John J. McCarthy Observatory

Summer 2025 Newsburst

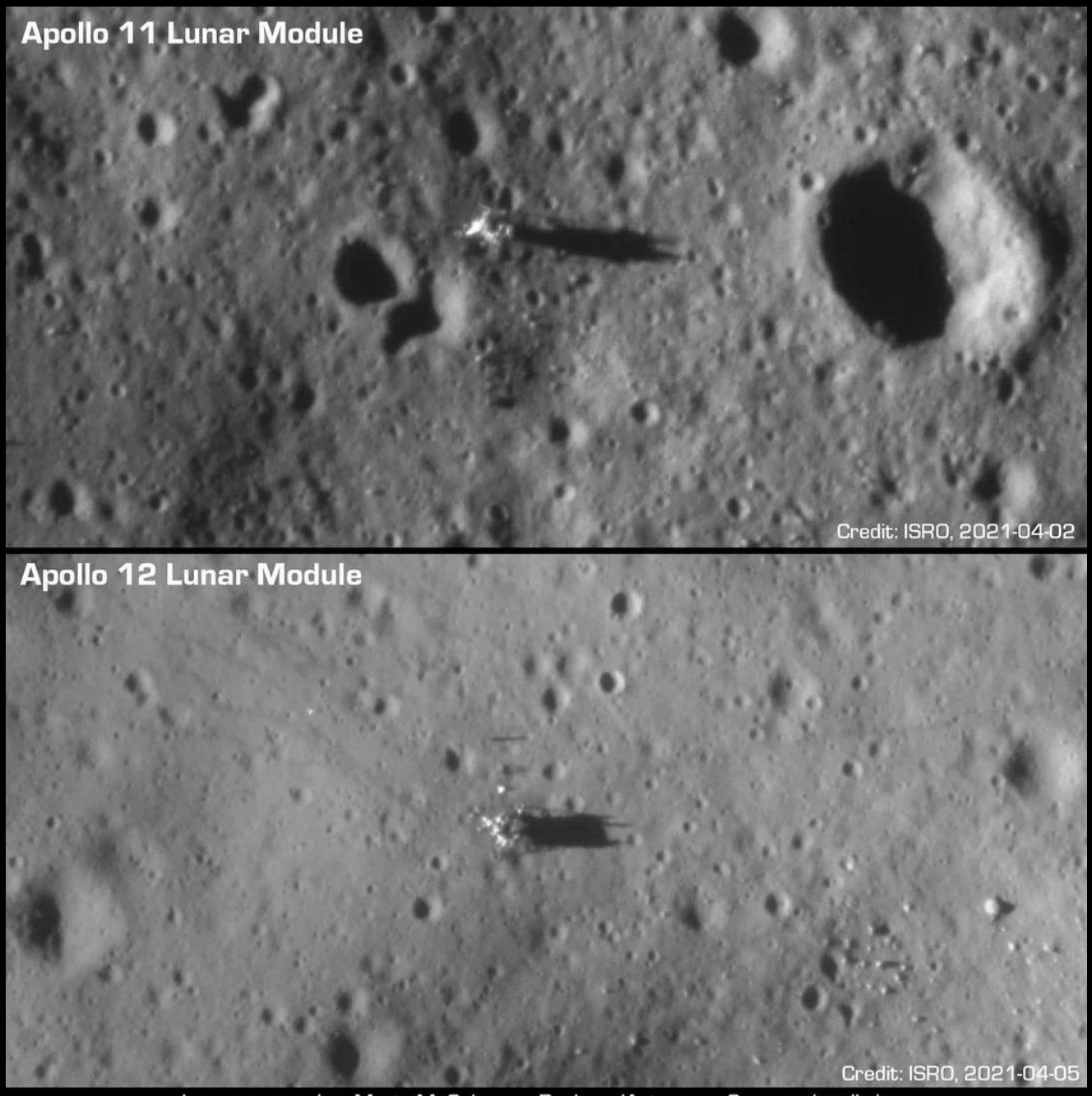


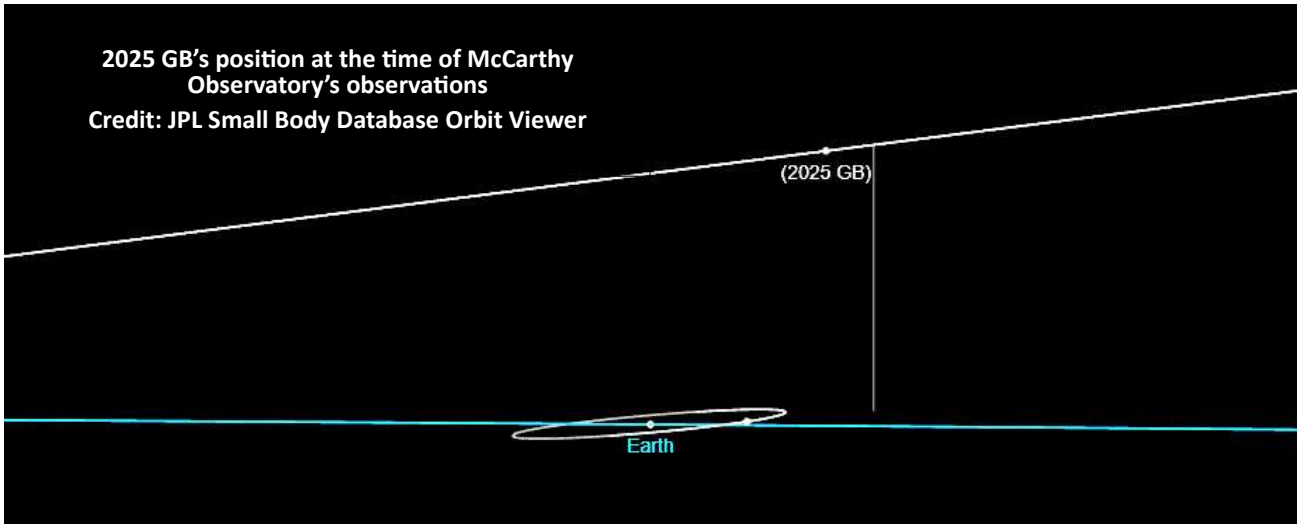
Image processing: Marty McGuire BackyardAstronomyGuy.com/apollo-isro

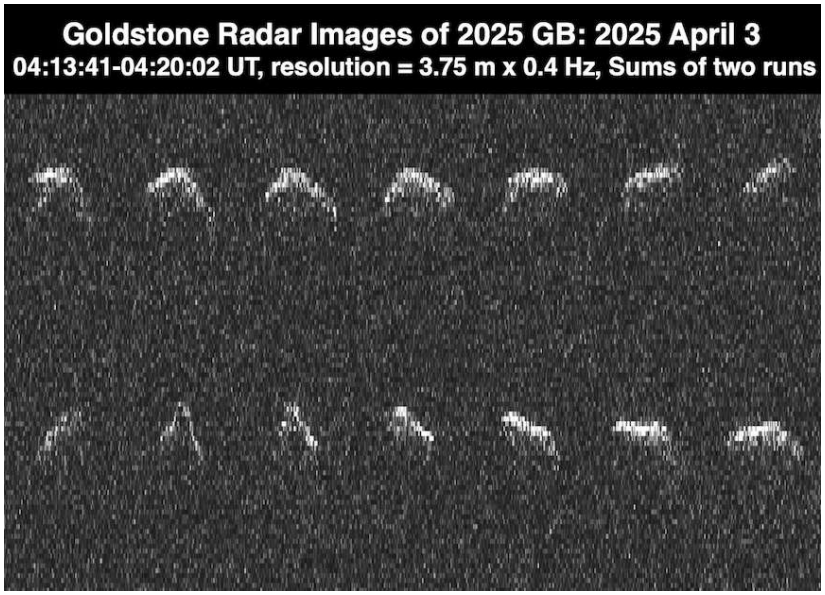
Indian Space Research Organization's (ISRO) Chandrayaan2 Orbiter has been in lunar polar orbit since August 2019. While mapping the Moon with its high resolution camera, the orbiter passed over the landing sites of Apollo 11, in the Sea of Tranquility, and Apollo 12, in the Ocean of Storms. Images captured from an altitude of 62 miles (100 km) show the mission hardware left behind on the surface.

