

# *Galactic Observer*

## *John J. McCarthy Observatory*

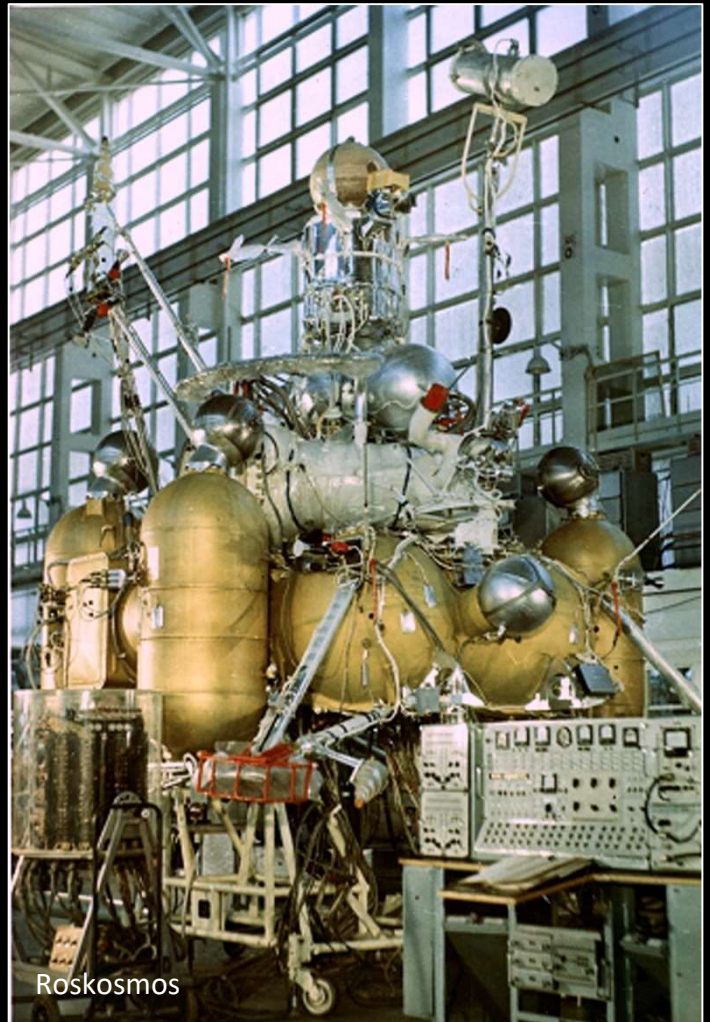
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**July 20, 1969**

Apollo 11's Lunar Module (above) as it prepared for a landing on the Mare Tranquillitatis while the Soviet Luna 15 (right) was in lunar orbit for a sample return attempt.



**55 Years Ago**

### **High Drama at the Finishing Line**

In a last ditch effort to upstage NASA's Apollo program and Moon landing, the Soviet Union launched Luna 15 on July 13, 1969, about 3½ days before Apollo 11. The robotic spacecraft was designed to return a sample from the Moon, which would then be paraded through Red Square before being placed on display for the world to see. The propaganda mission was beset by technical issues and came to an untimely end when contact with Luna 15 was lost four minutes into its six minute descent. The Soviet lander crashed into the surface about 500 miles (800 km) east of the Apollo 11 landing site while Armstrong and Aldrin were still on the Moon.

## July and August Astronomy Calendar and Space Exploration Almanac



Moon Tree in New Milford  
*Photo: Bill Cloutier*

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## “Out the Window on Your Left”

The undeclared space race between the world’s two superpowers kicked off on October 1957 with the Soviet Union launching the first artificial satellite. Despite an impressive start, the Soviet Union’s Moon program was beset with a series of setbacks and political infighting, particularly after the untimely death of Sergei Korolev, known only to the West as the “Chief Designer.” By 1969, the United States had successfully assembled the hardware and demonstrated all phases of a lunar mission, sans an actual landing.



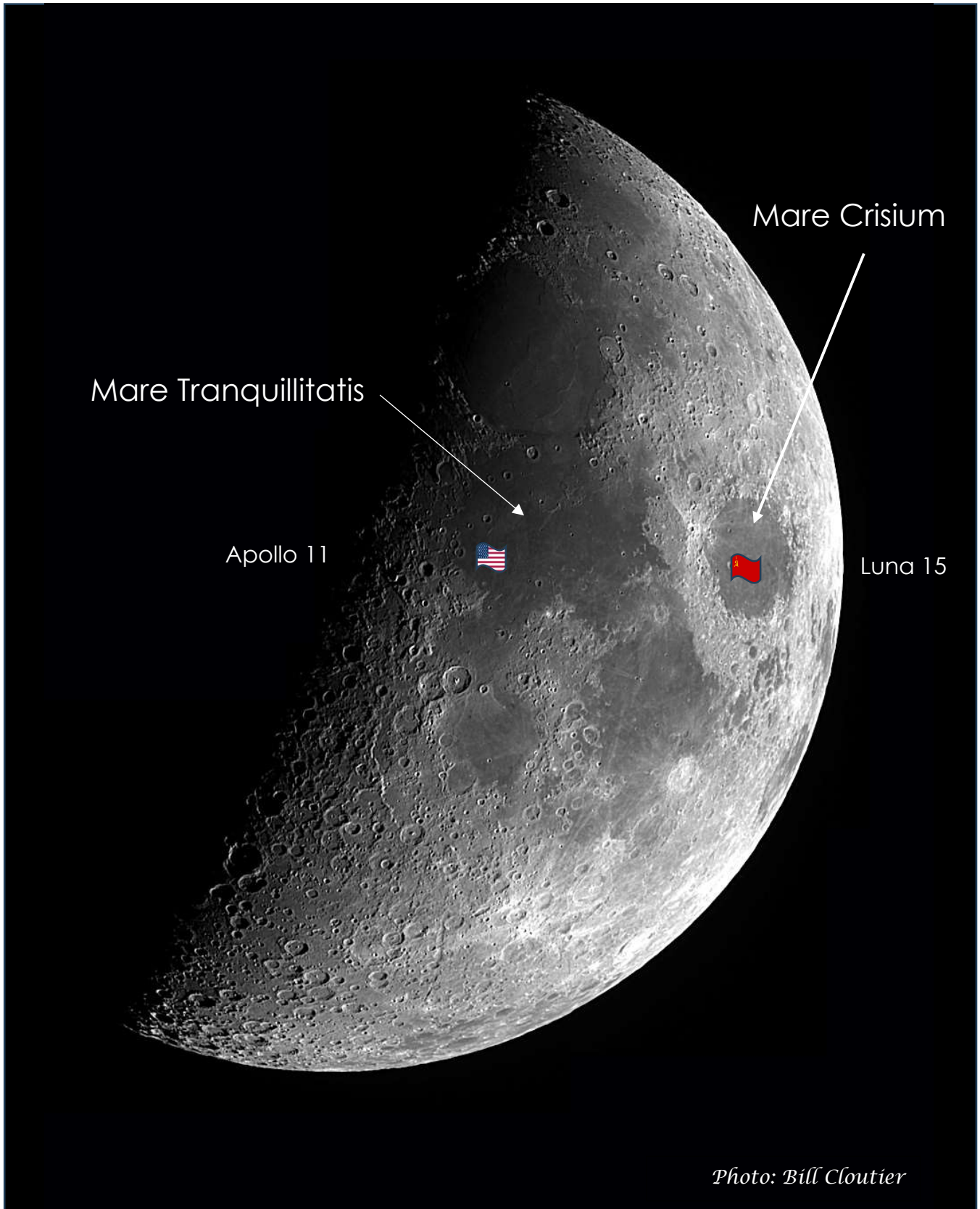
Proton-K Blok-D  
Roskosmos



Saturn V  
NASA

Hidden behind an “iron curtain” of secrecy, the Soviets attempted to launch its massive, 5-stage Moon rocket, (the “N1”) on February 21, 1969, and again on July 3, 1969. Both ended catastrophically, with the second attempt destroying the launch pad and delaying the program two years. Undeterred, and in a last minute effort to upstage Apollo, a series of robotic sample return missions were prepared. The first, launched a month before Apollo 11, failed to achieve orbit. The second, designated Luna 15, launched just 3½ days before Armstrong, Aldrin and Collins left Earth. Soviet controllers worked a number of technical and navigational issues in getting the spacecraft into lunar orbit two days before Apollo 11 arrived. However, the landing site in Mare Crisium proved to be much more rugged than initially expected and, in the end, Luna 15’s landing attempt didn’t occur until its 52<sup>nd</sup> orbit and after Armstrong and Aldrin had already completed their historic moonwalk. The astronauts were still on the surface and preparing the Lunar Module for liftoff when Soviet Controllers lost contact with Luna 15 during its descent. Speculation is that the spacecraft had developed some unintended lateral motion and crashed into the side of a lunar mountain. NASA had been concerned that Luna 15 operations might disrupt communications between the Apollo 11 crew and mission control in Houston. Frank Borman, the commander of Apollo 8, was asked to reach out to his contacts at the Soviet Academy of Sciences, which then provided orbital data for Luna 15 and reassurance that there would be no interference. The space drama was followed by astronomers on Earth as they listened into the transmissions from the two spacecraft with the radio telescopes at the Jodrell Bank observatory in Cheshire, England. It would be another year (September 1970) before a Soviet robotic probe, Luna 16, would return a small sample (3.5 ounces or 101 grams) of lunar soil to Earth. By then, the race was over.

July 20, 1969



*Photo: Bill Cloutier*

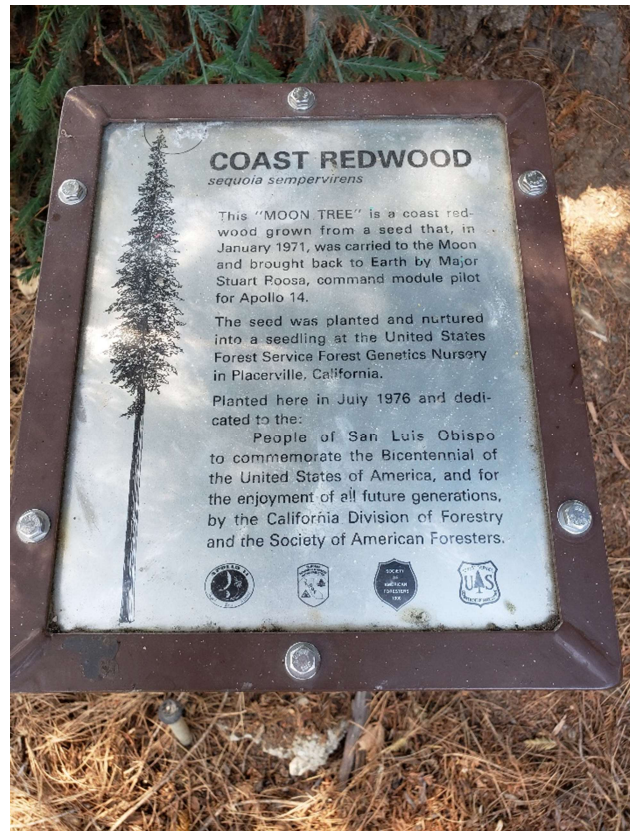
## Moon Trees



Among the personal belongings that Apollo 14 astronaut Stuart Roosa packed away in the Command Module was a container with 500 tree seeds to commemorate his prior work as a smoke jumper for the U.S. Forest Service. Upon the crew's return to Earth in February 1971, Roosa provided the five species of seeds to the Forest Service, which were then germinated in their nurseries and planted across the United States.

Inspired by Roosa's initiative, NASA flew more than 1,000 seeds of five different species of trees as part of the official flight kit on the 26-day uncrewed Artemis I test flight in 2022. Working again with the Forest Service, the "Artemis" moon seedlings are now being distributed to schools, libraries, museums and other institutions engaging with students or with the public as a living symbol of this remarkable human and scientific achievement, and as inspiration for future generations.

Thanks to the high school's science department, one of those seedlings, a sweetgum variety, has made its way to New Milford. The seedling has been planted on school grounds (pictured on page 1) on the southeast corner of the property.



