Lewes Astronomical Society

Newsletter - November 2024

Astronomy News, Spaceflight News, and Observational Highlights

Lewes Astronomical Society

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November 2024

Astronomy News

Could dark matter be detected using Mars? (1)

- One of the current theories about dark matter suggest it is made up of microscopic primordial black holes, formed within the first second after the Big Bang, and streaming through the Universe ever since. They could be as small as a single atom or up to the size of a very small asteroid
- The theory first appeared in the 1970s, only to be overlooked as the search for exotic particles took off. As these searches continue to turn up nothing, interest is returning to the idea of microscopic primordial black holes

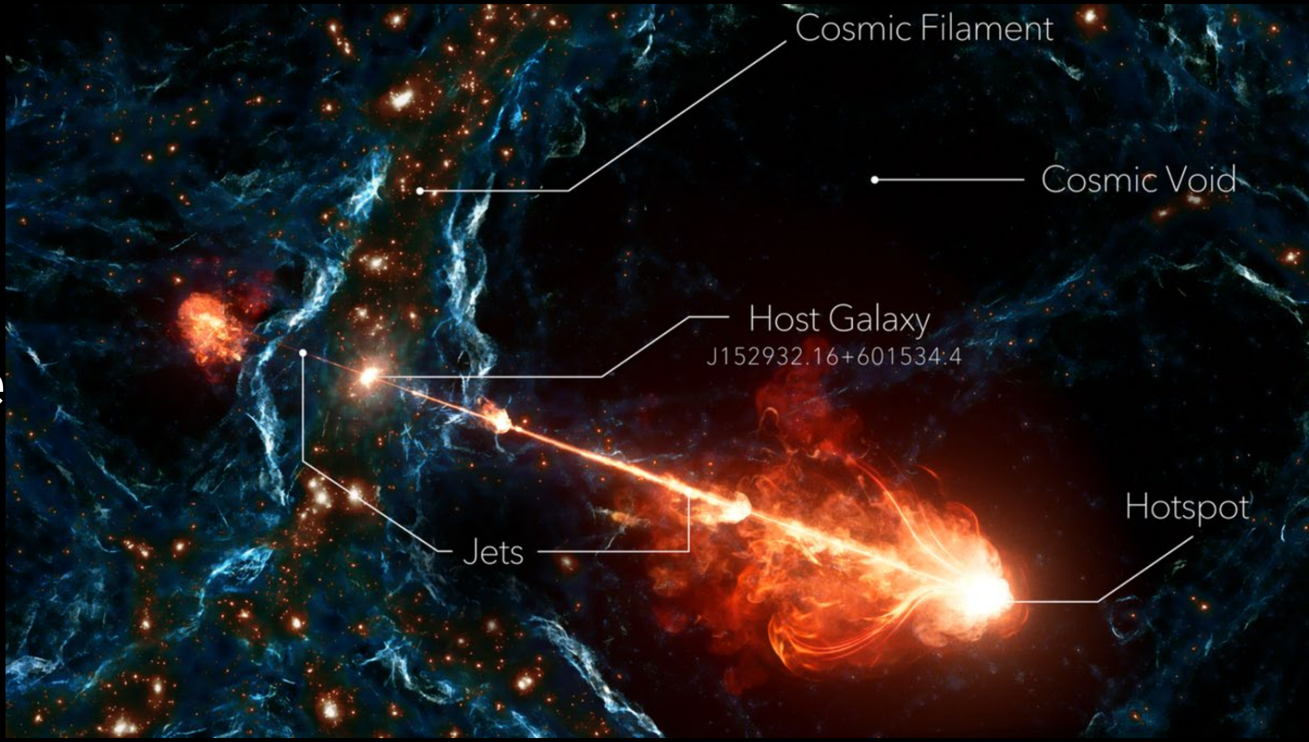
An artist's illustration depicts a primordial black hole (at left) flying past, and briefly "wobbling" the orbit of Mars (at right), with the sun in the background. MIT scientists say such a wobble could be detectable by today's instruments
Credit: Benjamin Lehmann, via SpaceEngine @ Cosmographic Software LLC

Could dark matter be detected using Mars? (2)

- If primordial black holes do exist then physicists at MIT, led by Professor David Kaiser, think they may have found a way to detect them
- The scientists believe that a primordial black hole would pass through the Solar System at least once a decade. A primordial black hole could carry a heavy punch due to its gravitational influence, causing a planet's orbit to wobble slightly.
- We know the distance between the Earth and Mars to an extraordinary accuracy of about 10cm using precision telemetry
- An asteroid-mass microscopic black hole flying near Mars could perturb its orbit by a detectable amount, up to one metre. A small asteroid-sized black hole could have a similar effect from hundreds of millions of miles away
- The passage of at least one primordial black hole through the Solar System every decade could affect the measurable distance between the Earth and Mars, hence offering an explanation for dark matter in the Universe

Largest black hole jets to date detected (1)

- Bipolar jets blasting out huge amounts of hot material from black holes at relativistic speeds is not a new phenomenon. It occurs when the supermassive black hole (SMBH) at the centre of a galaxy is feeding
- How far the jets extend beyond the host galaxy depends on the size of the black hole and its feeding rate. The emissions tend to be in either radio or x-ray wavelengths



Annotated image of the black hole jets called Porphyrion which emerge from a supermassive black hole that existed when the universe was half its current age
Credit: E. Wernquist / D. Nelson (IllustrisTNG Collaboration) / M. Oei

Largest black hole jets to date detected (2)

- Now researchers using data from Europe's LOFAR (LOw Frequency ARray) radio telescope have detected a gargantuan pair of jets coming from a galaxy (J152932.16+601534.4) 7.5 billion light years away. These jets span 23 million light years – that is equivalent to putting 140 Milky Way’s side-by-side. Confirmation of where the galaxy is located came from the Giant Metrewave Radio Telescope (GMRT) in India, and the Dark Energy Spectroscopic Instrument (DESI) at the Kitt Peak National Observatory in Arizona
- The jet megastructure has been given the nickname of “Porphyrion” after the largest of the giants from Ancient Greek mythology
- The LOFAR data suggests that such massive black hole jets may not be that rare, with the latest count being about 8,000. Such massive outflows will undoubtedly have had some influence on the filaments that make up the cosmic web

Largest black hole jets to date detected (3)