The descent stage of the Apollo 11 lunar module, named Eagle, is visible in the top image approximately 400 meters west of West Crater. Astronaut Neil Armstrong took an unplanned excursion to the rim of that crater during his brief stay on the surface. The descent stage of the Apollo 12 lunar lander, named Intrepid, sits on the rim of shallow crater designated "Snowman" by the astronauts in which the Surveyor 3 spacecraft had previously soft-landed (off the field of view on the left).

Near-Earth Asteroid 2025 GB

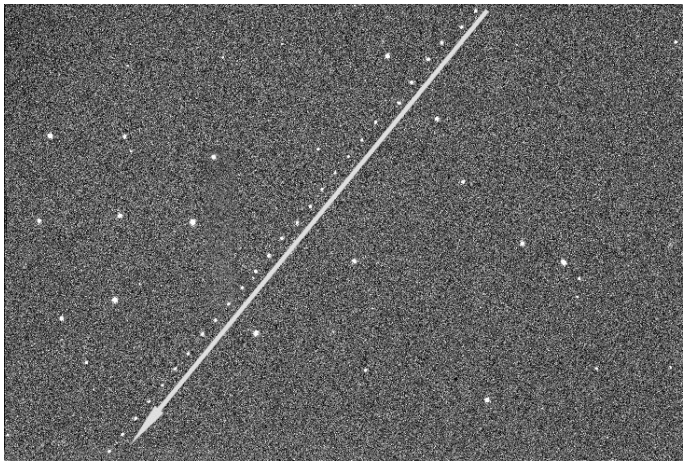
Discovered by ATLAS-Haleakala (T05) on April 1, 2025