Apollo 14 "Moon Tree" in San Luis Obispo, California  
Photo: Bill Cloutier

## Calypso Finally Sails

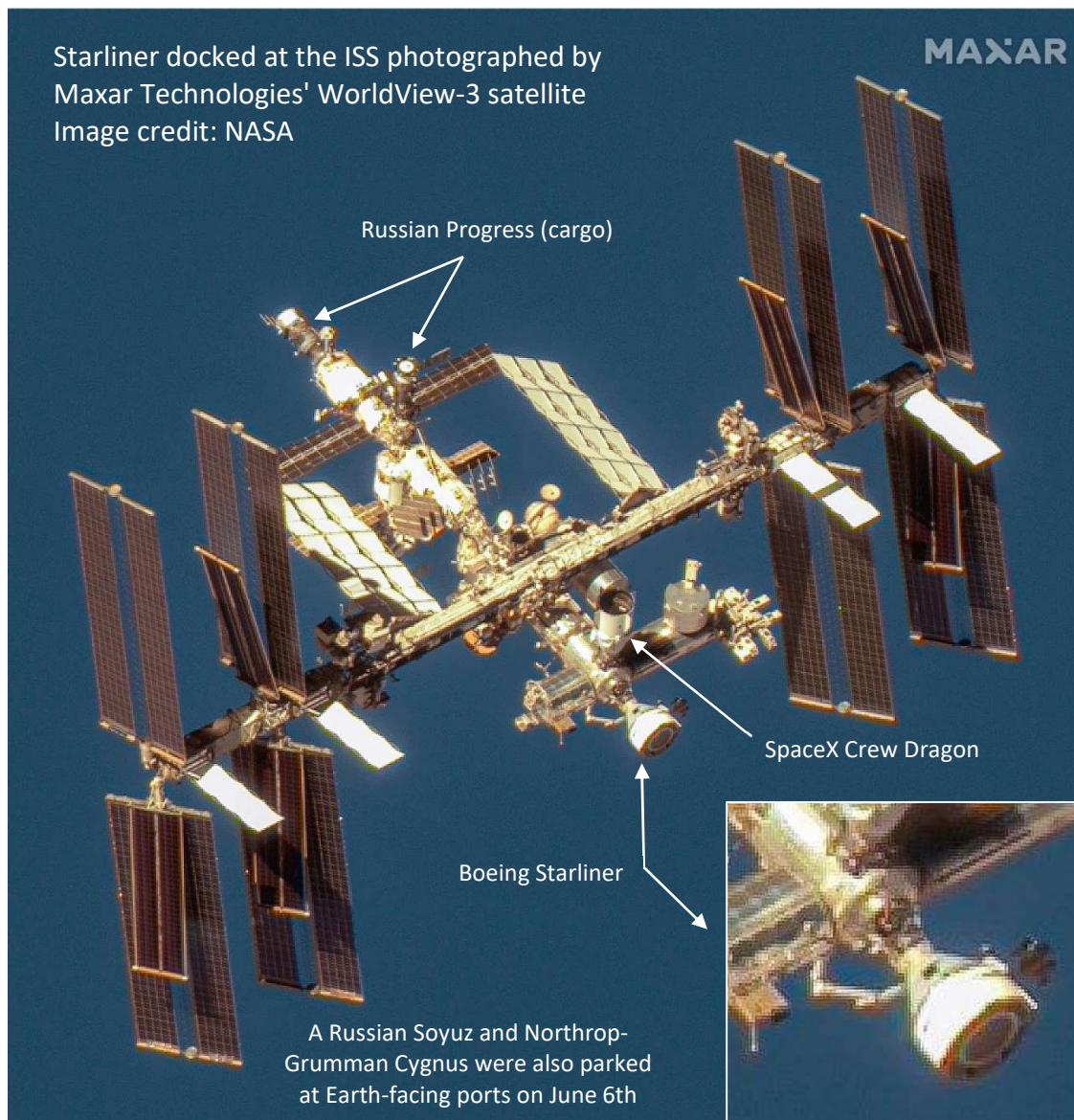
After two launch attempts on May 6<sup>th</sup> and June 1<sup>st</sup>, Boeing's Starliner launched from pad 41 at the Cape Canaveral Space Force Station on June 5<sup>th</sup> for what was expected to be a week-long mission to the International Space Station (ISS). It was the first crewed flight of the spacecraft after a troubled developmental history and two challenging uncrewed test flights in 2019 and 2022.

Starliner "Calypso" on approach to the ISS  
Image credit: NASA



Unfortunately, the trip to the ISS for astronauts Butch Wilmore and Suni Williams was not without difficulties and suggests that issues with the earlier test flights were not totally addressed. The vehicle had been cleared for launch with a “minor” helium leak in its propulsion system. As the astronauts chased the ISS, four more helium leaks were detected. More disconcerting, docking with the station was initially aborted when five of the spacecraft’s 28 reaction control system thrusters failed. Four were brought back on line as the Starliner crew assumed manual control of the spacecraft and maintained a safe distance from the station. After an exhaustive review, the spacecraft was docked to forward port on the station's Harmony module and Butch and Suni joined the seven cosmonauts and astronauts currently living and working on the ISS.

Since the issues with the spacecraft are primarily with the Starliner’s service module, NASA has delayed the crew’s return. This will give engineers on the ground time to study the problems while the spacecraft is docked to the ISS (the service module portion of Starliner will be jettisoned prior to its return to Earth). While no firm date for return has been set, expectations are that the spacecraft will leave the ISS in early July and land at White Sands, New Mexico a day later.





## Far Side Sample Return



The Chang'e-6 lander in Apollo crater imaged by a small rover  
Credit: CNSA/CLEP

Chang'e-6 is the sixth mission in the Chinese Lunar Exploration Program (CLEP) and the first designed to retrieve a sample from the Moon's far side. A stack of four spacecraft, Chang'e-6 was launched on May 3<sup>rd</sup> from the Wenchang spaceport. The lander, which included an ascent vehicle, successfully touched down in Apollo crater, located within the South Pole-Aitken basin on June 1<sup>st</sup>. A scoop and drill collected up to 2,000 grams (4.4 pounds) of rock and regolith which were loaded into the ascent vehicle. A relay satellite, Queqiao-2, launched into a lunar orbit in March, allowed the mission team to stay in contact with the vehicles while out of sight with Earth.

The lander was equipped with an alpha spectrometer provided by the French Research Institute of Astrophysics and Planetology to study the out-gassing of radon and other volatiles from the lunar regolith, an Italian-built passive laser retro-reflector for future optical range-finding navigation, and a Swedish-provided mass spectrometer. It also deployed a small rover onto the surface.

On June 3<sup>rd</sup>, the ascent vehicle lifted off the surface and into lunar orbit, docking with the orbiter/return vehicle three days later. Once docked, the sample was transferred to a reentry capsule. The return vehicle, containing the reentry capsule, left lunar orbit and headed back towards Earth. It released the capsule on June 25<sup>th</sup>, which landed in Inner Mongolia. The spacecraft is expected to be repurposed for another mission.

China is expected to launch two more robotic missions to the south pole of the Moon, Chang'e-7 in 2026 and Chang'e-8 around 2028, in preparation for establishing a permanent lunar base in the 2030s. The country ambitious space exploration program also includes an asteroid/comet mission, as well as a Mars sample return mission. The first crewed mission to the Moon (and return to Earth) is expected no later than 2030.

## They Are Not Alone!

They may be invisible to the human eye, but the organisms that share the living space on the International Space Station can be just as deadly as those Hollywood aliens.



Starliner astronauts  
Wilmore and Williams pose  
with the current ISS crew  
Credit: NASA

Space is not as empty and sterile as portrayed. When humans venture out, so do the multitude of microbial life forms that we coexist with on Earth. However, researchers have found that microbes, like bacteria, mutate in extreme and isolated environments, such as the ISS where they are exposed to microgravity, higher levels of solar radiation and carbon dioxide, to become genetically and functionally distinct.

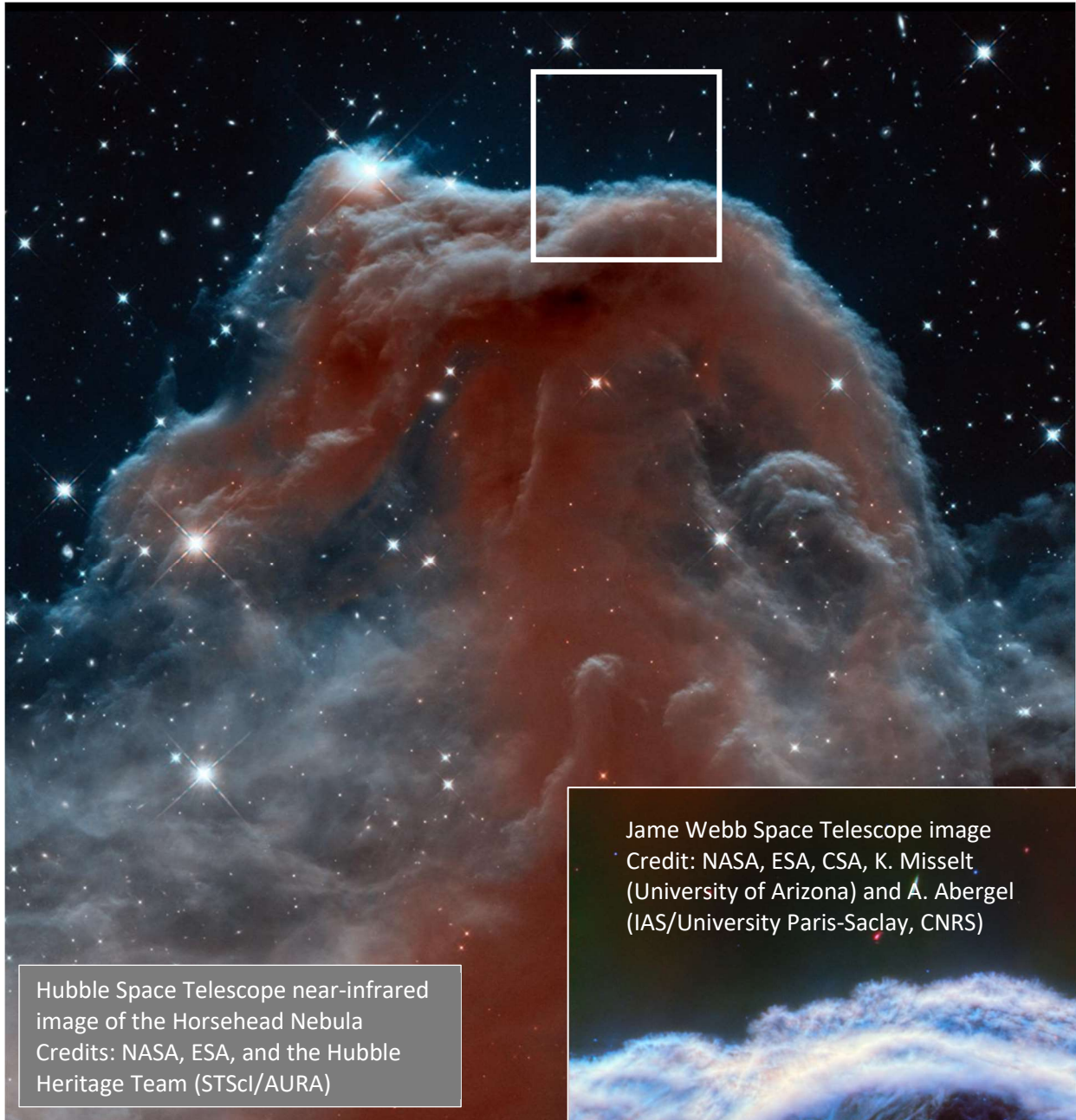


Enterobacter bugandensis

Thirteen strains of *E. bugandensis*, a drug-resistant bacterium, have been detected on surfaces within the ISS. The bacterium is classified as an “opportunistic pathogen,” and a threat particularly to those individuals already battling disease or who are immunocompromised. Researchers have also found that *E. bugandensis* not only coexists with other microorganisms, but in some instances, may help those organisms to survive.

The research underscores the need to 1) fully understand the genomic transformation of these mutated strains, as compared to their Earthly counterparts, and 2) develop effective countermeasures to ensure the health and safety of astronauts.

