip to Disney World to ride Space Mountain with his new cosmonaut friends.
- “It helped prove to the rest of the world that 2 completely opposite political systems could work together,” he later recalled at a 30th anniversary gathering in 2005.
- Stafford also chaired an oversight group looking into how to fix the then-flawed Hubble Space Telescope, earning a NASA public service award. He provided more services to his country and, indeed, the planet than are possible to mention here.
- “Today General Tom Stafford went to the eternal heavens which he so courageously explored as a Gemini and Apollo astronaut as well as a peacekeeper in Apollo Soyuz” NASA Administrator Bill Nelson said, “Those of us privileged to know him are very sad, but grateful we knew a giant.”

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De-icing Euclid's Vision (1)

- The Euclid Space Telescope, a fully European mission, built and operated by ESA, with contributions from NASA, with the mission to chart a third of the sky. Scientists hope this will reveal more about the nature of dark matter and dark energy.
- However, Euclid has recently been experiencing a bit of bother with its “dark universe detective” vision.
- This was determined to have been caused by a thin layer of ice clouding the visible light imager. Even a tiny amount of water absorbed during assembly can smuggle its way to space and freeze onto the first surface they can.



Euclid Space Telescope. Credit: ESA

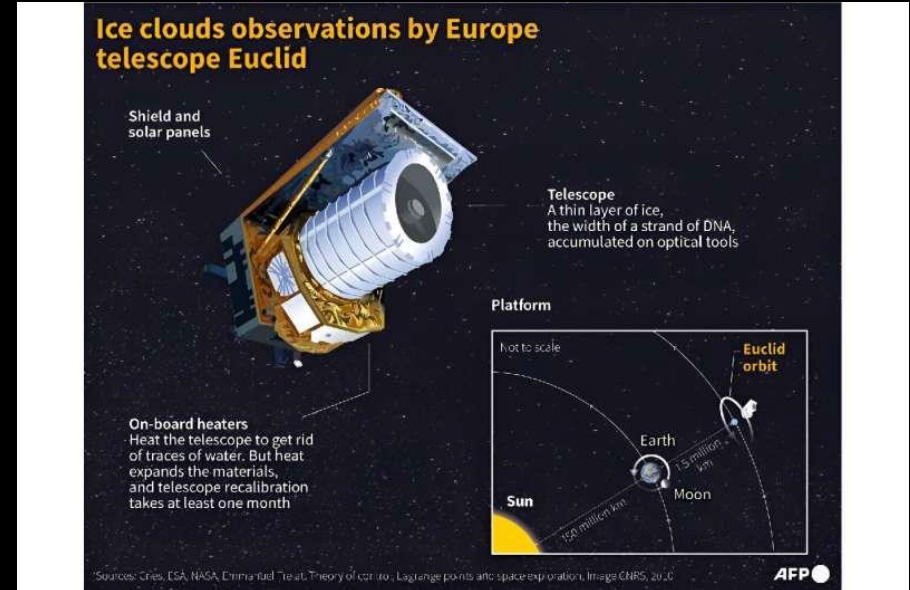


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De-icing Euclid's Vision (2)

- Euclid has already experienced quite a few issues since its launch in July 2023; cosmic rays have previously confused the spacecraft's fine guidance sensor, requiring a complicated software update; and unwanted sunlight also interfered with observations, which required a slight adjustment in rotation.
- Shortly after Euclid was launched, ESA carried out an “outgassing campaign”, warming up the telescope with onboard heaters to sublimate most of the water molecules present at launch.
- A great deal of research has led scientists to determine that the water molecules, equivalent to the width of a strand of DNA, are likely frozen onto mirrors in Euclid's optics.