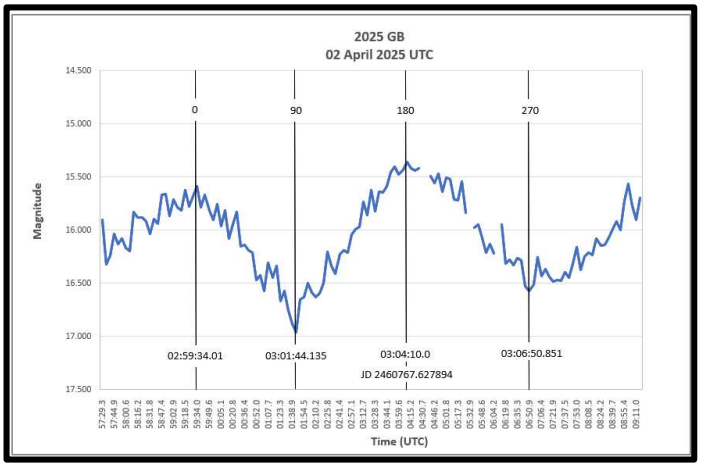




2025 GB passed within 0.00484 au (1.9 lunar distances) on April 3rd. The asteroid is classified as an Apollo with an perihelion distance of .994 au (which is inside Earth's orbit).

Goldstone observed 2025 GB with its 70-meter antenna (DSS-14), on April 3rd, with the radar images revealing an elongated, angular shape and confirming a rapid rotation (around 10 minutes).



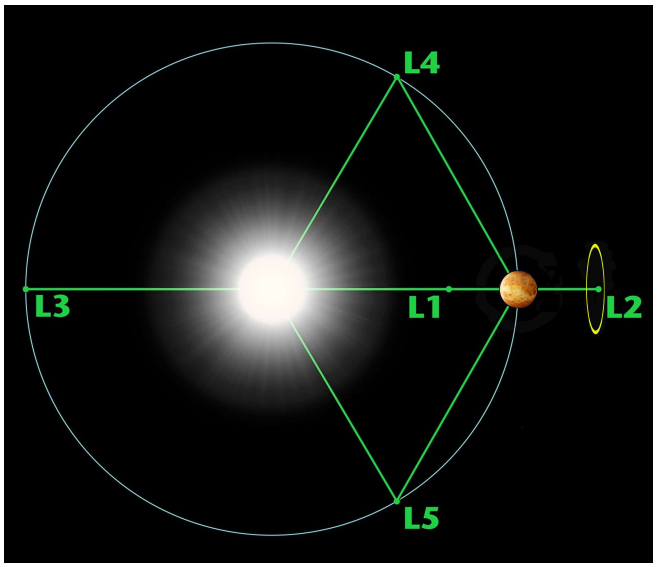


2025 GB's motion was captured by the McCarthy Observatory's camera mounted on the 17-inch PlaneWave telescope (left). Changes in the brightness (reflected sunlight) from the rotation of the asteroid on April 2nd as it traversed the camera's field of view is shown on the right.

Venusian Space Rock Threat

Venusian co-orbital asteroids share Venus's orbital path around the Sun. There are 20 known Venus co-orbitals identified to date with more likely hidden in the glare of the Sun. According to a study published in the journal Astronomy & Astrophysics, while the orbits of some co-orbitals may remain stable for millions of years, they can also be perturbed over time (for example, by a close approach by the Earth) and evolve into orbits that cross Earth's path.

As such, it is important that these potentially hazardous asteroids be identified before they pose a threat to the Earth. As the authors of the study concede, the inherent difficulties of detecting these asteroids from the Earth, with the Sun limiting observing opportunities, require observations be made from positions within Venus' orbit or those nearby Venus, for example from a halo orbit at the Sun-Venus Lagrange point L2.

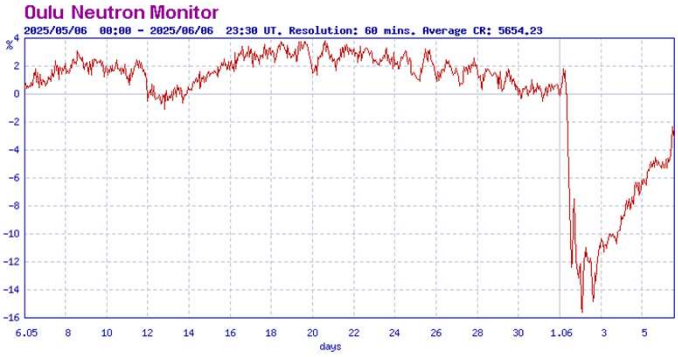


Sun-Venus Lagrange Points where objects require relatively little energy to remain in place due to the offsetting gravitational forces of two large masses.

Record Decrease

Cosmic rays (CRs) originate from outside of the Solar System. Moving a near-light speed, CRs consist of fully ionized protons and alpha-particles, with a smaller, but important population of heavier nuclei, from carbon to uranium. When CRs interact with Earth's atmosphere, they produce a cascade of secondary particles which includes neutrons. A world-wide network of detectors monitors CR arrival via the neutron component.

