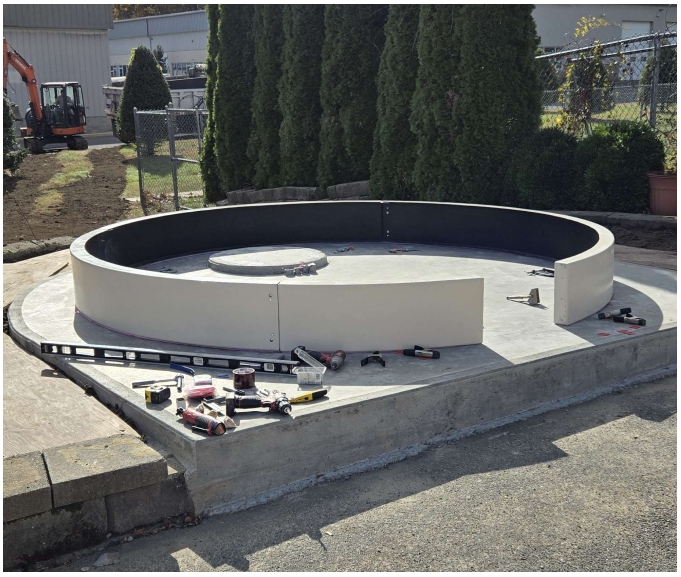
John J. McCarthy Observatory

December 2025 Newsburst

Construction of the future center for Near-Earth Object research takes shape on the southwest corner of the McCarthy Observatory site

Photo: Bill Cloutier

A New Observatory for NEO Studies



From top left: pier footing with electrical/communication conduits, first dome ring positioned on concrete pad, wall assembly, dome installation, and initial telescope placement

Photos: McCarthy Observatory

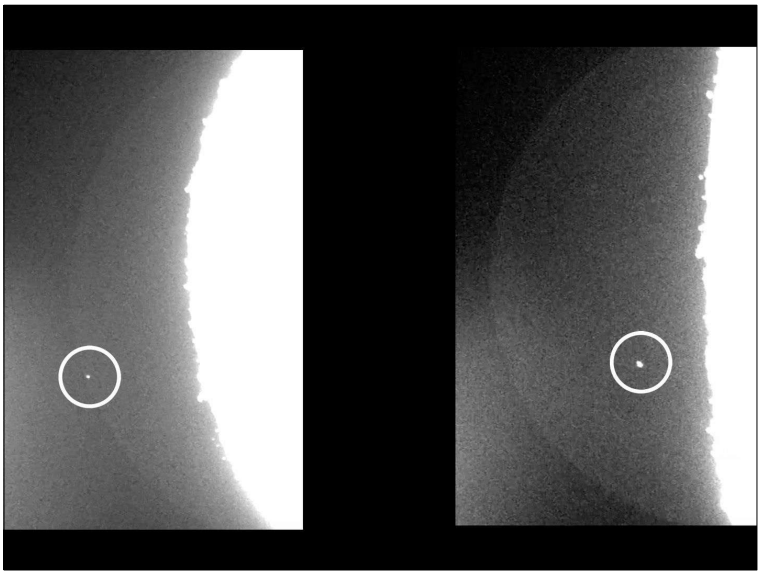
Financed, in part, with a grant from The Planetary Society (one of only two grants awarded to astronomers in North America this year), a facility dedicated to the study of Near-Earth Objects (NEOs) has been constructed on the grounds of the McCarthy Observatory. The ten-foot dome is now home to the once-retired 16-inch Meade Schmidt-Cassegrain telescope that was the workhorse for NEO observations for over twenty years in the Observatory's main dome.

This new facility is being designed for remote operation. The older telescope will provide a test bed to develop operating and communication protocols, design security and weather interlocks, and identify system enhancements needed for more efficient NEO detection. Single point of failure components, such as the telescope mount or electronic accessories, can be upgraded as funds become available to maintain the robustness of the entire system.