Ice Clouds on Observations Credit: ESA



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De-icing Euclid's Vision (3)

- The team could begin turning on every onboard heater for several days to increase temperatures from around -140°C in some parts to -3°C . This will clean the optics but may cause subtle differences in Euclid's optical alignment due to expansion from heat. In such a sensitive mission, the effects of this would be severe.
- Instead of heating the entire telescope, the team will individually heat low-risk optical parts in areas where released water is unlikely to contaminate other instruments or optics. If the issue persists and impacts the mission, they will continue to heat other groups of Euclid's mirrors.
- "De-icing should restore and preserve Euclid's ability to collect light from these ancient galaxies, but it's the first time we're doing this procedure. We have very good guesses about which surface the ice is sticking to, but we won't be sure until we do it," explains Reiko Nakajima, VIS instrument scientist.

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Soyuz Successfully Docks at ISS (1)



A Soyuz rocket lifts off March 23rd, carrying three Astronauts to the International Space Station.
Credit: NASA/Bill Ingalls

- There has been keen interest in the aborted and successful launches of the Soyuz MS-24, and of the completed docking with ISS on Monday 26th March
- A Russian Spacecraft carrying three astronauts; NASA astronaut Tracy Dyson; Russian Oleg Novitsky; and Marina Vasilevskaya of Belarus, has arrived at the International Space Station (ISS) after blasting off on Saturday from the Russian-leased Baikonur launch facility in Kazakhstan.

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Soyuz Successfully Docks at ISS (2)

- Novitsky, an experienced Russian cosmonaut, and Vasilevskaya, Belarus' first female cosmonaut, are due to spend 14 days in orbit. They will return home aboard the Soyuz MS-24 Spacecraft. Dyson is on her third trip to the ISS and is due to spend 184 days in space.
- They join the current ISS crew, made up of NASA astronauts Loral O'Hara, who also be returning on the Soyuz in 14 days; Mathew Dominick; Mike Barratt; and Jeanette Epps; as well as Russians Oleg Kononenko; Nikolai Chub; and Alexander Grebenkin.



Top: Vasilevskaya;
Middle: Dyson;
Bottom: Novitsky
Credit: NASA/Bill Ingalls

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Soyuz Successfully Docks at ISS (3)

- Two days prior to the successful launch, the Thursday attempt was prevented by an automatic safety system, triggered by a voltage drop in a power source, just 20 second before liftoff.
- Questions have been raised concerning the reliability of Russia's space program.
- The US has now begun using privately built SpaceX rockets and capsules, ending a decade long Russian monopoly on launches. However, space cooperation remains between the US and Russia in a time when relations between Moscow and Washington have almost totally eroded.



Aborted Soyuz Rocket
Credit: Roscosmos
Space Corporation

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Spaceflight News and Updates (1)

- **Milestones passed on Life Support System: The Blue Origin's Orbital Reef is a NASA-funded commercial space station and has recently completed tests for its critical life support system. Recycling water and oxygen produced by human activities significantly reduces the launch mass for rockets heading to a station. A trace contaminant control test, water contamination oxidation test, urine water recovery test, and water tank test were all successfully completed.**
- **NASA's Swift temporarily suspends science operations: NASA's Neil Gehrels Swift Observatory entered safe mode on 15th March, suspending science operations due to degrading performance from one of its three gyroscopes. The team are working on updates that will permit Swift to continue science operations using its two remaining gyros, and hope to restart observations as soon as possible.**

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Spaceflight News and Updates (2)

- **Microgravity found to cause severe disruption in rhythmic gene expression in humans: Astronauts exposed to microgravity experience changes to physiology, including immune suppression, increased inflammation, and reduced muscle mass and bone density. A new study from the University of Surrey has simulated these effects: 20 men completed a 90-day protocol with two weeks of baseline, before 60 days of constant bed rest and two weeks recovery. Results show that 91% of gene expression was affected, with major disruption to number, timing and amplitude of rhythmic genes. Disruption to muscle function was restored during recovery period, but lasting effects were identified with protein translation. Future studies, using the same test subjects, will look at how sleep, circadian rhythms and hormones are impacted by microgravity.**

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Spaceflight News and Updates (3)

