## John J. McCarthy Observatory June 2025 Newsburst



The European Space Agency's Mars Express has been orbiting the Red Planet since 2003. Its High Resolution Stereo Camera (HRSC) is capable of stereo imaging the entire planet in unprecedented detail. The color composite (above) is centered on the Valles Marineris canyon system, the largest in the solar system. A volcanic plateau, dominated by several massive shield volcanoes, can be seen in the upper left of the image.

Ninety individual images, taken from altitudes between 2,500 and 6,200 miles (4,000 to 10,000 km), were used to assemble the mosaic. The range of colors is indicative of the planet's diverse surface composition. While reddish tones are from oxidized iron, the darker blue, gray and black tones are indicative of the basaltic sand that blankets the surface and accumulates in dune fields. Water-weathered minerals, like clay and sulfates, appear as bright highlights.

#### Credit: ESA/DLR/FU Berlin/G. Michael

# John J. McCarthy Observatory History

June 30, 2000

Masonry block facing installation

Ash Dome delivery and assembly on June 7th

> 14-sided, double walled ring, fabricated out of 10 inch laminated veneer lumber, provided dome support

June 1, 2000

Twenty five years ago, after almost two years of planning and fundraising, the Western Connecticut Chapter of the Society for Amateur Scientists began the construction of a world-class, community science center. Designed to leverage astronomy to further science literacy, create scientific curiosity, and reinforce interest and skills in science, the allvolunteer organization broke ground on May 6th and was able to complete the facility by early fall, with a formal dedication on December 2nd.

# Hubble at 35



Upper left: Mars, Upper right: planetary nebula NGC 2899, Lower left: a small portion of the Rosette Nebula, Lower right: barred spiral galaxy NGC 5335.

Image: NASA, ESA, STScI; Image Processing: Joseph DePasquale (STScI), Alyssa Pagan STScI)

NASA released an assortment of images to celebrate the 35<sup>th</sup> anniversary of the Hubble Space Telescope. Developed as a partnership between the United States and the European Space Agency, the telescope was launched in April 1990 aboard the space shuttle Discovery and inserted into an orbit 320 miles (515 km) above Earth's surface. Five service missions, the last one conducted in 2009, were critical in extending the telescope's life and improving its capability with new science instruments and cameras.

#### **Ozone Depletion**

There are currently over 12,000 active satellites orbiting Earth, 88% of which are in low-Earth orbit (300 to 600 miles or 500 to 1,000 km). Adding to the total tonnage of space hardware are thousands of non-functioning satellites, spacecraft, and spent rocket bodies, along with millions of pieces of orbital debris – a large majority of which will eventually burn up in Earth's atmosphere.

Aluminum is a common material used in spacecraft construction. During reentry, the aluminum reacts with oxygen to form aluminum oxide nanoparticles. Researchers estimate that the population of satellites that reentered the atmosphere in 2022 generated around 17 metric tons of aluminum oxide compounds. The nanoparticles can act as catalysts, accelerating the breakdown of ozone by reacting with chlorine molecules. Since aluminum oxide is only a catalyst, it is not destroyed in the reaction and continues to activate chlorine as it migrates down through the atmosphere for decades.



A stack of 60 Starlink satellites prior to deployment Credit: Space X

#### Donaldjohanson

On April 20, 2025, NASA's Lucy spacecraft flew within just 600 miles of the asteroid Donaldjohanson in its traverse of the main asteroid belt. Images returned show a peanut-shaped rock.

Scientists believe that Donaldjohanson was formed roughly 150 million years ago when two smaller asteroids collided. The fusion created an irregular shape, 5 miles long and 2 miles wide (8 by 3.2 km). Lucy's next encounter will be with the Trojan asteroid (3548) Eurybates, and its satellite Queta, in August 2027.



Image credit: NASA/Goddard/SwRI/ Johns Hopkins APL

#### **PUNCH Commissioning**

NASA's "Polarimeter to Unify the Corona and Heliosphere," or PUNCH mission, employs a constellation of four small satellites in polar orbit to conduct 3D observations of the Sun's inner heliosphere. With an occulter used to block the bright light from the solar disk, PUNCH's cameras will study the region where the corona transitions to the solar wind (the stream of charged particles that flows outward from the Sun) for a better understanding of how space weather affects us.