The new addition will free up time on the Observatory's main telescope for other activities, student pursuits and the use by the general public.

Lunar Impacts

Daichi Fujii, a Japanese astronomer, captured luminous flashes in the unlit portion of the Moon on October 30th and again on November 1st. The flashes, most likely from impacts of meteoroids from the Taurid meteor shower, lasted just a fraction of a second but were captured on video by Mr. Fujii. The Moon doesn't have an atmosphere to slow down space rocks, so impacts can occur at speeds of 45,000 to 160,000 mph (20 to 72 km/s). At these velocities, a small 10 pound (5 kg) meteoroid can excavate a crater over 30 feet (9 meters) across. The first impact detected by Mr. Fujii occurred just east of the Gassendi Crater while the second appeared on the Moon's limb in western Oceanus Procellarum.



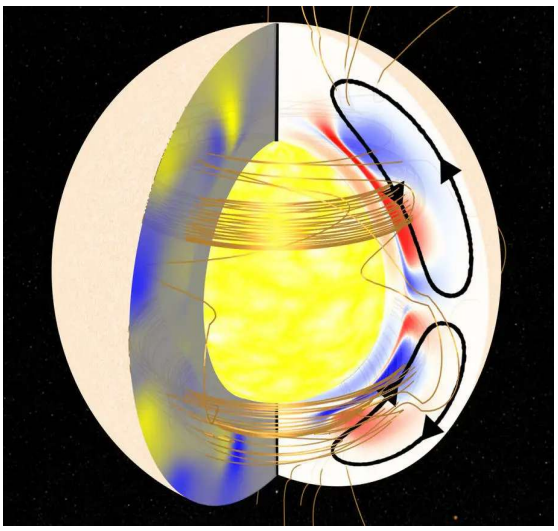
Light flashes from meteoroid impacts

Image credit: Daichi Fujii/Hiratsuka City Museum

Sun's Magnetic Poles

In February 2025, the European Space Agency's Solar Orbiter began a series of maneuvers to move the spacecraft out the plane of the solar system to gain a better vantage point of the Sun's poles. Currently at an angle of 17° with respect to the Sun's equator, the spacecraft will use future encounters with Venus to increase this angle to 33° by 2029. With its new inclination, the Solar Orbiter became the first spacecraft to directly observe the Sun's poles (the Ulysses spacecraft, which operated between 1990-2009, measured the environment around the poles from a much greater distance and didn't have the capability to directly image the poles).

The Solar Orbiter's first look at the south pole showed a very disorganized mix of polarities, consistent with solar maximum. The disorder should become more organized as the Sun's activity decreases (approaches solar minimum in a few years). More surprising was the velocity at which the Sun's magnetic field was migrating toward the pole - much faster than predicted and closer to the velocity seen at the Sun's equator.

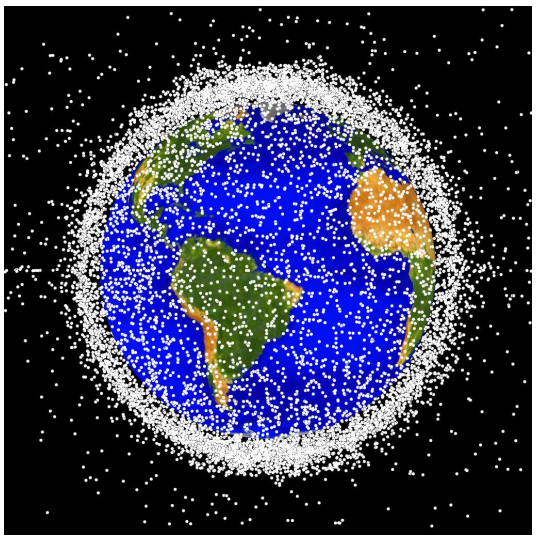


The meridional plasma flow acts like a conveyor belt to transport magnetic flux along the surface toward the poles, sinking, then returning toward the equator via the Sun's interior