- **New tech monitors and provides real-time data on local space weather: Space weather, made up of charged particles from the Sun, can cause serious issues for sensitive technology aboard spacecraft and satellites. Current space weather instruments provide timely data but have high time and money costs to make, with complex assembly and a requirement for powerful operational support systems. The Los Alamos team has now created the Compact Space Plasma Analyzer; a low-cost, rugged sensor capable of providing valuable information on the local space environment and spacecraft charge.**
- **Four astronauts, four countries, six months in orbit: Four astronauts, one each from Denmark, Japan, Russia, and the US, have returned to Earth after half a year at the International Space Station. Their capsule splashed into the Gulf of Mexico near the Florida Panhandle before dawn on Tuesday 12th March.**

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Spaceflight News and Updates (4)

- Japan's space agency says it hopes to forge a profitable launch business with its new H3 rocket: SpaceX are currently dominating the commercial launch business as the first private company to send humans into space, as well as having launched satellites for NASA. The Japanese Aerospace Exploration Agency and Mitsubishi Heavy Industries have plans to become a frontline contender in the private space race with their new H3 rocket, which had its first successful flight last month. H3's predecessor, the H-2A, boasted a 98% success rate, but had its competitive edge in the global market dampened by its high launch costs. H3 is designed to carry larger payloads than the H-2A but, although the launch cost is less than that of H-2A, it remains expensive at 50 billion yen (\$330 dollars). MHI officials hope to reduce this high fee after a dozen successful launches.

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Spaceflight News and Updates (5)

- **Science instrument delivered to Japan Aerospace Exploration Agency (JAXA) Martian Moons mission: Following a 6-year development process, NASA has handed over its Mars-moon Exploration with Gamma Ray and Neutrons (MEGANE) instrument to JAXA for integration onto the MMX Spacecraft. This marks a significant step in the Martian Moons eXploration (MMX) mission. MEGANE will characterize Mars' moons Phobos and Deimos to aid in determining their origin by measuring neutron and gamma-ray emissions.**

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April 2024

Observational Highlights

Lewes Astronomical Society

Data reproduced from In-The-Sky.org
Dominic Ford – original author & copyright holder

Planets (information for 1st April)

	<u>Planet</u>	<u>Rises</u>	<u>Sets</u>	<u>Highest</u>	<u>Direction</u>	<u>Altitude</u>	<u>Magnitude</u>	<u>Visible</u>
	MERCURY	06:43	21:06	13:55			+1.42	NO
	VENUS	06:17	17:53	12:04			-3.83	NO
	MARS	05:44	16:11	10:57			+1.19	NO
	JUPITER	07:52	22:46	15:19	West	25° ◇	-2.06	YES
	SATURN	05:58	16:45	11:21			+1.11	NO
	URANUS	07:57	23:07	15:32			+5.82	NO
	NEPTUNE	06:20	18:06	12:13			+7.96	NO

* = Highest point at Dawn (05:13 - last visible sighting)

** = Highest point at Dusk (21:54 - first visible sighting)

◇ = Highest point when first visible (20:53)

◇◇ = Highest point when first visible

◻ = Highest point when last visible

◻◻ = Highest point when last visible

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100 Deep Sky Objects - 1 (Information for 1st April)