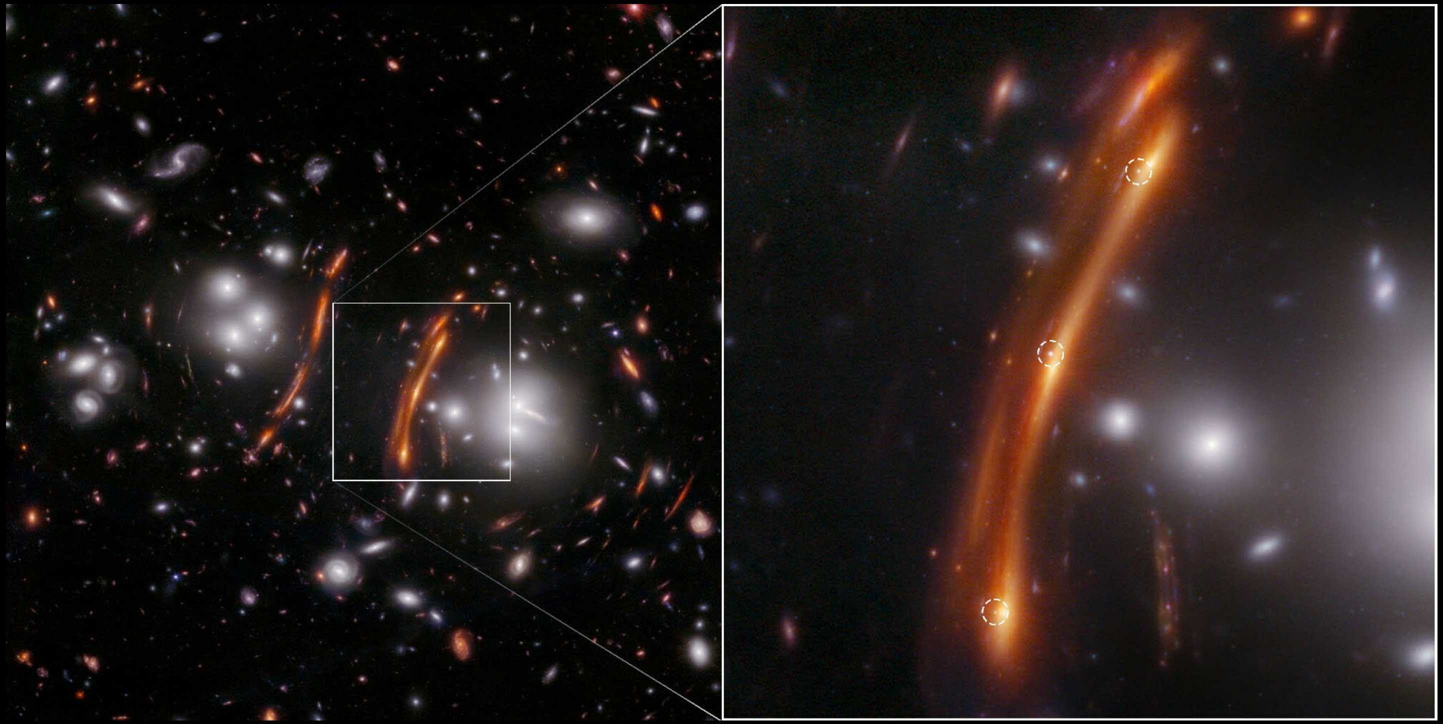
- Using the W. M. Keck Observatory in Hawai'i, the team has found that the black hole responsible for Porphyrion is a radiative-mode active black hole, which were common in the early Universe. Most jets found in the present-day universe are in a jet-mode state
- See the lead researcher (Martijn Oei, Caltech) talk about the discovery at: https://vimeo.com/1010675933
- See a short animation at: https://youtu.be/GSTpgsDHZ9k
- The closest known black hole jets emanate from the Centaurus A (NGC 5128) galaxy, located in the Centaurus constellation in the southern hemisphere, approximately 11-13 million light years away. Here the SMBH is about 55 million solar masses. For comparison, the black hole at the centre of the Milky Way, Sagittarius A*, is only about 4 million solar masses. The jets coming from Centaurus A stretch a mere 10 Milky Way diameters across space

Largest black hole jets detected (4)

Colour composite image of Centaurus A, revealing the lobes and jets emanating from the active galaxy’s central black hole. This is a composite of images obtained with three instruments, operating at very different wavelengths. The 870-micron submillimetre data, from LABOCA on APEX, are shown in orange. X-ray data from the Chandra X-ray Observatory are shown in blue. Visible light data from the Wide Field Imager (WFI) on the MPG/ESO 2.2 m telescope located at La Silla, Chile, show the stars and the galaxy’s characteristic dust lane in close to "true colour“
Credit: ESO/WFI (Optical); MPIfR/ESO/APEX/A.Weiss et al. (Submillimetre); NASA/CXC/CfA/R.Kraft et al. (X-ray)

Lensed supernova confirms Hubble Tension (1)

- Measuring the rate of expansion of the Universe is one of the most active areas of research in the field of astrophysics. Although the Universe is known to be expanding, the rate (known as the Hubble Constant = H_0) at which it is doing so is a difficult calculation



NASA’s JWSTe’s NIRCam (Near-Infrared Camera) image of the galaxy cluster PLCK G165.7+67.0, also known as G165, on the left shows the magnifying effect a foreground cluster can have on the distant universe beyond. The foreground cluster is 3.6 billion light-years away from Earth. The zoomed region on the right shows supernova H0pe triply imaged (labelled with white dashed circles) due to gravitational lensing. In this image blue represents light at 0.9, 1.15, and 1.5 microns (F090W + F115W + F150W), green is 2.0 and 2.77 microns (F200W + F277W), and red is 3.56, 4.1, and 4.44 microns (F356W + F410M + F444W)
Credit: NASA, ESA, CSA, STScI, B. Frye (University of Arizona), R. Windhorst (Arizona State University), S. Cohen (Arizona State University), J. D’Silva (University of Western Australia, Perth), A. Koekemoer (Space Telescope Science Institute), J. Summers (Arizona State University)

Lensed supernova confirms Hubble Tension (2)

- Two main methods: using the Cosmic Microwave Background (CMB), or using standard candles such as Cephid variables and Type 1a supernova, give rates which differ by about 10%, and this is known as the Hubble Tension. The CMB rate, as measured by ESA's Planck cosmology probe, is 66.93 ± 0.62 (km/s)/Mpc; the standard candle rate, as measured by the Hubble Space Telescope, is 73.24 ± 1.74 (km/s)/Mpc
- Earlier this year, JWST, following up on the earlier observation by Hubble, confirmed the validity of the standard candle results
- With the two main methods disagreeing it would be useful if another independent method could be used to confirm which model is closer
- In a separate exercise, Hubble imaged the cluster, PLCK G165.7+67.0, in 2015 as it is known for its high rate of star formation (over 300 solar masses per year) and higher supernovae rates

Lensed supernova confirms Hubble Tension (3)

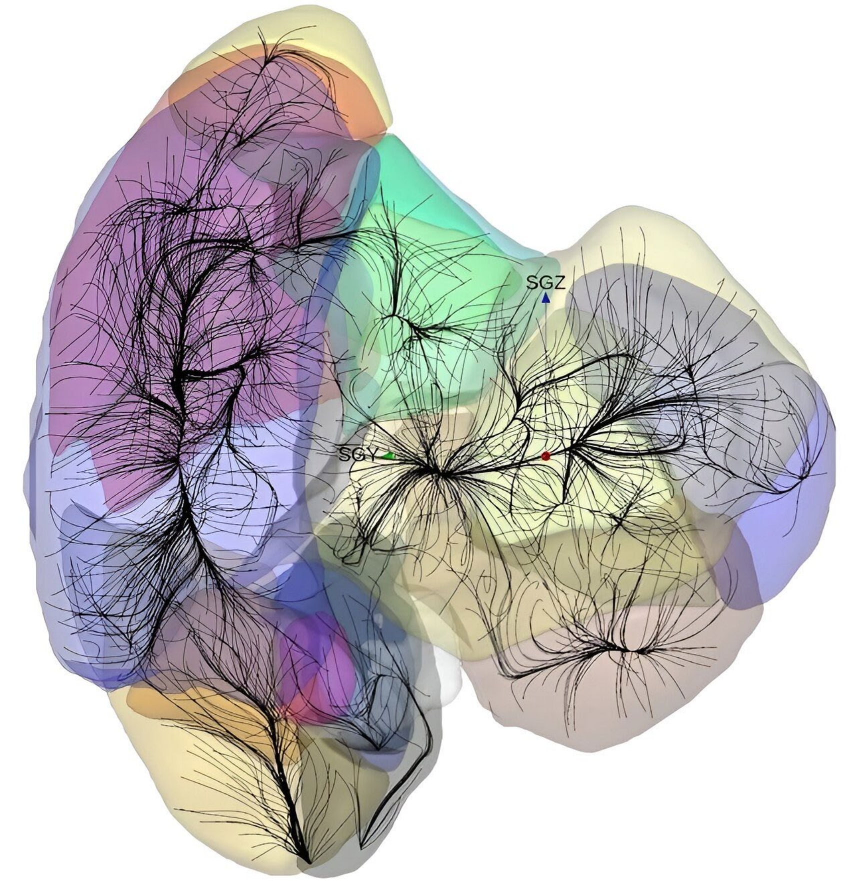
- JWST has now taken a look at the same cluster and spotted 3 dots of light which weren't visible in the Hubble images of 2015
- Further analysis has shown that these lights are from an exploding white dwarf star, a type 1a supernova, which has been gravitationally lensed; it has come from a background galaxy a long way behind the cluster. The middle light has been flipped relative to the two outer ones, as predicted by lensing theory
- The three images are the result of light travelling via a different pathway each time, with a different length. As the images arrived at the same time this indicates that each image captures the supernova at different times during the explosion

Lensed supernova confirms Hubble Tension (4)