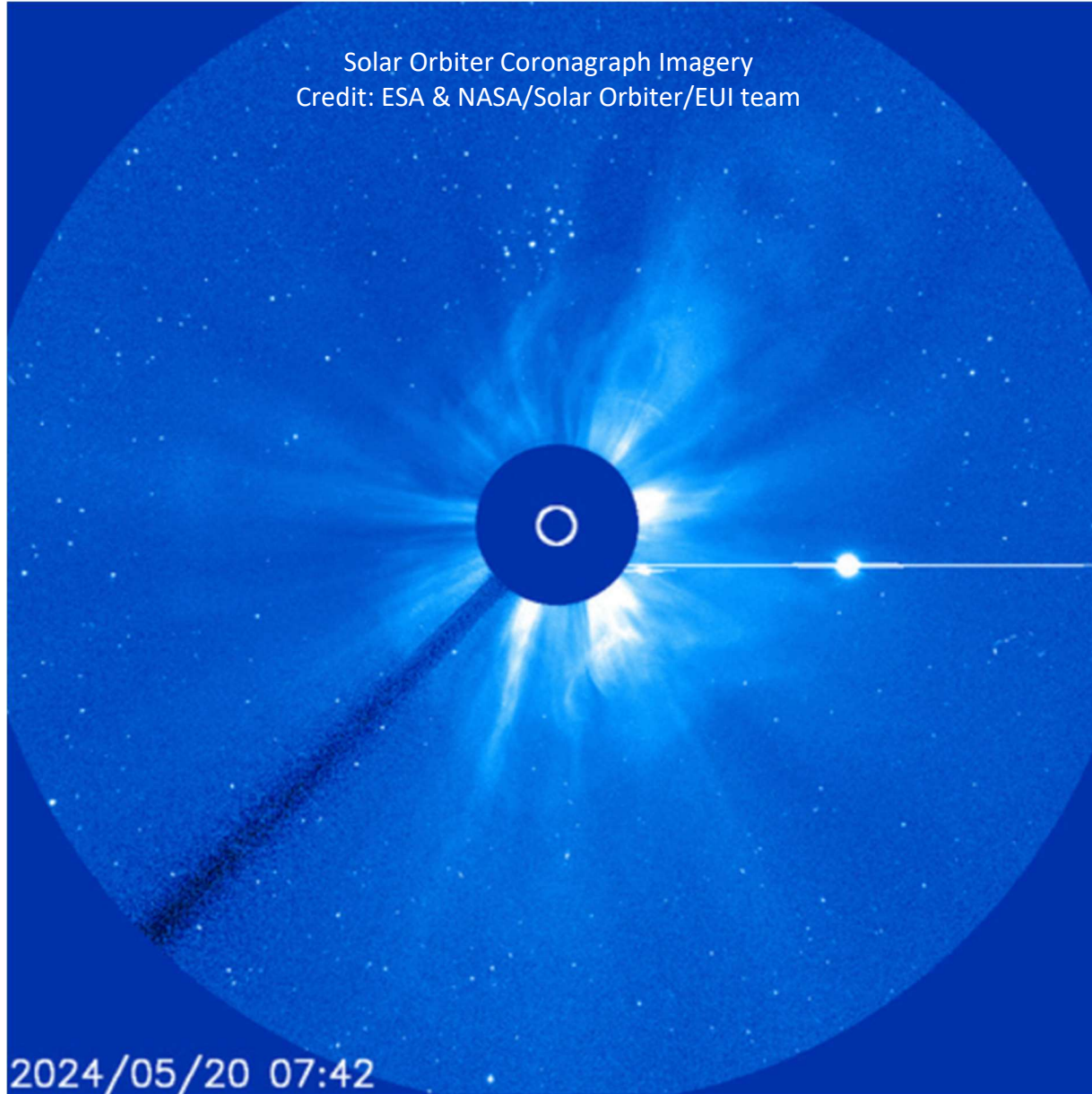
Going Deeper with Webb



The James Webb Space Telescope has revealed new details of a section of the Horsehead Nebula’s “mane” with its mid-infrared camera. The images captures the glow of substances like dusty silicates and soot-like molecules called polycyclic aromatic hydrocarbons.

Located about 1,300 light years from Earth in the constellation Orion, the collapsing interstellar cloud of gas and dust glows from the ultraviolet radiation of a nearby star.

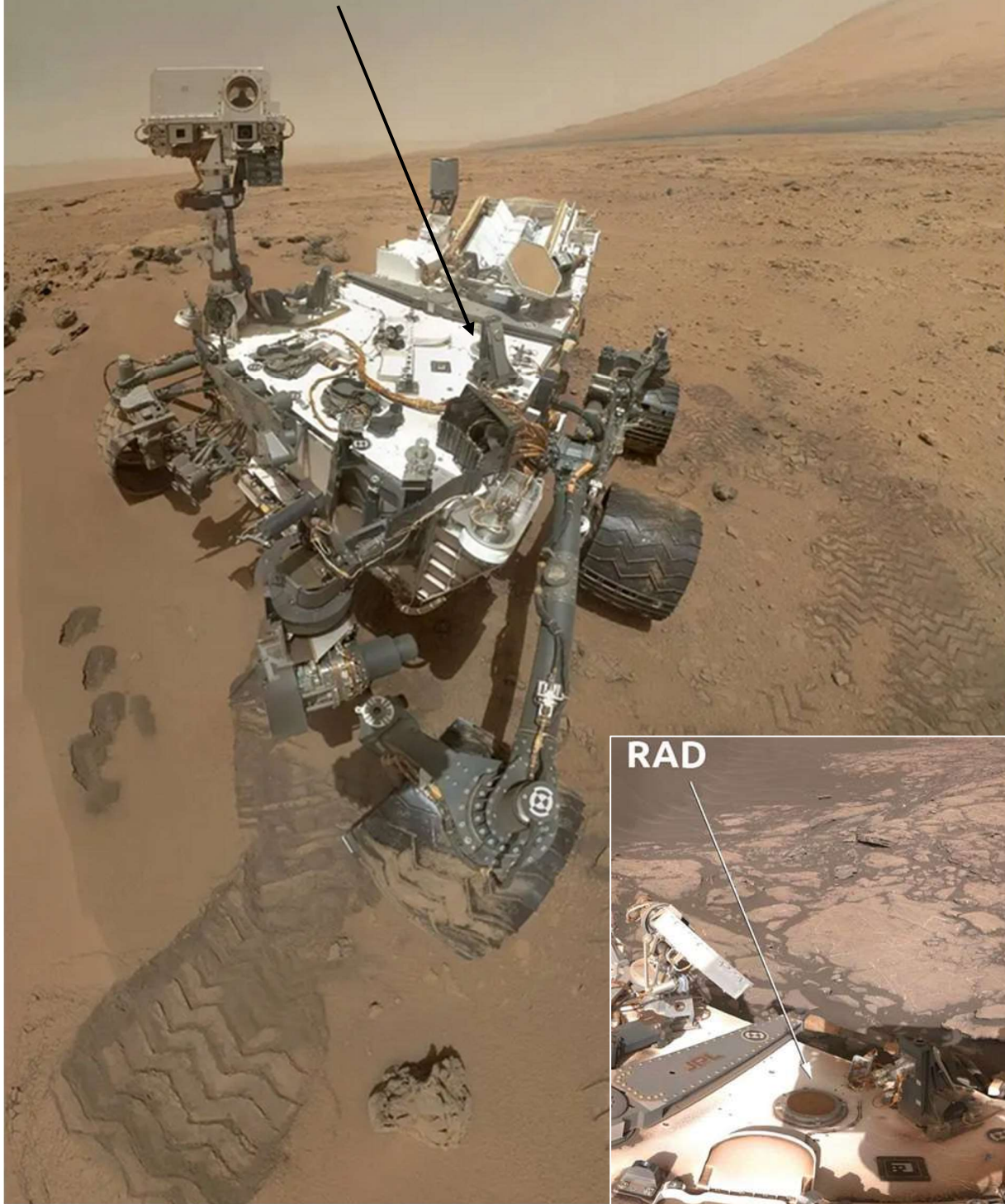
## Radiation Storm on Mars



The monster sunspot (AR3664) that unleashed multiple Coronal Mass Ejections (CMEs) in early May and sparked the most severe geomagnetic storm on Earth in 20 years, likely turned its sights on Mars two weeks later. Early on May 20<sup>th</sup>, a far side X-class flare and halo CME were observed by the Solar Orbiter spacecraft. X-rays and gamma rays from the flare, moving at the speed of light, arrived at Mars first, followed shortly after by a cloud of plasma and charged particles.

Without a global magnetic field or thick atmosphere for protection, NASA's Curiosity rover's Radiation Assessment Device (RAD), recorded the largest energy surge since the rover landed on Mars 12 years ago. Had astronauts been on the surface, and standing next to Curiosity, they would have received a radiation dose of 8,100 micrograys — equivalent to 30 chest X-rays. Data from RAD is intended for use in planning for exposure mitigation techniques, for example, using the natural Martian landscape for shielding astronauts from radiation storms.

Curiosity's RAD instrument is designed to detect and analyze the most biologically-significant energetic particle radiation on the Martian surface for assessing the habitability of the planet for future astronauts  
Credits: NASA/JPL-Caltech



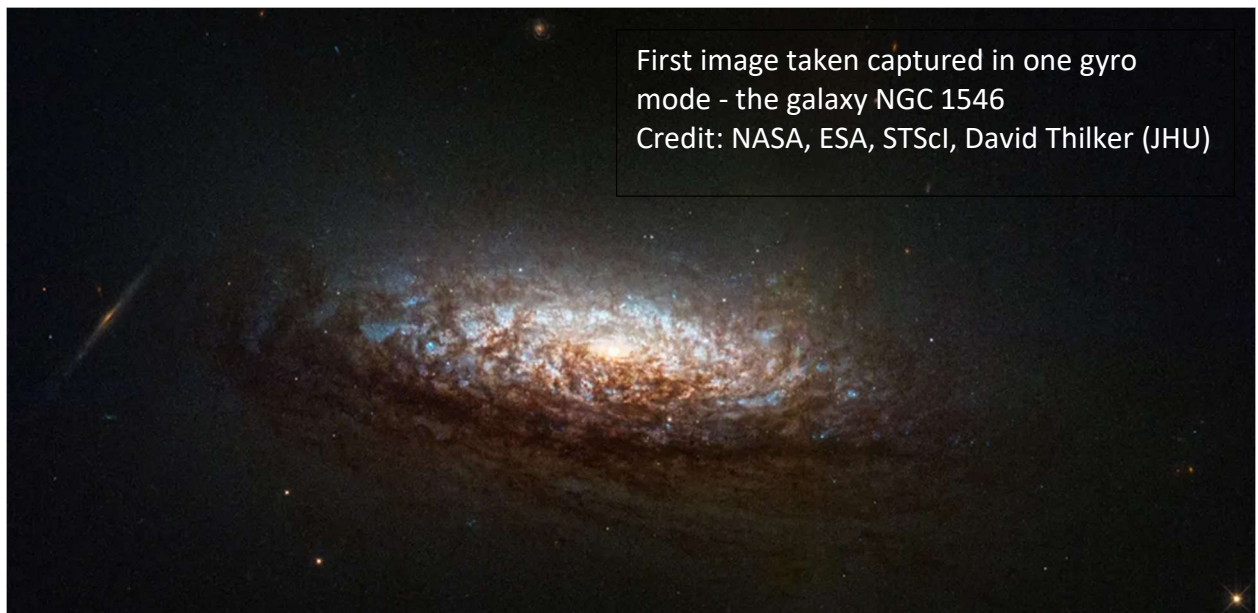
## And Then There Was One



NASA's Hubble Space Telescope on May 19, 2009  
after deployment during Servicing Mission 4  
Credit: NASA

The Hubble Space Telescope has transitioned to one gyroscope operation. Six new gyros had been installed during the last servicing mission in 2009, but with the retirement of the space shuttle, the telescope has been living on borrowed time. A second operational gyro is being kept in reserve.

There has been discussion of sending a private mission to the telescope to raise its orbit and perform essential repairs, including a review conducted by SpaceX on using a Crew Dragon spacecraft. At present, NASA has not made any decision, although the agency has been hesitant to expose the telescope's mirror to any contamination from a visiting spacecraft.