<u>Object</u>	<u>Name</u>	<u>Constellation</u>	<u>Type</u>	<u>↗</u>	<u>↘</u>	<u>Highest</u>	<u>Direction</u>	<u>Alt</u>	<u>Mag</u>
Cr70	Orion's Belt	Orion	Open Cluster	21:14	23:52	21:14 ♁	South-West	30°	+0.6
Cr50	The Hyades	Taurus	Open Cluster	21:19	00:12	21:19 ♁	West	34°	+1.0
Mel20	The Alpha Persei Cluster	Perseus	Open Cluster	21:22	05:44	21:22 ♁	North-West	45°	+1.2
Cr39	Collinder 39	Perseus	Open Cluster	21:22	05:44	21:22 ♁	North-West	46°	+1.2
M45	The Pleiades	Taurus	Cluster with Nebulosity	21:24	00:24	21:24 ♁	West	34°	+1.3
Mel111	The Coma Star Cluster	Coma Berenices	Open Cluster	21:30	05:20	05:20 ♁	South	65°	+1.8
Cr256	Collinder 256	Coma Berenices	Open Cluster	21:30	05:36	00:46	South	65°	+1.8
NGC1980	Open Cluster	Orion	Cluster with Nebulosity	21:40	23:28	21:40 ♁	South-West	22°	+2.5
C33	The Eastern Veil Nebula	Cygnus	Nebula	00:52	05:13	05:13 *	East	41°	+2.7
Cr69	The Lambda Orionis Cluster	Orion	Open Cluster	21:44	00:47	21:44 ♁	South-West	36°	+2.8
Mel186	Melotte 186	Ophiuchus	Open Cluster	01:02	05:31	05:31 ♁	South	40°	+3.0
Cr359	Collinder 359	Ophiuchus	Open Cluster	03:03	05:20	05:20 ♁	South	40°	+3.0
Cr65	Collinder 65	Orion	Open Cluster	21:47	01:08	21:47 ♁	South-West	39°	+3.0
M44	Beehive Cluster	Cancer	Open Cluster	21:48	02:51	21:58	South	58°	+3.1
IC1396	The Elephant Trunk	Cepheus	Cluster with Nebulosity	21:54	05:13	05:13 *	North-East	49°	+3.5

* = Highest point at Dawn (05:13 - last visible sighting)

♁ = Bright object first visible sighting

** = Highest point at Dusk (21:54 - first visible sighting)

♁♁ = Bright object first visible sighting

100 Deep Sky Objects - 2 (Information for 1st April)

Object	Name	Constellation	Type	↗	↘	Highest	Direction	Alt	Mag
Cr399	Brocchi's Cluster	Vulpecula	Open Cluster	02:53	05:13	05:13 *	South-East	47°	+3.6
M42	Orion Nebula	Orion	Cluster with Nebulosity	21:54	23:30	21:54 **	South-West	21°	+4.0
NGC2264	The Christmas Tree Cluster	Monoceros	Cluster with Nebulosity	21:54	01:52	21:54 **	South-West	42°	+4.1
Cr62	Collinder 62	Auriga	Open Cluster	21:54	01:16	21:54 **	West	55°	+4.2
Cr464	Collinder 464	Camelopardalis	Open Cluster	21:54	05:13	05:13 *	North-West	72°	+4.2
NGC2232	Open Cluster	Monoceros	Open Cluster	21:54	00:26	21:54 **	South-West	27°	+4.2
IC4665	Open Cluster	Ophiuchus	Open Cluster	00:35	05:13	05:13 *	South	43°	+4.2
NGC1981	Open Cluster	Orion	Open Cluster	21:54	23:35	21:54 **	South-West	22°	+4.2
C14	The Perseus Double Cluster	Perseus	Open Cluster	21:54	05:13	21:54 **	North-West	38°	+4.3
M47	Open Cluster	Puppis	Open Cluster	21:54	00:44	21:54 **	South	23°	+4.4
M39	Open Cluster	Cygnus	Open Cluster	02:24	05:13	05:13 *	East	46°	+4.6
Cr106	Collinder 106	Monoceros	Open Cluster	21:54	01:28	21:54 **	South-West	38°	+4.6
NGC6633	Open Cluster	Ophiuchus	Open Cluster	01:11	05:13	05:13 *	South-East	41°	+4.6
IC4756	Graff's Cluster	Serpens Cauda	Open Cluster	01:28	05:13	05:13 *	South-East	28°	+4.6
NGC2244	Open Cluster	Monoceros	Open Cluster	21:54	01:18	21:54 **	South-West	37°	+4.8

* = Highest point at Dawn (05:13 - last visible sighting)