- These trifold supernova images are very unique and special: the supernova distance, together with the time delays and the lensing properties, allow scientists to calculate the Hubble Constant (H_0). The supernova has been named SN H0pe as it should give scientists a better understanding of the Universe’s changing expansion rate
- In the final analysis, the rate came out as 75.4 (km/s)/Mpc plus 8.1 or minus 5.5

Milky Way: part of even larger structure (1)

- The Milky Way is known to be part of a larger group of galaxies known as the Local Cluster. This, in turn, is part of the Virgo Cluster and of the Virgo Supercluster, and in turn, Laniakea
- Now, researchers at the University of Hawai'i believe we are part of an even larger superstructure called the Shapley Concentration
- The Shapley Concentration is known as a basin of attraction, acting to pull together huge superclusters. It is about ten times more massive in volume than Laniakea, which itself is about 500 million light years across



A data visualization of the motions of galaxies in structures called basins of attraction. The Milky Way is the red dot   Credit: University of Hawai'i

Milky Way: part of even larger structure (2)

- Astronomers led by R. Brent Tully at the University of Hawai’i measured the movement of 56,000 galaxies to understand their distribution and their relationship to the basins
- “Our universe is like a giant web, with galaxies lying along filaments and clustering at nodes where gravitational forces pull them together”, reported Dr Tully, Emeritus Professor of Astrophysics. “Just as water flows within watersheds, galaxies flow within cosmic basins of attraction. The discovery of these larger basins could fundamentally change our understanding of cosmic structure”
- The Shapley Concentration is about half the volume of the largest structure known in the Universe, “The Great Wall”, which stretches over 1.4 billion light years

Most detailed I/R map of Milky Way made (1)

- Take one of the most powerful telescopes on Earth, make 200,000 images spanning 420 nights over a 13-year period and collect over 500 terabytes of data, and the result is the most comprehensive infrared map of the Milky Way ever made
- The team worked from 2010 to mid-2023 at the ESO's VISTA telescope at the Paranal Observatory in Chile

This collage highlights a small selection of regions of the Milky Way imaged as part of the most detailed infrared map ever of our galaxy. Here we see, from left to right and top to bottom: NGC 3576, NGC 6357, Messier 17, NGC 6188, Messier 22 and NGC 3603. All of them are clouds of gas and dust where stars are forming, except Messier 22, which is a very dense group of old stars. The images were captured with ESO's Visible and Infrared Survey Telescope for Astronomy (VISTA) and its infrared camera VIRCAM. The gigantic map to which these images belong contains 1.5 billion objects. The data were gathered over the course of 13 years as part of the VISTA Variables in the Vía Láctea (VVV) survey and its companion project, the VVV eXtended survey (VVVX) Credit: ESO/VVVX survey

Most detailed I/R map of Milky Way made (2)

- Using the telescopes VIRCAM, VISTA's infrared camera, they captured an area of sky covering over 8600 full moons and over 1.5 billion objects. This is ten times more than the team managed to achieve back in 2012
- Using VISTA (the Visible and Infrared Survey Telescope for Astronomy), the team were able to peer into areas of the Milky Way hidden by dust and also spot very cold objects like brown dwarfs and free-floating planets
- Each area of sky was revisited on numerous occasions, allowing researchers to determine object locations, how they moved and if they changed brightness. They were also able to track hypervelocity stars that have been catapulted out of the central region after wandering too close to Sagittarius A*

Most detailed I/R map of Milky Way made (3)

- Further work will benefit from the improvements being made to VISTA, with a new instrument called 4MOST and the ESO’s Very Large Telescope (VLT) is to receive the MOONS instrument
- See the video of the infrared and visible light views of the Lobster Nebula (NGC 6357). The visible light image created from the Digitized Sky Survey 2 and, for the central part, the ESO VLT. The new infrared image was taken with the VISTA telescope at the Paranal Observatory in Chile. In the infrared, the dust that obscures many stars becomes nearly transparent, revealing a whole host of new stars that are otherwise invisible. Go to: https://youtu.be/Yalty4aTvCw

Exciting new rock find on Mars (1)

- The Perseverance rover continues to find the unusual and unexpected
- Whilst climbing up towards the top of the Jezero Crater ridge, Perseverance spotted a loose black and white rock in the distance, totally different to anything seen before

NASA's Mars Perseverance rover captured this image of a black-and-white striped rock using its Left Mastcam-Z camera. Mastcam-Z is a pair of cameras located high on the rover's mast. This image was acquired on 13th September 2024 (Sol 1268) at the local mean solar time of 12:40:29
Credit: NASA/JPL-Caltech/ASU

Exciting new rock find on Mars (2)

- Investigators nicknamed it “Freya Castle” and used the Mastcam-Z camera to get a closer look
- By the time the data was downloaded Perseverance had moved on and it was only then that researchers realised just how unusual the 20cm rock is
- As it is unlike anything found in the floor of the crater the assumption is that it has rolled down the slope form somewhere higher up. Hopefully, in the near future, Perseverance will come across a bed of the new rock so that it can be studied in more detail

Astronomy Brief News and Updates (1)

- Exoplanets around Barnard's star – Barnard's star, a small red dwarf star in the constellation of Ophiuchus. It is the nearest individual star to Earth, at 5.96 light years. Astronomers working at the ESO Very Large Telescope (VLT) in Chile have confirmed the discovery of an exoplanet with the mass of at least half that of Venus orbiting Barnard's star. One orbit lasts 3.15 days; the surface temperature is about 125°C. The team also believe there are a further three exoplanet candidates
- Carbon dioxide found on Charon - Astronomers using JWST's Near Infrared Spectrograph (NIRSpec) have discovered carbon dioxide and hydrogen peroxide on the surface of Pluto's moon, Charon. Hydrogen peroxide is formed when UV light and charged particles from the solar wind break down water ice. This gives new insight on to the possible chemical composition of other Kuiper Belt Objects
- How Mars became uninhabitable – Curiosity's exploration of the Gale Crater has given researchers a solid foundation on which to propose how Mars lost its water and became uninhabitable. Sampling of carbonates left behind in the crater floor shows that there is an over-abundance of heavy isotope versions of carbon and oxygen, and where the lighter versions escaped into the atmosphere in a period of extreme evaporation. This suggests either there was a period of wet and dry cycles, or that the carbonates were laid down in extremely salty water under cold, ice-forming conditions

Astronomy Brief News and Updates (2)

- Could the Moon have been captured? – Moon rock, especially that collected by the Apollo astronauts over 50 years ago, shows a great deal of similarity with material found on Earth. The long-established and favoured proposition is that the Moon formed from a collision with Earth by another large planetary body – often known as Theia – very early in the Solar Systems evolution, about 4.5 billion years ago. A couple of researchers from Penn State University have raised questions about the collision theory though. The main issue is to do with the inclination of the Moon as compared with the Earth. The collision would have produced a huge amount of debris. This would have clumped together in a ring above Earth's equator prior to coalescing as the Moon. In fact, the Moon is more closely aligned with the Sun than the Earth. The Penn State researchers suggest that a more likely scenario is a binary-exchange capture where the Earth snatched the Moon from a passing rocky planet. A similar situation has occurred with Triton, the largest moon of Neptune, where it was likely to have been pulled from the Kuiper Belt. In the case of the Moon, its initial orbit would have been elongated, it would have also orbited closer than it does now; this would have caused extreme tides on Earth. These would have given the Moon a bit of a kick allowing its orbit to slowly become circular and to drift away from Earth. No one knows for sure, so it remains just an interesting hypothesis

Astronomy Brief News and Updates (3)