Credit: NASA

Chinese Cooperation

As the likelihood of collisions between satellites and orbital debris increases, coordination and cooperation between countries and fleet operators is critical to protecting vital assets and ensuring the safety of those living and working in space. Earlier this year, NASA and its partners had to move the space station into a higher orbit to avoid a fragment of a Chinese Long March rocket launched in 2005. In the past, NASA has been proactive, for example, putting the Chinese on notice that it would initiate evasive action to avoid a collision. However, for the first time, the Chinese National Space Agency recently initiated first contact with NASA over a possible collision between satellites and took action to move its asset.



Low-Earth Orbit is the region of space with the most concentrated area for orbital debris

Credit: NASA ODPO

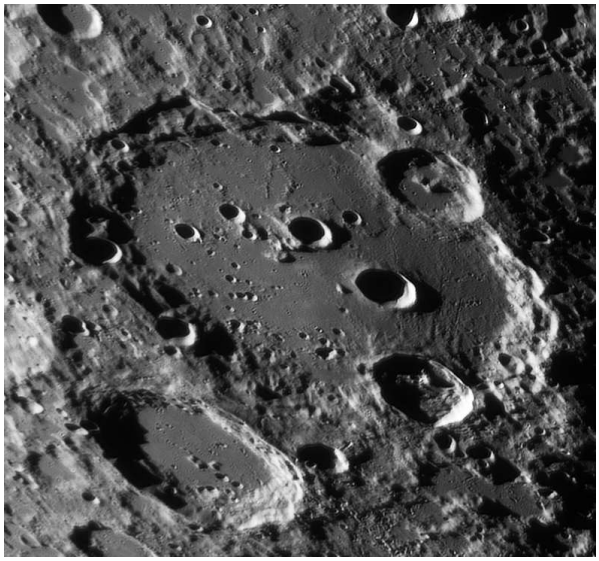
McCarthy Observatory Celebrates 25 Years of Opening the Universe to All

Seven months after the shovels hit the dirt in May 2000, the community gathered together for the dedication of a world-class observatory on the campus of the newly constructed high school in New Milford, Connecticut. The opening of this multi-purpose science facility was the result of over two years of planning, fundraising and volunteer-led construction.

The McCarthy Observatory, operated and maintained by volunteers, was conceived to use the rich field of astronomy to encourage curiosity and inspire critical thinking. The initiative was prompted by an observed decline in science literacy.

Asteroid Mining on the Moon

While there is interest in mining asteroids for platinum group metals, a paper published in the journal Planetary and Space Science suggests a means to access this resource without traveling halfway across the solar system. Since large craters are created by asteroid impacts, the research team looked closer to home – the Moon. Out of the 1.3 million lunar craters with diameters greater than 0.6 miles (1 km), the team estimated that almost 6,500 were created by asteroids that could contain commercial quantities of valuable ores like palladium or iridium, with a potential value exceeding one trillion dollars. While the 1967 Outer Space Treaty might be brought into play to challenge any resource claim, not all nations are participants and the prospective of astronomical profits could challenge the legal framework of past agreements.



Clavius, one of the largest and oldest craters on the Moon

Photo: Bill Cloutier

3I/ATLAS Update

Despite the hype and radical theories about its make-up, 3I/ATLAS, in all respects, appears to be a comet. It was discovered on July 1st by the Asteroid Terrestrial-impact Last Alert System (ATLAS) telescope in Chile. Its velocity and trajectory indicate that it is not gravitationally bound to our Sun – just a visitor passing through from another part of our galaxy. It does however, exhibit differences (as expected) from comets that formed around our star.