◇ = Bright object first visible sighting

** = Highest point at Dusk (21:54 - first visible sighting)

◇◇ = Bright object first visible sighting

100 Deep Sky Objects - 3 (Information for 1st April)

Object	Name	Constellation	Type	↗	↘	Highest	Direction	Alt	Mag
NGC1499	The California Nebula	Perseus	Bright Nebula	21:54	02:51	21:54 **	North-West	40°	+5.0
M35	Open Cluster	Gemini	Open Cluster	21:54	02:47	21:54 **	South-West	51°	+5.1
Cr107	Collinder 107	Monoceros	Open Cluster	21:54	01:22	21:54 **	South-West	37°	+5.1
NGC6871	Open Cluster	Cygnus	Open Cluster	23:07	05:13	05:13 *	East	52°	+5.2
M34	The Spiral Cluster	Perseus	Open Cluster	21:54	22:31	21:54 **	North-West	32°	+5.2
NGC869	h Per Cluster	Perseus	Open Cluster	21:54	05:13	21:54 **	North-West	38°	+5.3
NGC2281	Open Cluster	Auriga	Open Cluster	21:54	02:22	21:54 **	West	69°	+5.4
Cr97	Collinder 97	Monoceros	Open Cluster	21:54	01:22	21:54 **	South-West	38°	+5.4
NGC7686	Open Cluster	Andromeda	Open Cluster	04:37	05:13	05:13 *	North-East	31°	+5.6
M37	The Auriga Salt-and-Pepper	Auriga	Open Cluster	21:54	03:44	21:54 **	West	55°	+5.6
NGC752	Open Cluster	Andromeda	Open Cluster	21:54	01:23	21:54 **	North-West	23°	+5.7
Cr89	Collinder 89	Gemini	Open Cluster	21:54	02:50	21:54 **	South-West	51°	+5.7
M5	Globular Cluster	Serpens Caput	Globular Cluster	23:48	05:13	03:39	South	41°	+5.7
M13	Great Globular Cluster	Hercules	Globular Cluster	22:20	05:13	05:02	South	75°	+5.8
M48	Open Cluster	Hydra	Open Cluster	21:54	02:06	21:54 **	South	33°	+5.8

* = Highest point at Dawn (05:13 - last visible sighting)

◇ = Bright object first visible sighting

** = Highest point at Dusk (21:54 - first visible sighting)

◇◇ = Bright object first visible sighting

100 Deep Sky Objects - 4 (Information for 1st April)

Object	Name	Constellation	Type	↗	↘	Highest	Direction	Alt	Mag
M11	Wild Duck Cluster	Scutum	Open Cluster	02:38	05:13	05:13 *	South-East	27°	+5.8
M50	The Heart-Shaped Cluster	Monoceros	Open Cluster	21:54	00:42	21:54 **	South-West	27°	+5.9
NGC2169	The "37" Cluster	Orion	Open Cluster	21:54	01:41	21:54 **	South-West	42°	+5.9
M36	The Pinwheel Cluster	Auriga	Open Cluster	21:54	03:48	21:54 **	West	53°	+6.0
IC405	The Flaming Star Nebula	Auriga	Nebula	21:54	03:31	21:54 **	West	50°	+6.0
NGC7000	The North American Nebula	Cygnus	HII Region	02:52	05:13	05:13 *	South-East	49°	+6.0
NGC2301	Open Cluster	Monoceros	Open Cluster	21:54	01:15	21:54 **	South-West	34°	+6.0
M16	The Eagle Nebula	Serpens Cauda	Open Cluster	02:45	05:13	05:13 *	South-East	22°	+6.0
NGC7160	Open Cluster	Cepheus	Open Cluster	21:54	05:13	05:13 *	North-East	49°	+6.1
M12	Globular Cluster	Ophiuchus	Globular Cluster	00:45	05:13	05:07	South	37°	+6.1
NGC884	chi Per Cluster	Perseus	Open Cluster	21:54	05:13	21:54 **	North-West	39°	+6.1
M46	Open Cluster	Puppis	Open Cluster	21:54	00:48	21:54 **	South	23°	+6.1
NGC1746	Open Cluster	Taurus	Open Cluster	21:54	01:37	21:54 **	West	41°	+6.1
NGC1545	Open Cluster	Perseus	Open Cluster	21:54	05:13	21:54 **	North-West	50°	+6.2
M3	Globular Cluster	Canes Venatici	Globular Cluster	21:54	05:13	02:03	South	67°	+6.3