- **Low gravity affects heart muscle** – researchers from John Hopkins University School of Medicine sent 48 human bioengineered heart tissue samples up to the ISS for 30 days. Analysis of the data taken every 30 minutes for a period of 10 seconds on the samples shows that the low gravity encountered in space weakened the tissue and affected the normal rhythmic beats, causing arrhythmias, as compared with an identical set of tissue samples kept back on Earth. The ISS samples beat only about half the rate of the control samples. The protein bundles in the muscle cells changed, becoming shorter and more disorganised – a characteristic of heart disease. There was also oxidative damage and inflammation. These conditions are seen in astronauts when returning from periods in space, although most of the effects wear off in time. Further studies are ongoing to screen for drugs that might protect the heart from the effects of low gravity. These drugs may also work back on Earth to help older people maintain the correct heart function
- **Betelguese maybe not alone** – the repeated dimming and brightening of Betelguese, as seen over the past few years, was thought to be due to the star expelling large amounts of material as a prelude to going supernova. But a competing theory has emerged, that Betelguese has an unseen companion! This star, named “Alpha Ori B”, would clear the light-blocking dust making Betelguese appear brighter

Astronomy Brief News and Updates (4)

Comet C/2023 A3 (Tsuchinshan-ATLAS) photographed from the ISS at a height of 272 miles above the south east Pacific Ocean near New Zealand on 28th September 2024. Credit: NASA/Matthew Dominick

November 2024

Spaceflight News

Vulcan Centaur second successful launch (1)

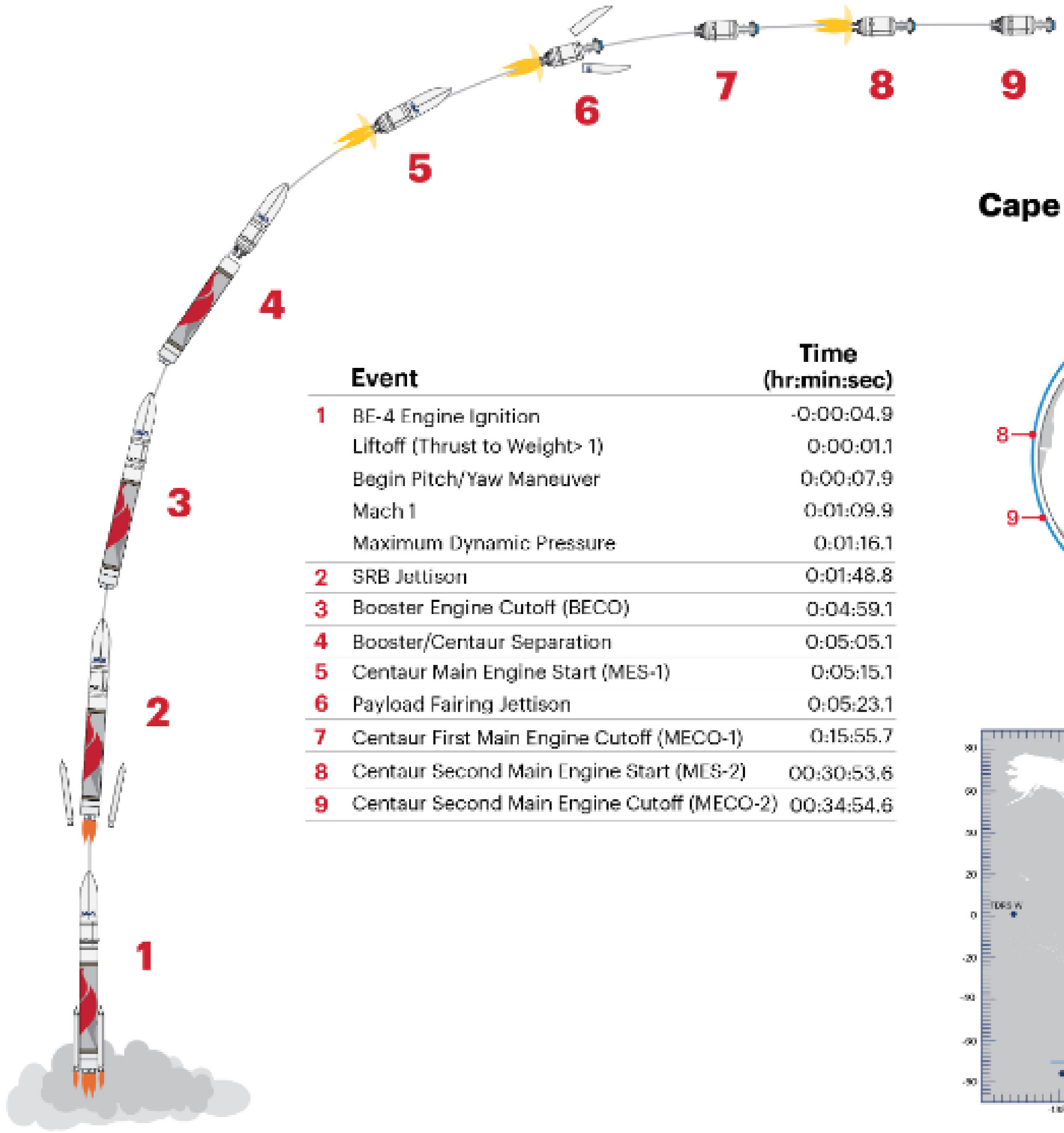
- United Launch Alliance (ULA) completed the second launch of its new Vulcan Centaur rocket on 4th October 2024
- The Vulcan Centaur, the replacement for the Atlas V, was launched from Cape Canaveral Space Force Station at 11:25 GMT

Credit: United Launch Alliance (ULA)

Vulcan Centaur second successful launch (2)

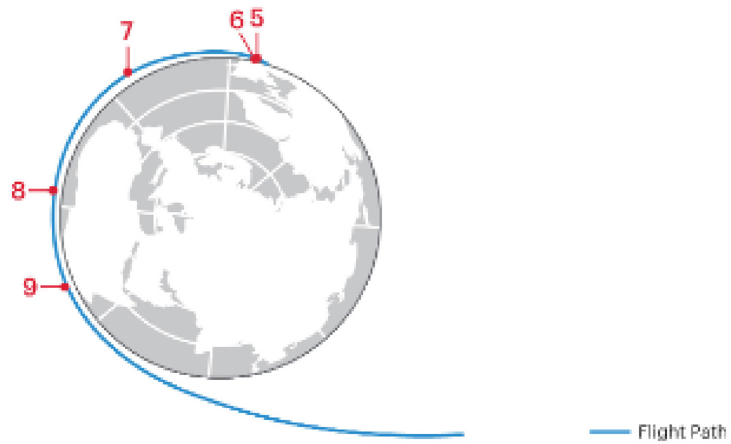
- The launch, coded named “Cert-2”, had been planned to put the new Dream Chaser robotic space plane in to orbit but, in the event, this was not ready so an inert “mass simulator” was used instead
- All the mission boxes were ticked, jettisoning the two solid booster rockets (SRBs) after two minutes, and a flawless stage separation after three minutes. A failed nozzle on one of the SRBs did result in a shower of sparks but the Vulcan Centaur was unaffected
- The upper stage performed two long engine burns and this completed the test
- ULA are hoping the successful test will lead to sign-off by the U.S. Space Force and then to two national security missions (USSF-106 and USSF-87) before the year end, and up to 20 more missions in 2025
- Watch the launch at: https://youtu.be/mYKl79UGKu8

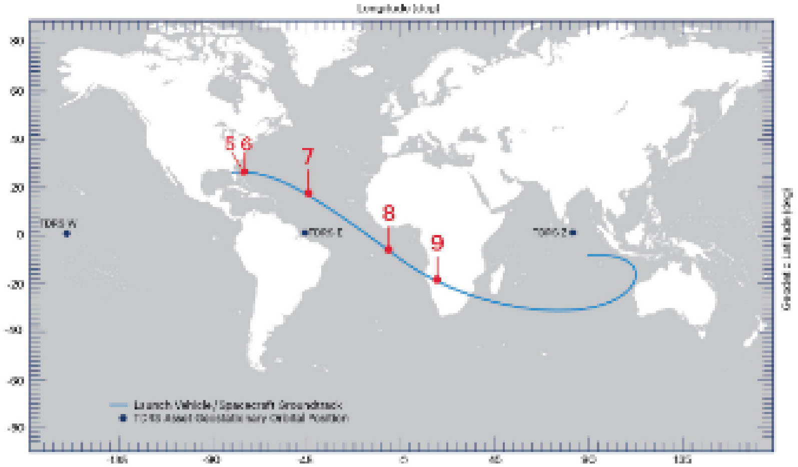
FLIGHT PROFILE



	Event	Time (hr:min:sec)
1	BE-4 Engine Ignition	-0:00:04.9
	Liftoff (Thrust to Weight> 1)	0:00:01.1
	Begin Pitch/Yaw Maneuver	0:00:07.9
	Mach 1	0:01:09.9
	Maximum Dynamic Pressure	0:01:16.1
2	SRB Jettison	0:01:48.8
3	Booster Engine Cutoff (BECO)	0:04:59.1
4	Booster/Centaur Separation	0:05:05.1
5	Centaur Main Engine Start (MES-1)	0:05:15.1
6	Payload Fairing Jettison	0:05:23.1
7	Centaur First Main Engine Cutoff (MECO-1)	0:15:55.7
8	Centaur Second Main Engine Start (MES-2)	00:30:53.6
9	Centaur Second Main Engine Cutoff (MECO-2)	00:34:54.6