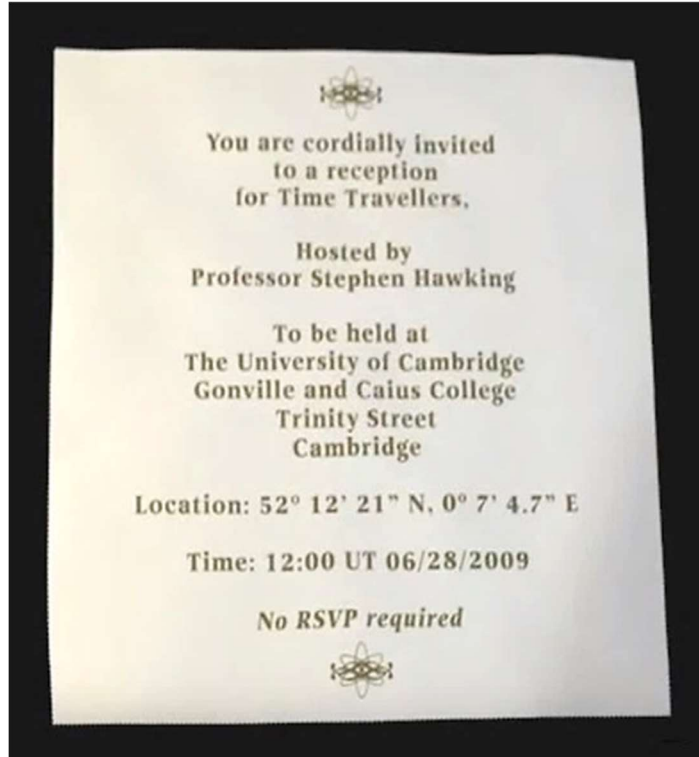


First image taken captured in one gyro  
mode - the galaxy NGC 1546  
Credit: NASA, ESA, STScI, David Thilker (JHU)

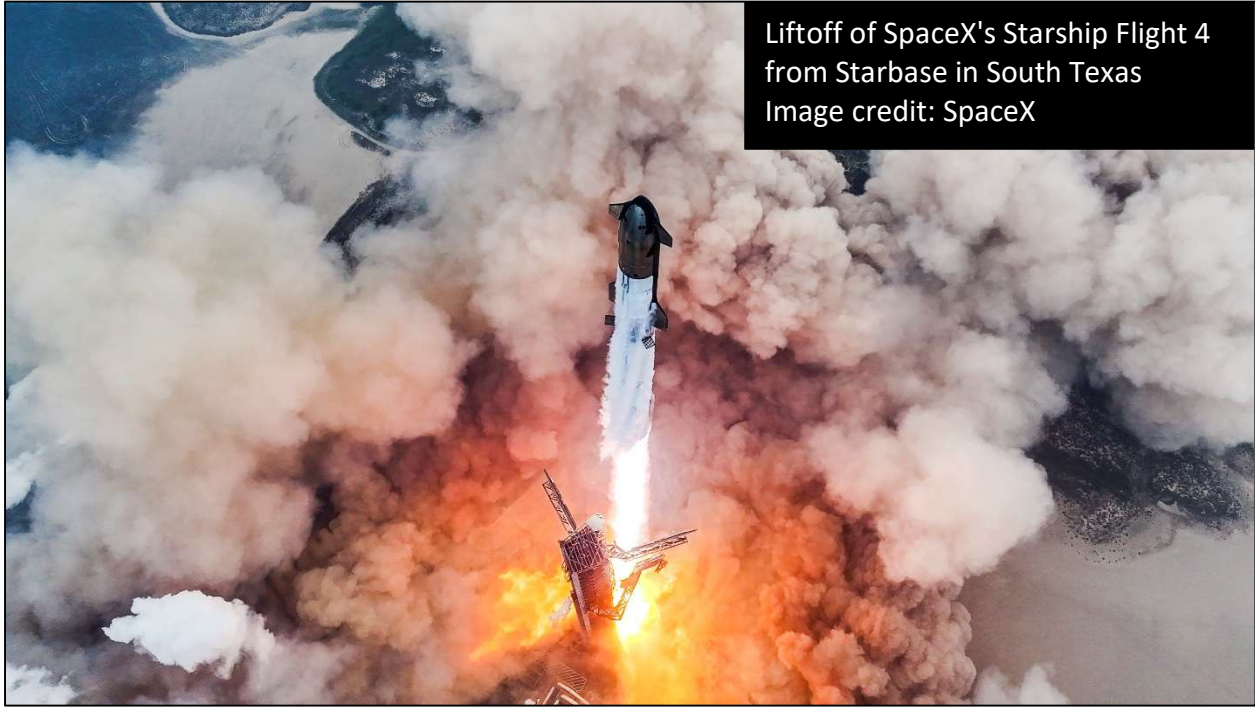
## Time Travelers No-Show

Fifteen years ago, the cosmologist Dr. Stephen Hawking performed a time travel experiment. Professor Hawking rented a room at Cambridge University and decorated it with balloons and banners. Canapes and champagne was also available for those that might venture across time and space.

The professor waited and, after a few hours, left the empty room. Only then did he send out the invitations. While modern physics does not prohibit time travel, the lack of attendance may be indicative of its difficulty. Hawking believed that a solution, if one exists, would come in the form of an advanced theory of gravity. Should a means of time travel be developed in the future, the invitation remains open.



## Starship Aces Test Flight



Liftoff of SpaceX's Starship Flight 4  
from Starbase in South Texas  
Image credit: SpaceX

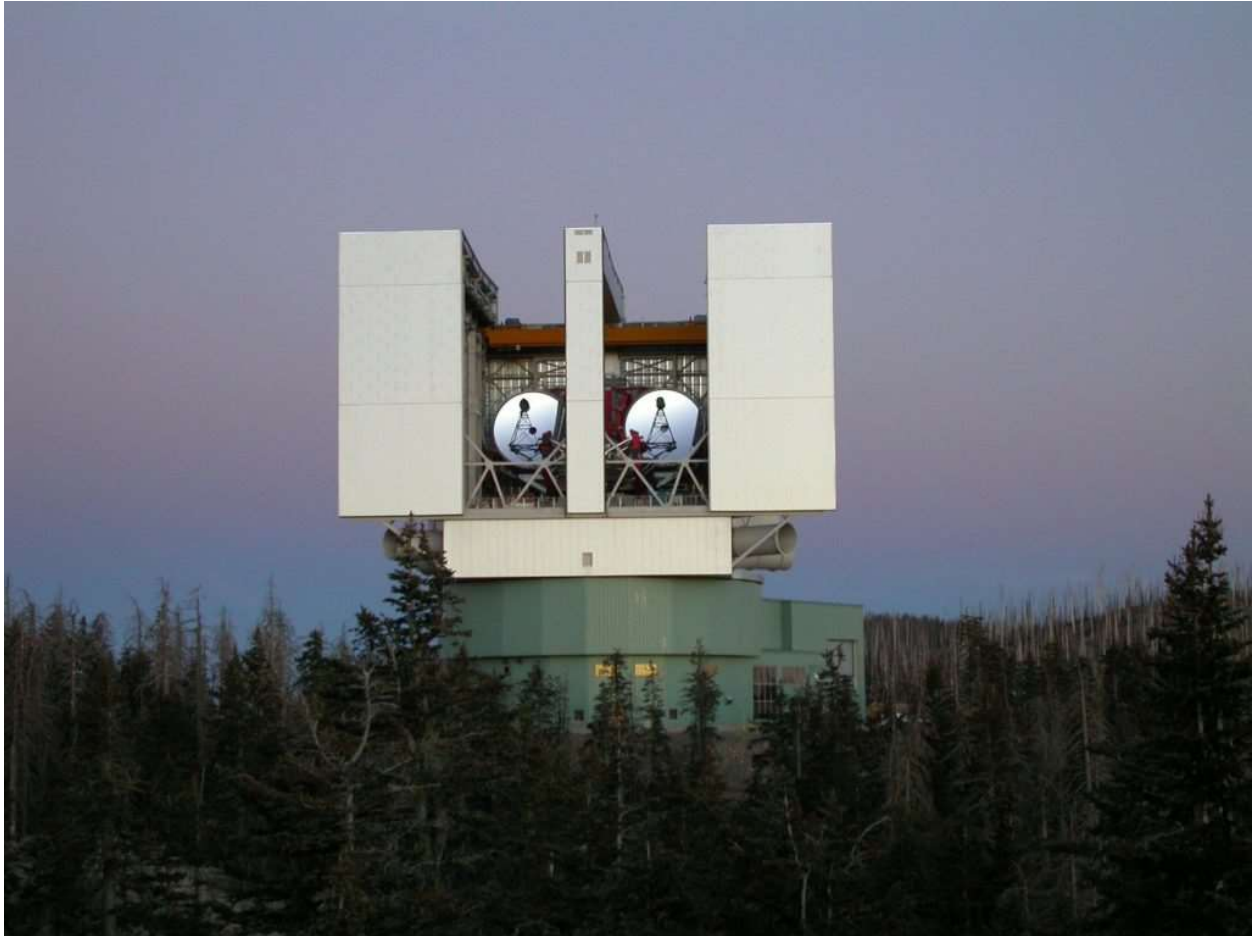
An orbital view from SpaceX's Starship Flight 4  
Image credit: SpaceX



The fourth test flight of SpaceX's new rocket addressed a number of issues that beset the previous flight with the Super Heavy booster making a controlled splashdown in the Gulf of Mexico and Starship surviving a fiery reentry to "land" in the Indian Ocean. Starship did lose a number of heat shield tiles and severe damage could be seen to one of its flaps, but the vehicle was able to maintain control during the descent before performing a landing burn about 65 minutes after liftoff. The test flight was considered an overwhelming success despite the failure of one of the 33 Raptor engines in the Super Heavy booster and significant degradation of the thermal protection system. SpaceX is already preparing the vehicles that will fly flight five, which could come as early as late August.



## An Otherworldly View



Through the use of adaptive optics to compensate for atmospheric distortion, the University of Arizona's-managed Large Binocular Telescope on Mount Graham has captured images of distant moons that rival those previously only seen by visiting spacecraft.

The two 27-foot (8-meter) mirrors, mounted side by side, recently imaged Io, Jupiter's volcanic moon. The images reveal surface features as small as 50 miles (80 km)

Image credit: INAF/Large Binocular Telescope Observatory/Georgia State University; IRV-band observations by SHARK-VIS/F. Pedichini; processing by D. Hope, S. Jefferies, G. Li Causi



## A New Ocean World

Almost a decade after the New Horizons spacecraft conducted the first-ever flyby of Pluto on July 14, 2015, researchers are still making discoveries. In a newly released paper, planetary scientists have presented evidence of an ocean hiding beneath Pluto's icy crust.

Based on computer modeling, the ocean is located beneath a surface shell that is between 25 and 50 miles (40 and 80 km) in depth. This insulating layer is thick enough to keep the interior ocean liquid despite surface temperatures that average  $-380^{\circ}\text{F}$  ( $-229^{\circ}\text{C}$ ).



New Horizons' photo of Pluto and Sputnik Planitia, the left side of a heart-shaped feature rich in nitrogen, carbon monoxide and methane ices  
Credit: NASA/Johns Hopkins University Applied Physics Laboratory/  
Southwest Research Institute

Visual evidence includes the presence of cryovolcanoes, such as those observed on other "Ocean Worlds," Ceres, Europa, Ganymede, Enceladus, Titan, and Triton. Researchers were also able to estimate the oceans density/salinity based on the cracks and bulges present in the ice covering Pluto's Sputnik Planitia Basin (up to 8% denser than Earth's oceans).