* = Highest point at Dawn (05:13 - last visible sighting)

◇ = Bright object first visible sighting

** = Highest point at Dusk (21:54 - first visible sighting)

◇◇ = Bright object first visible sighting

100 Deep Sky Objects - 5 (Information for 1st April)

<u>Object</u>	<u>Name</u>	<u>Constellation</u>	<u>Type</u>	<u>↗</u>	<u>↘</u>	<u>Highest</u>	<u>Direction</u>	<u>Alt</u>	<u>Mag</u>
M15	Globular Cluster	Pegasus	Globular Cluster	03:44	05:13	05:13 *	East	22°	+6.3
NGC6940	Open Cluster	Vulpecula	Open Cluster	01:03	05:13	05:13 *	East	43°	+6.3
M38	The Starfish Cluster	Auriga	Open Cluster	21:54	04:07	21:54 **	West	53°	+6.4
NGC457	The Dragonfly Cluster	Cassiopeia	Open Cluster	21:54	05:13	21:54 **	North-West	33°	+6.4
NGC7243	Open Cluster	Lacerta	Open Cluster	03:24	05:13	05:13 *	East	41°	+6.4
NGC1662	Open Cluster	Orion	Open Cluster	21:54	00:05	21:54 **	West	29°	+6.4
NGC1528	Open Cluster	Perseus	Open Cluster	21:54	05:13	21:54 **	North-West	50°	+6.4
NGC1647	Open Cluster	Taurus	Open Cluster	21:54	00:49	21:54 **	West	35°	+6.4
NGC129	Open Cluster	Cassiopeia	Open Cluster	21:54	05:13	05:13 *	North-East	32°	+6.5
NGC654	Open Cluster	Cassiopeia	Open Cluster	21:54	05:13	21:54 **	North-West	38°	+6.5
IC1805	The Heart Nebula	Cassiopeia	Cluster with Nebulosity	21:54	05:13	21:54 **	North-West	42°	+6.5
IC1848	The Soul Nebula	Cassiopeia	Cluster with Nebulosity	21:54	05:13	21:54 **	North-West	43°	+6.5
M92	Globular Cluster	Hercules	Globular Cluster	23:18	05:13	05:13 *	South-East	81°	+6.5
NGC2539	Open Cluster	Puppis	Open Cluster	21:54	01:27	21:54 **	South	26°	+6.5
M29	The Cooling Tower	Cygnus	Open Cluster	22:02	05:13	05:13 *	East	51°	+6.6

* = Highest point at Dawn (05:13 - last visible sighting)