Its route through the solar system poses no threat to the Earth, with Mars being the closest planet encountered (at which time Earth was on the opposite side of the Sun). While Earth-bound telescopes were unable to follow 3I/ATLAS when closest to the Sun at the end of October, space-based assets, for example, those spacecraft that monitor the Sun and its surroundings, were able to track the interstellar visitor throughout its passage. Now that the comet has emerged from the Sun's glare, terrestrial telescope are once again targeting the object, looking for changes in the icy body from its close encounter.

What we do know:

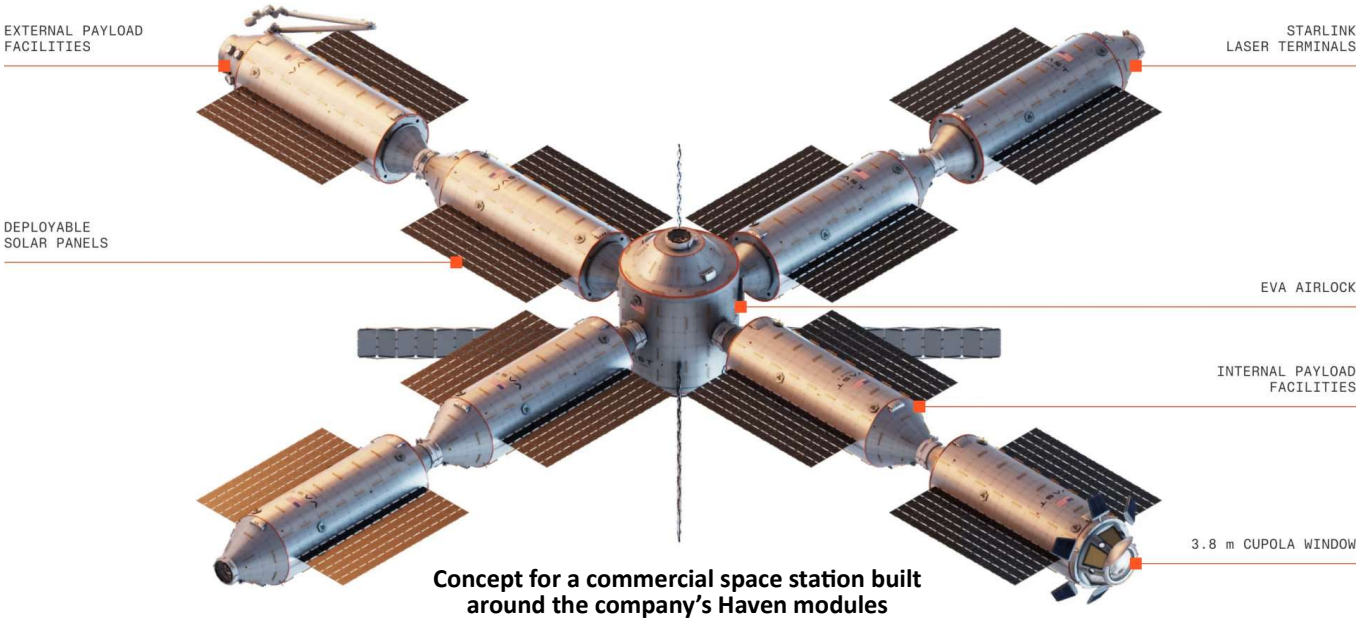
- With the nucleus currently hidden by a large coma (a bright cloud of gas and dust), estimates of its size suggest an upper limit on its diameter at 3.5 miles (5.6 kilometers), although it could be as small as 1,444 feet (440 meters)
- 3I/ATLAS is well studied, having been observed by telescopes across the globe, as well as NASA's solar observatories PUNCH, STEREO, and SOHO, planetary orbiters MAVEN and the Mars Reconnaissance Orbiter, the Mars rover Perseverance, deep space missions Lucy and Psyche, and ESA's Mars Express and the ExoMars Trace Gas Orbiter, so there is a plethora of data to analyze
- 3I/ATLAs has also been observed by a number of space telescopes including the Hubble Space Telescope, James Webb Space Telescope, Transiting Exoplanet Survey Satellite (TESS), Neil Gehrels Swift Observatory, and SPHEREx
- Its characteristics are consistent with that of a comet