Cape Canaveral Space Force Station, FL





Starship launch: always amazing, almost routine! (1)

- The SpaceX Starship development program goes from strength-to-strength. A step-by-step approach to launching the world’s largest rocket is certainly paying dividends – and the world can’t get enough of it

SpaceX’s fully stacked Starship 5 rocket stands atop the Orbital Launch Mount at Starbase in southern Texas
Credit: Will Robinson-Smith/Spaceflight Now

Starship launch: always amazing, almost routine! (2)

- Every launch and flight is a major step forward: from the four-minute flight of Starship 1 in April 2023, where separation failure caused loss of telemetry and self-destruction, to Starship 4, which aced the launch on 6th June 2024, separation, and near faultless return to Earth of both stages
- With Starship 5, the next step was to recover the 72m stage 1 booster, Super Heavy, back at the launch site for reuse, and to get the 50m second stage Starship (or more simply "Ship") to perform a landing on the ocean
- And the flight on 13th October was a total success

Credit: SpaceX

Starship launch: always amazing, almost routine! (3)

- Lift-off at 12:25 GMT was followed by stage separation and, seven minutes after launch, the return of Super Heavy to its launch mount, being caught by giant “chopstick” arms on the launch tower (nicknamed “Mechazilla”) as it hovered
- Then, 65 minutes after launch, and after re-entering the atmosphere, the second stage Starship fired three of its six engines to hover over the ocean, before tipping over and exploding. This time, engineers rebuilt the heat shield, spending 12,000 hours replacing the thermal protection system with new generation tiles and a backup ablative layer and giving additional protection to the stabiliser flaps

Credit: NasaSpaceFlight.com

Starship launch: always amazing, almost routine! (4)

- SpaceX had wanted to launch Starship 5 in August but the FAA wouldn’t give them clearance until it had checked the revised vehicle configuration and mission profile
- This caused SpaceX to acrimoniously challenge the FAA in a very public way. But the FAA stood its ground, although there seems to have been some sort of compromise after earlier pronouncements of a delay until late November at the earliest
- Next up, SpaceX have already carried out a static fire of Starship 6, a common prelaunch test. They hope to get this one up as soon as possible
- Watch the launch and booster catch at: https://youtu.be/PyR_M5rCL64

ESA’s Hera launched on mission to Didymos (1)

- The first resumed SpaceX Falcon 9 launch following selected clearance by the FAA has been used to send ESA’s Hera spacecraft on its way to the asteroid binary system of Didymos and Dimorphos
- Hera is accompanied by two smaller cubesats called named Milani and Juventas
- It is expected to arrive at the asteroid in about two-year’s time

Credit: Spaceflight Now

ESA’s Hera launched on mission to Didymos (2)

- In a brief window before the arrival of Hurricane Milton shut down the Cape Canaveral Space Force Station in Florida, the Falcon 9 and Hera separated 1 hour 16 minutes after the launch on 7th October 2024 at 14:52 GMT. The first stage of the Falcon 9 didn’t return to Earth, as per normal, as SpaceX had to use all the fuel on the booster to put Hera on the right trajectory
- Hera is going back to the asteroid system made famous by the test collision between the DART craft and Dimorphos in September 2022. This deliberate impact was designed to see if a potentially dangerous deep space object, such as an asteroid on a collision course with Earth, could be deflected away. The test proved it could

NASA’s Europa Clipper on its way to – Europa (1)

- A Falcon Heavy rocket safely launched the Europa Clipper spacecraft on its six-year mission to Jupiter’s moon Europa. In clear blue skies the SpaceX rocket powered by 27 Merlin engines, lifted off at 16:06 GMT on 14th October 2024 from pad 39A at the Kennedy Space Center

A SpaceX Falcon Heavy rocket with two veteran side boosters stands atop its Pad 39A launch pad at NASA's Kennedy Space Center in Florida ahead of the planned 14th October 2024 launch of NASA's Europa Clipper spacecraft
Credit: SpaceX/NASA/JPL

NASA’s Europa Clipper on its way to – Europa (2)

- After four minutes, the two solid boosters separated. Normally, these would return to Earth to be reused but, with the extra power needed to boost Europa Clipper out of orbit and on its way to deep space, these had to be used to their maximum extent. This was the first time in eleven launches of Falcon Heavy that all three first-stage boosters have been expended

Credit: NASA TV

- Europa Clipper was sent on its interplanetary trajectory about an hour after launch with communications being established with the probe. Confirmation came that the probe had deployed its solar panels successfully

Evolution of the EVA spacesuit (1)

- 63 years ago, the Soviet cosmonaut Yuri Gagarin was the first person sent into space; he was followed later the same year by Alan Shepherd from the United States
- Their spacesuits were pretty primitive by today's standards; basically, versions of the flying suits used by military pilots when using high-altitude spy planes like the U2
- Four years later, and cosmonauts (Alexei Leonov – 18th March 1965), and astronauts (Ed White – 3rd June 1965) left the protective environment of their space capsules and ventured into the unforgiving and hostile environment of the vacuum of outer space. The EVA (extravehicular activity) spacesuit had arrived
- Since then, suits have been modified and improved as our understanding has got better about how we need to be able to move and operate in space and on other bodies such as the Moon. New man-made materials and manufacturing techniques have improved massively. The first bulky suits have been replaced by sleeker, body-fitting protective clothing, seen on the Polaris Dawn crew

Evolution of the EVA spacesuit (2)

Soviet SK-1 spacesuit (as worn by Yuri Gagarin in 1961)
Credit: Mikhail (Vokabre) Shcherbakov, CC BY-SA 2.0

Navy Mark IV high-altitude/vacuum suit – used for Project Mercury (1961–1963); photo of Alan Shepherd
Credit: NASA, Public Domain

The Diving Bell "Berkut" (“Golden Eagle”) worn by Alexei Leonov for the first spacewalk
Credit: Lobanov Andrey, CC BY-SA 3.0

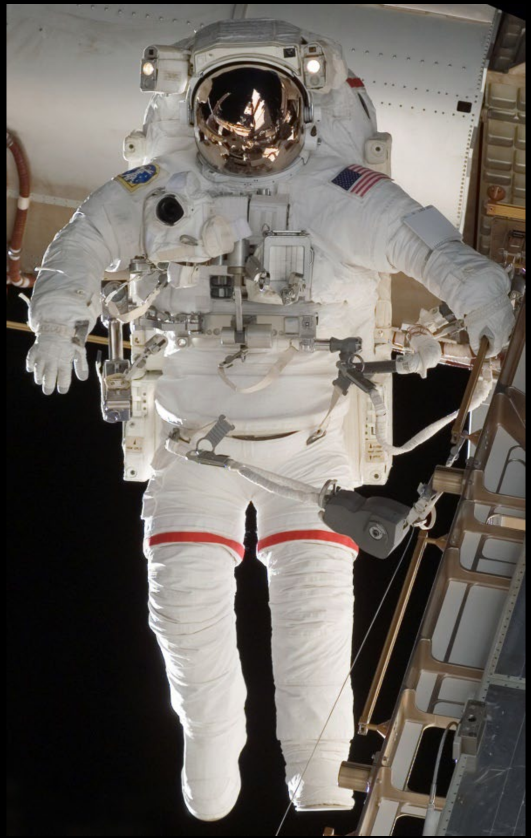
G4C. All Gemini program spacewalks from Ed White (Gemini IV) onwards
Credit: NASA, Public Domain