Fast moving coronal mass ejections (CMEs), plasma with an embedded magnetic field, can deflect CRs. Such an instance occurred when sunspot 4100 produced a long-lasting M8.2-class solar flare and fast moving CME in the final days of May. The transit was marked by a "Forbush Decrease" (named after American physicist Scott Forbush) of galactic cosmic ray intensity in early June.



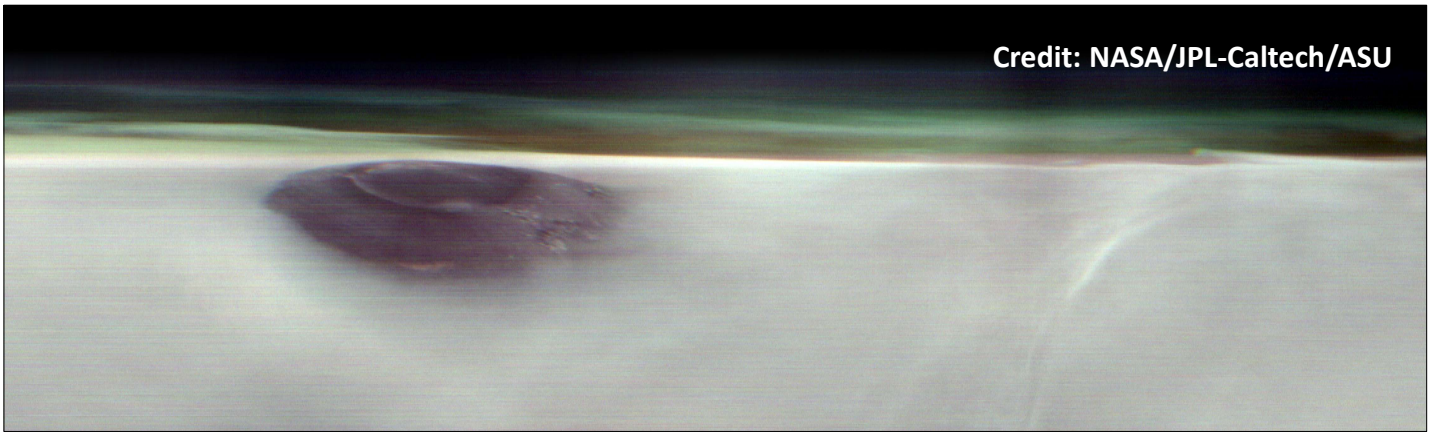
The large decrease in neutron counts during the CME transit as measured from the detectors at the Sodankyla Geophysical Observatory in Oulu, Finland

Oxygen Depletion

A study based on NASA planetary modeling by researchers at Toho University, and 400,000 simulations, predicts that the Earth will no longer be able to support life in just one billion years, earlier than previously expected. While our Sun will continue to fuse hydrogen in its core for another 5 billion years, it will become hotter and brighter as it ages. As the temperature rises on Earth, evaporation will increase, CO_2 levels will decrease and photosynthesis will stop, killing plant life and ceasing the production of oxygen. The atmosphere will slowly evolve to a state of high methane with conditions similar to those found on Earth 2.5 billion years ago.