## Shuttle History



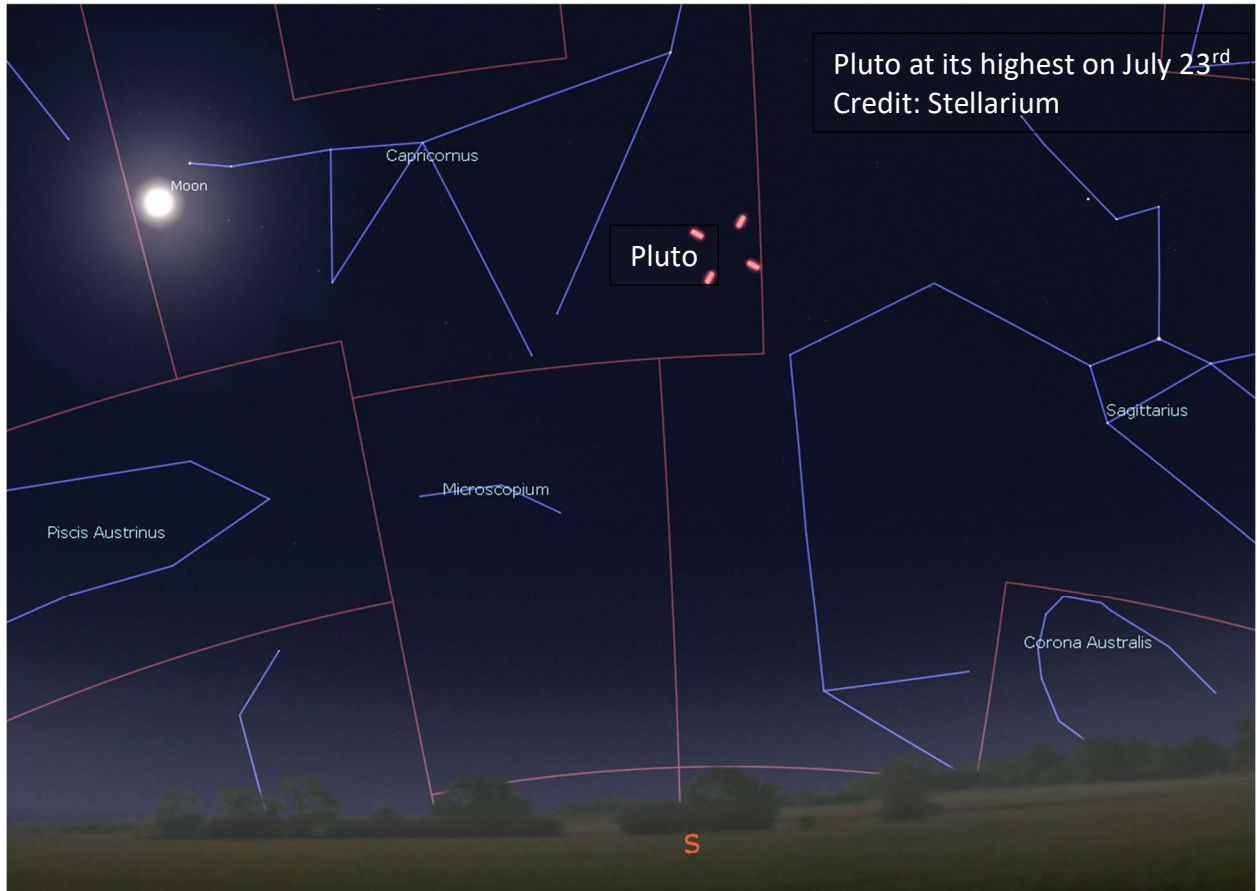
Forty-seven years ago, on August 12, 1977, Enterprise flew free. The space shuttle was carried aloft on the back of a modified Boeing 744. Onboard were two NASA astronauts, Fred Haise and Gordon Fullerton. Haise and Fullerton would fly the first, third, and fifth free-flight tests, while astronauts Joe Engle and Richard Truly would fly the second and fourth flights.

Unlike the previous eight captive-carry flights, the shuttle separated from the 747 on the 12<sup>th</sup> and glided back to the dry lakebed runway on the Dryden Flight Research Center at Edwards Air Force Base in California in front of a crowd of roughly 65,000 visitors and 900 members of the press.

Enterprise was constructed to be a test vehicle and was not intended to travel into space. Originally the shuttle was going to be named Constitution, in celebration of the U.S. Constitution's Bicentennial but a campaign by fans of the popular sci-fi TV show, "Star Trek" persuaded the White House to select "Enterprise."

After testing was complete, the Smithsonian Institution took ownership of Enterprise in 1985. It was put on display for eight years at the Smithsonian National Air and Space Museum's Steven F. Udvar-Hazy Center. In 2012, after the conclusion of the shuttle program, the space shuttle Discovery was transferred to the Smithsonian with the Enterprise moved to the Intrepid Sea, Air & Space museum in New York City where it remains today.

## Pluto at Opposition



The former planet, Pluto, reaches Opposition on July 23<sup>rd</sup>. At this time, Pluto will lie directly opposite the Sun in our sky, rising at sunset, highest shortly after midnight, and setting at sunrise. It is also the time when a planet will appear at its brightest.

Since dwarf planet 134340 Pluto is so distant (almost 3.2 billion miles or 5.1 billion km from Earth), extremely dim ( $>14^{\text{th}}$  magnitude), low in the sky ( $25^{\circ}$  at its highest), and located in a crowded star field, finding this enigmatic world that was only discovered in 1930 requires some perseverance.

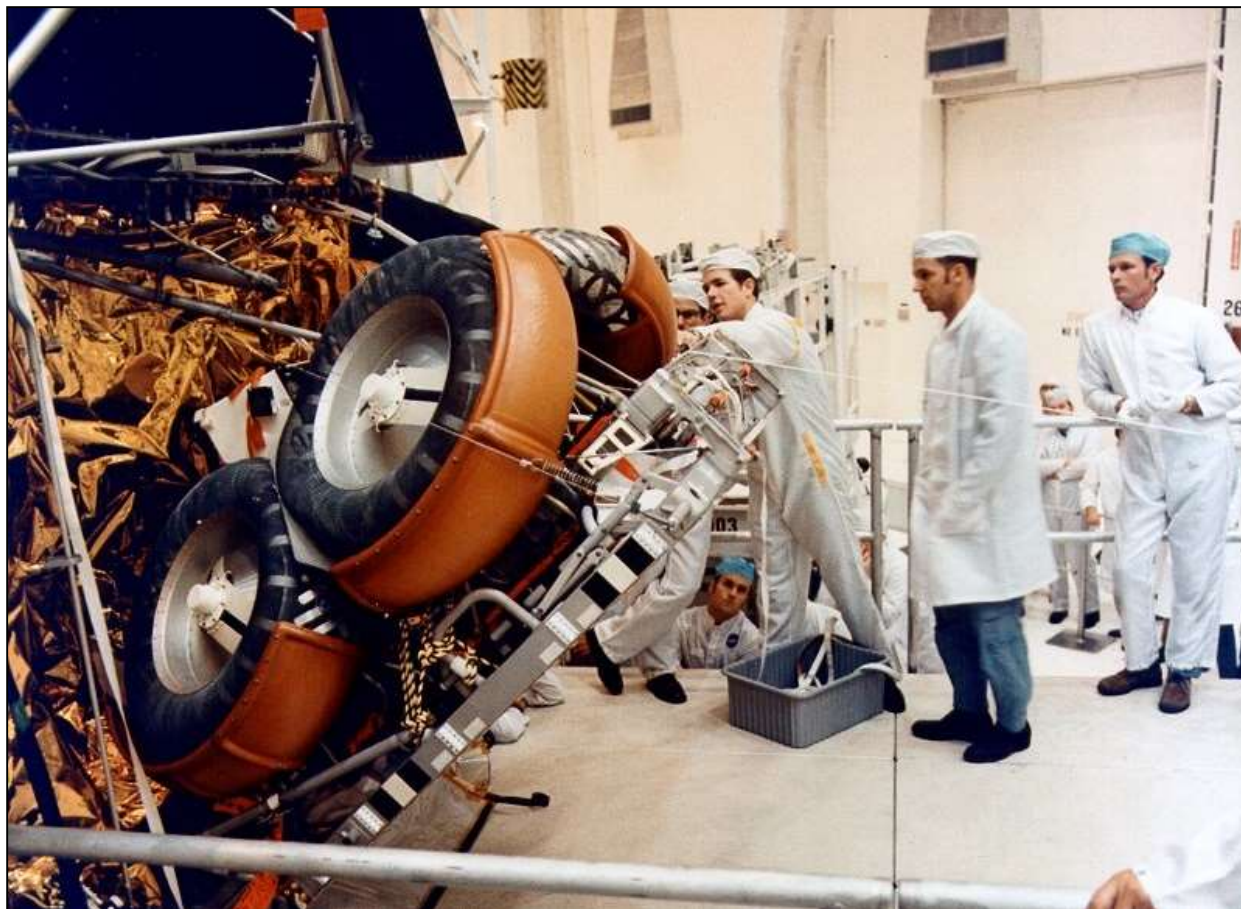
In July, Pluto will be in the constellation Capricornus, not far from the star clouds of the Milky Way Galaxy. The discovery method employed by young Clyde Tombaugh, comparing images of the same star field over multiple nights for objects in motion, is still used by amateur astronomers today to detect this elusive planet.



### First Wheeled Vehicle on Moon

Fifty-three years ago, astronaut David Scott became the first person to drive a vehicle on the Moon. The Commander of the Apollo 15 mission used an electric powered vehicle that had been specifically designed and built (by Boeing and Delco) to operate in lunar conditions (lower gravity, vacuum, and on loose, fragmented regolith). The Apollo 15 Lunar Roving Vehicle (LRV) was the first of three rovers driven on the Moon. It covered a total of 17 miles (28 km) in three separate excursions, carrying the astronauts up to 3 miles (5 km) from the landing site.

The LRV's chassis was constructed from aluminum alloy tubing and was hinged so that it could be folded for storage on the outside of the Lunar Module. Its four wire wheels were constructed of woven steel strands and titanium chevrons for traction. Each wheel was equipped with its own electric motor for a top speed of approximately 8 miles per hour (13 km/hr). The LRV was designed to carry the two astronauts and their life support systems, communications and scientific equipment, photographic gear and up to 60 pounds (27 kg) of lunar samples as they explored their surroundings. However, NASA restricted the rover's range to the distance the astronauts could walk back to the Lunar Module in the event of an emergency.



Astronaut David Scott (center) watches as technicians fit check the folded Lunar Rover Vehicle in an exterior bay of the Lunar Module. The rover was deployed by the astronauts once on the Moon's surface using a system of pulleys, ropes and cloth tapes.

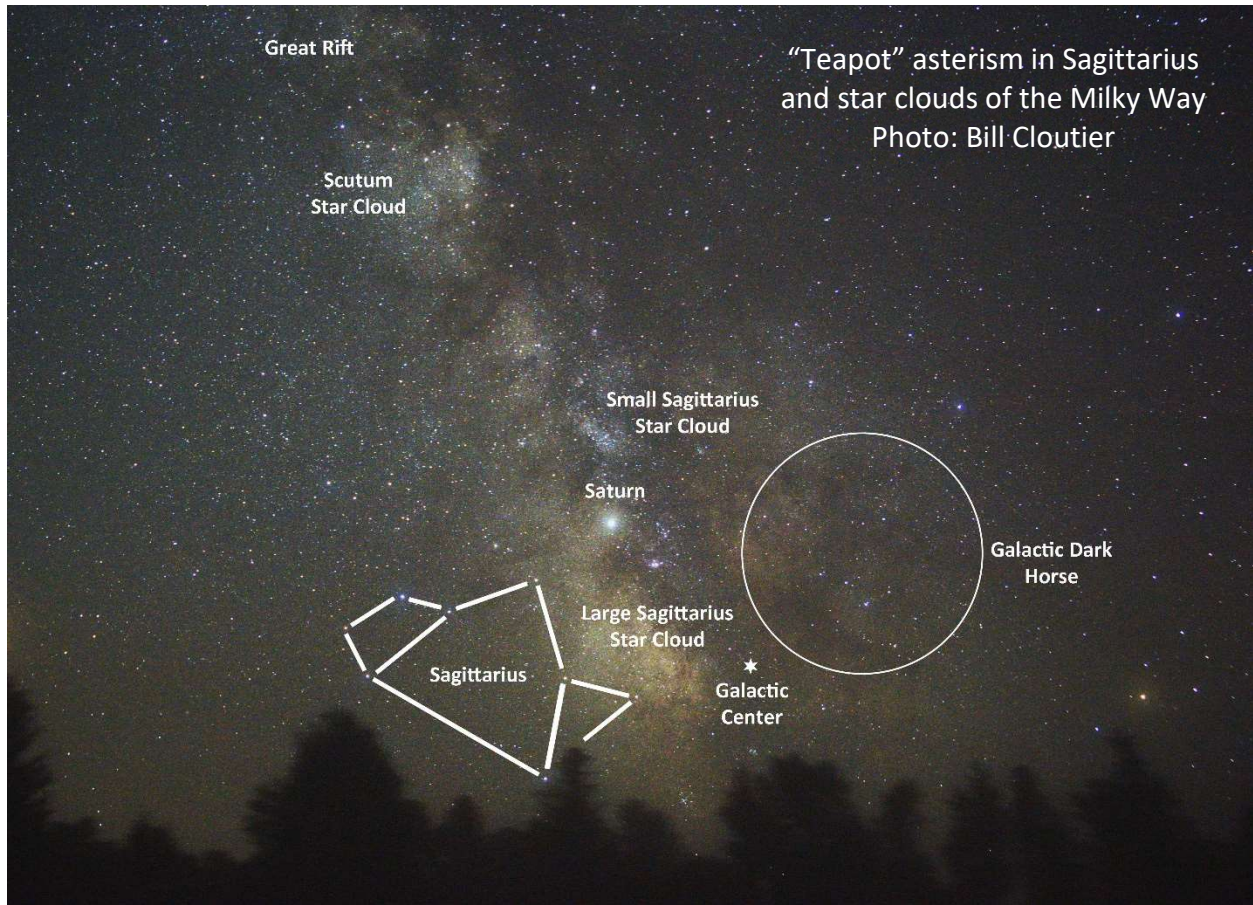
Photo Credit: NASA

## Summer Activities

Summer is a great time to enjoy the night sky. Some suggestions for this summer:

1. Spot the polar mesospheric clouds (also known as Noctilucent clouds or NLCs). These high-altitude clouds, seeded by meteoroid dust and comprised of water-ice crystals, form between 47 to 53 miles (76 to 85 km) above the Earth's surface, near the boundary of the mesosphere and thermosphere, a region known as the mesopause. They are best seen 30 minutes to 60 minutes after sunset or before sunrise. While typically confined to the polar regions, record cold temperatures in the mesosphere are increasing the production of NLCs and pushing them farther south. In 2019, they were seen as far south as Los Angeles and Las Vegas (a record low latitude)
2. Take in a meteor shower. A meteor shower occurs when the Earth passes through a cloud of debris usually left behind by a comet. With no telescope required, this naked-eye activity can be enjoyed in a lawn chair and a warm blanket. While an occasional meteor can be spotted at any time, August 12<sup>th</sup>/13<sup>th</sup> is best time night to catch the Perseids meteor shower. Comet Swift-Tuttle is the source of the small grains of dust that create the Perseids. This year, the Moon will be absent from the sky, creating perfect viewing conditions for one of the best showers of the year.
3. Locate the Summer Milky Way. Our solar system resides in one of the outer arms of a very large, rotating pinwheel of 200-300 billion stars called the Milky Way Galaxy. During the summer, we can see the inner arms of the pinwheel in the direction of the galactic core. Unfortunately, a dark sky is required, as excessive lighting is ruining the natural inky black of the celestial sphere. However, it can be seen from parts of New Milford, late at night and once the moon has set. If you have never seen the Milky Way:
  - Locate the Big Dipper (the most prominent asterism in the northern sky). The last two stars in the bowl of the Dipper point to the North Star.
  - Imagine a line extended from the two Dipper stars, through the North Star and an equal distance beyond. You should now be between the constellations Cepheus and Cassiopeia. Cassiopeia is shaped like a W or  $\Sigma$  and is the starting point for our journey down the Milky Way.
  - The Milky Way flows from Cassiopeia south to Cygnus (the Swan or Northern Cross). Cygnus can be recognized by its brightest star Deneb (at the tail) and the three bright stars that form the wings.
  - Continuing south, the bright star Altair provides the next navigation aid, directing us to Sagittarius, an asterism shaped like a teapot. On a dark night, the star clouds of the Milky Way appear like steam from the spout of the teapot. The spout is also in the general direction of the center of our galaxy (26,000 light years away).

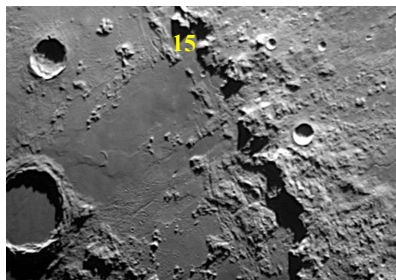
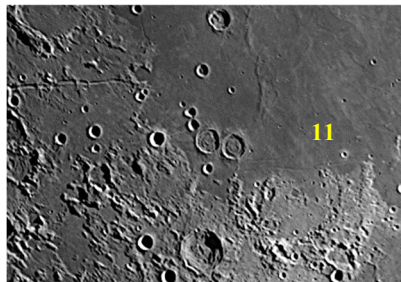
From a good observing site, you should see a band of cloudiness through this area of the sky. Through binoculars, the "clouds" can be resolved into bright areas populated by stars and darker areas with few or no stars. The darker patches are regions of gas and dust that obscure our view of the galactic center.



4. Find the Apollo landing sites. July marks the anniversaries of two moon landings. Apollo 11 landed on the southwestern shore of the Sea of Tranquility on July 20, 1969. Apollo 15 landed in the foothills of the Apennine Mountains on July 30, 1971. The southwestern shore of the Sea of Tranquility is visible 5 days after a New Moon. The Sun rises on the Apennine Mountains around the First Quarter Moon.



Sea of Tranquility and Apollo 11 landing site



Apennines Mts and Apollo 15 landing site

Sunrise and Sunset (from New Milford, CT)

<u>Sun</u>	<u>Sunrise (AM)</u>	<u>Sunset (PM)</u>
July 1 <sup>st</sup> (EDT)	05:23	8:31
July 15 <sup>th</sup>	05:33	8:25
July 31 <sup>st</sup>	05:47	8:11
August 1 <sup>st</sup>	05:48	8:10
August 15 <sup>th</sup>	06:02	7:52
August 31 <sup>st</sup>	06:19	7:27

Astronomical and Historical Events for July and August

July

- 1<sup>st</sup> History: launch of ESA’s Euclide spacecraft (telescope and two scientific instruments designed to explore the evolution of the dark universe) aboard a SpaceX Falcon 9 rocket from Cape Canaveral, Florida (2023)
- 1<sup>st</sup> Close approach by Aten-class near-Earth asteroid 2022 BY39
- 1<sup>st</sup> History: opening of the Smithsonian National Air & Space Museum (1976)
- 1<sup>st</sup> History: NASA officially activates the Launch Operations Center on Merritt Island, Florida; later renamed the Kennedy Space Center (1962)
- 1<sup>st</sup> History: 100-inch diameter mirror for the Hooker Telescope arrives on Mt. Wilson (1917)
- 1<sup>st</sup> History: discovery of asteroid *6 Hebe* by Karl Hencke (1847)
- 2<sup>nd</sup> Close approach by Apollo-class near-Earth asteroid 2024 LH
- 2<sup>nd</sup> History: launch of the Orbiting Carbon Observatory-2 (OCO-2) (2014)
- 2<sup>nd</sup> History: launch of European Space Agency’s Giotto spacecraft to Comet Halley (1985)
- 3<sup>rd</sup> History: launch of the ill-fated Nozomi spacecraft to Mars by Japan (1998)
- 3<sup>rd</sup> History: launch of the Solar Anomalous and Magnetospheric Particle Explorer (SAMPEX) by a Scout rocket (1992)
- 4<sup>th</sup> Close approach by Amor-class near-Earth asteroid 2024 KQ1
- 4<sup>th</sup> History: Juno spacecraft enters orbit around Jupiter (2016)
- 4<sup>th</sup> History: impact of Comet *Tempel 1* by Deep Impact’s impactor (2005)
- 4<sup>th</sup> History: Pathfinder spacecraft, with rover Sojourner, lands on Mars (1997)
- 4<sup>th</sup> History: Chinese astronomers record a "guest star" (supernova) in the constellation Taurus; visible for 23 days and 653 nights (1054); the remnant (Crab Nebula) later catalogued by Charles Messier as Messier 1 or M1
- 5<sup>th</sup> New Moon
- 5<sup>th</sup> Earth at Aphelion – furthest from the Sun (1.017 AU or 94.5 million miles)
- 5<sup>th</sup> History: Isaac Newton’s “Mathematical Principles of Natural Philosophy” published, describing the laws of motion (1687)
- 6<sup>th</sup> History: discovery of Jupiter’s moon *Lysithea* by Seth Nicholson (1938)
- 7<sup>th</sup> History: launch of the Mars Exploration Rover B (Opportunity) (2003)
- 8<sup>th</sup> History: likely breakup of Comet *Shoemaker-Levy 9* as a result of a close encounter with Jupiter – the fragments would impact the gas giant two years later (1992)
- 8<sup>th</sup> History: launch of the Space Shuttle Atlantis (STS-135) to the International Space Station; final space shuttle flight to low-Earth orbit (2011)



Astronomical and Historical Events for July (continued)

- 9<sup>th</sup> History: closest pass of Jupiter's cloud tops by the Voyager 2 spacecraft (1979)
- 10<sup>th</sup> History: flyby of Comet *Grigg-Skjellerup* by the European Space Agency's Giotto spacecraft following its close encounter of Halley's Comet (1992)
- 10<sup>th</sup> History: flyby of asteroid *21 Lutetia* by the European Space Agency's Rosetta spacecraft (2010)
- 10<sup>th</sup> History: launch of Telstar 1, prototype communication satellite designed and built by Bell Telephone Laboratories (1962)
- 10<sup>th</sup> History: Alvan Graham Clark born, optician and telescope maker (1832)
- 11<sup>th</sup> Close approach by Apollo-class near-Earth asteroid 2022 YS5
- 11<sup>th</sup> History: launch of the Soviet Gamma Observatory (1990)
- 11<sup>th</sup> History: Skylab re-enters into the Earth's atmosphere (1979)
- 12<sup>th</sup> Moon at Apogee (furthest distance from Earth)
- 12<sup>th</sup> History: launch of the High Energy Astronomical Observatory (HEAO-1), designed to survey the entire sky for x-ray emissions (1977)
- 12<sup>th</sup> History: launch of Soviet Mars orbiter Phobos 2 (1988)
- 13<sup>th</sup> First Quarter Moon
- 13<sup>th</sup> **McCarthy Observatory Second Saturday Stars** (open house - see website for details)
- 13<sup>th</sup> History: Soviet Union launches Luna 15, a lunar lander and sample return mission, in an attempt to upstage Apollo 11; crashes during landing (1969)
- 13<sup>th</sup> History: Langley Research Center's birthday (1917)
- 14<sup>th</sup> History: flyby of the dwarf planet Pluto by the New Horizons spacecraft dwarf planet and its largest moon Charon (2015)
- 14<sup>th</sup> History: flyby and first close-up view of Mars by the Mariner 4 spacecraft (1965)
- 15<sup>th</sup> History: Pioneer 10 becomes the first spacecraft to enter the main asteroid belt (1972)
- 16<sup>th</sup> Close approach by Apollo-class near-Earth asteroid 2024 BY15
- 16<sup>th</sup> History: Dawn spacecraft enters orbit around the asteroid *4 Vesta* (2011)
- 16<sup>th</sup> History: over twenty fragments of comet Shoemaker-Levy 9, up to 2 km in diameter, collide with Jupiter between July 16<sup>th</sup> and the 22<sup>nd</sup> (1994); the comet had been discovered a year earlier by astronomers Carolyn and Eugene Shoemaker and David Levy
- 16<sup>th</sup> History: launch of Badr-A, first Pakistan satellite (1990)
- 16<sup>th</sup> History: launch of Apollo 11, with astronauts Neil Armstrong, Edwin "Buzz" Aldrin and Michael Collins, first manned lunar landing (1969)
- 16<sup>th</sup> History: first launch of a Proton rocket by the Soviet Union (1965)
- 16<sup>th</sup> History: first photo of a star other than our Sun (Vega) taken at the Harvard College Observatory (1850)
- 17<sup>th</sup> History: discovery of dwarf planet *225088 Gongong* by Megan Schwamb, Michael Brown, and David Rabinowitz (2007)
- 17<sup>th</sup> History: docking (and crew handshake) of an Apollo spacecraft with astronauts Thomas Stafford, Vance Brand, and "Deke" Stayton with a Soyuz spacecraft with cosmonauts Alexei Leonov and Valeri Kubasov (the Apollo-Soyuz Test Project (ASTP)) (1975)
- 17<sup>th</sup> History: William Bond and John Adams Whipple take the first photograph of a star (Vega) at the Harvard College Observatory (1850)
- 18<sup>th</sup> History: discovery of Jupiter's moon *Callirrhoe* (2000)
- 18<sup>th</sup> History: John Glenn born, first American to orbit the Earth in 1962 (1921)
- 18<sup>th</sup> History: launch of Rohini 1, India's first satellite (1980)
- 18<sup>th</sup> History: launch of Gemini X, with astronauts John Young and Michael Collins (1966)