Evolution of the EVA spacesuit (3)

Soviet “Yastrab” (“Hawk”) used in 1969 by the Soyuz 4/5 crews Credit: Мемориальный музей Космонавтики в Москве

Apollo/Skylab EVA. Photo of Eugene Cernan (Apollo 17) – taken by Harrison Schmidt Credit: NASA, Public Domain

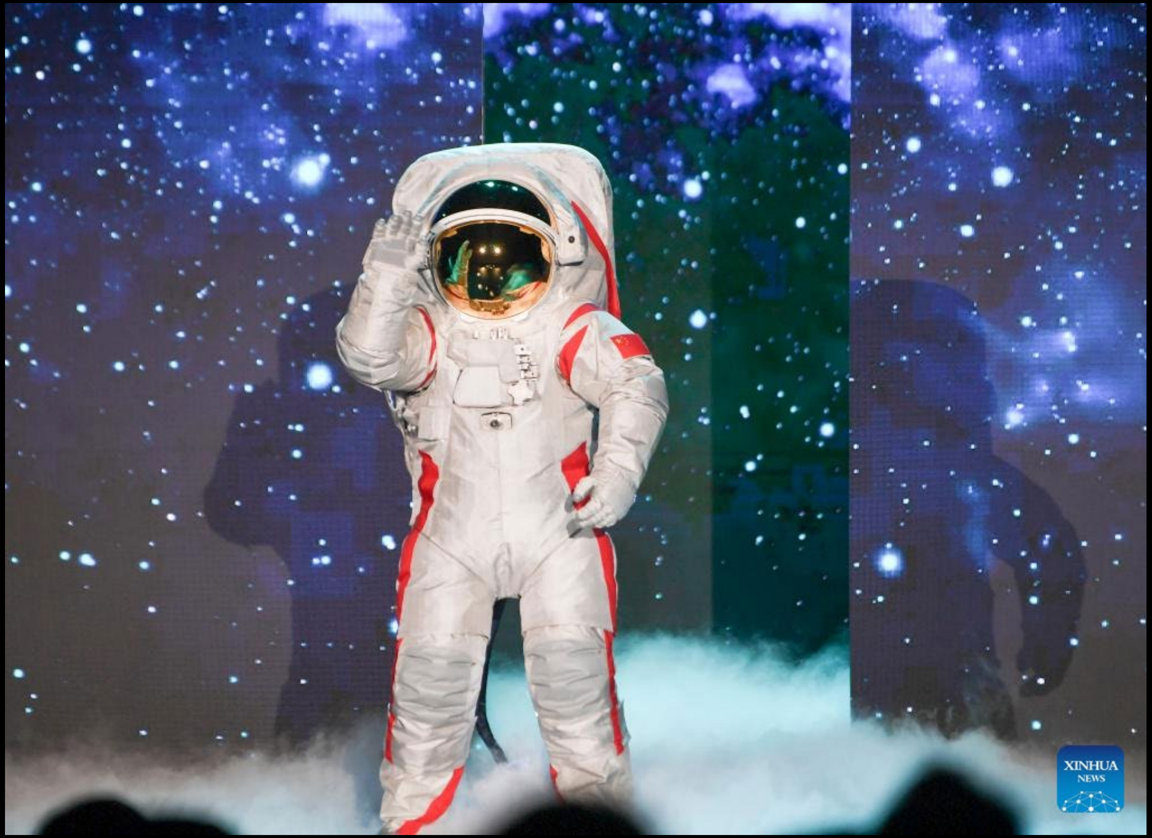
Orlan-MK spacesuit. Russia’s current EVA suit since 1977 Credit: Allocer, CC BY-SA 3.0



Extravehicular Mobility Unit used on Space Shuttle missions; this is Rick Mastracchio (STS-118) Credit: NASA, Public Domain

Evolution of the EVA spacesuit (4)

Polaris Dawn mission commander, Jared Isaacman, in the new EVA suit next to Crew Dragon
Credit: Polaris Program Photos



A model wearing China's moon-landing spacesuit greets the participants during the third Spacesuit Technology Forum in southwest China's Chongqing municipality, 28th September 2024
Credit: XINHUA News

Spaceflight Brief News and Updates (1)

- Voyager 2 instrument shut down – as the power supply on Voyager 2 continues to dwindle, another scientific instrument has been turned off in order to conserve energy. The plasma science instrument was the seventh of the ten installed to be switched off. It had been instrumental in determining that Voyager 2 had crossed the boundary between the heliosphere and interstellar space in 2018. Engineers are likely to have to run down further instruments over the coming months in order to make one last into the 2030s
- Falcon 9 grounded (for a third time) – the almost faultless progress of the SpaceX Falcon 9 flights has been seriously interrupted this year as the FAA grounded the rocket following the launch of the Crew 9 mission. In this case, the upper (second) stage suffered an anomaly with the de-orbit burn and landed in the Pacific Ocean, rather than the Atlantic. The Crew Dragon (Freedom) with its two astronaut passengers successfully docked at the ISS and will be used to return the Boeing Starliner astronauts, Williams and Wilmore, back home in February 2025. This is the second time the second stage has not performed as it should. The FAA gave the all-clear to SpaceX on 11th October 2024. Hera was successfully launched on 7th October but this was given exceptional clearance

Spaceflight Brief News and Updates (2)

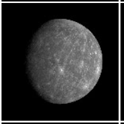
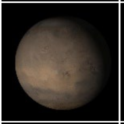
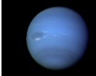
- Ramses 2029 rendezvous with Apophis – the 375m wide asteroid Apophis will make a very close flypast of Earth on 13th April 2029, when it will come within the geostationary orbits of satellites and be visible to the naked eye. ESA is proposing to send a probe to rendezvous with Apophis on this date, but they haven't got very long to get one ready. The funding decision won't be taken until next year but, in anticipation of a positive outcome, ESA is working with OHB Italia to allow teams to proceed with phase1 of the mission development. Ramses will be an adapted version of Hera, and the mission development funding comes from an underspend on the budget for the Hera mission. NASA's OSIRIS-REx spacecraft, following its successful sample collection from the asteroid Bennu, has been repurposed (as OSIRIS-APEX) and will intercept Apophis one month later
- Blue Origin New Shepherd launch – following a two-week delay, Blue Origin launched the second of its human-rated spacecraft on 23rd October 2024. The uncrewed NS-27 mission lifted off from the Launch Site One in West Texas at 15:27 GMT. The rocket, carrying 12 research payloads, reached a height of 101km. The booster then returned for a successful landing just over seven minutes after launch. The capsule, named RSS Kármán Line (after the 100km high boundary that marks the boundary to outer space), returned by parachute about three minutes later

November 2024

Observational Highlights

Lewes Astronomical Society

Planets (Information for 1st November)

	Planet	Rises	Sets	Highest	Direction	Altitude	Magnitude	Visible
	MERCURY	08:43	17:01	12:52			-0.29	NO
	VENUS	10:28	18:05	14:16			-4.04	NO
	MARS	21:18	13:22	05:20	South	60°	-0.02	YES
	JUPITER	18:28	10:40	02:34	South	61°	-2.72	YES
	SATURN	14:53	01:32	20:13	South	30°	+0.86	YES
	URANUS	17:06	08:34	00:50	South	58°	+5.61	YES
	NEPTUNE	15:13	02:57	21:05	South	36°	+7.84	YES

* = Highest point at Dawn (05:30 - last visible sighting)
** = Highest point at Dusk (17:54 - first visible sighting)
▫ = Highest point when last visible
◊ = Highest point when first visible
▫▫ = Highest point when last visible
◊◊ = Highest point when first visible