◇ = Bright object first visible sighting

** = Highest point at Dusk (21:54 - first visible sighting)

◇◇ = Bright object first visible sighting

100 Deep Sky Objects - 6 (Information for 1st April)

<u>Object</u>	<u>Name</u>	<u>Constellation</u>	<u>Type</u>	<u>↗</u>	<u>↘</u>	<u>Highest</u>	<u>Direction</u>	<u>Alt</u>	<u>Mag</u>
M10	Globular Cluster	Ophiuchus	Globular Cluster	00:34	05:13	05:13 *	South	35°	+6.6
NGC1444	Open Cluster	Perseus	Open Cluster	21:54	05:13	21:54 **	North-West	47°	+6.6
NGC6709	Open Cluster	Aquila	Open Cluster	01:16	05:13	05:13 *	South-East	42°	+6.7
NGC1027	Open Cluster	Cassiopeia	Open Cluster	21:54	05:13	21:54 **	North-West	43°	+6.7
NGC7789	The Caroline's Rose	Cassiopeia	Open Cluster	21:54	05:13	05:13 *	North-East	33°	+6.7
NGC2129	Open Cluster	Gemini	Open Cluster	21:54	02:31	21:54 **	South-West	49°	+6.7
NGC2343	Open Cluster	Monoceros	Open Cluster	21:54	00:36	21:54 **	South-West	25°	+6.7
NGC1342	Open Cluster	Perseus	Open Cluster	21:54	02:43	21:54 **	West	36°	+6.7
NGC2423	Open Cluster	Puppis	Open Cluster	21:54	00:48	21:54 **	South	24°	+6.7
NGC7023	The Iris Nebula	Cepheus	Nebula	21:54	05:13	21:54 **	East	68°	+6.8
NGC6811	The Hole in a Cluster	Cygnus	Open Cluster	01:15	05:13	05:13 *	North-East	62°	+6.8
NGC2175	Open Cluster	Orion	Cluster with Nebulosity	21:54	02:21	21:54 **	South-West	48°	+6.8
NGC1502	Open Cluster	Camelopardalis	Open Cluster	21:54	05:13	21:54 **	North-West	53°	+6.9
M67	Open Cluster	Cancer	Open Cluster	21:54	01:47	22:09	South	50°	+6.9
M52	The Cassiopeia Salt-and-Pepper	Cassiopeia	Open Cluster	21:54	05:13	05:13 **	North-East	39°	+6.9

* = Highest point at Dawn (05:13 - last visible sighting)

◇ = Bright object first visible sighting

** = Highest point at Dusk (21:54 - first visible sighting)

◇◇ = Bright object first visible sighting

100 Deep Sky Objects - 7 (Information for 1st April)

Object	Name	Constellation	Type	↗	↘	Highest	Direction	Alt	Mag
M81	Bode's Galaxy	Ursa Major	Galaxy	21:54	05:13	22:01	North	69°	+6.9
NGC225	The Sailboat Cluster	Cassiopeia	Open Cluster	21:54	05:13	05:13 *	North-East	32°	+7.0
NGC7635	The Bubble Nebula	Cassiopeia	HII Region	21:54	05:13	05:13 *	North-East	39°	+7.0
NGC6960	The Western Veil Nebula	Cygnus	Supernova Remnant	00:53	05:13	05:13 *	East	42°	+7.0
NGC7380	The Wizard Nebula	Cepheus	Open Cluster	21:54	05:13	05:13 *	North-East	41°	+7.2
M103	Open Cluster	Cassiopeia	Open Cluster	21:54	05:13	21:54 **	North-West	36°	+7.4
M27	Apple Core Nebula	Vulpecula	Planetary Nebula	01:11	05:13	05:13 *	East	44°	+7.4
NGC6888	The Crescent Nebula	Cygnus	HII Region	22:02	05:13	05:13 *	East	53°	+7.5
M14	Globular Cluster	Ophiuchus	Globular Cluster	01:10	05:13	05:13 *	South	35°	+7.6
C9	The Cave Nebula	Cepheus	HII Region	21:54	05:13	05:13 *	North-East	48°	+7.7

	Twilight	Civil	Naut	Astro		Rises	Sets
	Ends	20:07	20:47	21:31	Sun	06:35	19:33
	Starts	06:02	05:22	04:39	Moon	03:04	09:42

* = Highest point at Dawn (05:13 - last visible sighting)

◇ = Bright object first visible sighting

** = Highest point at Dusk (21:54 - first visible sighting)

◇◇ = Bright object first visible sighting

Phases of the Moon



<u>Phase</u>	<u>Date</u>	<u>Time</u>	<u>Lunation</u>
NEW MOON	8th April	19:20	1253
FIRST QUARTER	15th April	20:13	1253
FULL MOON	24th April	00:48	1253
LAST QUARTER	1st May	12:27	1253



Credit: Sean Smith/NASA