What is so unusual about this interstellar visitor:

- Its coma has unusually high levels of carbon dioxide and nickel metals
- The comet has both a pronounced tail (pointing away from the Sun) and a small anti-tail pointing in the direction of the Sun. The anti-tail, a stream of large dust particles, is erupting from the Sun-facing side where solar heating is greatest
- The ratio of carbon dioxide to water suggests that it formed in a very cold environment
- The proportion of nickel-to-iron is opposite of that found in comets around our Sun
- The comet exhibits a green glow despite a lack of the usual carbon molecules

The scientific method is a measured process – even the most unusual attribute can have a rationale explanation, without the need to stray from reality, if followed to a logical end.

A Next Generation Space Station



Concept for a commercial space station built around the company's Haven modules

Credit: Vast Space

Construction of the football-field size International Space Station (ISS) began in 1998 with operation and maintenance of the station shared by five space agencies — NASA, CSA (Canadian Space Agency), ESA (European Space Agency), JAXA (Japan Aerospace Exploration Agency), and the Russian State Space Corporation Roscosmos. Thermal stress (daily heating and cooling cycling in orbit) and dynamic loading (from spacecraft docking and undocking) have weakened the primary structure with reports of new air leaks more frequent, particularly in the older Russian segment. NASA, CSA, ESA and JAXA have committed to maintaining the ISS through 2030 with Russia tentatively agreeing to participate through 2028. However, at some point in the near future, the station will be intentionally de-orbited with what remains after its passage through the atmosphere falling into the southern Pacific ocean.

The orbiting laboratory is expected to be replaced, in part, by commercial enterprises. Toward that end, NASA plans to incentivize private companies through its Commercial LEO Destinations (CLD) funding plan. While there is still some uncertainty in how this will be accomplished, the agency has already provided funding under an initial phase to several companies to mature the designs of their concept space stations and, in the case of Axion Space, to provide access to an ISS docking port to attach their modules.

Vast Space is attempting to leapfrog the competition with its Haven modular design. The privately-held American aerospace company, headquartered in Long Beach, California, launched its first demonstration module in early November. The module is being used as a test bed for essential system capabilities over its expected six month operating life. Meanwhile Vast is qualifying what it calls a "minimum viable product," Haven-1, for launch next Spring.

Haven-1, with its single docking port, will rely upon visiting SpaceX Crew Dragons for life support. The module is expected to host four crew visits, each lasting about 10 days, over its three-year life span. The Haven-1 module will be equipped with a microgravity laboratory and research center and manufacturing platforms.

Vast expects to incorporate lessons-learned from Haven-1 to construct Haven-2, an ISS-comparable, multi-module space station. Haven-2 will be built around a large, center core module which would be launched with SpaceX's Starship (with SpaceX's Falcon Heavy delivering the peripheral modules). In its finished configuration, eight modules would be accessed from the core. Vast intends to have the first module in orbit by 2028 with assembly of the station completed by 2032.