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

Object	Name	Constellation	Type	↗	↘	Highest	Direction	Alt	Mag
Cr70	Orion's Belt	Orion	Open Cluster	22:09	06:07	02:52	South	38°	+0.6
Cr50	The Hyades (C41/Mel25)	Taurus	Open Cluster	19:41	06:02	01:44	South	55°	+1.0
Cr39	Collinder 39	Perseus	Open Cluster	17:24	05:59	00:39	South	88°	+1.2
Mel20	The Alpha Persei Cluster	Perseus	Open Cluster	17:24	05:59	00:37	South	87°	+1.2
M45	The Pleiades (Cr42/Mel22)	Taurus	Cluster with Nebulosity	18:25	05:58	01:04	South	63°	+1.3
Cr256	Collinder 256	Coma Berenices	Open Cluster	01:08	05:51	05:51 ◊	East	40°	+1.8
Mel111	The Coma Star Cluster	Coma Berenices	Open Cluster	01:08	05:51	05:51 ◊	East	40°	+1.8
NGC1980	Open Cluster (Cr72)	Orion	Cluster with Nebulosity	23:02	05:42	02:52	South	33°	+2.5
C33	The Eastern Veil Nebula	Cygnus	Nebula	17:54	00:24	18:10	South	70°	+2.7
Cr69	The Lambda Orionis Cluster	Orion	Open Cluster	21:42	05:39	02:52	South	49°	+2.8
Cr65	Collinder 65	Orion	Open Cluster	21:06	05:36	02:42	South	54°	+3.0
Cr359	Collinder 359	Ophiuchus	Open Cluster	17:48	21:33	17:48 ◊◊	South-West	32°	+3.0
Mel186	Melotte 186	Ophiuchus	Open Cluster	17:48	21:34	17:48 ◊◊	South-West	32°	+3.0
M44	Beehive Cluster (NGC2632/Cr189)	Cancer	Open Cluster	22:08	05:35	05:35 ◊	South	58°	+3.1
M31	Andromeda Galaxy (NGC224)	Andromeda	Galaxy	17:53	05:30	17:53 ◊◊	East	47°	+3.4

* = Highest point at Dawn (05:30 - last visible sighting)   ** = Highest point at Dusk (17:54 - first visible sighting)

◊ = Bright object last visible sighting after dawn   ◊◊ = Bright object first visible sighting before dusk

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

Object	Name	Constellation	Type	↗	↘	Highest	Direction	Alt	Mag
Cr439	The Elephant Trunk (IC1396)	Cepheus	Cluster with Nebulosity	17:54	05:30	18:53	North	83°	+3.5
Cr399	Brocchi's Cluster	Vulpecula	Open Cluster	17:54	00:31	17:54 **	South-West	56°	+3.6
M42	Orion Nebula (NGC1976)	Orion	Cluster with Nebulosity	23:21	05:30	02:52	South	33°	+4.0
NGC2264	The Christmas Tree Cluster (Cr112)	Monoceros	Cluster with Nebulosity	23:04	05:30	03:57	South	49°	+4.1
Cr62	Collinder 62	Auriga	Open Cluster	19:04	05:30	02:39	South	80°	+4.2
Cr349	Open Cluster (IC4665)	Ophiuchus	Open Cluster	17:54	21:32	17:54 **	South-West	32°	+4.2
Cr464	Collinder 464	Camelopardalis	Open Cluster	17:54	05:30	02:30	North-West	67°	+4.2
NGC1977	Running Man Nebula	Orion	Open Cluster	21:12	05:30	02:58	South	34°	+4.2
NGC1981	Open Cluster (Cr73)	Orion	Open Cluster	23:18	05:30	02:52	South	34°	+4.2
NGC2232	Open Cluster (Cr93)	Monoceros	Open Cluster	00:13	05:30	03:44	South	34°	+4.2
C14	The Perseus Double Cluster	Perseus	Open Cluster	17:54	05:30	23:33	North	83°	+4.3
M47	Open Cluster (NGC2422/Cr152)	Puppis	Open Cluster	02:43	05:30	04:53	South	24°	+4.4
Cr106	Collinder 106	Monoceros	Open Cluster	23:27	05:30	03:53	South	45°	+4.6
Cr386	Graff's Cluster (IC4756/Mel210)	Serpens Cauda	Open Cluster	17:54	22:24	17:54 **	South-West	38°	+4.6
M39	Open Cluster (NGC7092/Cr438)	Cygnus	Open Cluster	17:54	03:13	18:46	South	87°	+4.6

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◊ = Bright object last visible sighting after dawn   ◊◊ = Bright object first visible sighting before dusk

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

Object	Name	Constellation	Type	↗	↘	Highest	Direction	Alt	Mag
NGC6633	Open Cluster (Cr380/Mel201)	Ophiuchus	Open Cluster	17:54	22:17	17:54 **	South-West	37°	+4.6
NGC2244	Open Cluster (C50/Cr99/Mel47)	Monoceros	Open Cluster	23:29	05:30	03:48	South	47°	+4.8
NGC1499	The California Nebula	Perseus	Bright Nebula	18:26	05:30	01:20	South	75°	+5.0
Cr107	Collinder 107	Monoceros	Open Cluster	23:40	05:30	03:54	South	43°	+5.1
M35	Open Cluster (NGC2168/Cr82/Mel41)	Gemini	Open Cluster	21:36	05:30	03:25	South	63°	+5.1
M34	The Spiral Cluster (NGC1039/Mel17)	Perseus	Open Cluster	17:54	05:30	05:30 *	North-West	35°	+5.2
NGC6871	Open Cluster (Cr413)	Cygnus	Open Cluster	17:54	03:39	17:54 **	South-West	73°	+5.2
NGC869	h Per Cluster (Cr24/Mel13)	Perseus	Open Cluster	17:54	05:30	23:32	North	83°	+5.3
Cr97	Collinder 97	Monoceros	Open Cluster	23:32	05:30	03:48	South	45°	+5.4
NGC2281	Open Cluster (Cr116/Mel51)	Auriga	Open Cluster	20:49	05:30	04:05	South	80°	+5.4
M37	The Auriga Salt-and-Pepper (Cr75)	Auriga	Open Cluster	20:45	05:30	03:09	South	71°	+5.6
NGC7686	Open Cluster (Cr456)	Andromeda	Open Cluster	17:54	04:55	20:44	South	88°	+5.6
Cr89	Collinder 89	Gemini	Open Cluster	21:56	05:30	03:34	South	62°	+5.7
NGC752	Open Cluster (Cr23/Mel12)	Andromeda	Open Cluster	17:54	05:30	23:11	South	77°	+5.7
NGC6882	Open Cluster (Cr416)	Vulpecula	Open Cluster	17:54	02:02	17:54 **	South	65°	+5.7

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

Object	Name	Constellation	Type	↗	↘	Highest	Direction	Alt	Mag
M11	Wild Duck Cluster (NGC6705)	Scutum	Open Cluster	17:54	21:38	17:54 **	South-West	28°	+5.8
M13	Great Globular Cluster (NGC6205)	Hercules	Globular Cluster	17:54	00:28	17:54 **	West	45°	+5.8
M33	Triangulum Galaxy (NGC598)	Triangulum	Galaxy	17:54	04:59	22:47	South	69°	+5.8
M48	Open Cluster (NGC2548/Cr179)	Hydra	Open Cluster	23:55	05:30	05:30 *	South	33°	+5.8
Cr29	Collinder 29	Perseus	Open Cluster	17:54	05:30	23:50	North	84°	+5.9
M50	The Heart-Shaped Cluster (NGC2323)	Monoceros	Open Cluster	01:42	05:30	04:19	South	30°	+5.9
NGC2169	The "37" Cluster (Cr83)	Orion	Open Cluster	22:35	05:30	03:25	South	53°	+5.9
IC405	The Flaming Star Nebula	Auriga	Nebula	20:05	05:30	02:33	South	73°	+6.0
M36	The Pinwheel Cluster (NGC1960)	Auriga	Open Cluster	20:26	05:30	02:53	South	73°	+6.0
NGC2301	Open Cluster (Cr119/Mel54)	Monoceros	Open Cluster	00:31	05:30	04:08	South	39°	+6.0
NGC7000	The North American Nebula (C20)	Cygnus	HII Region	17:54	01:41	18:13	South	83°	+6.0
Cr350	Collinder 350	Ophiuchus	Open Cluster	17:54	21:13	17:54 **	South-West	28°	+6.1
M46	Open Cluster (NGC2437/Cr159)	Puppis	Open Cluster	03:37	05:30	04:58	South	24°	+6.1
NGC884	chi Per Cluster (Cr25/Mel14)	Perseus	Open Cluster	17:54	05:30	23:36	North	83°	+6.1
NGC1746	Open Cluster (Cr57/Mel28)	Taurus	Open Cluster	20:45	05:30	02:20	South	62°	+6.1