The Moon drifting through the field of view during the commissioning of PUNCH Image credit: Southwest Research Institute

# **Risky Business**



It was a year ago, on June 5<sup>th</sup>, when the Boeing Starliner spacecraft was launched to the International Space Station (ISS) from the Cape Canaveral Space Force Station for its first crewed mission – a mission expected to last about a week. Unfortunately, the mission did not get off to an auspicious start with multiple leaks in the helium system used to pressurize the spacecraft's propellant and failure of several of the vehicle's reaction control system thrusters, which compromised the spacecraft's ability to safely dock with the ISS.

Starliner has 28 small thrusters located in four "doghouses," equally spaced around the perimeter of its service module. The thrusters, pointing in different orientations, provide maneuverability in the forward, aft and radial directions. Along with the spacecraft's flight computer system, Starliner is designed to autonomously dock with the ISS.

As the spacecraft approached the ISS on June 6<sup>th</sup>, multiple thrusters began to fail, requiring astronaut Butch Wilmore to take manual control. After the fourth thruster was lost (all aft facing and non-symmetrical), along with the ability to safely approach the ISS, NASA attempted to reset the system from the ground. After two resets enough of the thrusters were brought back online to enable the autonomous docking sequence. Without the successful reset, the crew would have had to abort the mission although the thruster issue could have also affected reentry control.

Post-flight analysis suggests that thruster failure (5 total on ascent and 2 on reentry) was caused by overheating and the deformation of small Teflon seals inside the thrusters – from being in direct sun and repeated use under manual control. Seal degradation from exposure to vapors from the highly corrosive hypergolic fuels is suspected to be the root cause of the five helium leaks.

#### **Lost World Meteorite**

The origin of a vast majority of meteorites can be traced to a particular asteroid collective, a planet such as Mars, or our Moon. The origin of less than one percent is more muddled.

Northwest Africa (NWA) 15915 was discovered in Algeria in 2023. The 6.26 pound (2.84 kg) rock is a coarse-grained achondrite. While it formed in a lowoxygen environment like the planet Mercury, NWA 15915's unusual composition and strange mix of magnetic metal-rich minerals is significantly different than the composition of the current innermost planet, suggesting that it came from another large differentiated body in the inner Solar System – one that was likely destroyed in the violent beginnings of our solar system.

#### Fireworks at the End of Time

Astronomers have found a pair of white dwarf stars on a collision course (far in the future). When the time comes, in 23 billion years, the resulting type 1a supernova will outshine the Moon (10 times brighter) in our sky (assuming that the Earth survives our Sun's demise), despite being 150 light years away.

The two dwarf stars are slightly larger than the Earth with a combined mass 1.56 times our Sun (the highest total mass discovered to date). Currently, the two dead starts spiral around one another every 14 hours. Over billions of years, this time period will be reduced to less than a minute before both are destroyed in a double detonation.



Northwest Africa (NWA) 15915 Credit: By Stefan Ralew



Artist conception of WDJ181058.67+311940.94, two white dwarfs stars destined to merge Image: GSFC/D.Berry.

#### SPHEREX

The Spectro-Photometer for the History of the Universe, Epoch of Reionization and Ices Explorer (SPHEREx) telescope, launched in March, has taken the first science observations of its two-year mission.

The space telescope is designed to capture about 3,600 images each day, mapping the entire sky in 102 infrared wavelengths — or colors — to gain new insight into galaxy formation, cosmic inflation, and the origins of water and organic molecules in planetary systems.



A cloud of smoky molecules inside the Large Magellanic Cloud captured at two different wavelengths by the SPHEREx space telescope

Credit: NASA/JPL-Caltech

# **Crater Morphology**

Lunar craters are created in a blink of the eye when an asteroid or comet impacts the Moon's surface at an average velocity of 12 miles per second (20 km/s). The resulting excavation is generally 10 to 20 times the size of the impactor, depending upon its mass and velocity, and the geology of the surface. Craters are generally circular in appearance, and the material ejected by the impact evenly dispersed around the crater, unless the impact angle is very shallow (less than 15°). Simple lunar craters, less than about 9 miles or 15 km in diameter, are bowl shaped. Larger craters have a more complex geometry with craters greater than 20 miles (35 km), in diameter more saucer shaped.