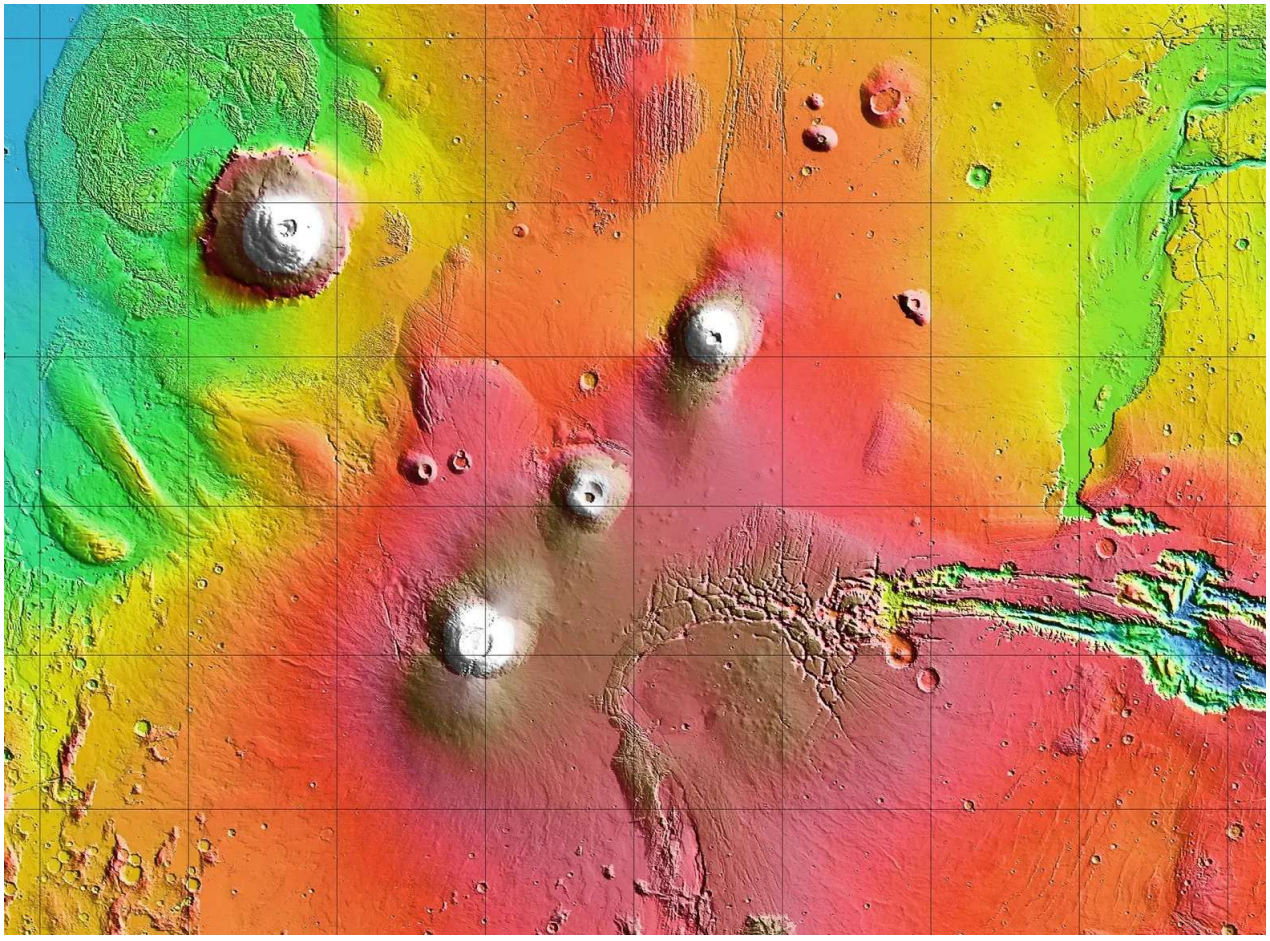
Earth's thin atmosphere visible from space
Credit: NASA

Martian Volcano



Arsia Mons, one of the large shield volcanoes on the Martian Tharsis (a large volcanic plateau in Mars' equatorial region) was captured by NASA's 2001 Mars Odyssey orbiter just before dawn. Shrouded in water-ice clouds, the rim of the volcano's caldera stands 12 miles (20 kilometers) high. The bowl-shaped depression on Arsia Mons is the largest caldera of the twelve large shield volcanoes, having a diameter of 75 miles (120 km).

The orbiter is the longest operating spacecraft, having begun science operations (studying the Red Planet's atmosphere) in early 2002.



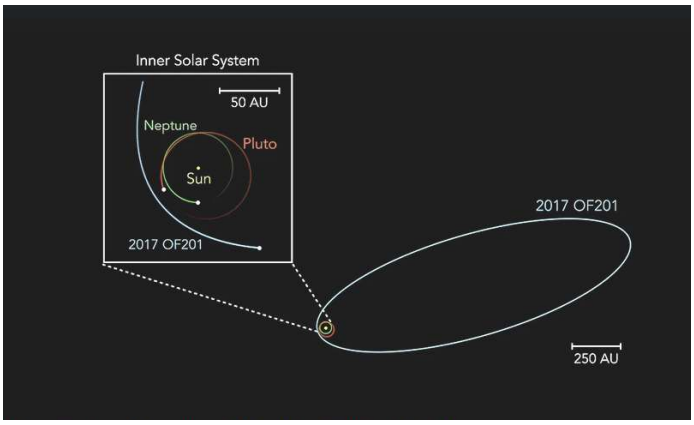
Arsia Mons is the southernmost of the three volcanoes that make up Tharsis Montes. Olympus Mons, the solar system's largest volcano, is at upper left. The false-color topographic view was generated with the Mars Orbiter Laser Altimeter (MOLA).

NASA/JPL-Caltech

New Dwarf Planet

A small team of astronomers led by Sihao Cheng at the Institute for Advanced Study's School of Natural Sciences announced the discovery of a trans-Neptunian object (TNO). Currently designated 2017 OF201, the TNO strays so far from the Sun that a single orbit takes about 25,000 years. It is estimated to have a diameter of about 435 miles (700 km), about a third the size of Pluto, although large enough to be classified as a dwarf planet.

Its discovery was fortuitous as the object spends only one percent of its orbital time close enough to be detected. At is furthest, 2017 OF201's orbit extends into the inner Oort Cloud (a vast, spherical shell of icy bodies that surrounds our solar system).