## Astronomical and Historical Events for July (continued)

- 18<sup>th</sup> History: launch of Soviet Zond 3 spacecraft; first successful flyby of Moon; transmitted photographs that included the far side (1965)
- 18<sup>th</sup> History: Allan Sandage born, astronomer specializing in observational cosmology (1926)
- 19<sup>th</sup> History: launch of UAE's Hope spacecraft atop a Japanese H-IIA rocket (2020)
- 19<sup>th</sup> History: launch of the Explorer 35 spacecraft into an elliptical lunar orbit; designed to study interplanetary plasma, magnetic field, energetic particles, and solar X-rays (1967)
- 20<sup>th</sup> History: Gus Grissom's Mercury capsule (Liberty Bell 7) retrieved from the Atlantic Ocean floor at a depth of 15,000 feet, 38 years after it had sunk after splashdown (1999)
- 20<sup>th</sup> History: Viking 1 lands on Mars (1976)
- 20<sup>th</sup> History: Apollo 11 lands on Moon at 4:17 pm EDT; first step onto the lunar surface at 10:56 pm (1969)
- 21<sup>st</sup> Full Moon (sometimes called Buck Moon)
- 21<sup>st</sup> History: launch of the Soviet Mars mission Mars 4 (1973)
- 21<sup>st</sup> History: launch of Mercury-Redstone 4 with astronaut Virgil (Gus) Grissom; second suborbital flight by the United States (1961)
- 21<sup>st</sup> History: discovery of Jupiter's moon *Sinope* by Seth Nicholson (1914)
- 22<sup>nd</sup> Mercury at its Greatest Eastern Elongation (27°) – apparent separation from the Sun in the evening sky
- 22<sup>nd</sup> History: launch of Chandrayaan 2 (consisting of an orbiter, the Vikram lander and a rover), India's second moon mission from the Satish Dhawan Space Center, Sriharikota, India. The lander crashed due to a software error just short of landing
- 23<sup>rd</sup> Dwarf Planet *134340 Pluto* at Opposition (34.047 AU)
- 23<sup>rd</sup> Close approach by Apollo-class near-Earth asteroid 2024 LY2
- 22<sup>nd</sup> History: first dogs (Dezik and Tsygan) to make a suborbital flight aboard a Soviet R-1 rocket (wore pressure suits and acrylic glass bubble helmets) (1951)
- 22<sup>nd</sup> History: landing of Soviet spacecraft Venera 8 on Venus (1972)
- 23<sup>rd</sup> History: launch of China's Tianwen-1 spacecraft to Mars from the Wenchang Spacecraft Launch Site. Spacecraft included an orbiter, lander and rover (2020)
- 23<sup>rd</sup> History: launch of Space Shuttle Columbia (STS-93) and the Chandra X-ray Observatory (1999); first mission commanded by a woman, Eileen Collins
- 23<sup>rd</sup> History: discovery of Comet Hale-Bopp by Alan Hale and Tom Bopp (1995)
- 23<sup>rd</sup> History: discovery of Neptune's rings (1984)
- 23<sup>rd</sup> History: launch of Landsat 1 into a near-polar orbit to obtain information on Earth's resources, environmental pollution, and meteorological phenomena (1972)
- 24<sup>th</sup> Moon at Perigee (closest distance to Earth)
- 24<sup>th</sup> History: launch of the Geotail spacecraft, a joint JAXA/NASA mission to study the magnetic environs of Earth (1992)
- 24<sup>th</sup> History: first rocket launch from Cape Canaveral (Bumper/V-2 rocket) in 1950
- 25<sup>th</sup> Close approach by Apollo-class near-Earth asteroid 2011 MW1
- 25<sup>th</sup> History: Svetlana Savitskaya becomes the first woman to walk in space (1984)
- 25<sup>th</sup> History: launch of Soviet Mars orbiter Mars 5 (1973)
- 26<sup>th</sup> Close approach by Apollo-class near-Earth and Potential Hazardous Asteroid 2011 AM24
- 26<sup>th</sup> History: launch of the Space Shuttle Discovery (STS-114) "Return to Flight," 907 days after the loss of Space Shuttle Columbia (2005)

## Astronomical and Historical Events for July (continued)

- 26<sup>th</sup> History: launch of Apollo 15 with astronauts David Scott, James Irwin and Alfred Worden; fourth lunar landing (1971)
- 26<sup>th</sup> History: launch of Syncom 2, first geosynchronous satellite (1963)
- 27<sup>th</sup> Last Quarter Moon
- 27<sup>th</sup> Close approach by Aten-class near-Earth and Potential Hazardous Asteroid 523664 (2012 OD1)
- 28<sup>th</sup> History: discovery of Neptune's moons *Despina* and *Galatea* by Stephen Synnott (1989)
- 28<sup>th</sup> History: launch of Skylab-3 astronauts Alan Bean, Jack Lousma and Owen Garriott (1973)
- 28<sup>th</sup> History: launch of Ranger 7; Moon impact mission (1964)
- 29<sup>th</sup> Southern Delta-Aquarids Meteor Shower peak (into morning of the 30<sup>th</sup>)
- 29<sup>th</sup> History: deorbit and destruction of the Salyut 6 space station; first of the Soviet's second-generation space station design (1982)
- 29<sup>th</sup> History: Deep Space 1 flyby of asteroid *Braille* (1999)
- 30<sup>th</sup> History: launch of NASA's Mars 2020 rover (Perseverance) aboard an Atlas 5 rocket from the Cape Canaveral Air Force Station, Florida (2020)
- 30<sup>th</sup> History: the Cassini spacecraft arrives at Saturn after a seven-year journey (2004)
- 30<sup>th</sup> History: launch of the Wilkinson Microwave Anisotropy Probe (WMAP); mapped the Cosmic Microwave Background radiation and determined the age of the universe to be 13.73 billion years old to within one percent (2001)
- 30<sup>th</sup> History: Apollo 15 lands on Moon at 6:16 pm EDT (1971)
- 30<sup>th</sup> History: discovery of Jupiter's moon *Carme* by Seth Nicholson (1938)
- 30<sup>th</sup> History: discovery of the asteroid 951 *Gaspra* by Grigory Neujmin (1916); the Galileo spacecraft passed within 1,000 miles (1,600 km) of *Gaspra* on October 29, 1991 on its way to Jupiter
- 30<sup>th</sup> History: Galileo observes Saturn's rings (1610)
- 31<sup>st</sup> History: David Scott, Commander of Apollo 15, becomes first person to drive a vehicle on the Moon (1971)
- 31<sup>st</sup> History: impact of the Lunar Prospector (1999)
- 31<sup>st</sup> History: flyby of Mars by Mariner 6 (1969)

## August

- 1<sup>st</sup> Peak of the Alpha Capricornids meteor shower
- 1<sup>st</sup> History: discovery of Martian meteorite (shergottite class) SAU 051 in Oman (2000)
- 1<sup>st</sup> History: launch of Lunar Orbiter 5, last of the Lunar Orbiter series; photographed potential Apollo and Surveyor landing sites and captured the first image of a nearly full Earth from space (1967)
- 1<sup>st</sup> History: Maria Mitchell born, first woman to be elected as an astronomer to the American Academy of Arts and Sciences (1818)
- 2<sup>nd</sup> Close approach by Apollo-class near-Earth asteroid 2020 PN1
- 3<sup>rd</sup> History: launch of the MESSENGER spacecraft to Mercury (2004)
- 3<sup>rd</sup> History: discovery of long-period variable star Mira, (Omicron Ceti) by David Fabricius (1596)
- 4<sup>th</sup> New Moon
- 4<sup>th</sup> Close approach by Aten-class near-Earth asteroid 2023 HB7

Astronomical and Historical Events for August (continued)

- 4<sup>th</sup> History: launch of the Phoenix polar lander spacecraft to Mars (2007)
- 5<sup>th</sup> Close approach by Aten-class near-Earth asteroid 2017 TU1
- 5<sup>th</sup> History: launch of the Juno spacecraft to Jupiter (2011); arrived on July 4, 2016
- 5<sup>th</sup> History: flyby of Mars by the Mariner 7 spacecraft (1969)
- 5<sup>th</sup> History: astronaut Neil Armstrong born (1930); Commander of Apollo 11 and first person to step out on the lunar surface
- 6<sup>th</sup> Southern Iota Aquarids meteor shower peak
- 6<sup>th</sup> History: the Rosetta spacecraft and her robotic lander companion Philae arrive in orbit around Comet 67P/Churyumov–Gerasimenko after a 10-year journey (2014)
- 6<sup>th</sup> History: landing of the Mars Science Laboratory (MSL or Curiosity) at the base of Mount Sharp inside Gale Crater (2012)
- 6<sup>th</sup> History: launch of Vostok 2 and cosmonaut Gherman Titov; second man in Space (1961)
- 6<sup>th</sup> History: Chinese astronomers first observe supernova in Cassiopeia; remained visible for more than 6 months (1181)
- 7<sup>th</sup> History: Brett Gladman, et al's discovery of Saturn moons *Ymir*, *Paaliaq* and *Kiviuq* (2000)
- 7<sup>th</sup> History: announcement of possible microfossils found in Martian meteorite ALH84001 (1996)
- 7<sup>th</sup> History: Viking 2 arrives at Mars (1976)
- 8<sup>th</sup> Moon at Apogee (furthest distance from Earth)
- 8<sup>th</sup> History: launch of Genesis spacecraft, solar particle sample return mission (2001)
- 8<sup>th</sup> History: launch of Pioneer Venus 2 (1978)
- 8<sup>th</sup> History: deorbiting of the Soviet Salyut 5 space station (1977)
- 8<sup>th</sup> History: launch of the Soviet Zond 7 Moon probe (1969)
- 9<sup>th</sup> History: discovery of *Remus*, moon of Asteroid 87 *Sylvia* by Franck Marchis, et al's (2004)
- 9<sup>th</sup> History: launch of the Soviet Luna 24 spacecraft, third attempt (and only successful attempt) to recover a sample from Mare Crisium (1976)
- 9<sup>th</sup> History: Henry Draper obtains the first spectrum photograph of a star (Vega) to show distinct lines (1872)
- 10<sup>th</sup> **McCarthy Observatory Second Saturday Stars** (open house - see website for details)
- 10<sup>th</sup> Close approach by Amor-class near-Earth and Potential Hazardous Asteroid 2024 KH3
- 10<sup>th</sup> History: launch of TOPEX/Poseidon Earth-monitoring satellite, joint venture between CNES and NASA that measured ocean surface topography to an accuracy of 4.2 cm (1992)
- 10<sup>th</sup> History: launch of Mars Reconnaissance Orbiter to Mars (2005)
- 10<sup>th</sup> History: launch of Kitsat A, first South Korean satellite (1992)
- 10<sup>th</sup> History: the Magellan spacecraft enters orbit around Venus; radar mapped 98% of the planet over the following two years (1990)
- 10<sup>th</sup> History: launch of the Lunar Orbiter 1 spacecraft; photographed smooth areas of the lunar surface for assessing future landing sites and captured iconic image of the Earth rising above the lunar surface (1966)
- 11<sup>th</sup> History: Asaph Hall discovers Martian moon *Deimos* (1877)
- 12<sup>th</sup> First Quarter Moon
- 12<sup>th</sup> Peak of the Perseids meteor shower (into the morning of the 13<sup>th</sup>)