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

Object	Name	Constellation	Type	↗	↘	Highest	Direction	Alt	Mag
NGC7160	Open Cluster (Cr443)	Cepheus	Open Cluster	17:54	05:30	19:07	North	78°	+6.1
NGC1545	Open Cluster (Cr49)	Perseus	Open Cluster	17:54	05:30	01:38	South	89°	+6.2
M3	Globular Cluster (NGC5272/Mel119)	Canes Venatici	Globular Cluster	02:06	05:30	05:30 *	East	26°	+6.3
M15	Globular Cluster (NGC7078/Mel234)	Pegasus	Globular Cluster	17:54	23:24	18:44	South	51°	+6.3
NGC6940	Open Cluster (Cr424/Mel232)	Vulpecula	Open Cluster	17:54	02:39	17:54 **	South	67°	+6.3
Cr91	Collinder 91	Monoceros	Open Cluster	23:50	05:30	03:38	South	41°	+6.4
M38	The Starfish Cluster (NGC1912)	Auriga	Open Cluster	20:09	05:30	02:45	South	75°	+6.4
NGC457	The Dragonfly Cluster (Cr12/Mel7)	Cassiopeia	Open Cluster	17:54	05:30	22:33	North	82°	+6.4
NGC1528	Open Cluster (Cr47/Mel23)	Perseus	Open Cluster	17:54	05:30	01:32	North	89°	+6.4
NGC1647	Open Cluster (Cr54/Mel26)	Taurus	Open Cluster	20:49	05:30	02:03	South	58°	+6.4
NGC1662	Open Cluster (Cr55)	Orion	Open Cluster	21:31	05:30	02:05	South	50°	+6.4
NGC7243	Open Cluster (Cr448/Mel240)	Lacerta	Open Cluster	17:54	03:39	19:29	South	89°	+6.4
Cr26	The Heart Nebula (IC1805)	Cassiopeia	Cluster with Nebulosity	17:54	05:30	23:46	North	79°	+6.5
Cr34	The Soul Nebula (IC1848)	Cassiopeia	Cluster with Nebulosity	17:54	05:30	00:08	North	80°	+6.5
M92	Globular Cluster (NGC6341/Mel168)	Hercules	Globular Cluster	17:54	21:51	17:54 **	West	55°	+6.5

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Lewes Astronomical Society

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

Object	Name	Constellation	Type	↗	↘	Highest	Direction	Alt	Mag
NGC129	Open Cluster (Cr2)	Cassiopeia	Open Cluster	17:54	05:30	21:43	North	80°	+6.5
NGC654	Open Cluster (Cr18/Mel9)	Cassiopeia	Open Cluster	17:54	05:30	22:57	North	78°	+6.5
NGC2539	Open Cluster (Cr176/Mel83)	Puppis	Open Cluster	03:37	05:30	05:27	South	26°	+6.5
M2	Globular Cluster (NGC7089/Mel235)	Aquarius	Globular Cluster	17:54	22:17	18:47	South	38°	+6.6
M29	The Cooling Tower (NGC6913)	Cygnus	Open Cluster	17:54	05:19	17:54 **	South	77°	+6.6
NGC1444	Open Cluster (Cr43)	Perseus	Open Cluster	17:54	05:30	01:06	North	88°	+6.6
NGC1027	Open Cluster (Cr30/Mel16)	Cassiopeia	Open Cluster	17:54	05:30	23:56	North	79°	+6.7
NGC1342	Open Cluster (Cr40/Mel21)	Perseus	Open Cluster	18:04	05:30	00:48	South	76°	+6.7
NGC2129	Open Cluster (Cr77)	Gemini	Open Cluster	21:44	05:30	03:18	South	62°	+6.7
NGC2343	Open Cluster (Cr128)	Monoceros	Open Cluster	02:10	05:30	04:24	South	28°	+6.7
NGC2423	Open Cluster (Cr153/Mel70)	Puppis	Open Cluster	03:18	05:30	04:53	South	25°	+6.7
NGC6709	Open Cluster (Cr392/Mel214)	Aquila	Open Cluster	17:54	23:01	17:54 **	South-West	43°	+6.7
NGC7789	The Caroline's Rose (Cr460/Mel245)	Cassiopeia	Open Cluster	17:54	05:30	21:11	North	84°	+6.7
NGC2175	Open Cluster (Cr84)	Orion	Cluster with Nebulosity	22:06	05:30	03:26	South	59°	+6.8
NGC6811	The Hole in a Cluster (Cr402/Mel222)	Cygnus	Open Cluster	17:54	00:33	17:54 **	West	78°	+6.8

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

Object	Name	Constellation	Type	↗	↘	Highest	Direction	Alt	Mag
NGC7023	The Iris Nebula	Cepheus	Nebula	17:54	05:30	18:29	North	72°	+6.8
M52	The Cassiopeia Salt-and-Pepper	Cassiopeia	Open Cluster	17:54	05:30	20:38	North	79°	+6.9
M67	Open Cluster (NGC2682/Cr204)	Cancer	Open Cluster	23:04	05:30	05:30 *	South	50°	+6.9
M81	Bode's Galaxy (NGC3031)	Ursa Major	Galaxy	17:54	05:30	05:30 *	North-East	67°	+6.9
NGC1502	Open Cluster (Cr45)	Camelopardalis	Open Cluster	17:54	05:30	01:25	North	78°	+6.9
Cr111	Collinder 111	Monoceros	Open Cluster	23:42	05:30	03:55	South	46°	+7.0
NGC225	The Sailboat Cluster (Cr7)	Cassiopeia	Open Cluster	17:54	05:30	21:57	North	79°	+7.0
NGC1582	Open Cluster (Cr51)	Perseus	Open Cluster	18:25	05:30	01:48	South	82°	+7.0
NGC1807	Open Cluster (Cr59/Mel29)	Taurus	Open Cluster	21:26	05:30	02:27	South	55°	+7.0
NGC1857	Open Cluster (Cr61/Mel32)	Auriga	Open Cluster	19:41	05:30	02:37	South	78°	+7.0

Twilight	Civil	Naut	Astro		Rises	Sets
Ends	17:09	17:48	18:26	Sun	06:50	16:34
Starts	06:15	05:36	04:58	Moon	06:51	16:11

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Phases of the Moon

Brown Lunation Numbers

numbered from first New Moon in 1923

Phase	Date	Time	Lunation
NEW MOON	1st November	12:47	1260
FIRST QUARTER	9th November	05:55	1260
FULL MOON	15th November	21:28	1260
LAST QUARTER	23rd November	01:27	1260

Credit: Vito Technology, Inc.

Credit: NASA
Data credit: Time and Place

Lewes Astronomical Society

November Star Guide

After dusk on 4th November, look southwest to find the crescent Moon. To its upper right is Venus, our nearest planetary neighbour, appearing as a dazzling evening star this month. By 8pm, the ringed planet Saturn is due south, and Jupiter, the largest planet in our solar system, shines brightly in the southeast. As the month progresses Mars will rise slightly earlier each night in the northeast.

Heralding the arrival of late Autumn is the small yet distinctive Pleiades star cluster in the constellation of Taurus, the bull. Known as the "Seven Sisters" by cultures from ancient Greece to the Aboriginal natives of Australia, most people today can see only six stars. The story of the missing sister may trace back over 100,000 years, to a time when a seventh star was visible but has since faded. This would make it one of humanity’s oldest shared myths, passed down as our ancestors migrated out of Africa across the globe.

November offers several meteor showers, the best being the Southern Taurids on 5th November with their radiant located in Taurus which is high in the sky looking south at around midnight.

The chart shows how the night sky will look at 11pm at the start of November, and 9pm by the end of the month, with the Moon’s position and phase on the 12th, 16th, and 19th November.