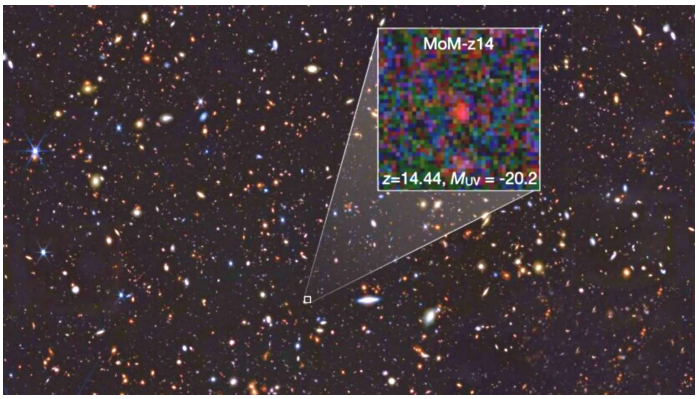


Current location of Pluto, Neptune, and 2017 OF_{201}
Image Credit: Jiaxuan Li and Sihao Cheng

New Oldest Galaxy

Astronomers continue to push back the time when the earliest galaxies formed. With its 6.5 meter (21.3 feet) diameter mirror and sensitivity in the infrared portion of the electromagnetic spectrum, astronomers have been able to use the James Webb Space Telescope to reveal galaxies at the edge of time.

The latest discovery is a small galaxy (about 50 times smaller than our Milky Way) that existed only 280 million years after the Big Bang. This is the most distant spectroscopically confirmed galaxy ever observed. Named MoM-z14, from the Mirage or Miracle survey, the discovery suggests that galaxies formed much more rapidly in the early universe than previously thought.



Credit: JWST, NASA/CSA/ESA/STScI

Prime Mission End

The Parker Solar Probe, launched in August 2018, has completed its primary mission. The spacecraft made its twenty-forth and final close pass of the Sun in June, getting to within 3.86 million miles (6.1 million km) of the photosphere. At closest approach, the spacecraft was traveling at approximately 430,000 mph (700,000 kph).

In 2021, the probe became the first spacecraft to fly through the corona – the Sun's upper atmosphere. From this unique vantage point, a new source for energetic particles in the solar corona was revealed. Researchers believe that magnetic re-connection, when magnetic field lines converge, break apart and explosively reconnect, is a key contributor to the heating of the solar atmosphere and acceleration of the solar wind charged particles (mostly electrons and protons).

Credit: Johns Hopkins University Applied Physics Laboratory

Coronal Rain

The false color image (above) shows the hydrogen-alpha light emitted by the solar plasma in the Sun's corona. The phenomenon, called "coronal rain," occurs when hot plasma in the Sun's corona cools and becomes more dense. Electrically charged, its descent back down to the photosphere follows the Sun's magnetic field lines.

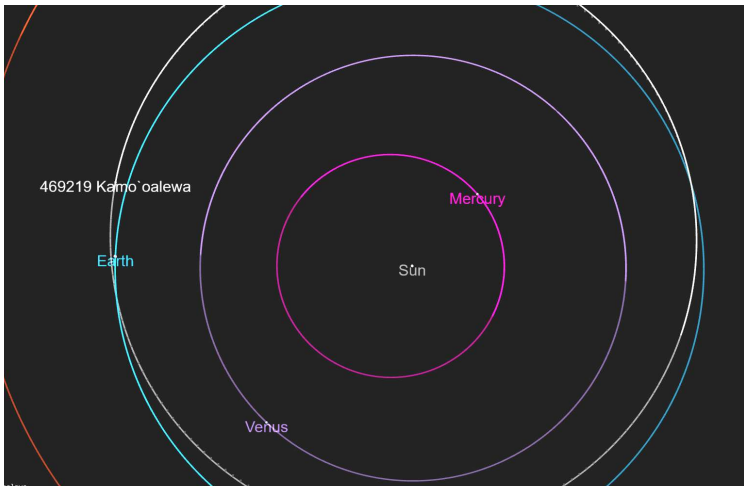
The image is a snapshot from a 23-minute time-lapse video captured by the Goode Solar Telescope at the Big Bear Solar Observatory. A new adaptive optics system, called Cona, is able to achieve diffraction-limited observations by reshaping the telescope's mirror 2,200 times per second to compensate for atmospheric turbulence.

Credit: Schmidt et al./NJIT/NSO/AURA/NSF

China's Asteroid Sample Return Mission

China has launched a sample return mission to the asteroid 469219 Kamo'oalewa (2016 HO3). The asteroid is one of Earth's co-orbital asteroids, orbiting the Sun along with the Earth. The elongated body measures between 131 and 328 feet (40 to 100 meters) in length.

Unlike other Near-Earth Objects, Kamo'oalewa appears to be a fragment of our Moon, possibly ejected during the formation of Giordano Bruno, a far-side crater. The theory is based upon the asteroid's reflectivity spectrum, rapid rotation rate, and relatively youthful age. The Tianwen 2 spacecraft is expected to return a sample to Earth sometime in 2027, before heading off for a rendezvous with comet 311P/PANSTARRS.