Tycho crater, the youngest large impact crater on the Moon's nearside, is about 53 miles (85 km) in diameter with a depth less than 3 miles (5 km). Tycho exhibits all the attributes of a large complex crater – flattened floor, central peaks, terraced sides, pools of solidified impact melt and blocks of the original crust, or slump blocks, that have slid down the inside of the crater wall. Central peaks are created when material pushed towards the edges of the crater during the impact flows back toward the center. Along with the rebound of rock from beneath the crater, the material amasses to form the "peaks."



Oblique view of Tycho crater acquired by NASA's Lunar Reconnaissance Orbiter from an altitude of 36 miles (59 km). The central peak complex rises more than 6,500 feet (2,000 meters) above the crater floor.

Credit: NASA/ASU/Arizona State University

#### **Multi-Planet System**

NASA's James Webb Space Telescope's image of the star system HR 8799 includes four large planets (gas giants), each with a mass between 7 and 10 times that of Jupiter. Using a coronagraph to block the light from the star, the filters on Webb's Near-Infrared Camera (NIRCam) reveal differences in the planets' temperature and composition.

All four planets are located outside the star's habitable zone (where liquid water can exist on the surface). The closest, designated HR 8799e, completes one orbit every 57 years, at a distance of 1.5 billion miles (2.4 billion km) from its star. The furthest, HR 8799b, takes almost 466 years at a distance of 6.3 billion miles (10.1 billion km) – twice Pluto's current distance from Earth. It is also the coldest and the richest in carbon dioxide. The orbital motion of the four exoplanets was confirmed by direct imaging - a first.

#### **Hidden Danger**

Analysis of swabs taken from inside one of China's Tiangong Space Station modules revealed a new strain of bacteria. Niallia tiangongensis, named after the space station, is a variant of a soil and sewagedwelling terrestrial microbe that can cause sepsis. The previously unknown strain has adapted to space, including mutations to respond to oxidative stress caused by a microgravity environment and to repair radiation damage.

In 2018, four previously unknown strains of antibiotic-resistant bacteria were found inside the International Space Station. Future spacefarers can be assured that they won't be alone in their travels.



HR 8799 is located 133 light-years away from Earth in the constellation of Pegasus. The 30 million-year-old main-sequence star has roughly 1.5 times our Sun's mass and 4.9 times its luminosity.

Credit: NASA, ESA, CSA, STScl, Laurent Pueyo (STScl)



Tiangong space station, photographed from a Shenzhou spacecraft Credit: China Manned Space Agency

#### **Designing a Spacesuit for Mars**

Included in the calibration target for NASA's Perseverance rover's SHERLOC instrument are small swatches of spacesuit materials. The samples are monitored for their ability to resist the harsh Martian environment, including radiation, intense cold, and toxic and corrosive dust. The five samples are (1) polycarbonate helmet visor material; (2) Vectran, a cut-resistant material used in astronaut gloves; (3) Ortho-Fabri, used for spacesuit rip-resistance; and two kinds of Teflon (4) and (5).



Credit: NASA/JPL-Caltech/MSSS

## **Monster Sunspot**



# FREE EVENT

60

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

June 14th 8:00 - 10:00 pm Free Star Party

#### Featuring:

Date: 2025 05 21 VT: 030100 R.A. 15 00 49.2 Decl. -07 03 03 Delta: 0.019 r: 1.031 El: 162.1 Ph: 17.6 X: 17.8 min: 35.52 P.A. 342.2 Azi: 341 Alt: +40

# Planétary Defense

2025 KB1 CM0 932 2025-05-21T03:01:29.4Z 225.20634 -7.05650 0.52 0.55 Gaia3 17.7 0.28 G G Gaia3 6.6 1.00 4.2 0.00.48 247 K

#### 2025 KB1

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

\*Observing if weather permits

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# **Contact Information**



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