## Astronomical and Historical Events for August (continued)

- 12<sup>th</sup> History: launch of NASA's Parker Solar Probe aboard a Delta 4 Heavy rocket from the Cape Canaveral Air Force Station (2018)
- 12<sup>th</sup> History: launch of the Mars Reconnaissance Orbiter (2005)
- 12<sup>th</sup> History: launch of the International Sun-Earth Explorer-3 (ISEE-3) satellite into a heliocentric orbit. Renamed International Comet Explorer, (ICE), it became the first spacecraft to visit a comet, passing through the plasma tail of comet *Giacobini-Zinner* in 1985 (1978)
- 12<sup>th</sup> History: launch of the High Energy Astronomical Observatory (HEAO-1) to monitor x-ray sources (1977)
- 12<sup>th</sup> History: Soviet spacecraft Vostok 4 launched one day after Vostok 3 - first time multiple manned spacecraft in orbit, although they did not rendezvous (1962)
- 12<sup>th</sup> History: launch of Echo 1, the first experimental communications satellite (1960)
- 13<sup>th</sup> History: discovery of Mars' south polar cap by Christiaan Huygens (1642)
- 16<sup>th</sup> Close approach by Apollo-class near-Earth asteroid 2021 GY1
- 16<sup>th</sup> History: launch of Explorer 12 spacecraft, measured cosmic-ray particles, solar wind protons, and magnetospheric and interplanetary magnetic fields (1961)
- 17<sup>th</sup> History: launch of Venera 7; Soviet Venus lander (1970)
- 17<sup>th</sup> History: launch of Pioneer 7 (1966)
- 17<sup>th</sup> History: Asaph Hall discovers Martian moon *Phobos* (1877)
- 18<sup>th</sup> History: launch of Suisei; Japan's Comet Halley mission (1985)
- 19<sup>th</sup> Full Moon (sometimes called Sturgeon Moon)
- 19<sup>th</sup> Close approach by Apollo-class near-Earth and Potential Hazardous Asteroid 2024 JV33
- 19<sup>th</sup> History: launch of first Philippine communications satellite Agila 2 (also known as Mabuhay 1 or ABS 5) (1997)
- 19<sup>th</sup> History: launch of Soviet Sputnik 5 spacecraft with dogs Belka and Strelka (1960)
- 19<sup>th</sup> History: discovery of S Andromedae (SN 1885A), supernova in the Andromeda Galaxy and the first discovered outside the Milky Way Galaxy; discovered by Irish amateur astronomer Isaac Ward in Belfast on the 19<sup>th</sup> and independently the following day by Ernst Hartwig at Dorpat (Tartu) Observatory in Estonia (1885)
- 19<sup>th</sup> History: Orville Wright born (1871)
- 19<sup>th</sup> History: John Flamsteed born; English astronomer known for his accurate astronomical observations and first Astronomer Royal (1646)
- 20<sup>th</sup> History: launch of Voyager 2 to the outer planets (1977)
- 20<sup>th</sup> History: launch of Mars orbiter/lander Viking 1 (1975)
- 20<sup>th</sup> History: Ernst Hartwig's discovery of S Andromedae Supernova (1885)
- 21<sup>st</sup> Moon at Perigee (closest distance to Earth)
- 21<sup>st</sup> History: discovery of Dar al Gani 975 Mars meteorite in Libya (1999)
- 21<sup>st</sup> History: launch of the Orbiting Astronomical Observatory-3, Copernicus, with a UV telescope and X-ray detector (1972)
- 21<sup>st</sup> History: launch of Gemini V with astronauts Gordon Cooper and Charles Conrad (1965)
- 22<sup>nd</sup> History: first light of the 100-meter Robert C. Byrd Green Bank Telescope - the world's largest fully steerable radio telescope. (2000)
- 23<sup>rd</sup> History: Lunar Orbiter 1 takes first photo of the Earth from the Moon (1966)
- 24<sup>th</sup> History: Pluto reclassified as a Dwarf Planet (2006)
- 24<sup>th</sup> History: launch of the Soviet Luna 11 spacecraft to analyze the Moon's chemical composition, study gravitational anomalies and measure radiation levels (1966)

Astronomical and Historical Events for August (continued)

- 25<sup>th</sup> Northern Iota Aquarids Meteor Shower Peak
- 25<sup>th</sup> History: flyby of Neptune by the Voyager 2 spacecraft (1989)
- 25<sup>th</sup> History: launch of the Spitzer Space Telescope (2003)
- 25<sup>th</sup> History: launch of the Advanced Composition Explorer spacecraft to study energetic particles from the solar wind, the interplanetary medium, and other sources (1997)
- 26<sup>th</sup> Last Quarter Moon
- 26<sup>th</sup> Close approach by Aten-class near-Earth asteroid 2020 RL
- 26<sup>th</sup> History: flyby of the planet Saturn by the Voyager 2 spacecraft (1981)
- 27<sup>th</sup> History: launch of the Mariner 2 spacecraft to Venus; first successful planetary encounter (1962)
- 28<sup>th</sup> Close approach by Apollo-class near-Earth asteroid 2021 RA10
- 28<sup>th</sup> History: flyby of the asteroids *Ida* and *Dactyl* by the Galileo spacecraft (1993)
- 28<sup>th</sup> History: discovery of Saturn's moon *Enceladus* by William Herschel (1789)
- 29<sup>th</sup> Close approach by Aten-class near-Earth asteroid 2012 SX49
- 29<sup>th</sup> History: discovery of a bright nova in the constellation Cygnus (Nova Cygni 1975); visible to the unaided eye for about a week (1975)
- 30<sup>th</sup> Close approach by Aten-class near-Earth asteroid 2016 RJ20
- 30<sup>th</sup> History: discovery of first Kuiper Belt Object (1992 QB1) by David Jewitt and Jane Luu
- 30<sup>th</sup> History: launch of Japanese satellite Yohkoh (Sunbeam) to observe phenomena taking place on the Sun (1991)
- 30<sup>th</sup> History: launch of STS-8 and astronaut Guy Bluford; first African-American in space and first night launch and landing by a shuttle (1983)
- 31<sup>st</sup> History: President Kennedy signs the Communications Satellite which created the Communications Satellite Corporation (COMSAT) and committed the U.S. to building a global communications system (1962)
- 31<sup>st</sup> History: first photo showing Moon's shadow on the Earth during Solar Eclipse taken by stratospheric balloonist Captain Albert Stevens (1932)

NET July: A SpaceX Falcon 9 rocket will launch a Crew Dragon spacecraft. The Polaris Dawn mission will be commanded by billionaire Jared Isaacman, making his second trip to space. He will be joined on the all-private mission by pilot Scott "Kidd" Poteet, and SpaceX employees Sarah Gillis and Anna Menon.

### Commonly Used Terms

- Apollo: a group of near-Earth asteroids whose orbits also cross Earth's orbit; Apollo asteroids spend most of their time outside Earth orbit.
- Aten: a group of near-Earth asteroids whose orbits also cross Earth's orbit, but unlike Apollos, Atens spend most of their time inside Earth orbit.
- Atira: a group of near-Earth asteroids whose orbits are entirely within Earth's orbit
- Centaur: icy planetesimals with characteristics of both asteroids and comets
- Kuiper Belt: region of the solar system beyond the orbit of Neptune (30 AUs to 50 AUs) with a vast population of small bodies orbiting the Sun
- Opposition: celestial bodies on opposite sides of the sky, typically as viewed from Earth
- Plutino: an asteroid-sized body that orbits the Sun in a 2:3 resonance with Neptune
- Trojan: asteroids orbiting in the 4<sup>th</sup> and 5<sup>th</sup> Lagrange points (leading and trailing) of major planets in the Solar System

### References on Distances

- the apparent width of the Moon (and Sun) is approximately one-half a degree ( $\frac{1}{2}^\circ$ ), less than the width of your little finger at arm's length which covers approximately one degree ( $1^\circ$ ); three fingers span approximately five degrees ( $5^\circ$ )
- 1 astronomical unit (AU) is the distance from the Sun to the Earth or approximately 93 million miles

### International Space Station and Artificial Satellites

- [www.heavens-above.com](http://www.heavens-above.com) for the times of visibility and detailed star charts for viewing the International Space Station and other manmade objects.

### Solar Activity

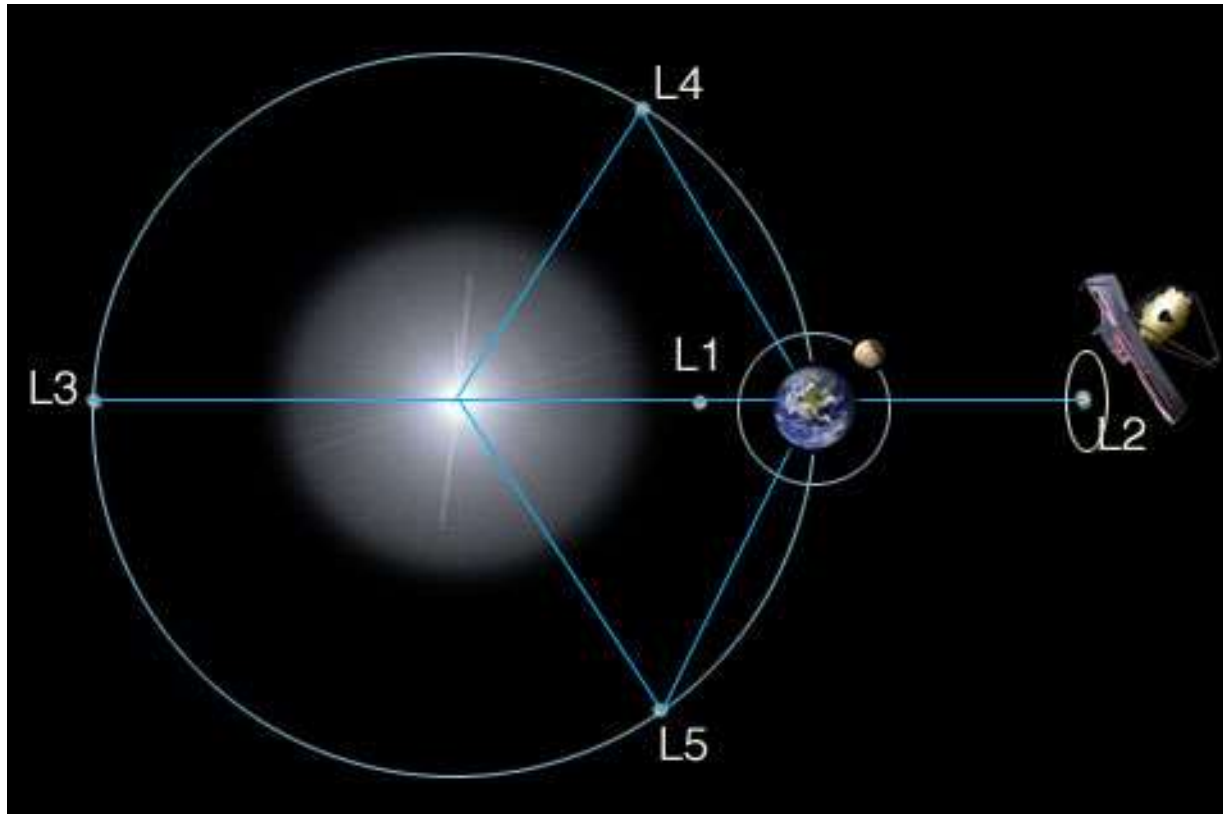
- For the latest on what's happening on the Sun and the current forecast for flares and aurora, check out [www.spaceweather.com](http://www.spaceweather.com)

### NASA's Global Climate Change Resource

- Vital Signs of the Planet: <https://climate.nasa.gov/>

## Lagrange Points

Five locations discovered by mathematician Joseph Lagrange where the gravitational forces of the Sun and Earth (or other large body) and the orbital motion of the spacecraft are balanced, allowing the spacecraft to hover or orbit around the point with minimal expenditure of energy. The L2 point (and location of the Webb and Euclid telescopes) is located 1 million miles (1.5 million km) beyond the Earth (as viewed from the Sun).



### James Webb Space Telescope

- <https://webb.nasa.gov/index.html>

### Euclid Space Telescope

[https://www.esa.int/Science\\_Exploration/Space\\_Science/Euclid](https://www.esa.int/Science_Exploration/Space_Science/Euclid)

### Mars – Mission Websites

- Mars 2020 (Perseverance rover): <https://mars.nasa.gov/mars2020/>
- Mars Science Laboratory (Curiosity rover): <https://mars.nasa.gov/msl/home/>
- Mars Atmosphere and Volatile Evolution (MAVEN): <https://science.nasa.gov/mission/maven/>



## Contact Information

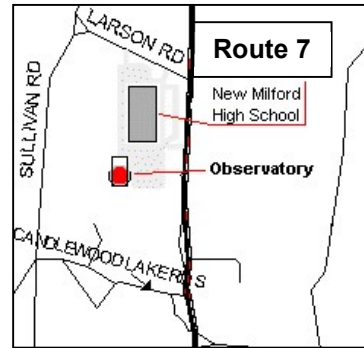
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