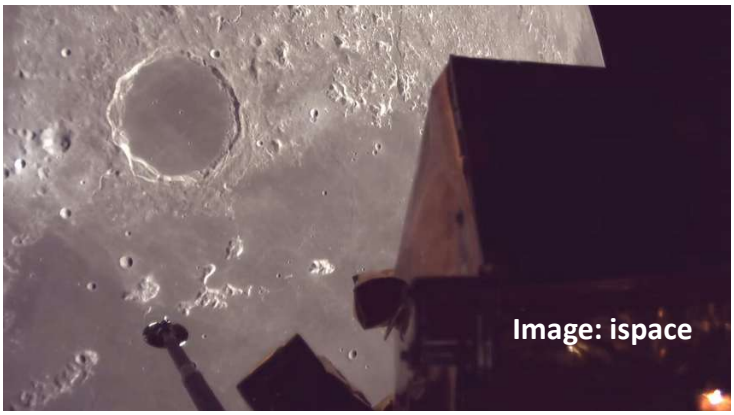
469219 Kamo'oalewa was discovered in 2016 by the Haleakala Observatory in Hawaii. The Apollo class asteroid has an orbital period of 366 days.

Credit: JPL Solar System Simulator

Japan Hard Landing

The end of the 4.5 month odyssey for ispace's Resilience lander came too soon as telemetry was lost during the start of the Phase 3 Braking Burn at an altitude of about 12 miles (20 km). The Tokyo-based company suspects a fault in the laser rangefinder, which is used to measure the distance to the lunar surface, delayed the deceleration needed for the planned landing, resulting in Resilience crashing into the surface.

At the time communications were lost, the display in the control room showed a vehicle velocity of 116 mph (187 km/h) with less than 2 minutes to touch down and an altitude of 170 feet (52 meters) when it should have been much higher - between 1 and 2 miles (1 and 3 km).

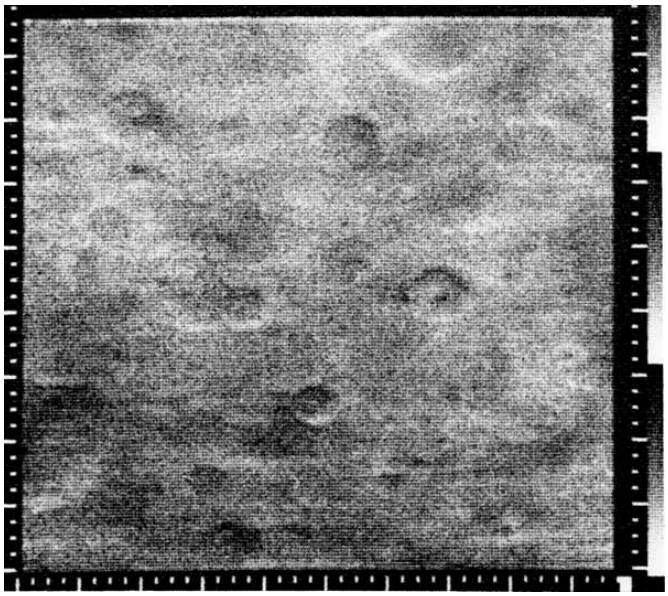


View from the Resilience lander as it passes over Plato crater, just south of the landing site in Mare Frigoris (Sea of Cold)

Mariner 4 – The Beginning

Sixty years ago, the Mariner 4 spacecraft returned the first images of another planet from space. After a 7.5 month journey, the solar-powered spacecraft flew by the Red Planet on July 14, 1965, capturing 21 images that covered about 1% of the Martian surface.

The images were stored on the onboard tape recorder and transmitted back to Earth once the flyby was complete. While the mission was a success, the images failed to show any evidence that life existed on Mars, past or present. Subsequent missions, including those currently underway, have shown that the Red Planet could have supported life in the distant past, but the search continues for conclusive evidence.



Heavily cratered portion of western Memnonia Fossae

Image Credit: NASA/JPL

First Images from the Legacy Survey of Space and Times Camera

The Trifid and Lagoon nebula region was one of the first targets for the Vera C. Rubin Observatory's new camera. The image (above) was created from 678 exposures, totaling a little more than seven hours of observing time.

Credit: NSF/DOE/ Vera C. Rubin Observatory

This image encompasses only a small porton of the Virgo cluster. The cluster, located some 50 million light years away, includes more than 2,000 members and an assortment of galaxy types. Two classic spiral galaxies can be seen in the lower right, as well as three interacting galaxies in the upper right. Named after the massive elliptical galaxy that dominates the cluster (not pictured), Virgo is the closest major cluster to us.