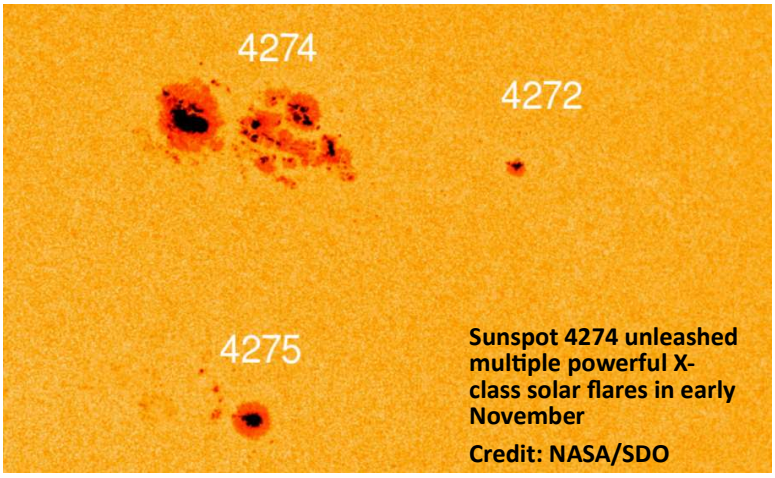
November Geomagnetic Storm

Cloud cloaked aurora in New Milford from the November 11th geomagnetic storm

Credit: Bill Cloutier

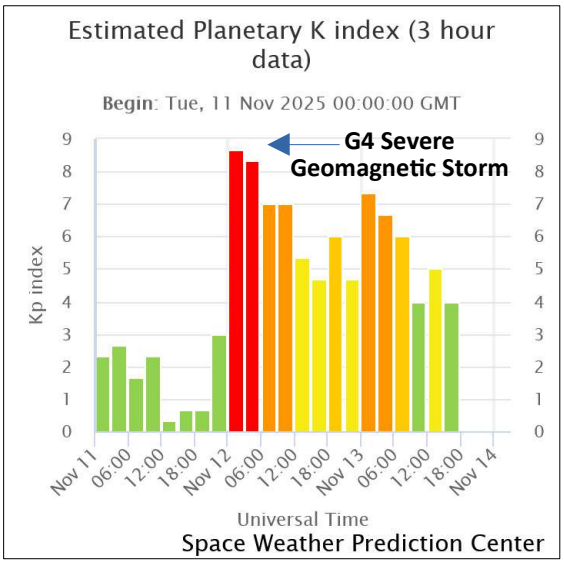
The Kp index is used to indicate the severity of the global magnetic disturbances

Credit: NOAA Space Weather Prediction Center



Sunspot 4274 unleashed multiple powerful X-class solar flares in early November

Credit: NASA/SDO



A very energetic sunspot rotated to face the Earth in early November. Over the course of a week, Sunspot 4274 released a series of flares which in turn sent clouds of corona plasma threaded with intense magnetic field lines (CMEs) towards the Earth. The first two CMEs combined to spark a severe (G4) geomagnetic storm on the night of November 11th. That was followed by third CME from a subsequent eruption (produced by the strongest solar flare in over a year) and, while it did not produce a major auroral storm, it was intense enough to generate a relatively rare Ground Level Event (GLE) – the most intense in almost 20 years. With most solar flares, the Earth's atmosphere prevents ionized particles from reaching the ground. However, in a GLE, the energy levels are so high that the particles (usually protons) are detected by ground stations. These particles, moving a a fraction of the speed of light, can damage satellites, disrupt communications and increase radiation exposure for airline passengers traveling at high altitudes.