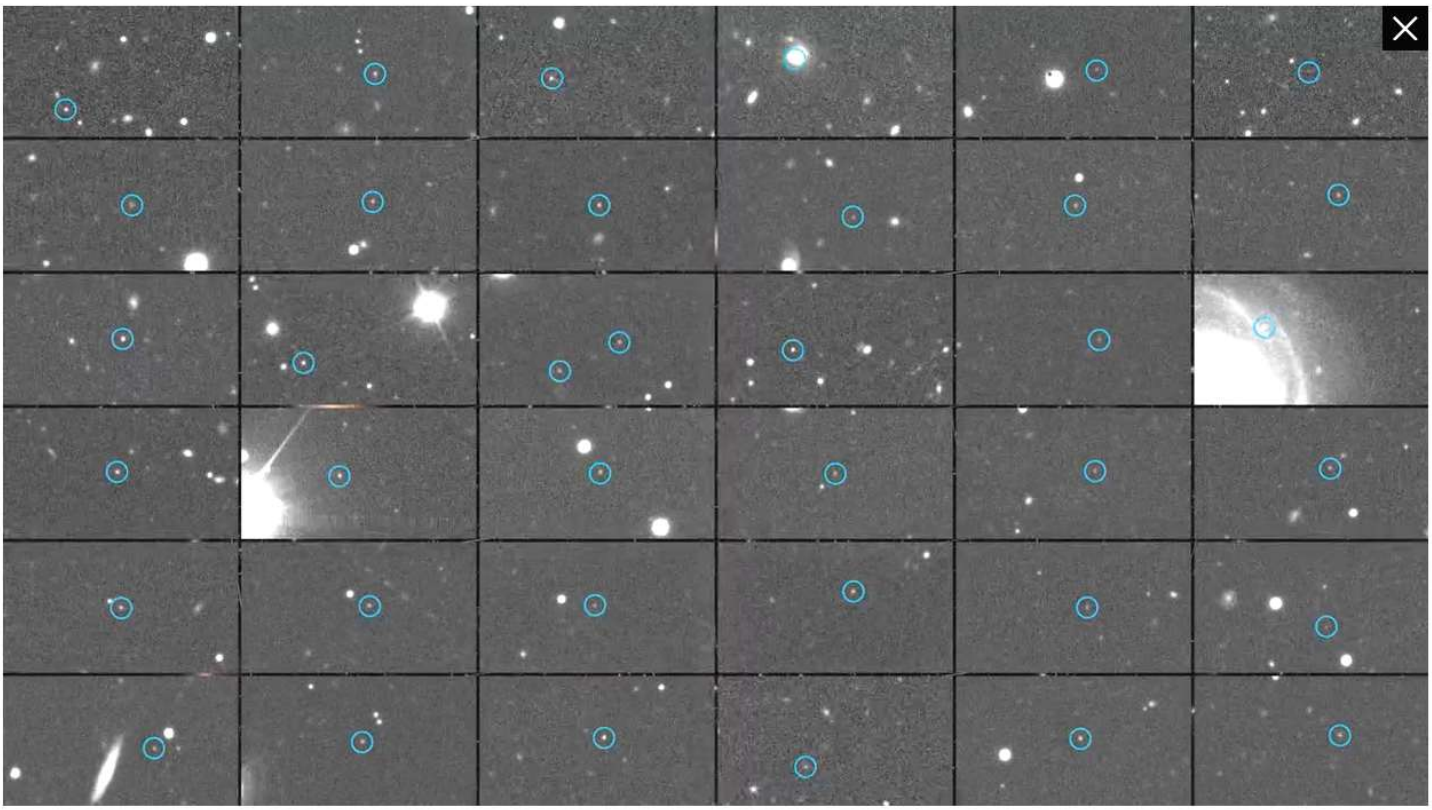
Credit: NSF/DOE/ Vera C. Rubin Observatory

Asteroid Discovery Machine

On June 23rd, the Vera C. Rubin Observatory, located on the summit of Cerro Pachón in Chile, released the first highly-detailed images of the sky taken with the largest digital camera ever built. The Legacy Survey of Space and Time Camera, or LSST, will image the southern hemisphere night sky over and over again for 10 years. With the 20 terabytes of data collected every night, scientists will create a map incorporating 17 billion stars in the Milky Way and 20 billion galaxies. Closer to home, the data is also expected to contain images of 6 million asteroids in our solar system.

The 6,200 pound (2,800 kg), 3,200 megapixel camera will cover the entire sky every three nights, taking 1,000 images a night, with each image covering an area of the sky more than 40 times the apparent size of the full moon.

Among the first release was a video comprised of 1,185 individual images showing the motion of small objects (for example, asteroids) against the unchanging background of stars and galaxies. Within this field almost 4,000 moving objects were detected, of which approximately 1,800 were previously known. The remainder are new discoveries that included 2,104 new asteroids (including 7 near-Earth objects), 11 Jupiter Trojans, and 9 trans-Neptunian objects or TNOs. The orbits of these TNOs extend beyond Neptune's and are small icy bodies – remnants of the formation of our Solar System.



A frame grab from the video called "A Swarm of New Asteroids," created from about 10 hours of observations. New discoveries are circled in blue. The search area is in the same region of the sky featured in Rubin's wide-field image of the Virgo Cluster featured on the previous page.

Credit: NSF–DOE Vera C. Rubin Observatory

Second Saturday Stars

FREE EVENT

John J. McCarthy Observatory
Behind the New Milford High School
860.946.0312
www.mccarthyobservatory.org

July 12th

8:00 - 10:00 pm

Free Star Party

Featuring:

Milky Way Season

All are welcome to enjoy
a brief presentation along with
observing* the sights of the
night sky through
a variety of telescopes!

*Observing if weather permits

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