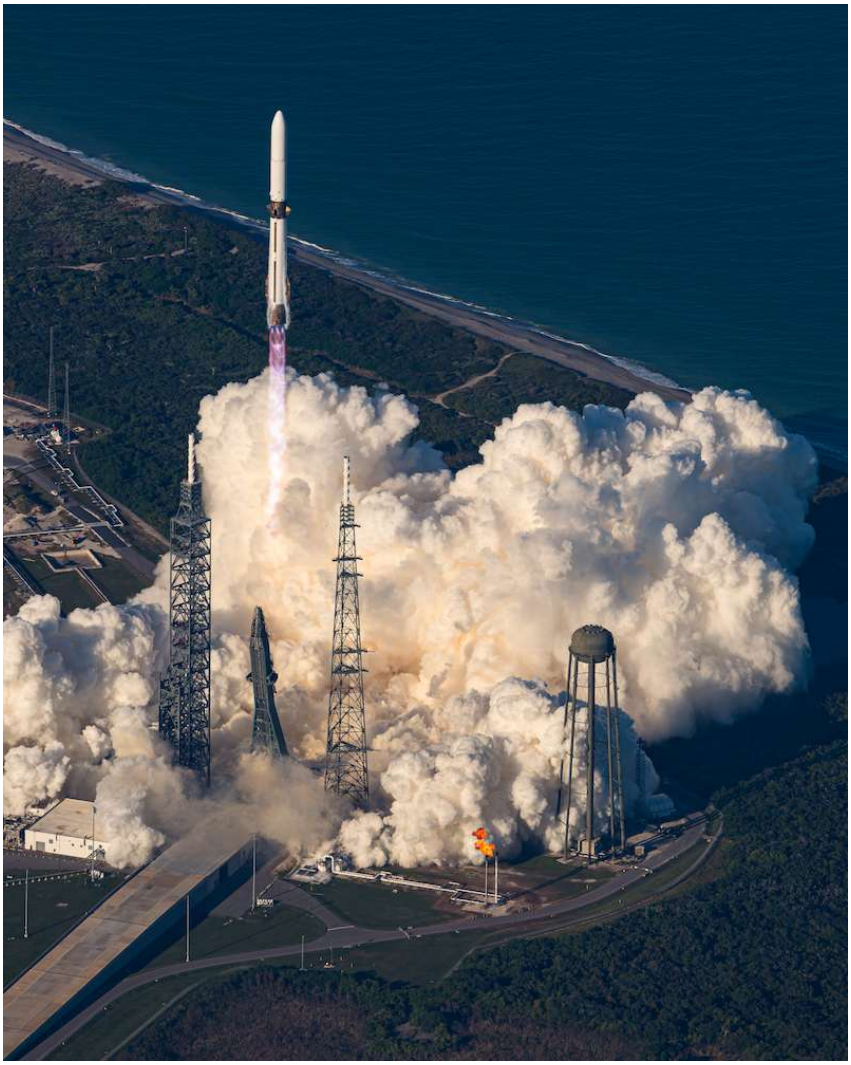
New Glenn and ESCAPADE

Blue Origin launched their New Glenn rocket for the second time on Thursday, November 13th. The flight of the company's new booster was a resounding success with the first stage returning to land on a barge positioned in the Atlantic Ocean 375 miles (604 km) downrange of the launch pad. Launch attempts earlier in the week had been delayed by a number of issues, including "highly elevated solar activity and its potential effects" on the payload – NASA's Escape and Plasma Acceleration and Dynamics Explorers (ESCAPADE) spacecraft.

Thirty-three minutes after liftoff, the twin ESCAPADE satellites, named Blue and Gold – the school colors of the University of California, Berkeley, which operates the mission, were released from the rocket's second stage about 30 seconds apart. Blue and Gold are destined for Mars, but with Mars at about its furthest distance from Earth, the spacecraft were placed into a loitering "kidney bean" shaped orbit around the Lagrange Point 2, about 930,000 miles or 1.5 million km behind the Earth (from the Sun's perspective). In a year's time, the ESCAPADE spacecraft will use a gravity assist from the Earth to jump-start their 11 month journey to Mars.

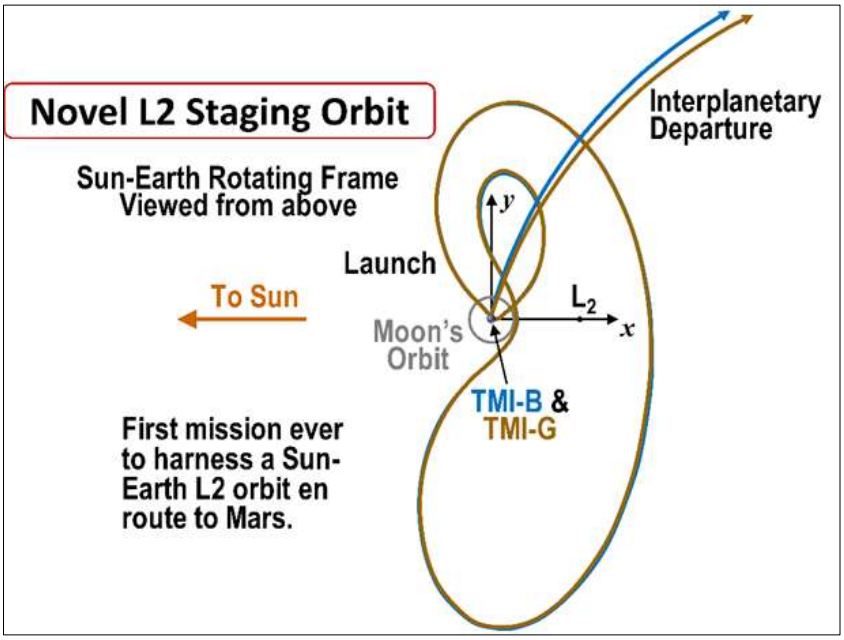
Once at the Red Planet, the Rocket Lab-built spacecraft will be placed into complementary orbits to record real-time changes in the planet's magnetosphere from the flow of charged particles from the Sun (solar wind). It is believed that the solar wind has contributed to the loss of Martian atmosphere over time along with the disappearance of a global magnetic field.

ESCAPADE is a NASA low-cost, high risk program. Its novel loitering orbit could be adapted for future missions. Rather than waiting for the planets to align every 26 months or so and a launch window to open, multiple spacecraft could be pre-positioned in similar loitering orbits to await windows of opportunity for the travel to Mars.



Launch of New Glenn with its ESCAPADE payload from Launch Complex 36 at Cape Canaveral Space Force Station in Florida

Credit: Blue Origin



Loitering orbit of the ESCAPADE satellites

Credit: UC-Berkeley

Second Saturday Stars

FREE EVENT

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

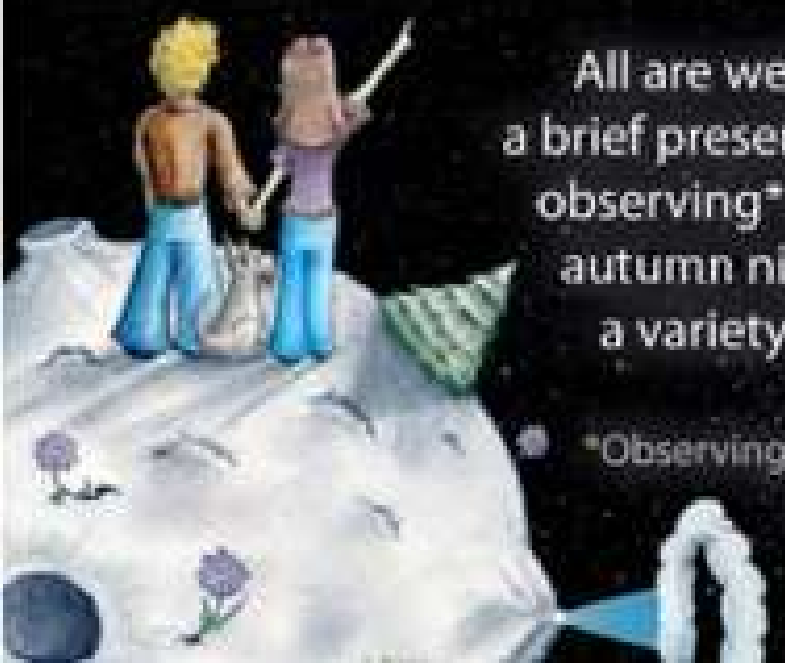
December 13th

7:00 - 9:00 pm

Free Star Party

Featuring:

McCarthy Observatory
25th Anniversary



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

*Observing if weather permits

Contact Information

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